

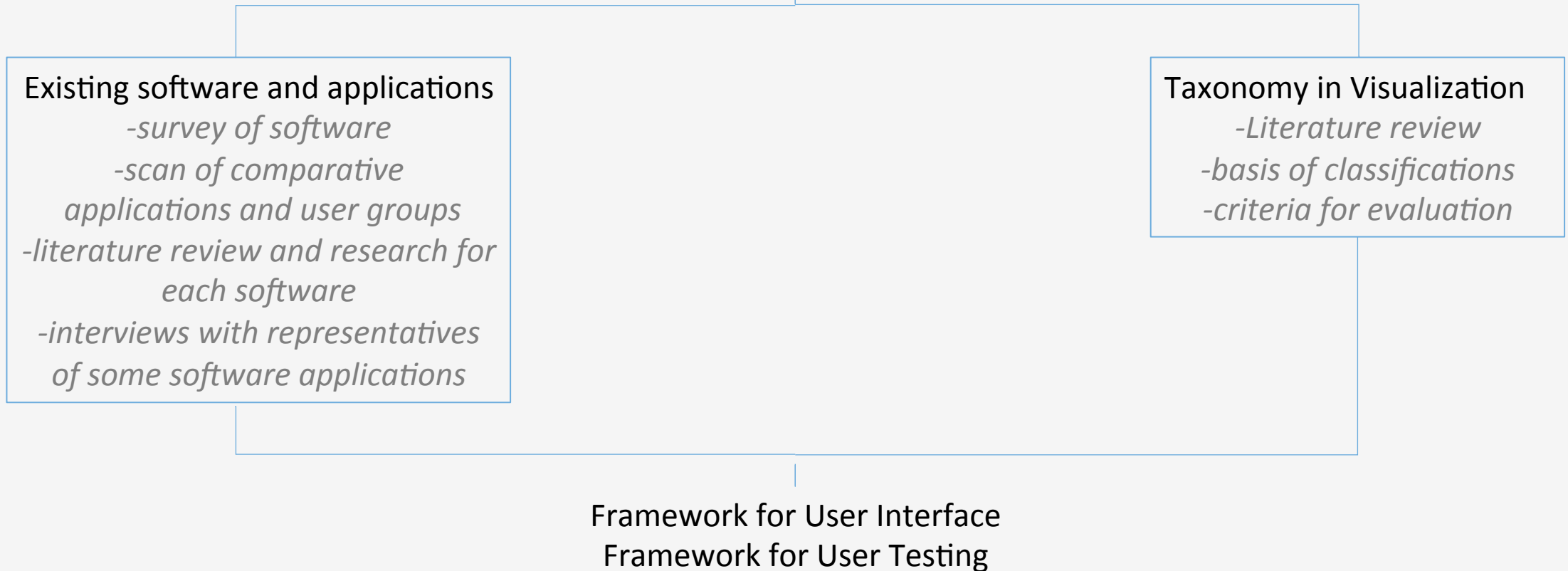


Comparative Methodology

iCity Theme 3.2; October 2016

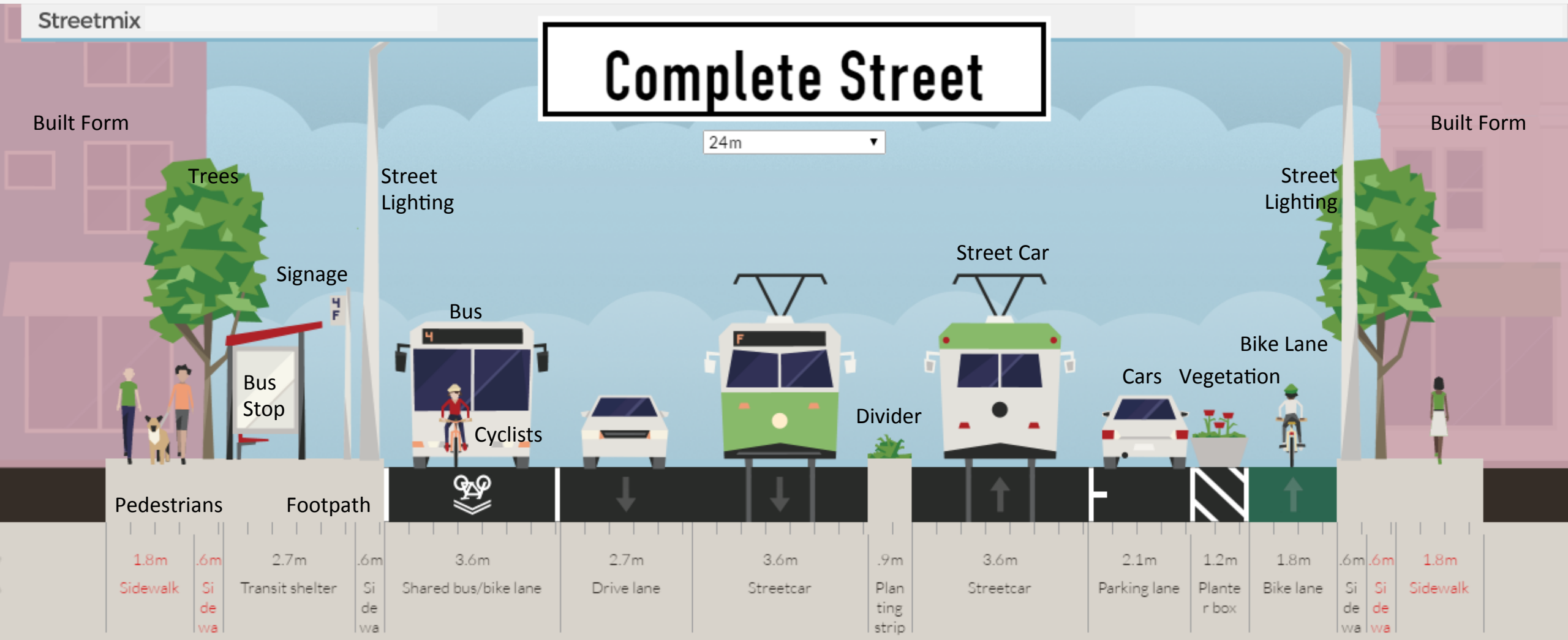
Comparative Methodology

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



Ontology

Showing the relations between the concepts and categories in a subject area or domain



Taxonomy

taxonomy is derived from Greek word “taxis”, meaning **‘arrangement or division’**, and “nomos”, meaning **‘law’**.

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





User tasks

- *Who are the different types of users?*
- *What are the various user tasks?*



Data representation

- *Data Attributes*
- *Data representations*



User tasks

- *Who are the different types of users?*
- *What are the various user tasks?*



Data representation

*Data attributes
Data representation types*



Interaction

*Types of Interactions
Quality of interactions
(engagement)*



User tasks

*Who are the different types of users?
What are the various user tasks?*

Quality of Interaction

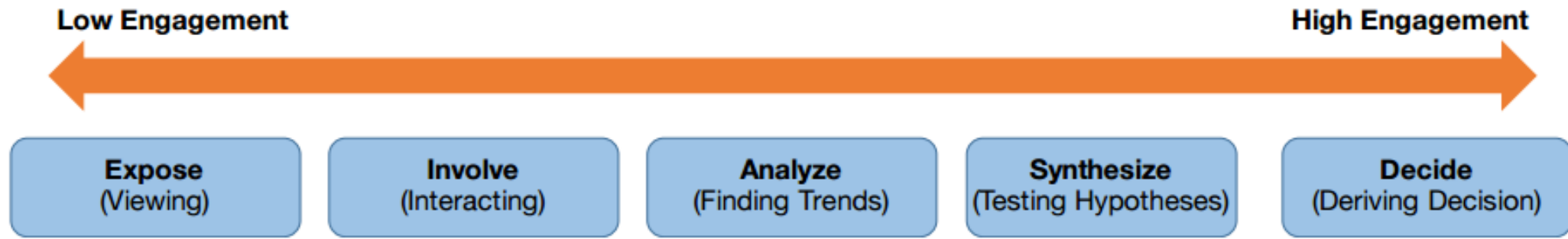


Figure 1: The degree of user engagement with visualizations (adopted from Bloom's digital taxonomy [1]). The degree of engagement increases from left to right as user performs higher-level cognitive tasks such as synthesizing information, and making final decisions.

Guiding questions:

Who are the users / user groups?

What are the software and applications being used?

What kind of tasks do these software facilitate?

Type of interaction with the software?

What is the level of engagement achieved?

Data input formats and output format?

Data attributes and Data representation types?

Software Application Categories

User - Centric

*Navigation
Route Mapping
User Generated Data
Social Media Use*

Transportation

*Traffic Movement
Parking Management*

Urban Design: Built Environment, -

*Neighborhood Planning
Complete Streets*

Big 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

Comparative Methodology

↓ Software Categories

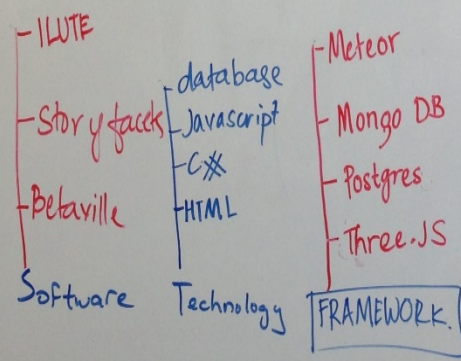
Questions →

	Description	Who are the Users?	What are the User Tasks being accomplished?	Type of Interaction	Level of Engagement	Data Visualization	Data Attributes	Data Formats Input/ Output
User - Centric Visualization								
Transportation								
Urban Design								
Big Data Analysis								
Land Use								
Simulation/ Interactions/ Games								
Infrastructure Management								
Mapping								

CITY COMPARATIVE METHODOLOGY

SCHEMA

- demographic
- land use
- transport
- Presentation
- Exploration & **analysis**
- Quantitative
- Qualitative
- Geo data
- Build environment
- Urban System Applications



- Description**
- slideshow
 - dash-board
 - overviews
 - interaction
 - Visual history
 - Exploration
 - Participatory
 - open source
 - Multi-environment

- User Type**
- **govt?**
 - surveyors
 - cartographers
 - computer scientists
 - citizen
 - analyst
 - engineer
 - technician
 - architect
 - planner
 - designer

- **micro-simulation**
- **decision support** ← ?
- collaboration (chat)
- History
- Collaboration: (work environment)
- Comment / query (?)
- proposal (define)
- **simulation**
- Analysis
- Exploration
- search
- visualization
- navigation
- modelling
- Task (High level)

- **decide (deriving decision)** ?
- **Synthesis (testing hypothesis)** ?
- analyse (finding trends)
- involve (interact)
- **Expose (view)**
- Engagement level

- Dimension**
- Compare
 - Brushing → (time, distance)
 - measure → (move)
 - transform → (scale, rotate)
 - annotate
 - selection
 - linking
 - pivot
 - filter
 - zoom
 - pan
 - scroll
 - walk / flythrough
 - orbit
 - Interaction (Low-level task)

- gather-plot
- mark-up language
- geo data
- 3d scatter plot
- 3d pie-chart
- 3d Bar Chart
- Data-Viz

- Data Attributes**
- image
 - video
 - audio
 - provenance
 - interval
 - categorical
 - geometry
 - dynamic
 - periodic
 - geo-spatial
 - text
 - ordinal
 - **Nominal** ?

- Open/Private**
- Agnostic
 - private
 - open
 - **Data-Sure**

- Data Format**
- **XTMF**
 - tabular
 - markup
 - 2d model
 - .CSV
 - .JSON
 - .OBJ
 - .SQL
 - .DAE
 - File Format

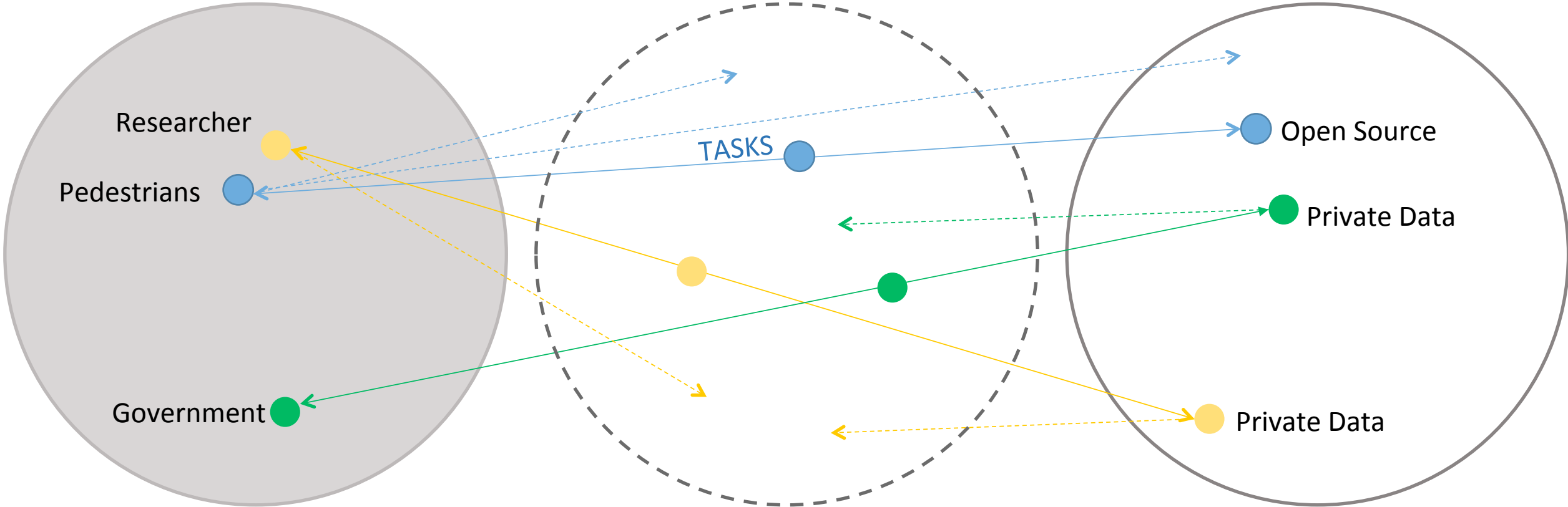
Application	Software	Technology /	Description / application	User Type	Tasks (High Level)	Engagement Level	Interactions (Low)	Data Visualization	Data Attributes	Open / Private	Data Format (input)	File Format	Link
Built environment, geodata	Beatville	HTML / WebGL ThreeJS, Pavement and Park GIS	an open-source multiplayer environment for real cities, in which ideas for new parks and development can be shared, discussed, tweaked, and brought to maturity in context, and with the kind of broad participation people take for granted in open-source software development.	designer, planner, architect, technician, transportation engineer, citizen	modelling, navigation, visualization, research (explanation, analysis (geometrical)), simulation, comment / query, multi-user collaboration (chat,	explore (viewing) involve (interacting) analyze (finding trends) synthesize (testing hypothesis) Decide (Deriving decisions)	Orbit, Walk/fly- through, pan, scroll, Zoom, Filter, pivot, linking, select, annotate, transform (move, scale, rotate), measure, (annotate measurement?)	3d Bar chart, 3d Pie chart, 3d Scatter Plot, Geo-Data	Nominal, ordinal, text, geospatial, periodic, dynamic, geometry	Agnatic	3D model, Markup	.DAE, SQL, OBJ, JSON,	https://236.1511/public
Qualitative and Quantitative Data Explanation and Analysis and Presentation Tool	StoryFacets	HTML, Javascript, D3 framework, Meteor, MongoDB	Explore data through interaction, virtual history, presentation, generate consumable overview, high level research browser, visualization dashboard, visualization, slide show,	technician, transportation engineer, citizen, Business analyst	dataset/media asset navigation, dataset visualization, dataset history visualization, decision support	explore (viewing, learning and viewing) involve (interacting) analyze (finding trends) synthesize (testing hypothesis) Decide (Deriving decisions),	zooming in/out, brushing and linking, scrolling, panning, filter, pivot, compare	Bar chart, Pie chart, Gather plot, Markup language	Categorical, Ordinal, Interval, Prevalence, audio, video, text, image	Agnatic	Tabular, Markup	CSV (Comma Separated Value), Markdown	http://storyfacets.tech.hertkings.com
Transport, land use, demographic	ILUTE (configuration)	.net, .xml, .xmf	agent (person, business)-based micro-simulation multi-year (over the course of year, scenario)	Planner, Researcher	Land use scenario forecasting (yearly currently) (similar to continuous simulation for multi years)	Planner: Interact, text hypothesis Researcher: model development or submodel development.	microsimulation	(binary matrix) Binary format (.mtx) files, Excel (tabular data) Csv data	relationships, all facets, concurrent transportation network (infrastructure characteristics, formal logic: based on model for eq. Marriage rate, birth	Private	Input: csv, mtx Output: Csv, mtx (origin-destination information)	?	https://github.com/TravelModellingGroup/ILUTE
Map & Survey, property data	ESRI / ArcGIS	Web	ArcGIS Solutions for Urban & Regional Planning, Spatial analysis, data management and mapping, Integrated collection of GIS software products; provides standard-based platform for spatial analysis, data management, and mapping, Esri / ArcGIS	cartographer, surveyor, designer, architect, engineer, planner with specialized training	geodata curation and display, consultation, concept development, visualization	explore (viewing) involve (interacting) analyze (finding trends) synthesize (testing hypothesis) Decide (Deriving decisions)	high level - interactive digital map with on/off information layer switching, call-out boxes, KML and GML support	multi- dimensional	variable; typically, topo and basic mapping model can be derived from geodata and property data	city of Toronto open data GIS repository actual data quality/comprehen siveness/relevance may be a research question	JSON, CSV, SHP, XML	http://www.esri.com/software/arcgis	
Map & Survey, property data	ESRI CityEngine	WebGL	Map and survey, property data, ARC GIS Pro 1.4, generative design of cities	AEC, cartographer, surveyor, designer, architect, engineer, planner with specialized training	planning, simulation, modelling, visualization	explore (viewing) involve (interacting) analyze (finding trends) synthesize (testing hypothesis) Decide (Deriving decisions)	high level - "smart model" Procedural modelling	multi- dimensional	variable; typically, topo and basic mapping model can be derived from geodata and property data	Mapping model	All 3d model formats	http://www.esri.com/software/arcgis	
IT infrastructure for city service delivery	IBM IoT		IT infrastructure for city service delivery - IBM® Intelligent Transportation software provides citywide traffic management, traffic prediction, transit analytics and transportation operation capabilities. It delivers advanced analytics and planning tools for operational decision support that can improve traffic management.	transportation engineer, technician	operation, planning		interactive map, infographic dashboard?		N/A				http://www-03.ibm.com/transportation

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

USERS

TASK FUNCTIONALITIES

DATA



USERS

TASK FUNCTIONALITIES

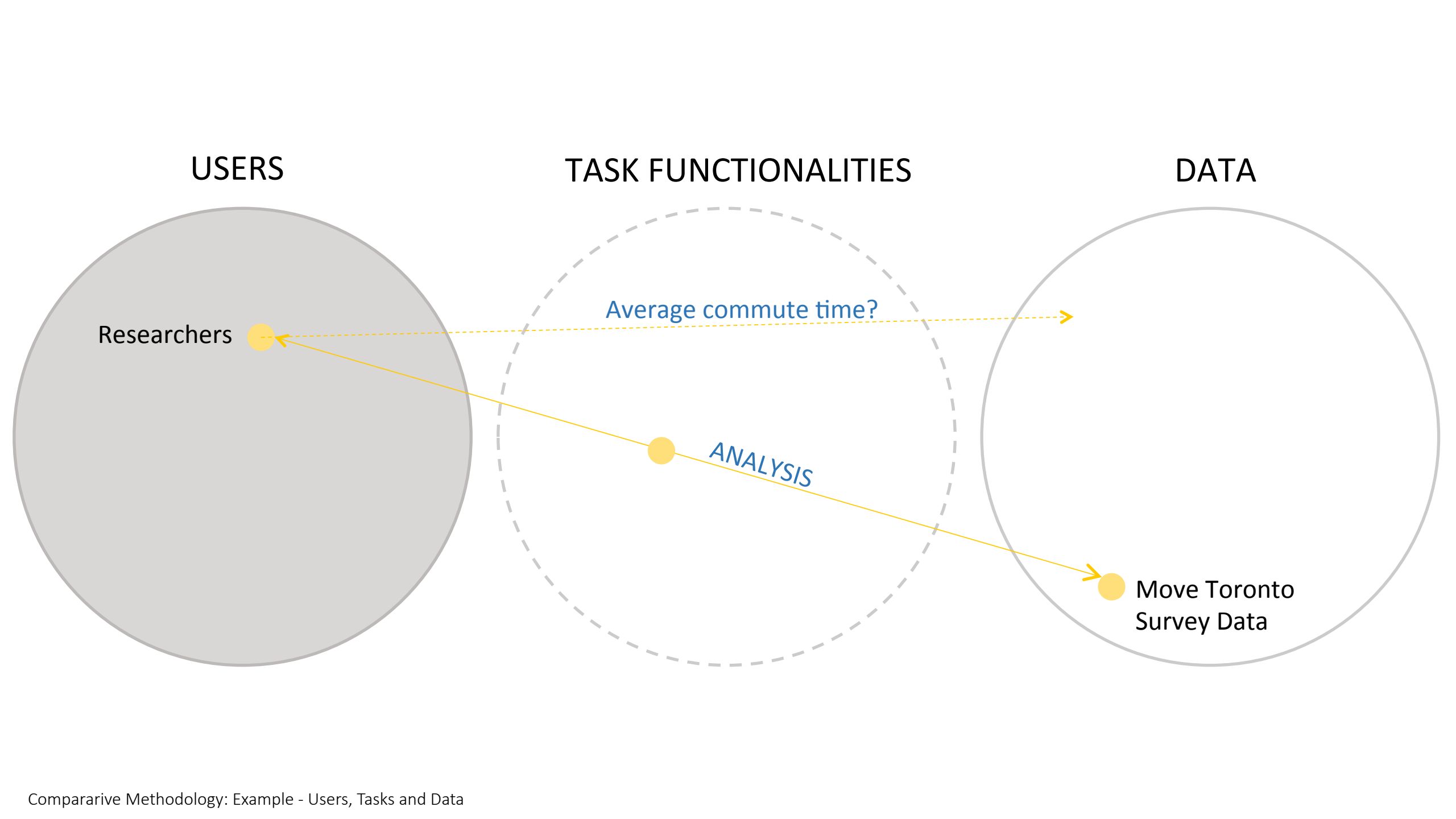
DATA

Researchers

Average commute time?

ANALYSIS

Move Toronto
Survey Data



USERS:

COMP. SCIENTISTS
TRANSPORTATION
PLANNERS / ENGINEERS
MUNICIPAL PLANNERS
TTC - TRANSIT OPERATIONS
SIGNAL + INFRASTRUCTURE
PLANNERS

UNIVERSITY PLANNERS
ARCHITECTS + ENGINEERS
REAL ESTATE + COMMUNITY
PLANNERS

MAPS + PROPERTY DATA
BUSINESS ANALYSTS
DESIGNERS, ARCHTS, ARCH
TECH TOWN. ENR. et al

TRANSP. TECH. + ENGINEERS
OPERATIONS / PLANNING

expose, observe, analyze, predict, compare
SYNTHESIS, HYPOTHESES
LUTE MODEL
microsimulation

expose, observe, utilize, analyze, compare
SYNTHESIS, HYPOTHESES
Epi / city engine

expose, observe, utilize, analyze, interact, compare
STORY FACTS
MEAN ASSET NAV. HIST + ANALYZE
Vehonnav

modeling, navigation, utilization, search, expansion
BETAVILLE
EASH / construction

LOT (EASH)

CITIZENS /
communities

XTMIF

JSON
CSV SHP
XML

CSV

3D
models
Markup

DATA

ROAD NETWORK
TTC ROUTES
PRIVATE VEHICLE STATS
TRANSIT VEHICLE DATA
PEOPLE / VEHICLE
TRIP INFORMATION
OCCUPANT + AGE
STOP / TTC / LOCATION

BLDG. TYPE / CATEGORY
BLDG HEIGHT
BLDG USES / LANDUSE
MARKING MODELS

(charts, gather plots
markup language)

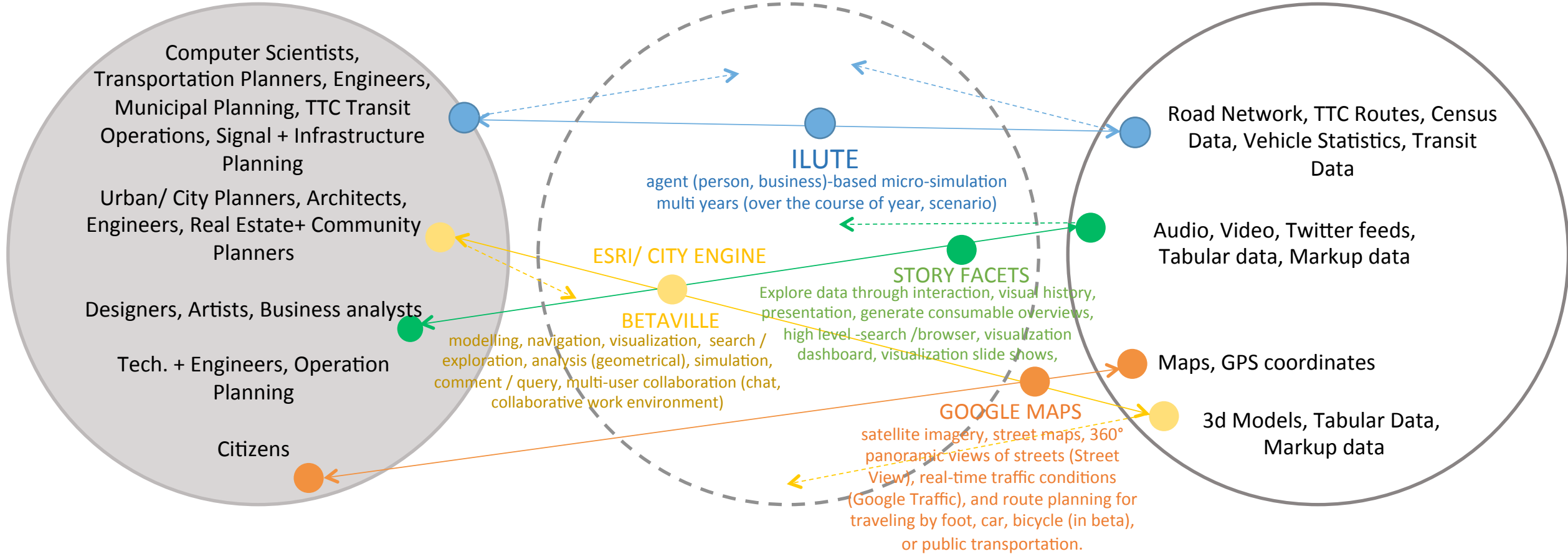
(ALL ABOVE)

TTC - signals + overhead
parking data / avail.


USERS

TASK FUNCTIONALITIES

DATA

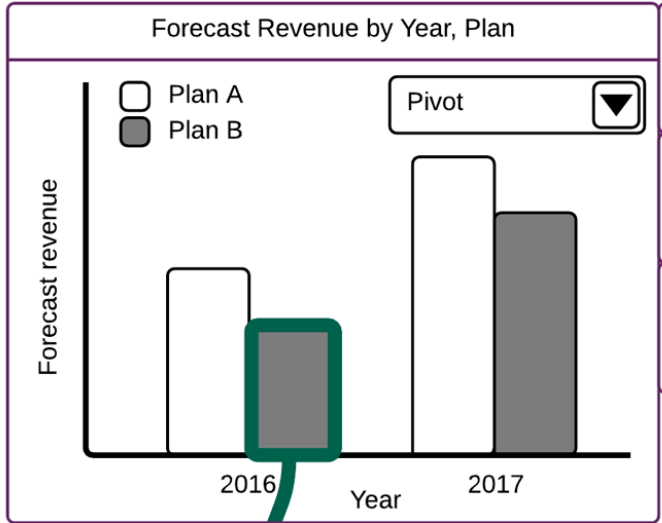



Controls


Chart Type 


- Choropleth map
- Globe
- Node-link
- Matrix
- Parallel coordinate
- Bar**
- Scatter
- GatherPlot
- Tag cloud

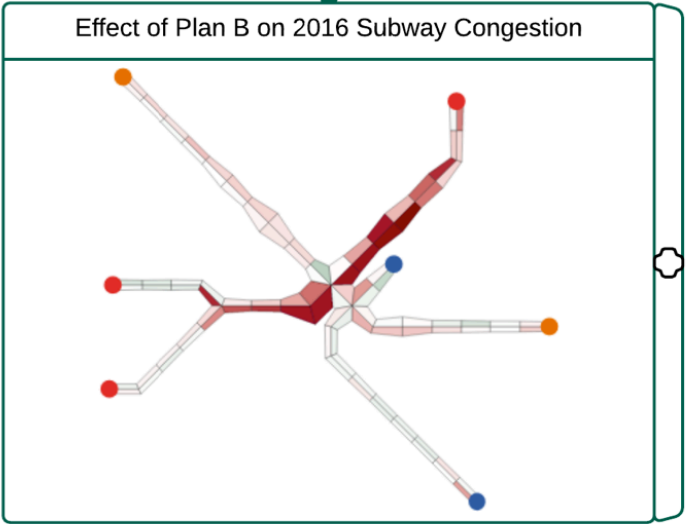
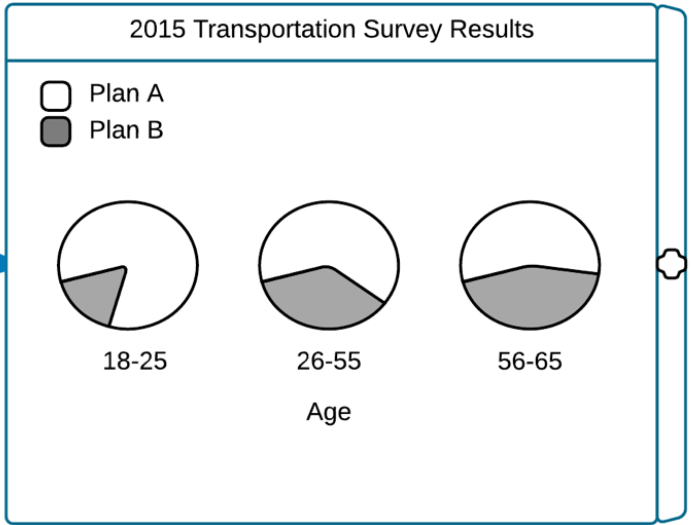
■ ■ ■



 Both plans are good, but the revenue forecast for Plan A is much better!

 Check out the latest survey results.

 Plan B has less revenue, but look what lack of repair can do to our city!



Concrete Falls off Interstate 80 Overpass

45 seconds left

Getting Answers IN WEST SACRAMENTO

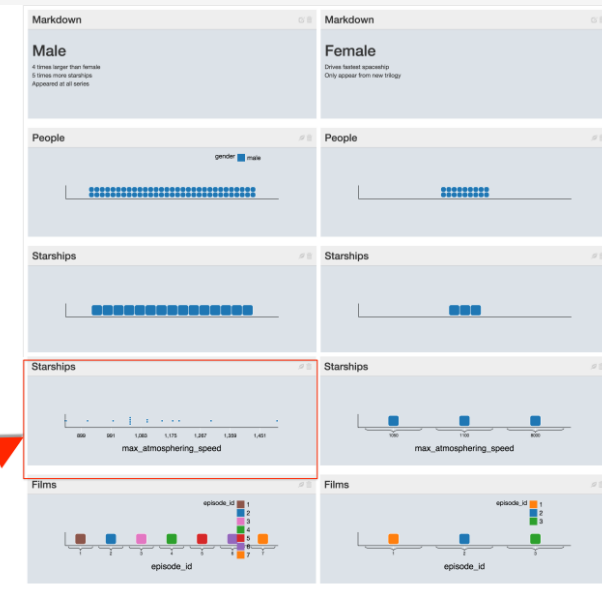
Concrete Chunks Fall from Overpass

New Card

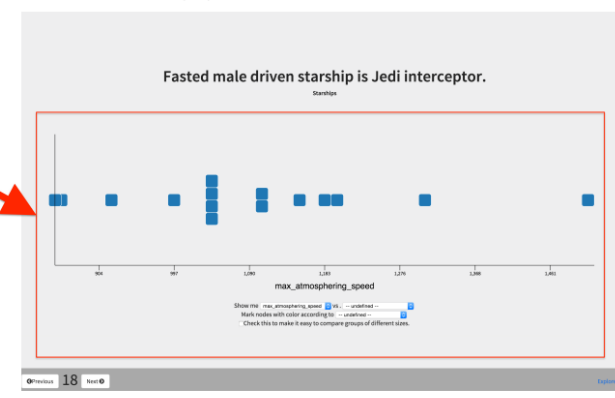
Add Data/Content



(a) Trail view



(b) Dashboard view



(c) Slideshow view

Conclusions:

1. Broader Scan of (Existing and Needed) Applications
2. Better Understanding of :
 - User Groups
 - User Tasks
 - Existing Data Types and Required Data-sets
3. Build a common understanding of various terminologies and concepts amongst our team
4. Identify overlaps in each of the above categories to help us refine the framework for the user-interface / dashboard
5. Along with the framework for interface, this also helped us refine our frame-work for User-testing.

Next Steps:

Joint workshops with each team to help refine the content and refine framework for user-interface.

Questions for further research:

How to accommodate users, task functionality, and data types to enhance user experience?

Do specific users need specific functionality?

What are the guidelines around privacy, accessibility of levels of information, and task functionality by users?

Glossary

Term	Meaning
Walk-through	Human eye level
Flythrough	Birds eye view
Ontology	Epistemology
Taxonomy	Laws of Classifications
Geospatial	Relating to or denoting data that is associated with a particular location.
Taxonomy	Classification
Methodology	System of Methods
Ontology	Epistemology
Navigation	Following a route
Representation	Rendition, Portrayal, Depiction
Visualization	Generating visual mental imagery
Micro-simulation	Imitating details?
Simulation	Imitation
Dimensions	Measurable extent
Attributes	Aspect or feature
Expose	View
Involve	Interact ing
Analyze	Finding trends
Synthesis	Testing hypothesis
Decide	Deriving decisions
Urban system	Systems related to cities
Application	Mobile Application
Software	For Desktop
User Type	Client, Operator, Customer
Task	Job, Purpose
Engagement Level	Interaction level
Data Format	Input Data
File Format	Output Data
Data	Information, Text, Media

Acronyms

Term	Vocabulary of acronym / description
General	
Mapping	
Open GL	Open Geographic Landscape?
GIS	Geographic Information System
GPS	Global Positioning System
Transportation	
OTN	Ontology for Transportation
ILUTE	Integrated Landuse Transportation E
XTMF	Xtensible travelling modelling framework
TMC	Traffic Management Centres
CCTV	Closed Circuit Television
ATIS	Advanced Traveller Information System
ATMS	Advanced Traveller Management System
ATTL	Advanced Transportation Technology Laboratory
AVL	Automatic Vehicle Location
DEM	Digital Elevation Models
TSP	Transit Signal Priority
Complete Streets	
VKT	Vehicle KM Travelled
LOS	Level of Service (urban street)
IVA	Intelligent Visual Analytics (urban street)

Comparative Methodology

A	B	C	D	E	F	G	H	I	J	K	L	M
Type of Urban System Application	Software	Technology / Platform	Description / application	User Type	Tasks (High Level)	Engagement Level	Interaction (Low level)	Data Visualization	Data Attributes	Open / Private Data Source	Data Format (input)	File Format
Selected Toolset / Methods												
Built environment, geodata	Betaville	HTML / WebGL ThreeJS, Postgres and Post GIS	an open-source multiplayer environment for real cities, in which ideas for new works of public art, architecture, urban design, and development can be shared, discussed, tweaked, and brought to maturity in context, and with the kind of broad participation people take for granted in open source software development.	designer, planners, architects, technicians, transportation engineers, citizens	modelling, navigation, visualization, search /exploration, analysis (geometrical), simulation, comment / query, multi-user collaboration (chat, collaborative work	expose (viewing) involve (interacting) analyze (finding trends) synthesis (testing hypothesis) Decide (Deriving decisions)	Orbit, Walk/ fly-through, pan, scroll, Zoom, Filter, pivot, linking, select, annotate, transform (move, scale, rotate), measure, (annotate measurement?)	3d Bar charts, 3d Pie chart, 3d Scatter Plot, Geo-Data	Nominal, ordinal, text, geo-spatial, periodic, dynamic, geometry	Agnostic	3D models, Markup	DAE, SQL, OBJ, JSON,
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),	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 Separated Values), Markdown
Transport, land use, demographics	ILUTE (configuration	.net, xtmf	agent (person, business)-based micro-simulation multiyears (over the course of year, scenario)	Planners, Researchers	Land use scenario forecasting (yearly currently) (aim is to continuous simulation for multi years)	Planner: Interact , test hypothesis Researcher: model development or submodel development.	microsimulation	(binary matrix) Binary format (mtx) files, Excel (tabular data) Csv data	relationships, all facets, census+transportation network+(information about business characteristics, formological: based on model for eg. Marriage rate, birth rate, etc)	Private	Input: csv, mtx; Output: Csv, mtx; (origin-destination information)	? https://github.com/TravelModellingGroup/ILUTE
	ESRI / ArcGIS	Web	ArcGIS Solutions for Urban & Regional Planning, Spatial analysis, data management and mapping,Integrated collection of GIS software products; provides a standards-based platform for spatial analysis, data management, and mapping, Esri / ArcGis	cartographers, surveyors, designer, architect, engineer, planners with specialized training	geodata curation and display, consultation, concept development, visualization	expose (viewing) involve (interact ing) analyze (finding trends) synthesis (testing hypothesis) Decide (Deriving decisions)		high level - interactive digital maps with on/off information layer switching, call-out boxes, KML and GML support	multi - dimensional	variable; typically, topo and basic massing models can be derived from geodata and property data	city of Toronto open data GIS repositories actual data quality/comprehensiveness/relevance may be a research question	JSON, CSV, SHP, XML
Maps & Surveys, property dat	ESRI CityEngine	WebGL	Maps and surveys, property data, ARC GIS Pro 1.4, generative design of cities	AEC, cartographers, surveyors,	planning, simulation, modelling, visualization	expose (viewing) involve (interact ing) analyze (finding trends)		high level -"smart models" Procedural modelling	multi - dimensional	variable; typically, topo and basic massing models can	Massing models	All 3d model formats

Toolsets Softwares

Glossary

Resources

Case studies



Go to Settings to activate Windows.

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