Visualizing the Sociotechnical System as an Urban Democratic Resource

The iCity case study

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Key Themes

1. Context and rationale for the socio-technical system to be a democratic resource

2. iCity project as a case study example

    - User centred process to develop a visualization taxonomy

    - Application and prototype testing

Context and Rationale

The increasing dependence of individuals on sociotechnical and technological systems in urban life today, has provided an enormous amount of data that reveal user stories.

Image: Saul Gravy/Getty, goo.gl/CVEKZL

The user stories provide insight into how individuals make choices around how they integrate these systems into the quality of their urban life.

- User stories and habits are captured as patterns
- Identification of shared user behaviors
- The accessibility of sociotechnical systems provide individuals with choices

Image: www.pexels.com

Visualization and visual analytics tools can provide critical support for researchers, designers and stakeholders to understand these democratic choices related to human activities.

Correlating and representing quantitative data from human actors provides insight, explanations for patterns and anomalies that aid in system decision support as a democratic resource.

Image: www.pexels.com

iCity as a Case Study

iCity is a collaboration between *academic researchers, industry partners, city transportation and planning departments in Toronto* to set out conditions for an interactive interface as a democratic resource for individuals and groups to highlight their needs /wants /values, and participate in strategic planning opportunities.

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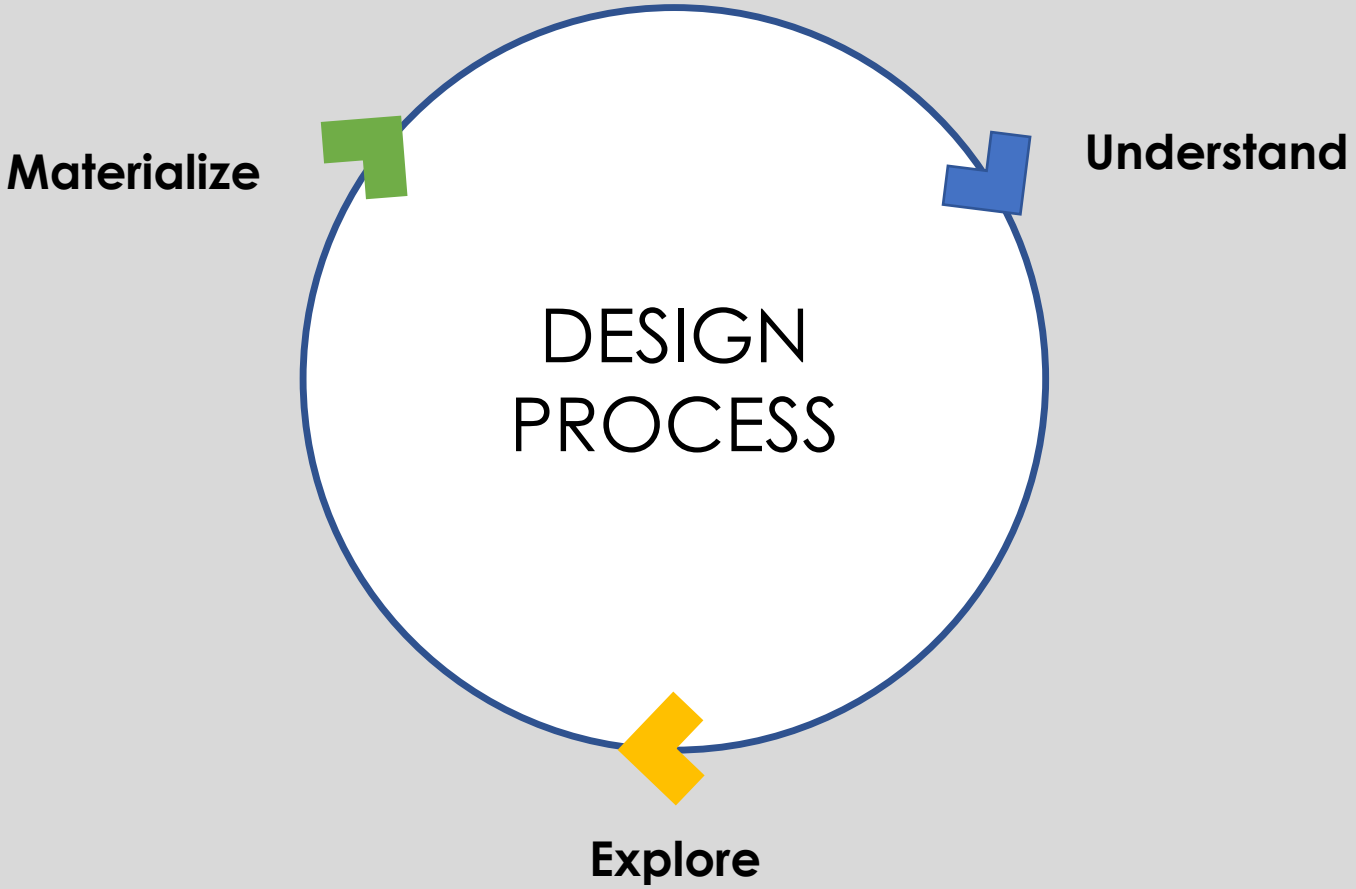
Image Source: goo.gl/F1TAyx

The iCity urban transport project focuses on the development of data analytics transportation and transit planning tools

Image: iCity Visualization, ESRI cityengine, Carl Skelton, Michael Carnevalle

At iCity we develop decision support tools combining social media and mobile data with GIS, demographic, socio-economic and transit data

Image: iCity Visualization; ***ESRI cityengine, Betaville***, Carl Skelton, Marcus Gordon , Carnevalle, Manpreet Juneja



Paper focuses on the design process adopted to study comparative methodologies and prototype frameworks for visualization interface.

Image: iCity Visualization; Jeremy Bowes, Manpreet Juneja

Definitions

1. Taxonomy

Taxonomy can thus be understood as meaning
‘laws of arrangement and division’.

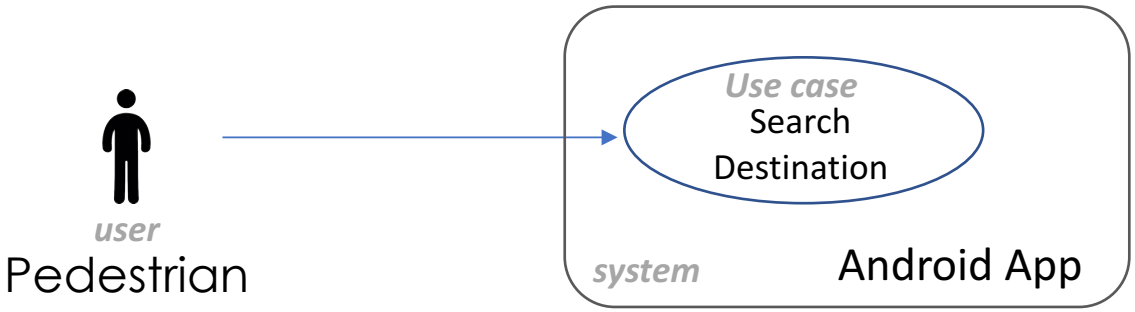
Eg: Library, arrangement of books

Image: goo.gl/LokQSx

Definitions

2. Use Case

A *use case* is a **series of related interactions between a user** (or more generally, an "actor") **and a system** that enables the user to achieve a goal.



Eg: Pedestrian searching destination

Image: Diagram, Manpreet Juneja

iCity approach & process

Understand

- Literature Review
- Comparative Methodology in Urban Transportation
- Expert Interviews

Image: Design Process, iCity process phases, Jeremy Bowes, Manpreet Juneja

Key Findings

Literature Review: *Key elements of Taxonnomy in visualizations*

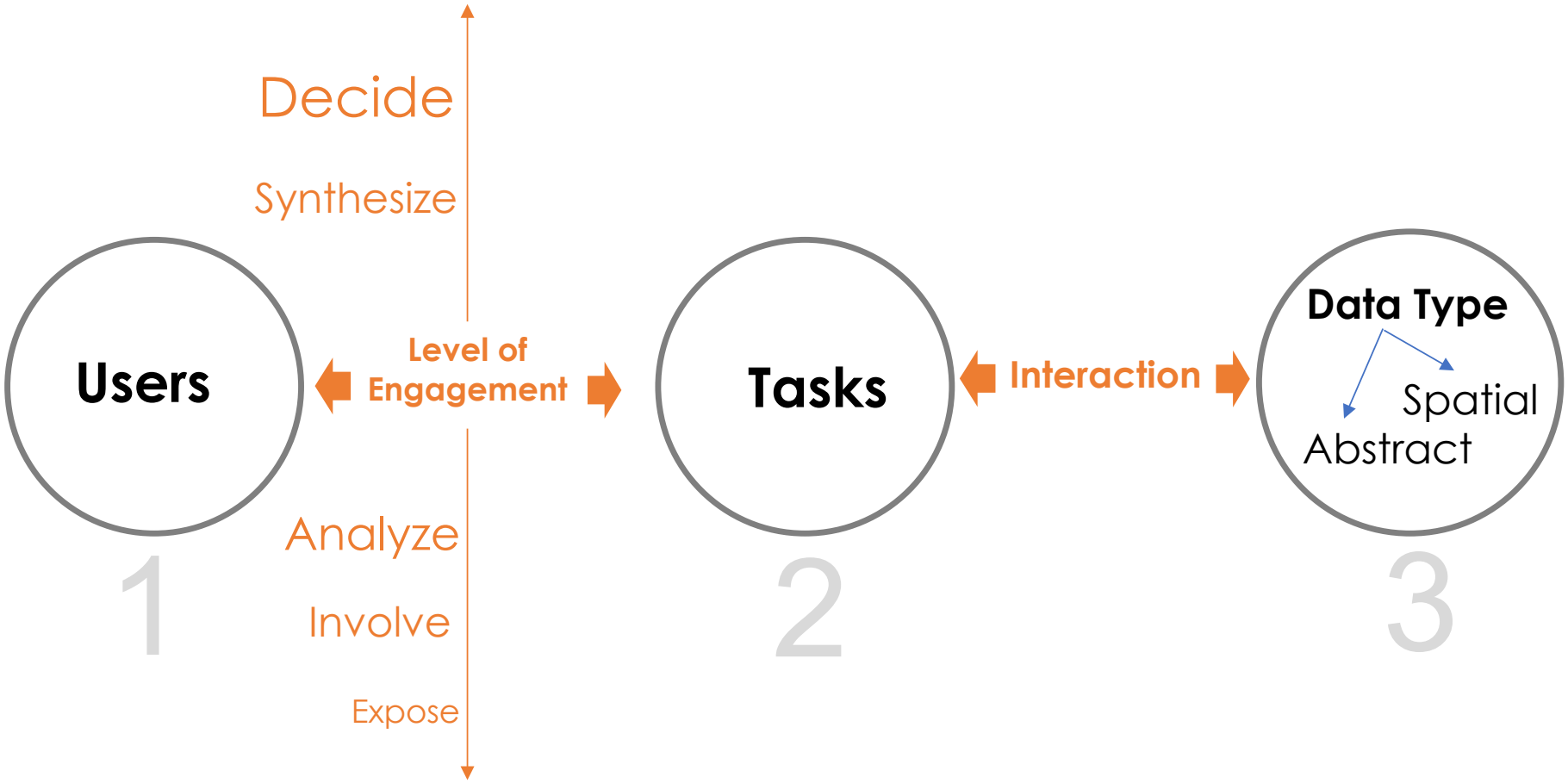


Image: Design Process, iCity process phases, Manpreet Juneja

Key Findings

Comparative Methodology: *A survey of landscape to understand the types of software that exist and the functions already being served.*

Software Application Categories: *Use Domains*

User Stories, Narratives
Navigation
Route Mapping
User Generated Data
Social Media Use

Transportation
Traffic Movement
Parking
Management

Urban Design: Built Environment
Neighborhood Planning
Complete Streets

Data Analysis
Intelligent Predictive Analysis
Simulation

Land Use
Agent-based Micro-simulation

Entertainment & Games
Interactive & Location Based Games
Mixed Reality

Infrastructure Management
Signal & Transit Operations
Sustainability
Resilient Cities

Mapping
Cartography
Geo-Visualization

Image: Comparative Methodology, iCity process phases, Manpreet Juneja, Marcus Gordon, Jeremy Bowes

Comparative Methodology Categories of Table

Software Categories

Questions		Description	Who are the Users?	What are the User Tasks being accomplished?	Type of Interaction	Level of Engagement	Data type	Data Representation	Data Formats Input/ Output
	User – Stories, Narratives								
	Transportation								
	Urban Design								
	Data analytics								
	Land Use								
	Simulation/ Interactions/ Games								
	Infrastructure Management								
	Mapping								

This helped us in aggregating **User Types**, **Use Domains**, **User Tasks**, and the **type of Data** being used for Urban Transportation Applications

Image: Comparative Methodology, iCity process phases, Manpreet Juneja, Marcus Gordon, Jeremy Bowes

Comparative Methodology Categories of Table

Type of Urban System Application	Software	Technology / Platform	Description / application	User Type	Tasks (High Level)	Engagement Level
Selected Toolset / Methods						
Qualitative and Quantitative Data Exploration and Analysis and Presentation Tool	StoryFacets	HTML, Javascript, D3 framework, Meteor, MongoDB	Explore data through interaction, visual history, presentation, generate consumable overviews, high level -search /browser, visualization dashboard, visualization slide shows,	technicians, transportation engineers, citizens, Business analysts	dataset/media asset navigation, dataset visualization, dataset history and analysis history visualization, decision support	expose (consuming, learning and viewing) involve (interacting) analyze (finding trends) synthesis (testing hypothesis) Decide (Deriving decisions),

Interaction (Low level tasks)	Data Visualization	Data Attributes	Open / Private Data Source	Data Format (input)	File Format	Link	Contact
zooming inset, brushing and linking, scrolling, panning, filter, pivot, compare	Bar chart, Pie chart, Gather plot, Markup language	Categorical, Ordinal, Interval, Provenance, audio, video, text, image	Agnostic	Tabular, Markup	CSV (Comma Seperated Values), Markdown	storyfacets-test.herokuapp.com	Cody Dunne

Image: Comparative Methodology, iCity process phases, Manpreet Juneja, Marcus Gordon, Jeremy Bowes

Taxonomy Sketch showing essentials aspects of visualizations

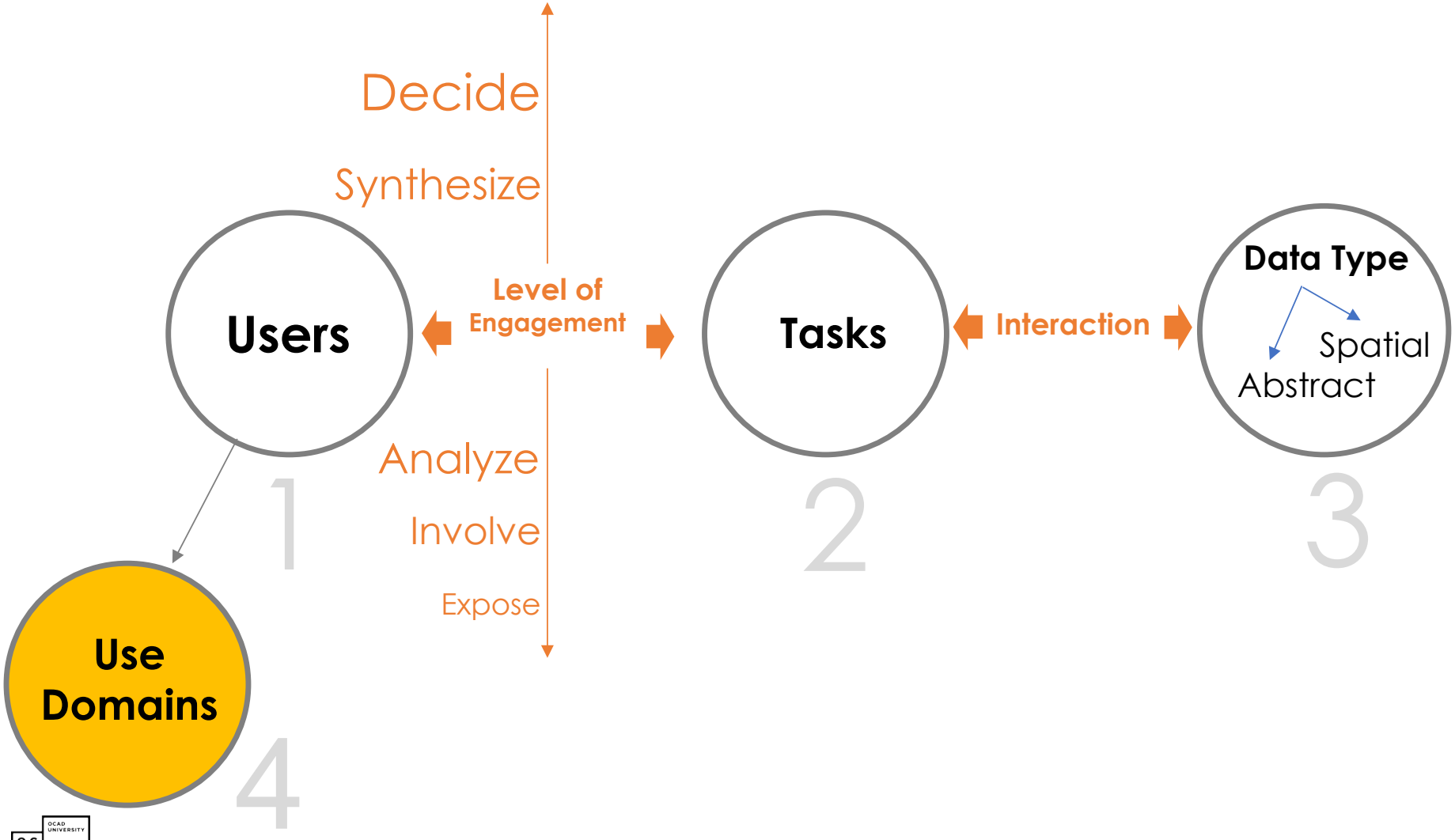


Image: Design Process, iCity process phases, Manpreet Juneja

iCity approach & process

Explore

- Use Case Survey
- Use Case Mapping
- Design Charrette, Priority mapping

Image: iCity Visualization; Jeremy Bowes, Manpreet Juneja

Use Case survey

User Type
Gender, Age, Nationality, Occupation
Application Scenario
Description of Tasks
Preconditions
Technology
Software, Environments and Frameworks
Assets
Formats, Functions
Task interaction
How are you using this software/ tool?
Data Visualization
What is the visualization functionality of this software/ tool?
Improvements
How could the software/ tool be changed to support the required tasks?

URBAN INFORMATICS USE CASE PROFILE

Case Number: C3
Date: January 30th, 2017

User Type
Gender: Male **Age:** 56 **Nationality:** Canadian **Occupation:** Architectural technician

Laz is a senior architectural technician working for city planning. His area of expertise is reviewing rezoning applications and new development projects.

Application Scenario

Laz is processing an application for a building rezoning in the new West Don neighbourhood. The applicants have not provided any parking statistical information, and Laz needs to ascertain whether the existing street, and lot spaces will be overburdened by new users if the project proceeds. He must perform Quantitative Data Exploration and Analysis of existing parking resources, land use, and demographics, to evaluate current and proposed parking space inventory against policy/ regulations, as documented in the city's geodata/survey and 3D model resources.

He needs to provide two documents of his findings:
- an explanatory presentation (slide show) for an upcoming community meeting;
- a formal record of the application's parking implications, context, applicable regulations
- recommended ruling based on the above items.

Description of Tasks

Exploration of geodata & 3D model of existing conditions,
record of parking inventory in defined area,
calculation of requirements with/without proposed changes,
export of tabular data and graphics,
preparation of formal document and slide presentation for ruling recommendation decision support/justification/communication with decision-makers and stakeholders

Preconditions
Knowledge of local study area, accessibility to platform, understanding of interface & functionality, availability of peak parking data,both on-street and private etc.

Technology
Software ArcGIS, CityEngine, Insights
Environments & Frameworks html5, webGL, Javascript

Assets
Formats online .SHP, .CSV, .XLS, JSON, .dwg, .dmg files
Functions 3d Bar charts, Geo-Data, Bar chart, interactive digital maps with on/off information layer switching, call-out boxes

Task Interaction **How are you using this software / tool?**
Orbit, Walk/ fly-through, pan, scroll, zoom, select, annotate, measure, (annotate measurement?), zooming inset, scrolling, panning, compare, microsimulation etc.

Data Visualization **What is the visualization functionality of this software / tool?**
Uses technological interface to visualize street segment, with displayed data of parking information per location as statistical comparison.
Capture of generated scenario data in a form for presentation. Access of demographic community data to project potential local patrons to future establishments. Interface to select, analysis, and prepare a visual summary of queried data on parking locations.

Improvements **How could the software / tool be changed to support the required tasks?**
Real-time 3D infographics superimposed, 2D map, highlighted statistical charts, prep of visual narrative

Image: Use Case Surveys, iCity process phases, Manpreet Juneja, Carl Skelton, Jeremy Bowes

Use Case Mapping Template

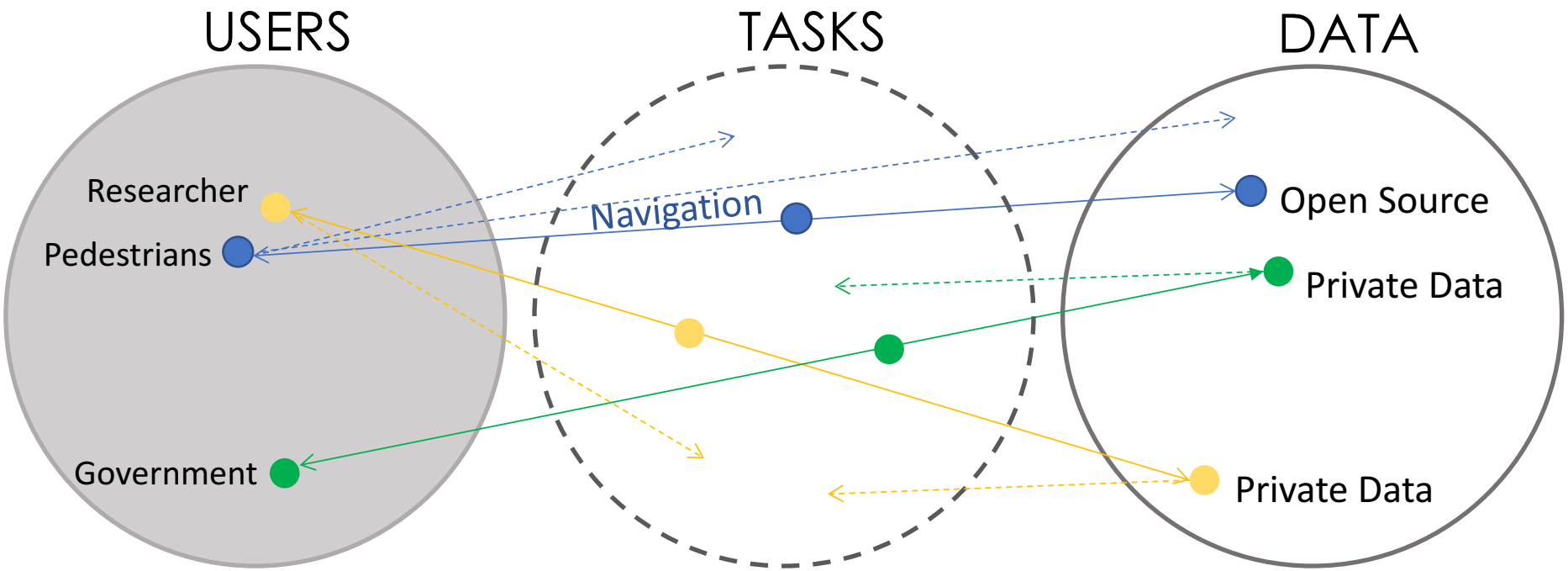


Image: Use Case Mapping - Users, Tasks and Data, Jeremy Bowes, Manpreet Juneja, iCity Team

Use Case Mapping

Selected Integrated Use Domain Example

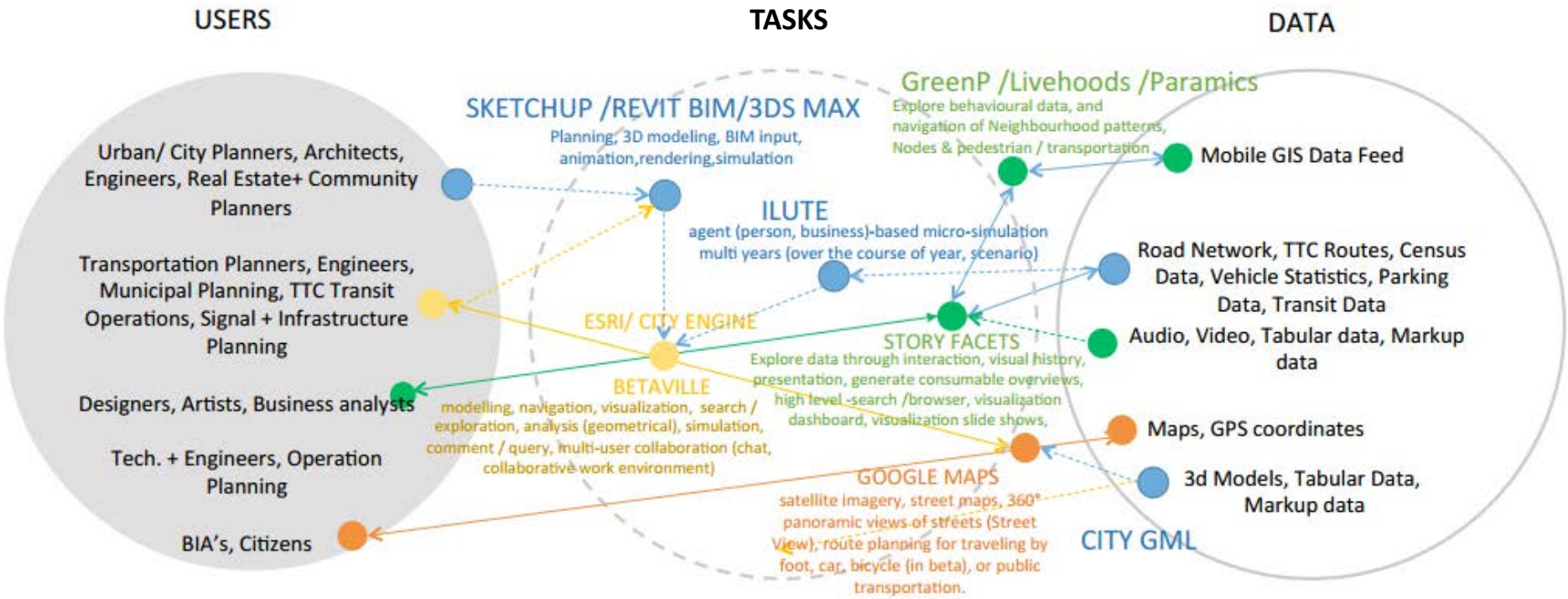
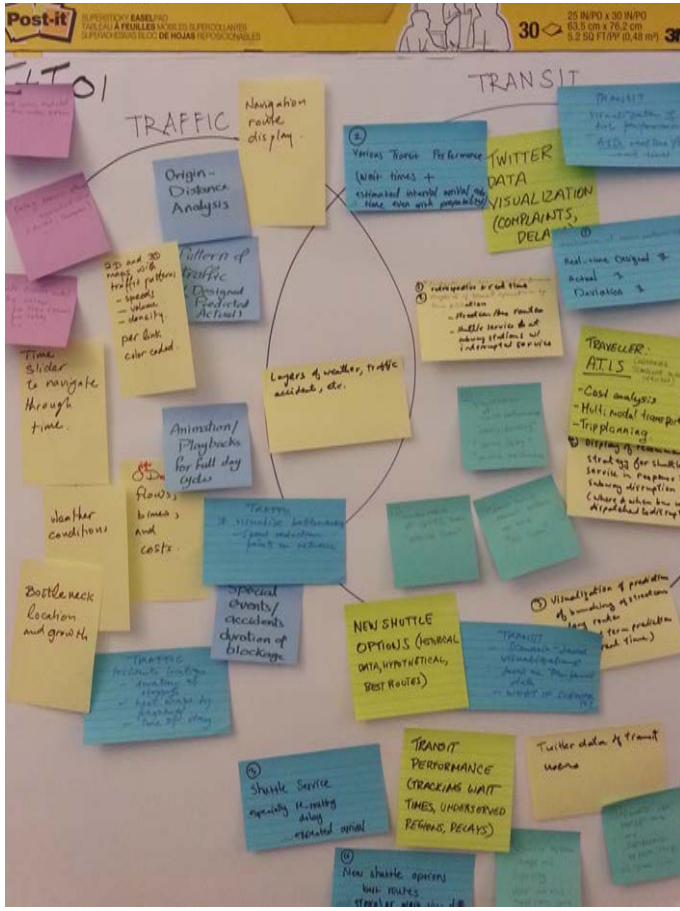
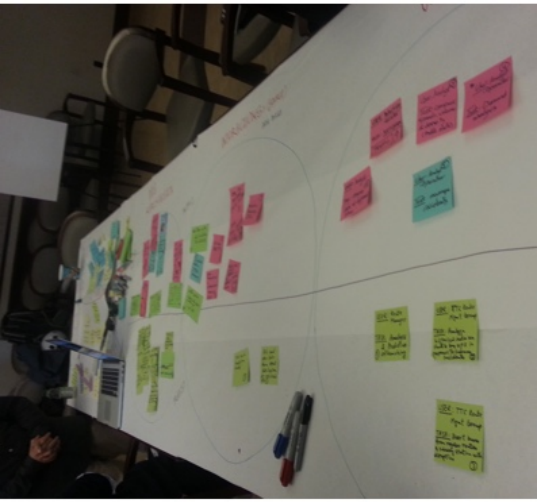


Image: Use Case Mapping, iCity process phases, Manpreet Juneja, Jeremy Bowes

Design Charrette

Test Taxonomy Sketch
Establish priorities to build interface prototypes





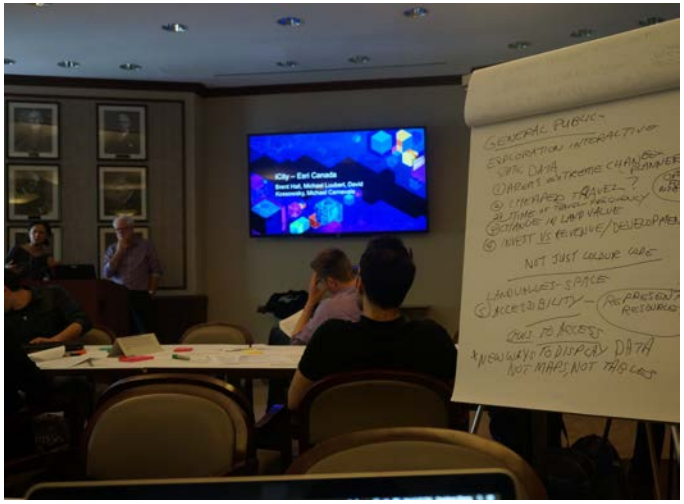


Image: Charrette Images, iCity process phases, iCity Team

iCity approach & process

Materialize

- User-Centred Taxonomy for Urban Transportation Applications
- Applications and Visualization Prototypes

Image: iCity Visualization; Jeremy Bowes, Manpreet Juneja

User centred Taxonomy for Urban Transportation Applications

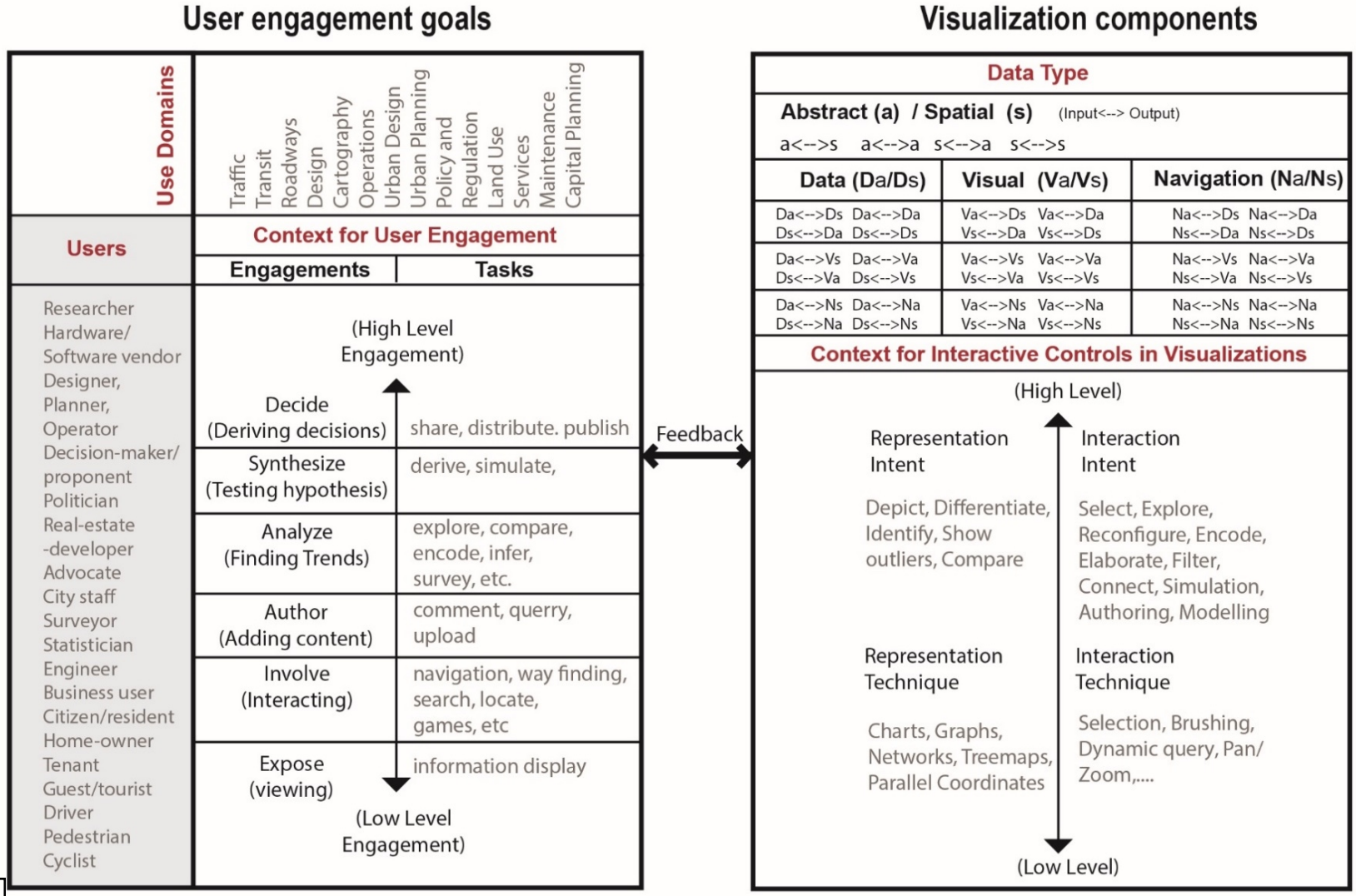
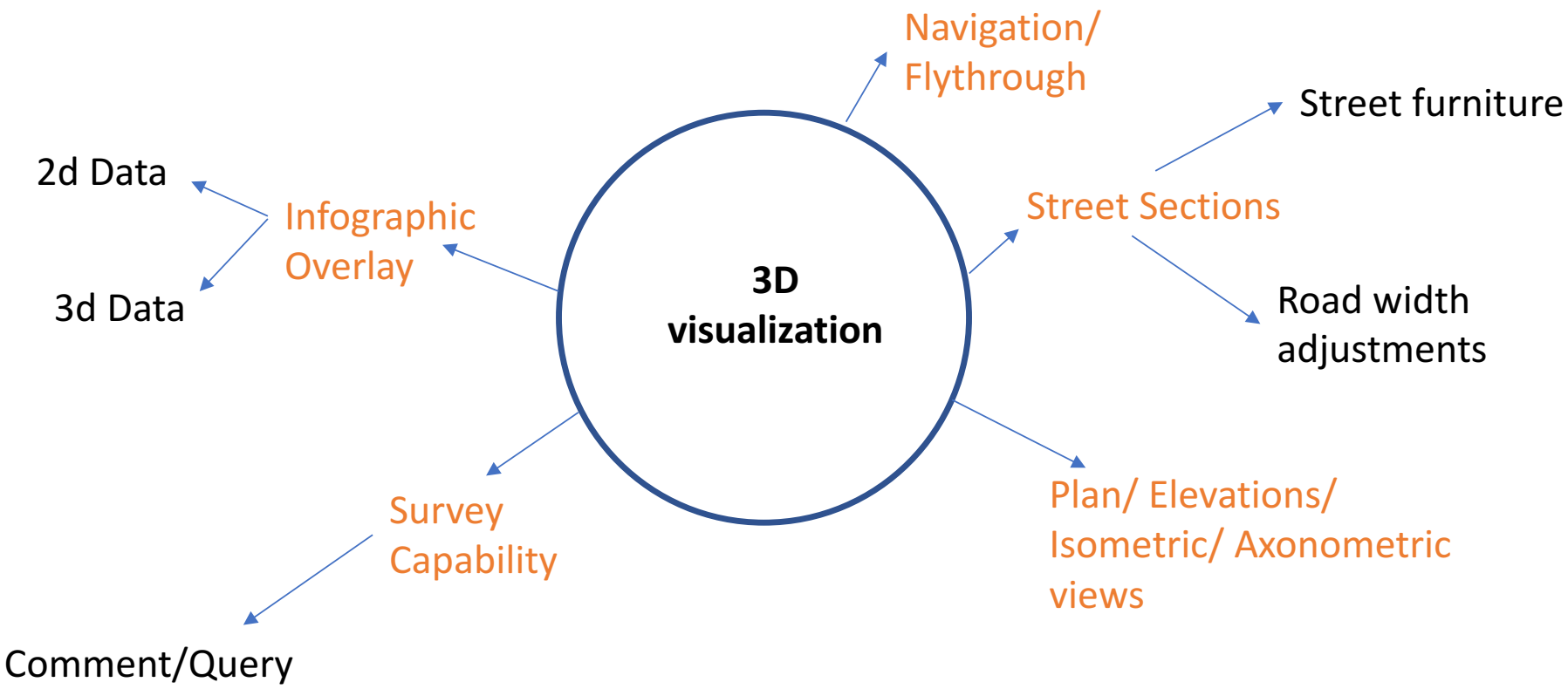


Image: Based on Pike (2009), Mahyar (2015) and Sorger (2015), iCity process phases, Taxonomy, iCity Team

Application and Visualization Prototypes

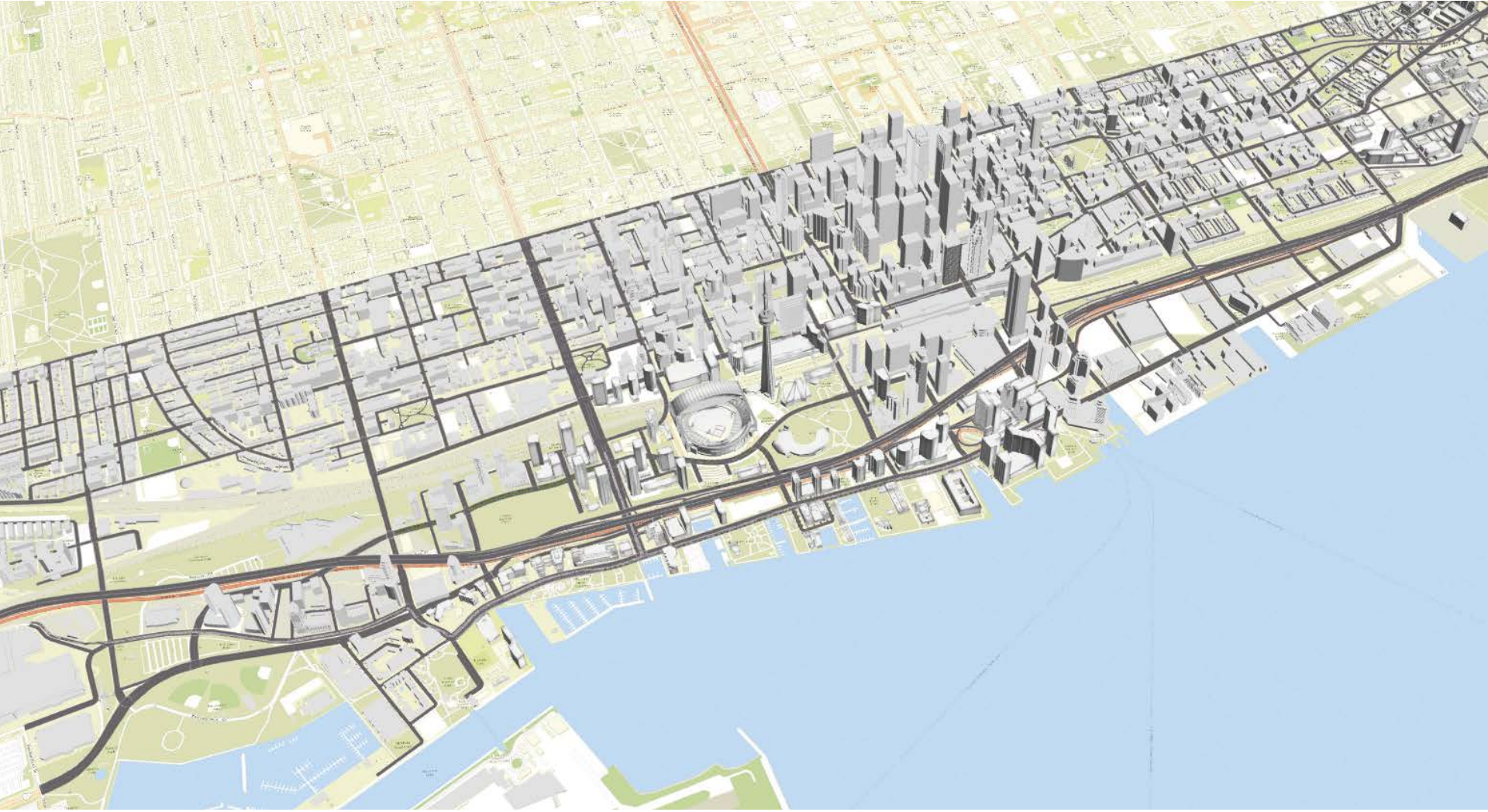
1. Geo-visualization analytic tools:

Complete Streets Research Software : Betaville, City Engine



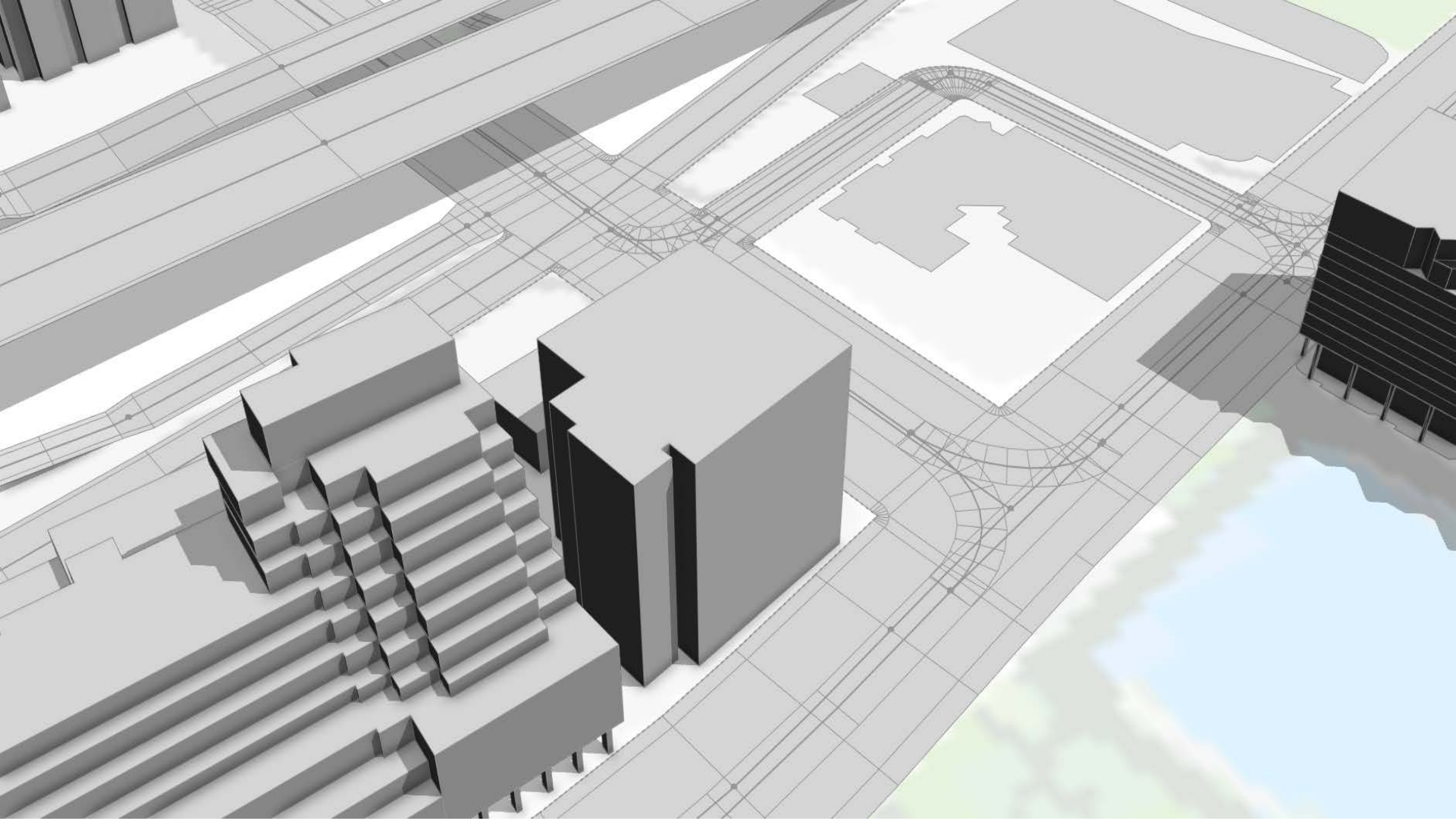
Visualization Prototype for Complete-Street interface

Image: iCity process phases, iCity Team



We are developing a realistic virtual model of city of Toronto

Image: iCity Waterfront Model, Esri CityEngine, Carl Skelton, Michael Carnevale, iCity Team



The model includes existing transportation routes, topography, built and natural environment within the city

Image: iCity Waterfront Model, Esri CityEngine, Carl Skelton, Michael Carnevale, iCity Team

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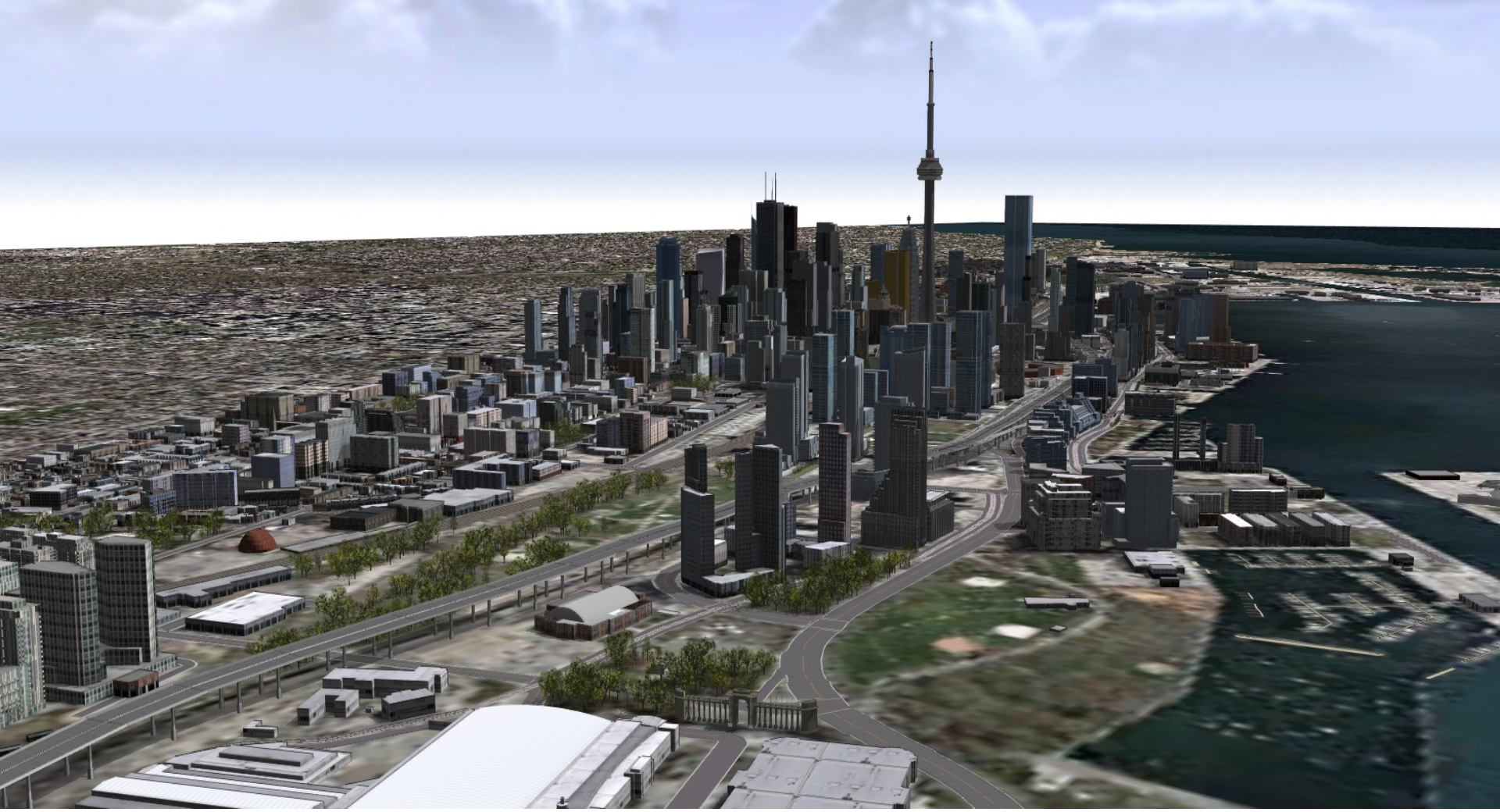


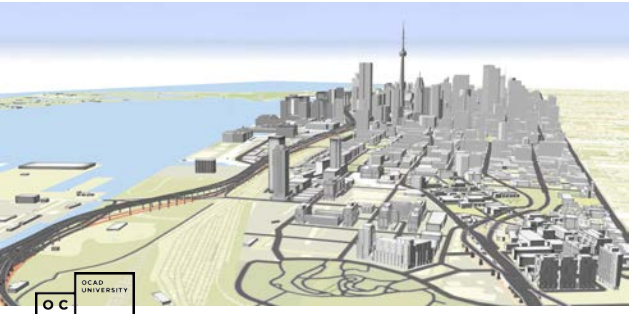
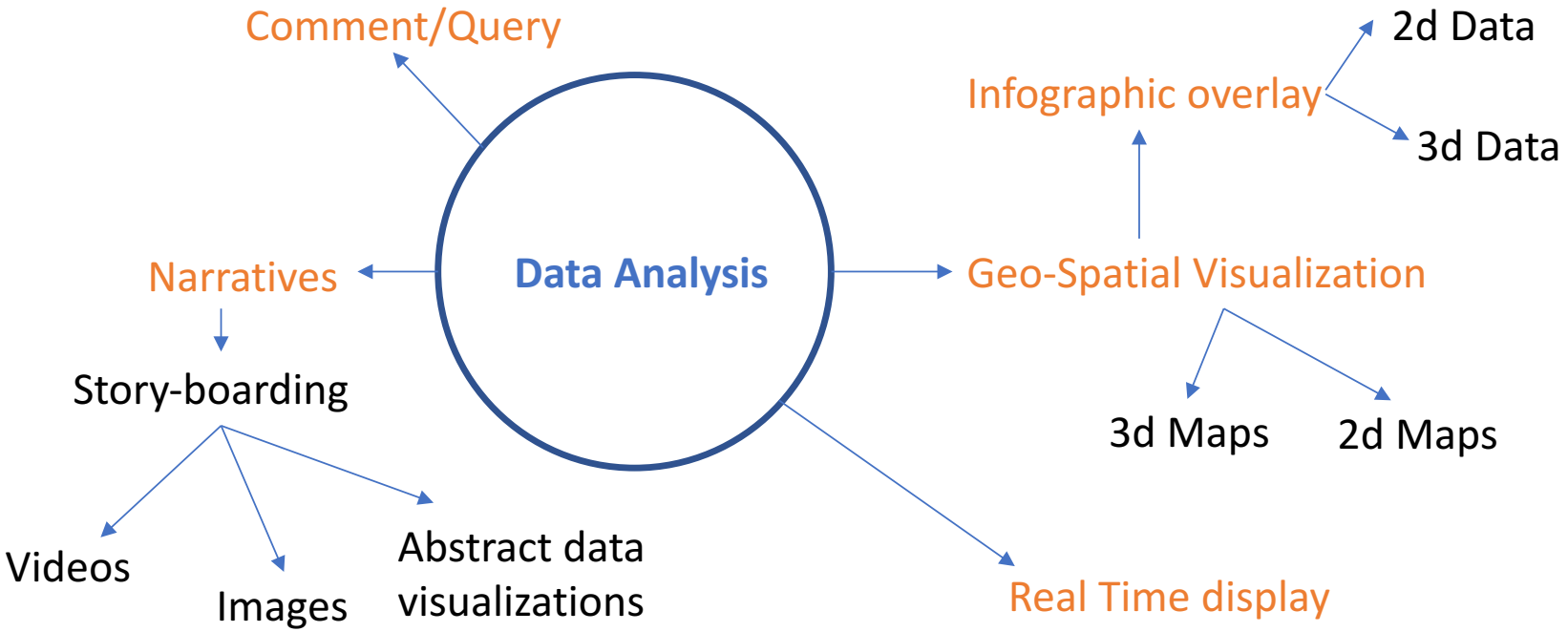


Image: iCity Waterfront Model, Esri CityEngine, Carl Skelton, Michael Carnevale, iCity Team

2. User-Stories and Data Analysis

Software -Story Facets, ESRI, IBM Watson Analytics, IBM Cognos



Visualization Prototype for Data Analysis interface

Image: iCity User Stories, iCity Team

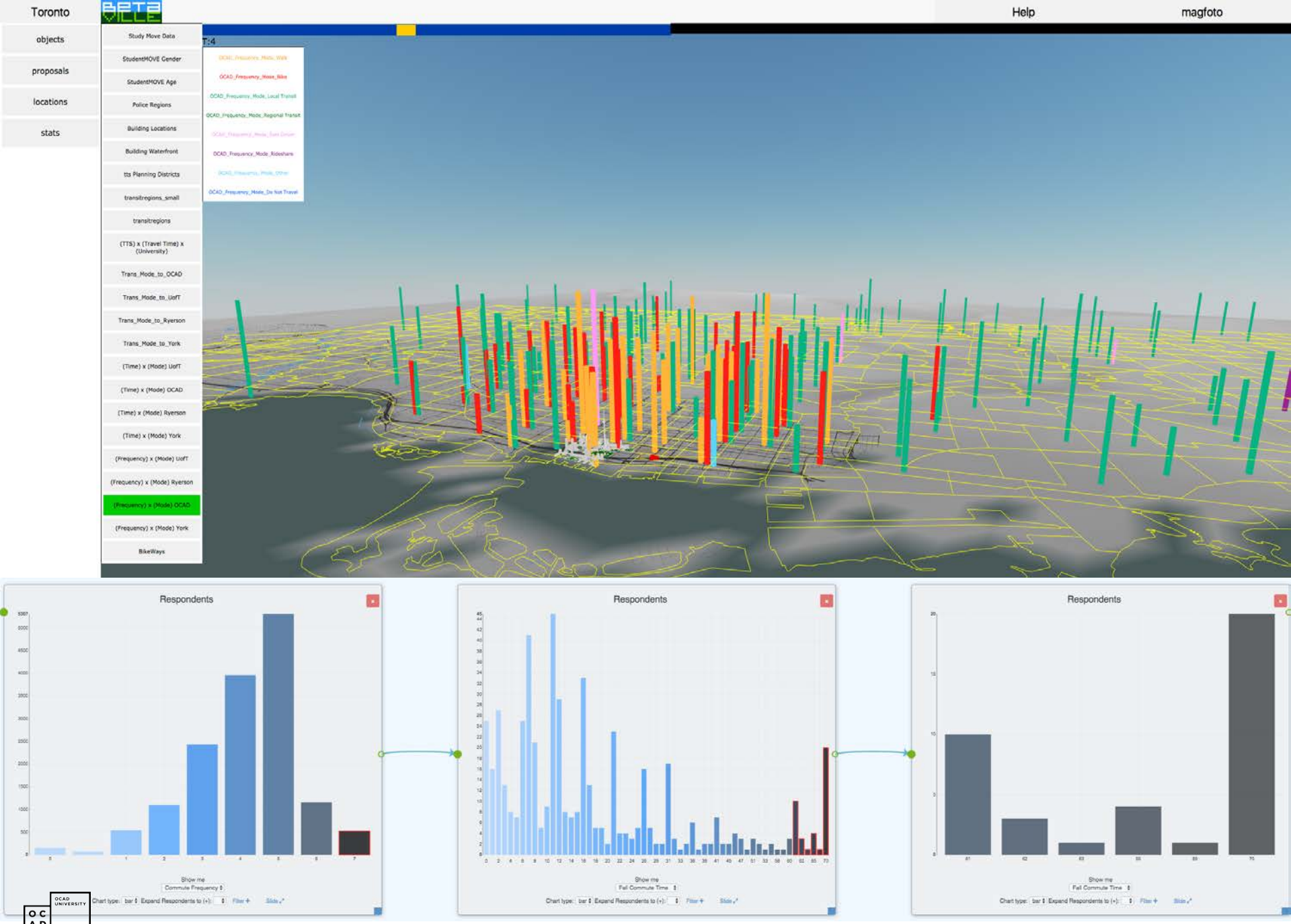
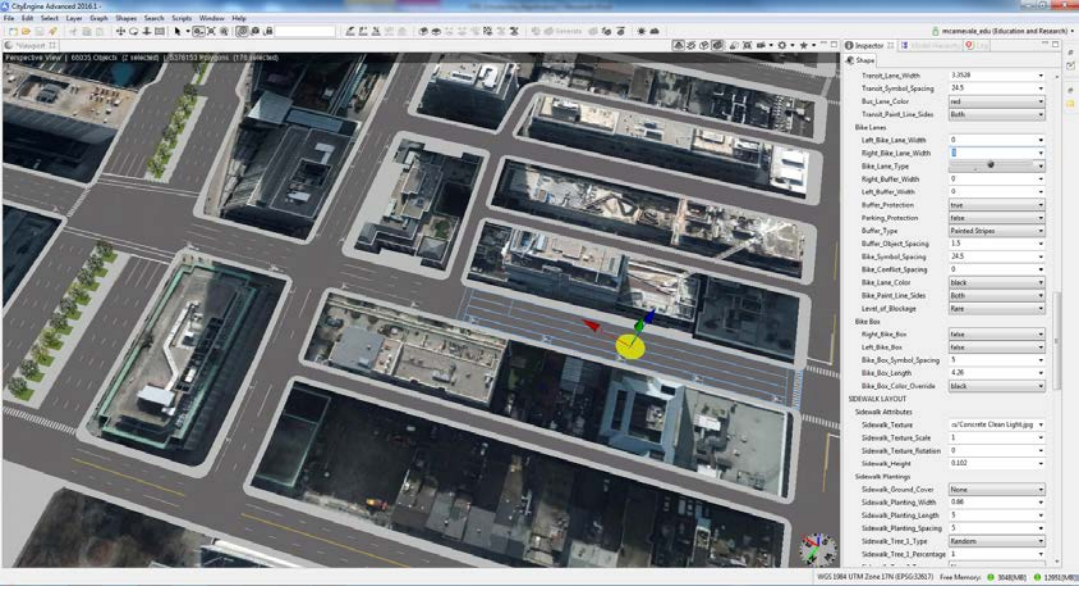
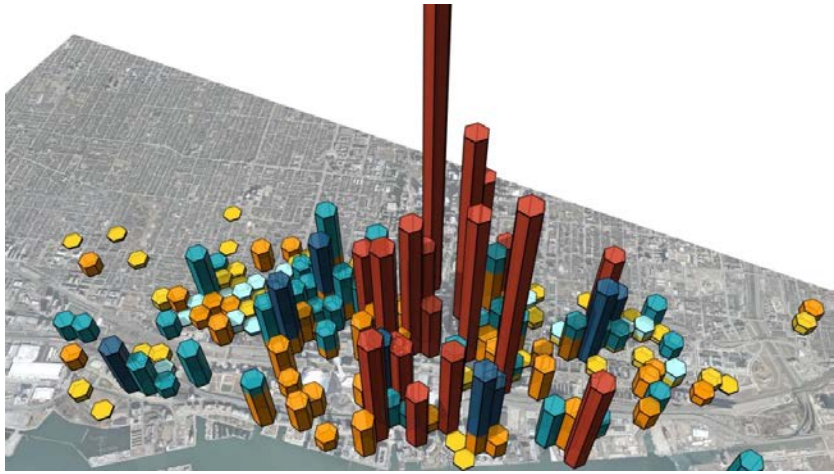
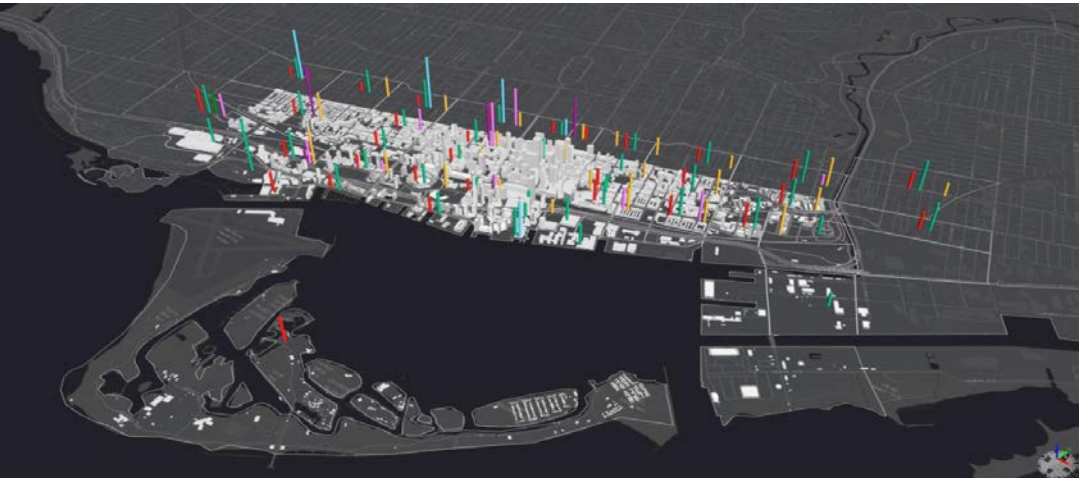


Image: iCity Geo-visualization using Betaville, 2d Analysis using StoryFacets; Davidson Zheng, Michael Carnevale, iCity Team

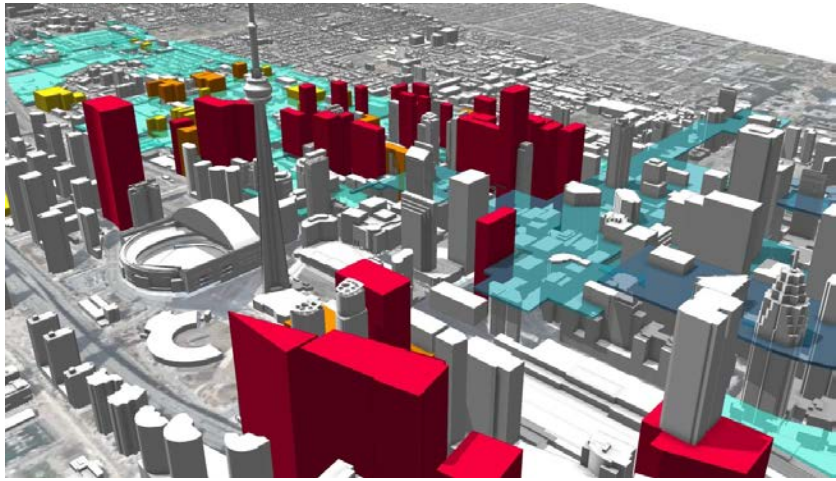




Registered parking availability by type and location



Travel modes and times to UofT



Building development height restrictions by zone

3d infographics overlay on 3d Map of the City of Toronto

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Image: iCity Esri CityEngine, and Betaville Model; Michael Carnevale, iCity Team

Integrated Data Analysis and Geo-visualization Mapping

Image: iCity Analytics; *Michael Carnevale, Carl Skelton, Marcus Gordon,* iCity Team

iCity as a Case Study Next Steps

Developing and Testing further working-prototypes with selected users to meet their priorities as outlined.

Validation of Taxonomy with expert users and citizens, to broaden it's application.

Creation of integrated dashboards, that collect and allow analysis of real – time data, to provide enhanced decision support.

In this way **users** of the systems can help **designers,** In identifying requirements, and address fundamental matters of **quality**, **equity**, and **social values**, with perspectives rooted in the experience of urban systems

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Questions ?