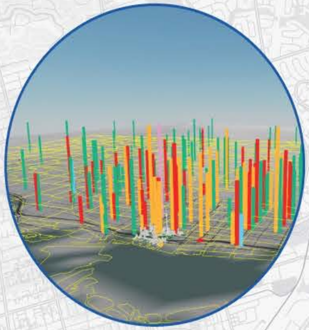
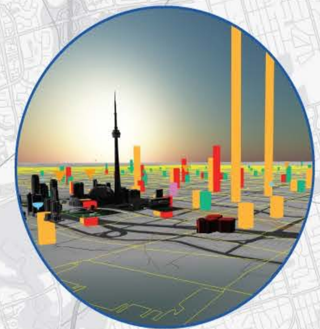
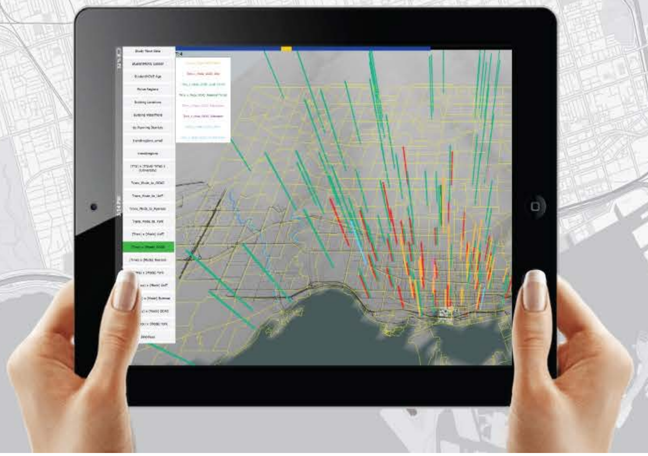


Comparative Methodology: Compara & Vizland

The iCity case study



Sara Diamond, Jeremy Bowes, Grice Mariano, Manpreet Juneja, Marcus Gordon, Carl Skelton, Manik Gunatilleke, Michael Carnevale, Minsheng Davidson Zheng

Visual Analytics Lab, OCAD University, Toronto, Canada

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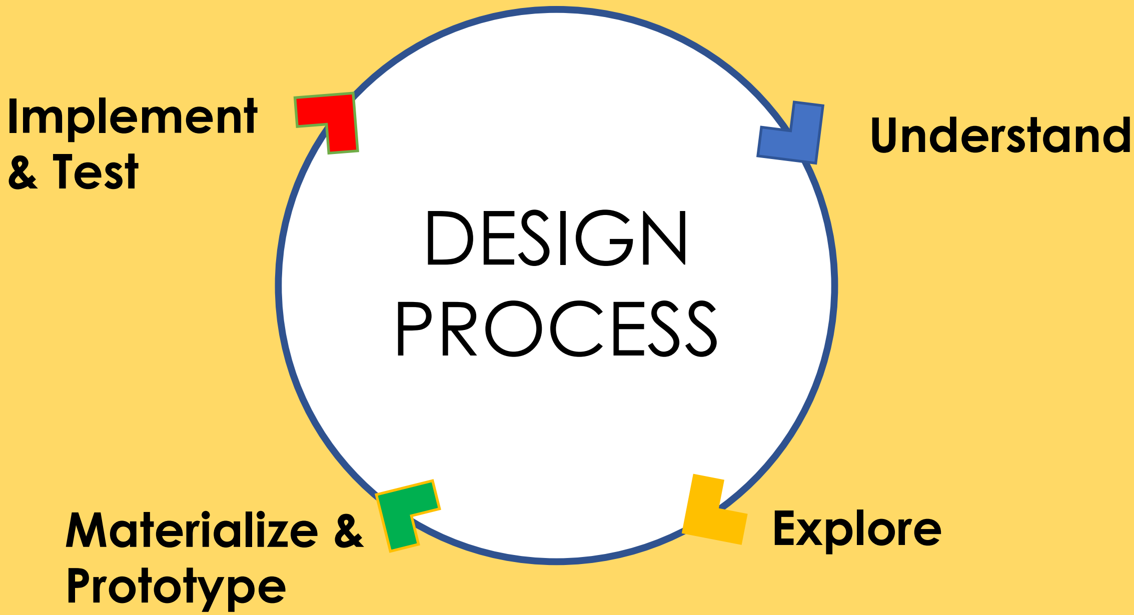
Image: iCity Visualization; ***ESRI cityengine, Betaville***, Carl Skelton, Marcus Gordon , Carnevalle, Manpreet Juneja

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

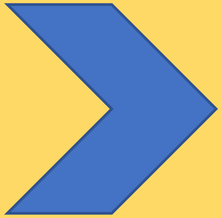
- Defining a taxonomy of visualizations can assist visualization system designers in understanding key visualization techniques that serve multiple user groups

Image: www.pexels.com

Thus, the challenge is to ensure diverse groups of users have **appropriate levels of accessibility** to data in usable forms, which in turn requires understanding the **visualization needs** of multiple user groups.



Research approach & process



- Literature Review / taxonomy
- **Comparative Methodology in Urban Transportation software applications, tools and methods**
- Expert Interviews

A well-developed taxonomy of visualization types can help designers understand which visualization techniques (or combinations of them) best serve the goals and needs of user and stakeholder groups.
(Chengzhi, 2013).

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

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

Use Domains: Software Application Categories

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

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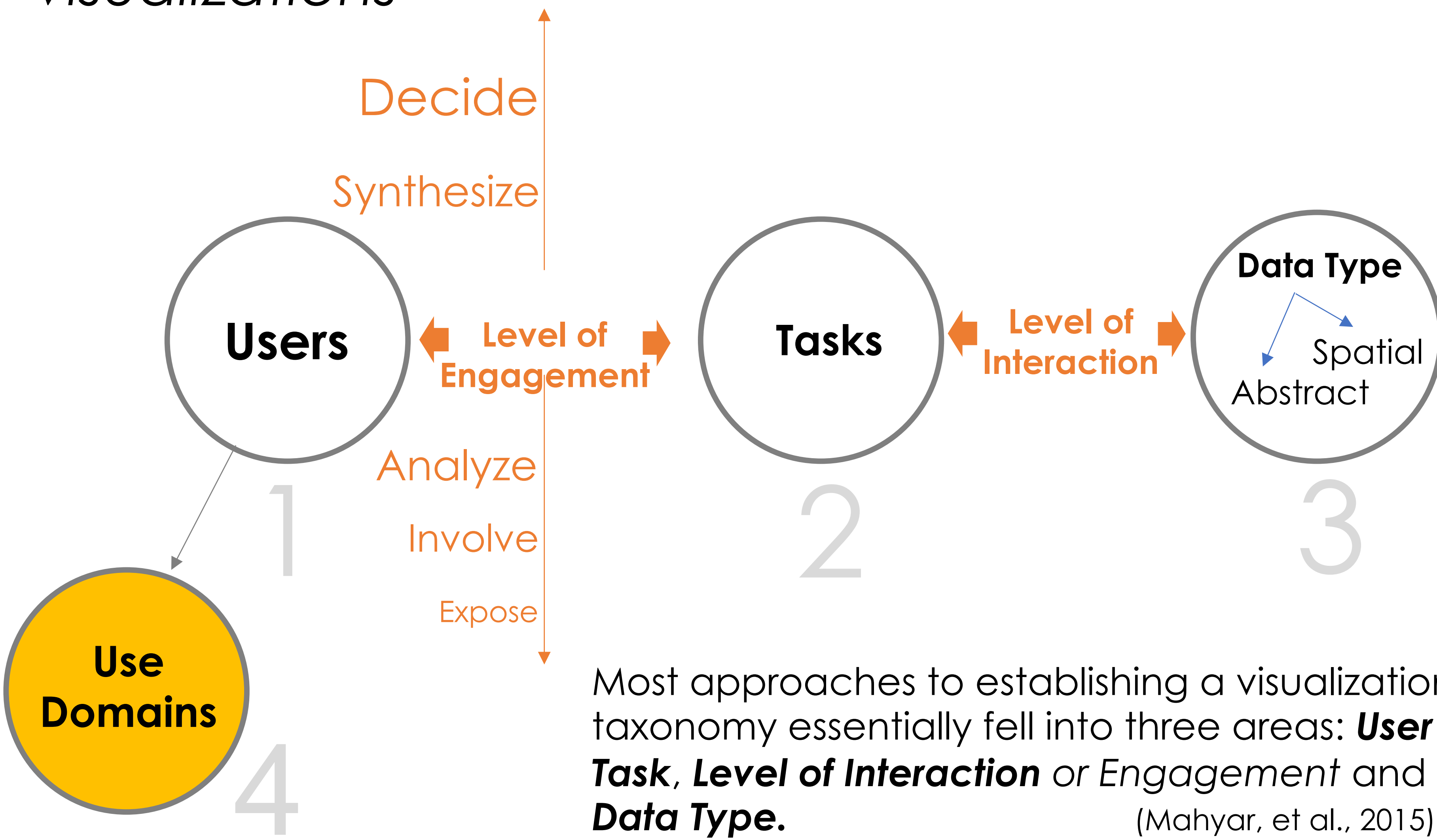
Image: Comparative Methodology, iCity process phases, Manpreet Juneja, Marcus Gordon, Jeremy Bowes

Taxonomy Sketch showing essential aspects of visualizations



Most approaches to establishing a visualization taxonomy essentially fell into three areas: ***User Task***, ***Level of Interaction*** *or Engagement* and ***Data Type.*** (Mahyar, et al., 2015)

Image: **Design Process**, iCity process phases, Manpreet Juneja

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

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

Most approaches to establishing a visualization taxonomy essentially fell into three areas: ***User Task***, ***Level of Interaction*** *or Engagement* and ***Data Type*** (Mahyar, et al., 2015).

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

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Research approach & process

Explore

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

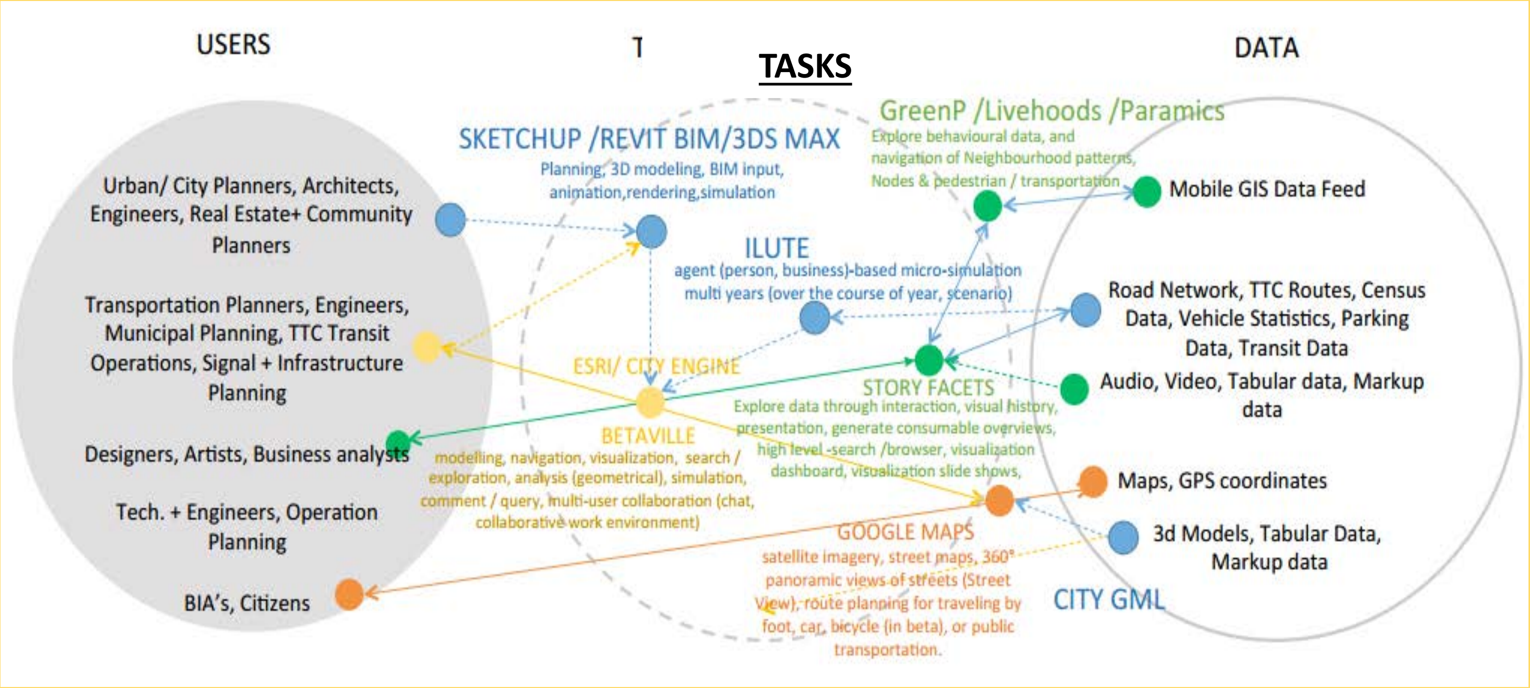


Image: iCity Visualization; Jeremy Bowes, Manpreet Juneja

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

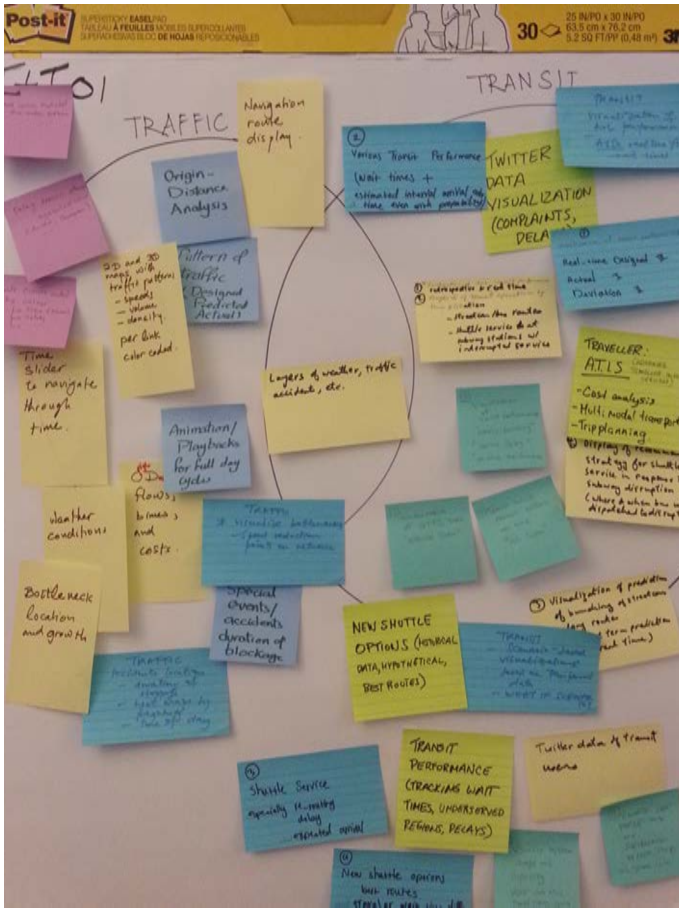
Improvements **How could the software / tool be changed to support the required tasks?**

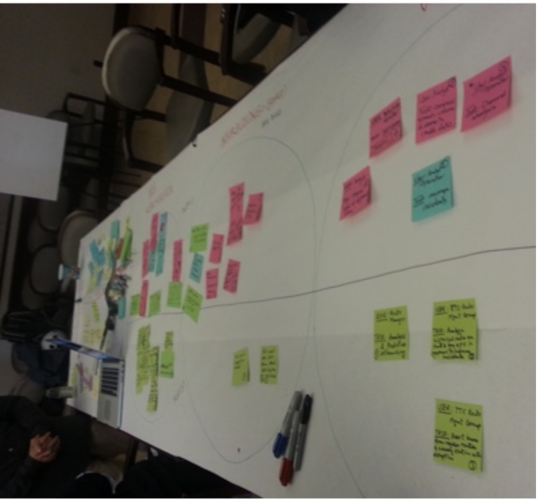
Real---time 3D infographics superimposed, 2D map, highlighted statistical charts, prep of visual narrative

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

Design Charrette

Test Taxonomy Sketch to
establish priorities to build interface prototypes





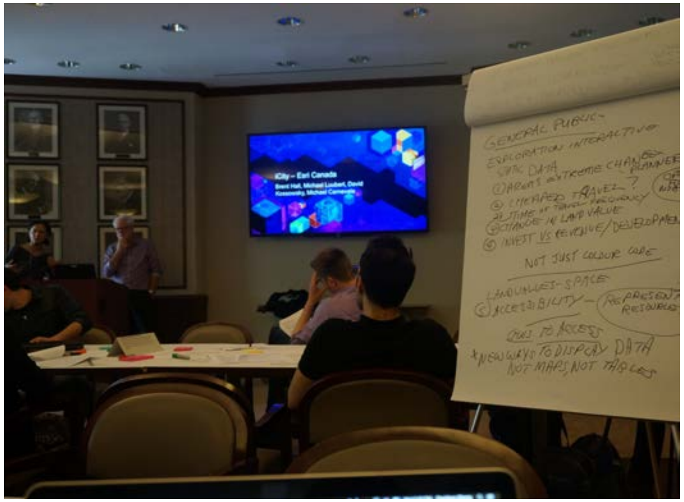


Image: Charrette Images, iCity process phases, iCity Team

Research approach & process

Materialize

- User-Centred Taxonomy for Urban Transportation Applications
- Applications and Visualization - – low fidelity prototype implementation

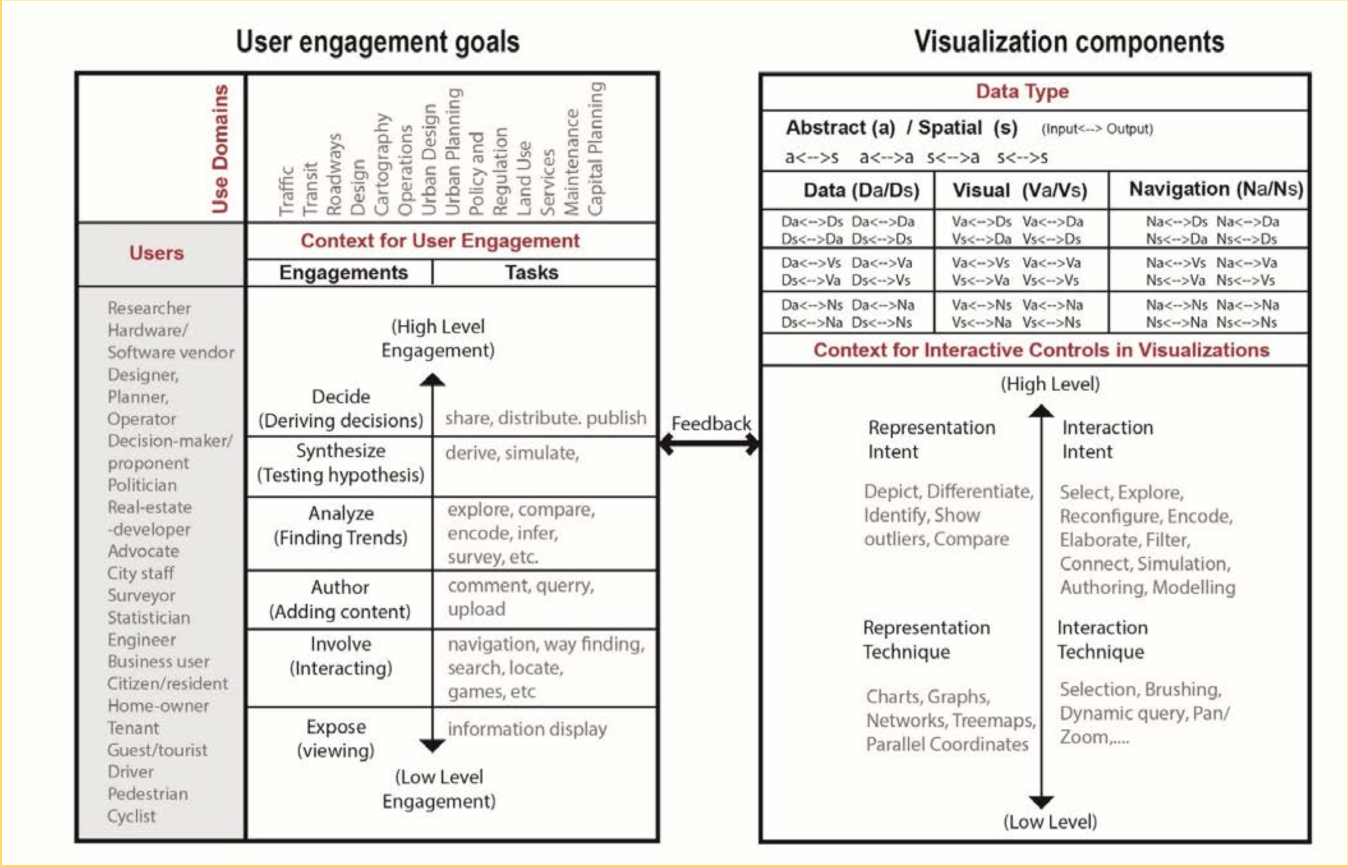


Image: Based on Pike (2009), Mahyar (2015) and Sorger (2015), iCity process phases, Taxonomy, iCity Team

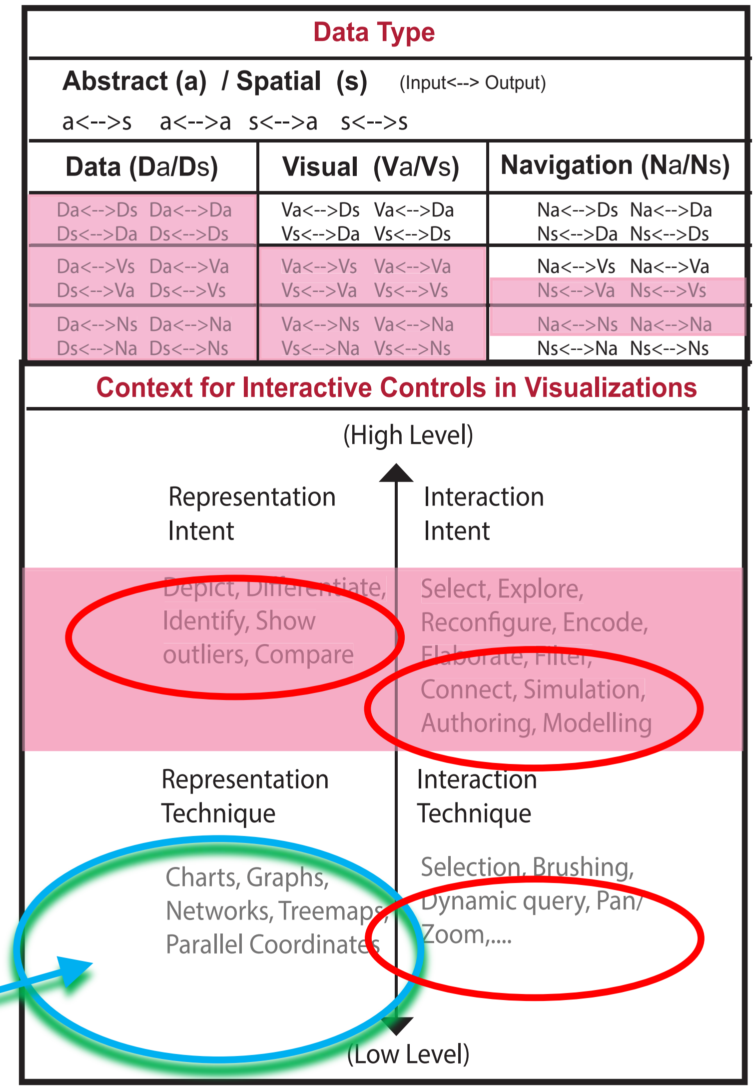
Use Case – the ***architectural technician***

- The technician's work in this use case involves **geospatial data**, (GIS) web, and graphic frameworks, making use of (a) abstract and (b) spatial data types.

- in this example, these include sheets, tables, maps and charts - both as input source & output target domains.

- *quantitative data sets of a neighborhood population, can be displayed as a table of data or a 3D geospatial plot to compare or simulate*

Visualization Components



Use Case Example's Interaction Model

Suggested Visual representation options are added here

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

USER CENTRED TAXONOMY
Use Case – the architectural technician

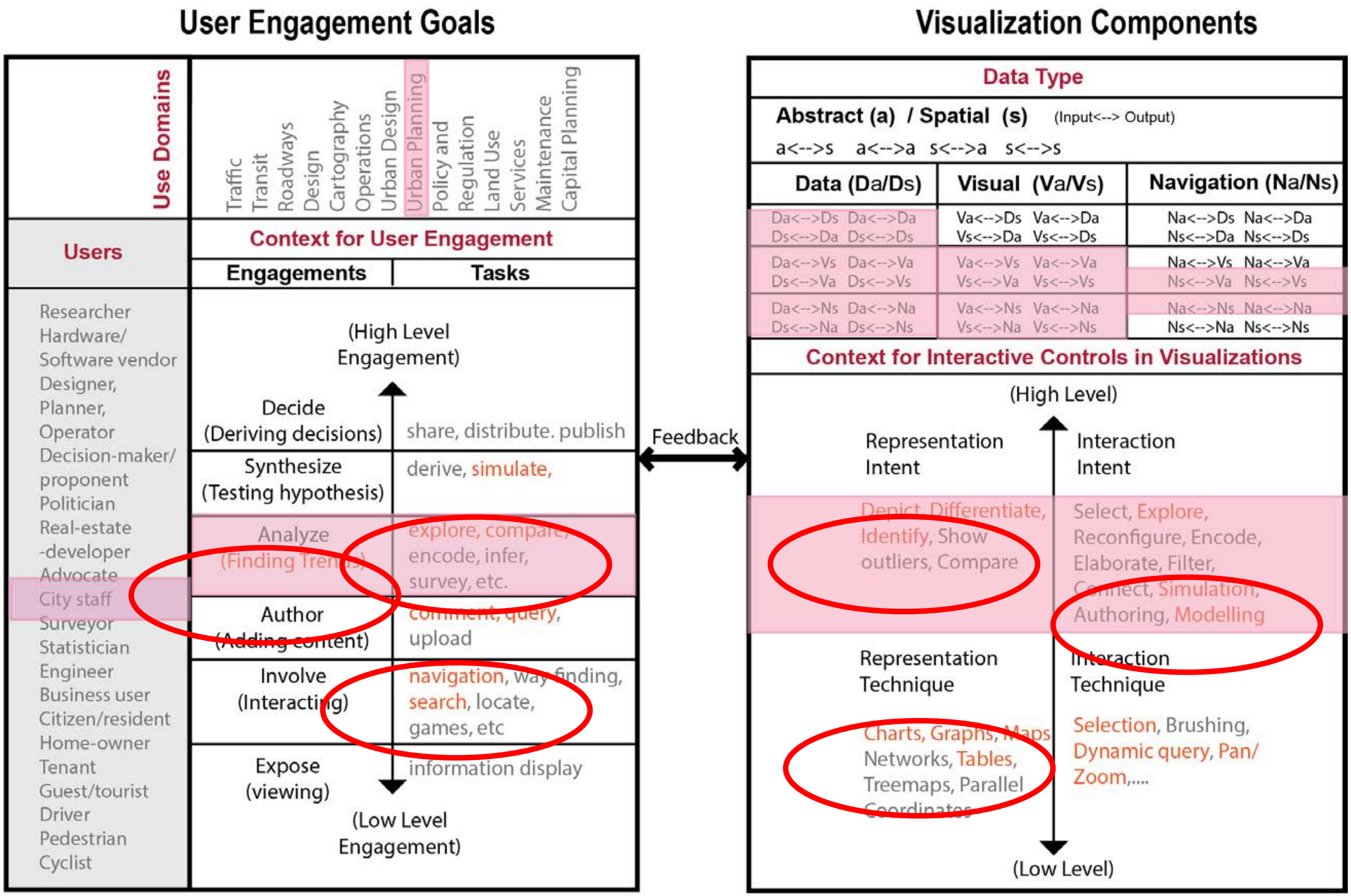


Image: **Based on Pike (2009), Mahyar (2015) and Sorger (2015), iCity process phases**, Taxonomy, iCity Team

Findings

- Identified a variety of approaches to the complexity of visualization processes, relevant **task levels** and **interactions** necessary to consider, that supplement insights through visualization supports

- Provided an understanding of the ways (**taxonomy**) through which researchers in the field of visual analytics propose the organization of data, user tasks and visual elements to create meaningful representations.

- Highlighted the need for visual libraries, and a way of comparing user needs around tasks, levels of interaction, data, and suitable visualization end products

Research approach & process

Implement

- Application of taxonomy to produce 3D modelling and dashboards tools to suit specific users
- Prototyping of the **comparative methodology** / chart into a user tool

The role that this research plays with comparative methodology is to **contribute to the cataloguing and mobilization of common visual analytics**, visualization methods, information technologies, and tools. The **comparative toolsets list** we created at the VAL for iCity acted as the **driving force for the process** to produce these prototypes.

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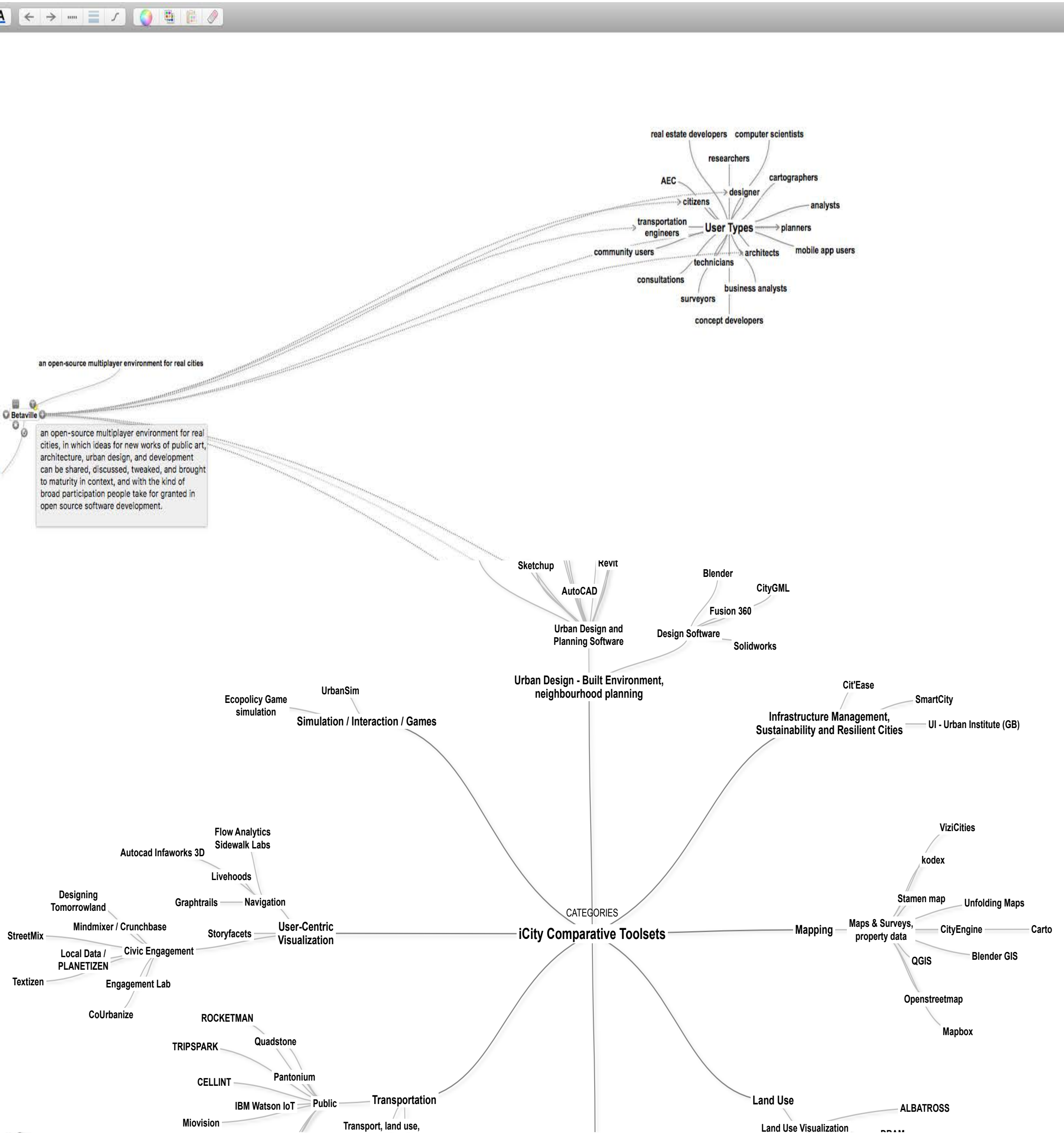
Image: iCity Visualization; Jeremy Bowes, Manpreet Juneja

COMPARA Prototyping Objectives

- Provide a semi-interactive explorative view of our comparative toolset list.
- Create a query tool to search keywords and characteristics of common 2D data visualization types.

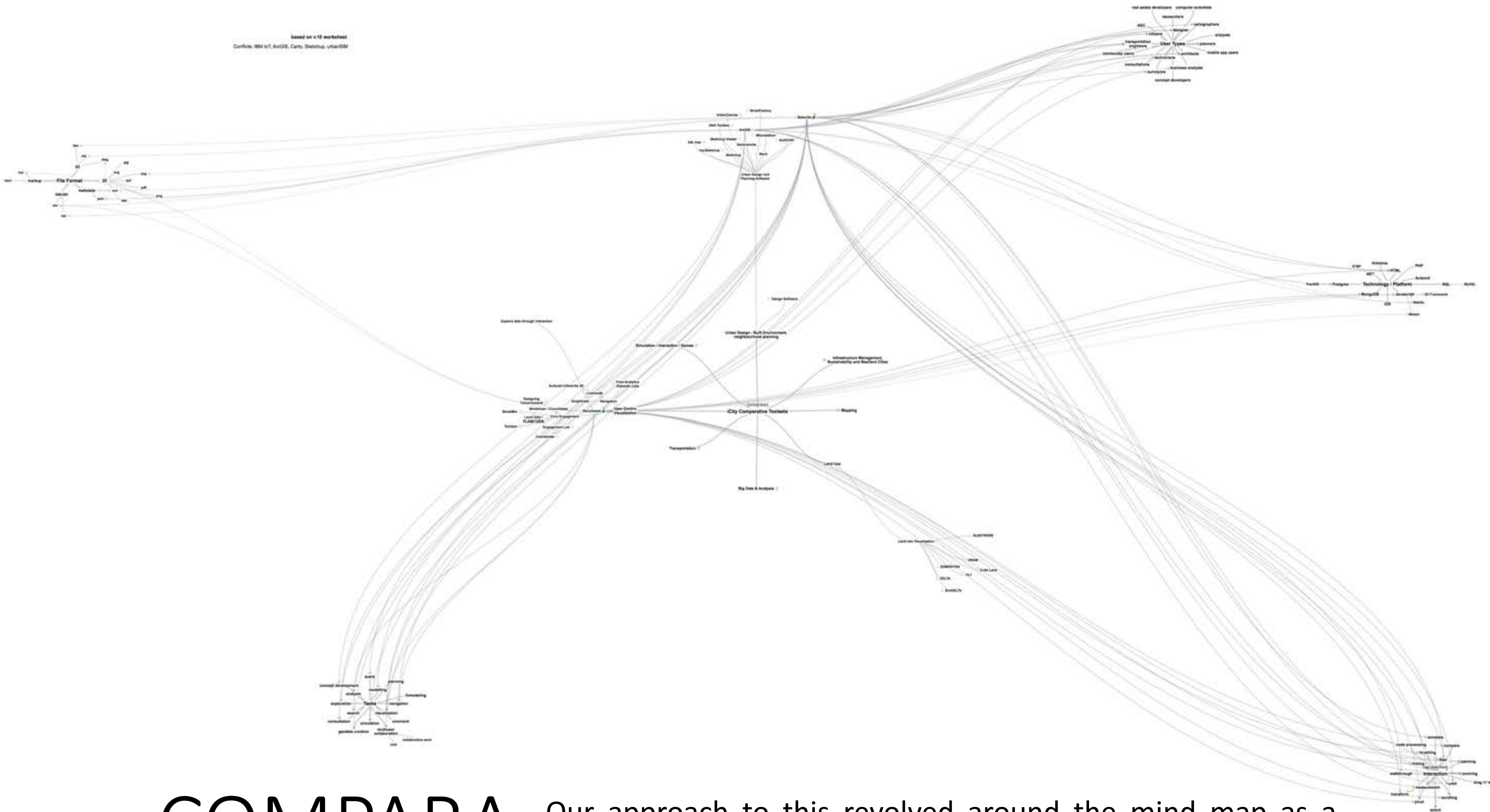
Image: iCity Visualization VAL Team: Marcus Gordon



Mapping Relationships

The first of the two prototypes focuses on the mapping of relationships. A worksheet was created in our research group with the intent to make it a first attempt towards a tax-onomy in visual analytics for iCity. The potential created by this effort is to create a discourse around visualization methods and software tools that deliver or utilize these methods.

Image: iCity Visualization VAL Team: Marcus Gordon



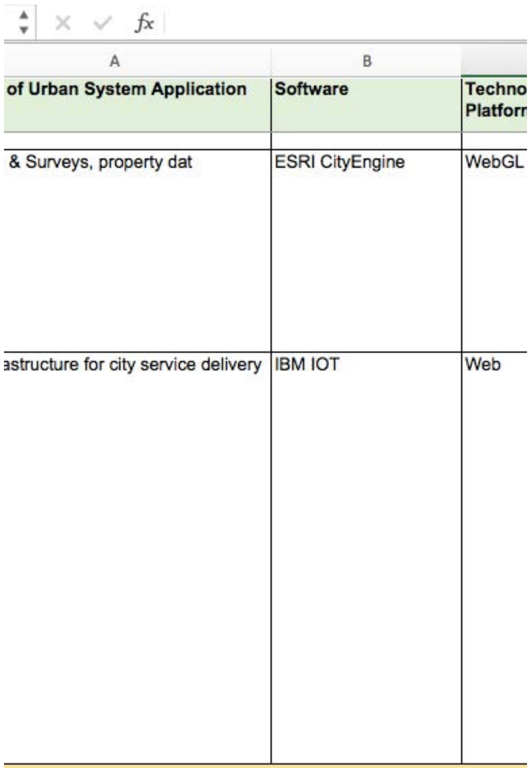
COMPARA Overview

Our approach to this revolved around the mind map as a visual language of choice when working on the structure of data. Its hierarchical nature combined with its freeform abilities faired well as a method to move from the digital spreadsheet list, to a form of interactive navigation.

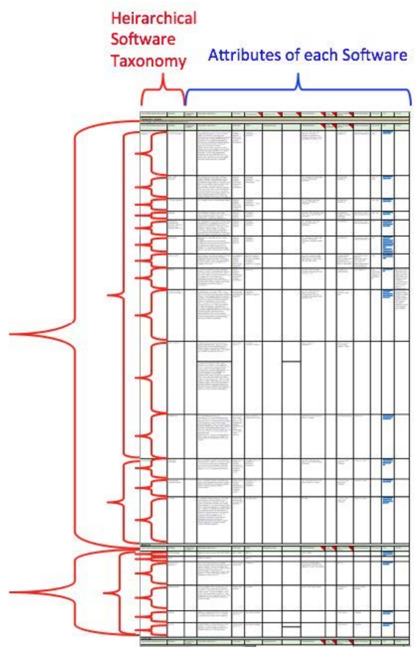
Mapping Relationships

Image: iCity Visualization VAL Team: Marcus Gordon

Comparative Toolset: Master List



Spreadsheet



The starting point of this taxonomy research consists of a spreadsheet that consisted of 8 main categories of content groups. This list was further divided into buckets, such as toolset name, owner/manufacturer, technology platform and others.

Cropped subsection of spreadsheet showing how the software hierarchy is organized, as well as the associated attributes for each software. Software are categorized based on their use and type.

Mapping Relationships

Image: iCity Visualization VAL Team: Marcus Gordon

designer,
planners,
architects,
technicians,
transportation
engineers,
citizens,
business
analysts,
researchers,
cartographers,
surveyors,
concept
developers

Tasks

Interactions

modelling,
navigation,
visualization,
search,
exploration,
analysis,
simulation,
query, comment,
multiuser
collaboration

User Types

filter, orbit,
zooming,
measurement,
walkthrough,
linking,
brushing,
scrolling,
panning,
compare, pivot,
select, annotate

Mapping Relationships

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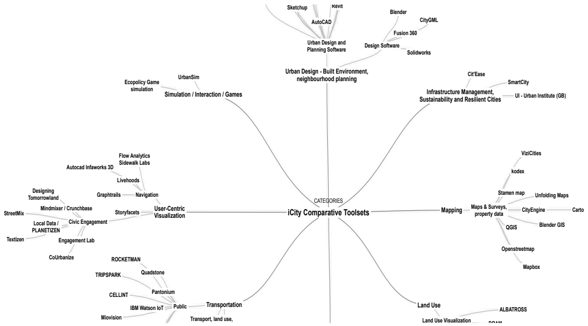
HTML,
Javascript,
WebGL, D3,
Meteor,
Postgres,
PostGIS,
MongoDB,
.NET, XTMF,
Hololens,
SQL

Technology / Platform

File Types

obj, dae,
dwg, dxf,
svg, jpg,
png, eps,
pdf, shp,
json, xml,
csv, sql,
html, md

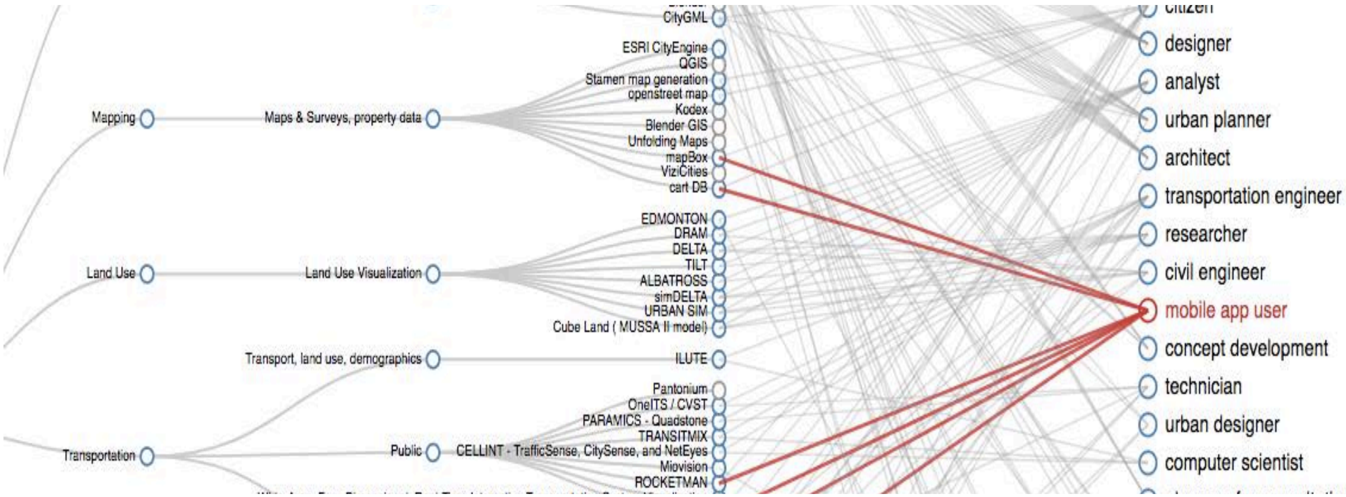


Toolset Map

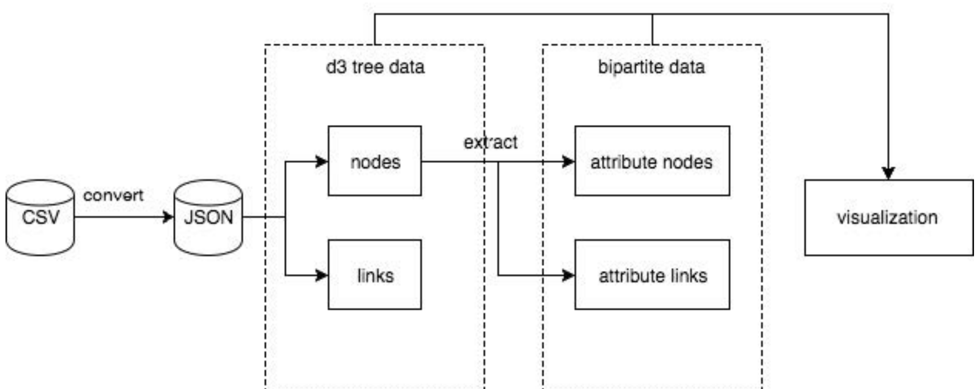
Placing these items in focus and seeking a slightly improved way to navigate the data, a mind map was made.

The premise here for the prototype was to envision a way to take this map, in its tree form, and convert it to a web format for anyone's use in the near future.

D3



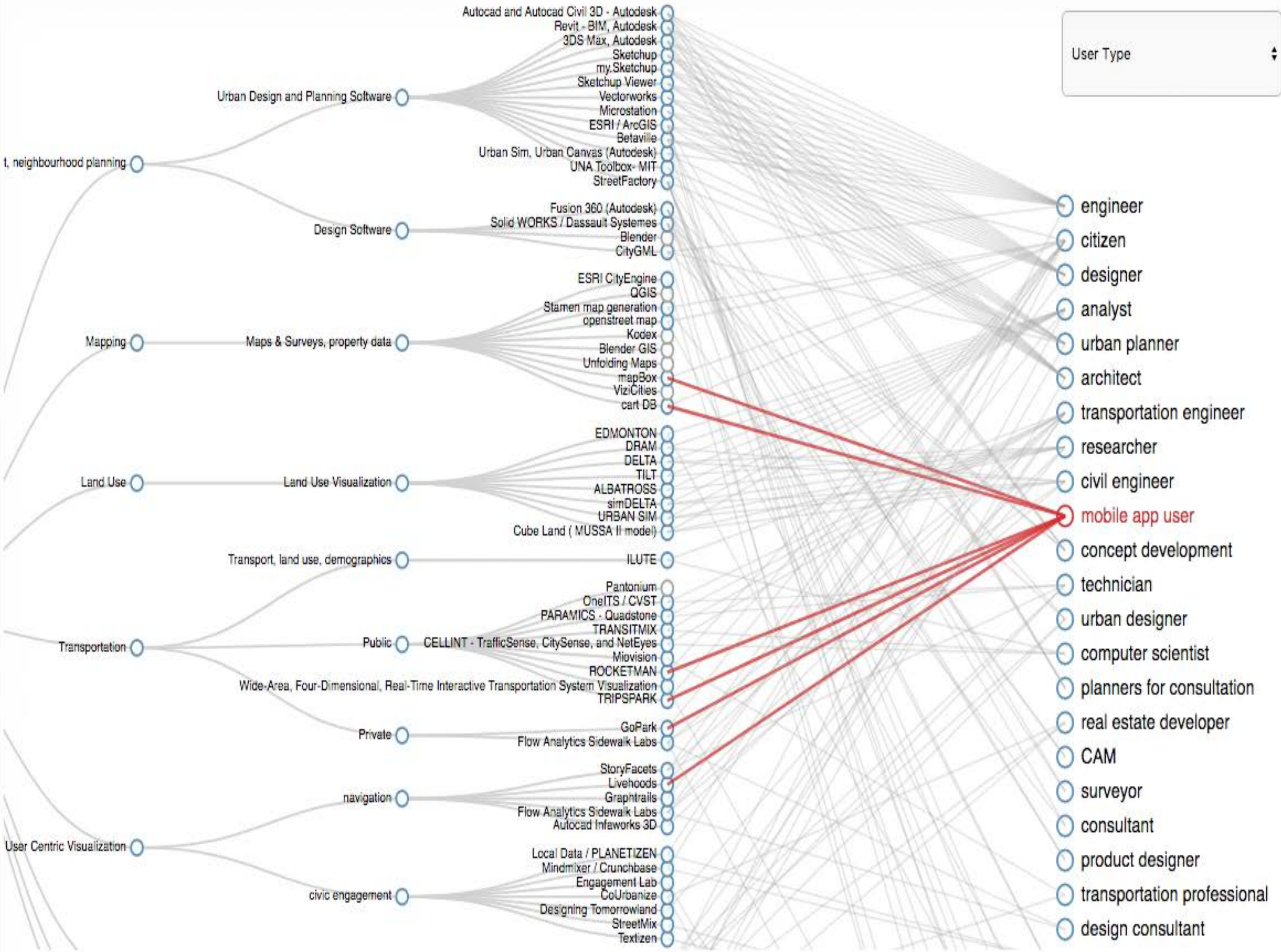
Compara v1



Working together with research assistants Davidson Zheng and Michael Carnevale, we created a first iteration of a web based prototype. This allowed for the dataset modelled from the master spreadsheet, to be explored interactively. The interaction here showed the various connections that tools had with the user types and tasks.

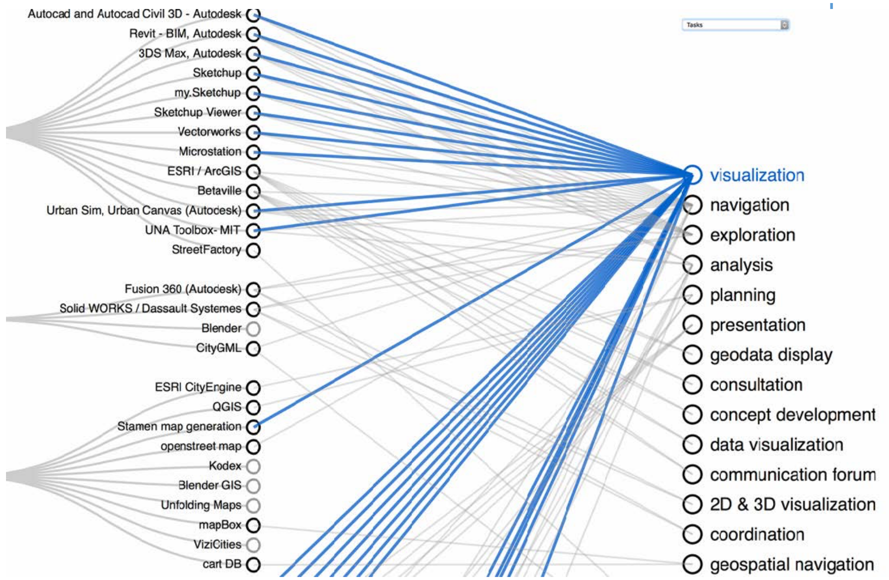
Mapping Relationships

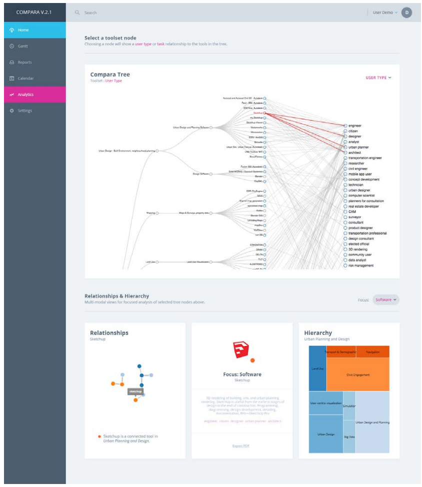
Image: iCity Visualization VAL Team: Marcus Gordon



Mapping Relationships

Image: iCity Visualization VAL Team: Marcus Gordon





Compara v2

So what's next for Compara?
The idea is for Compara to act as a component to a larger dashboard-like environment, and also to become a stepping stone into further experimentation with the D3 visualization library.

Image: iCity Visualization VAL Team: Marcus Gordon

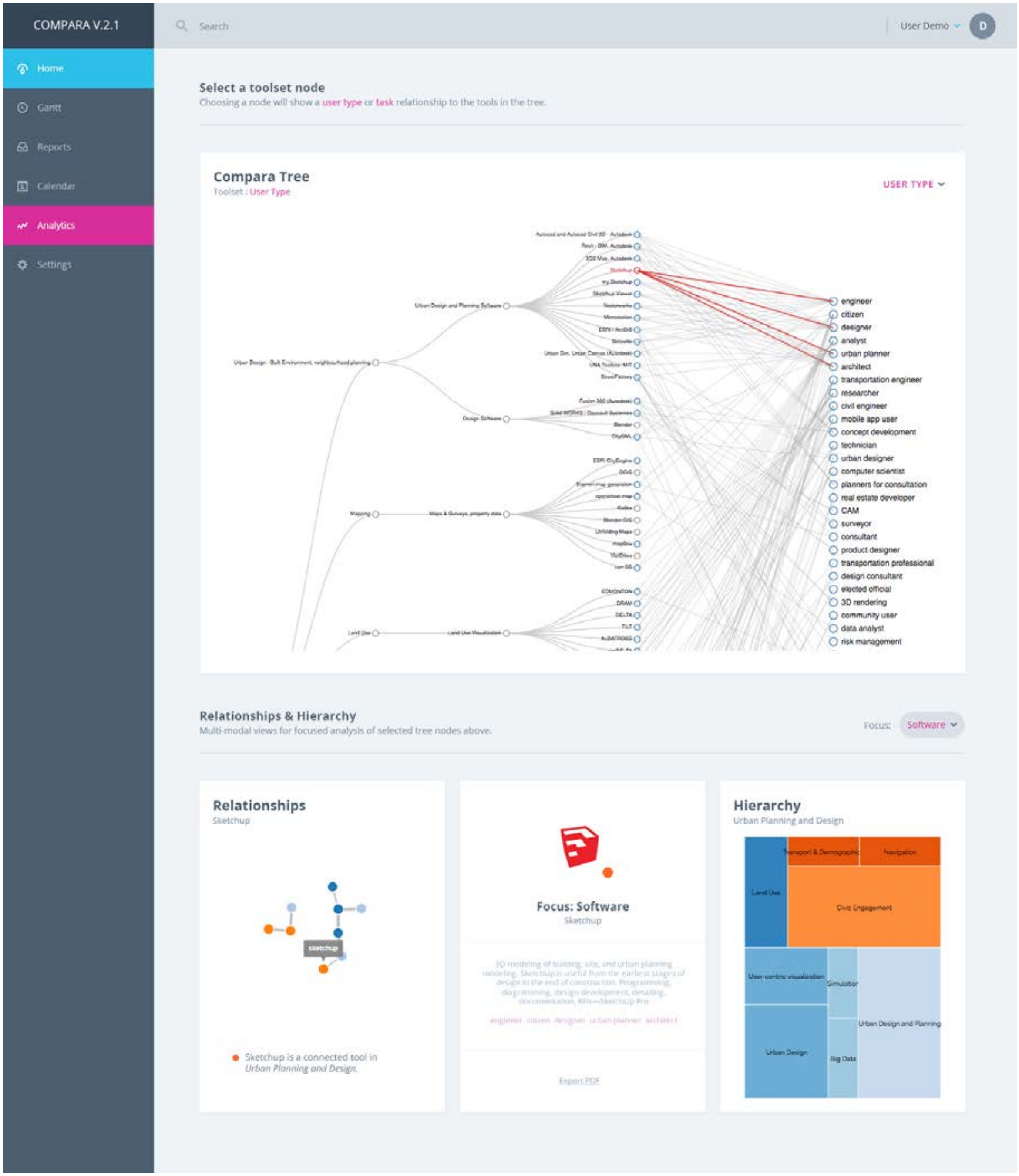


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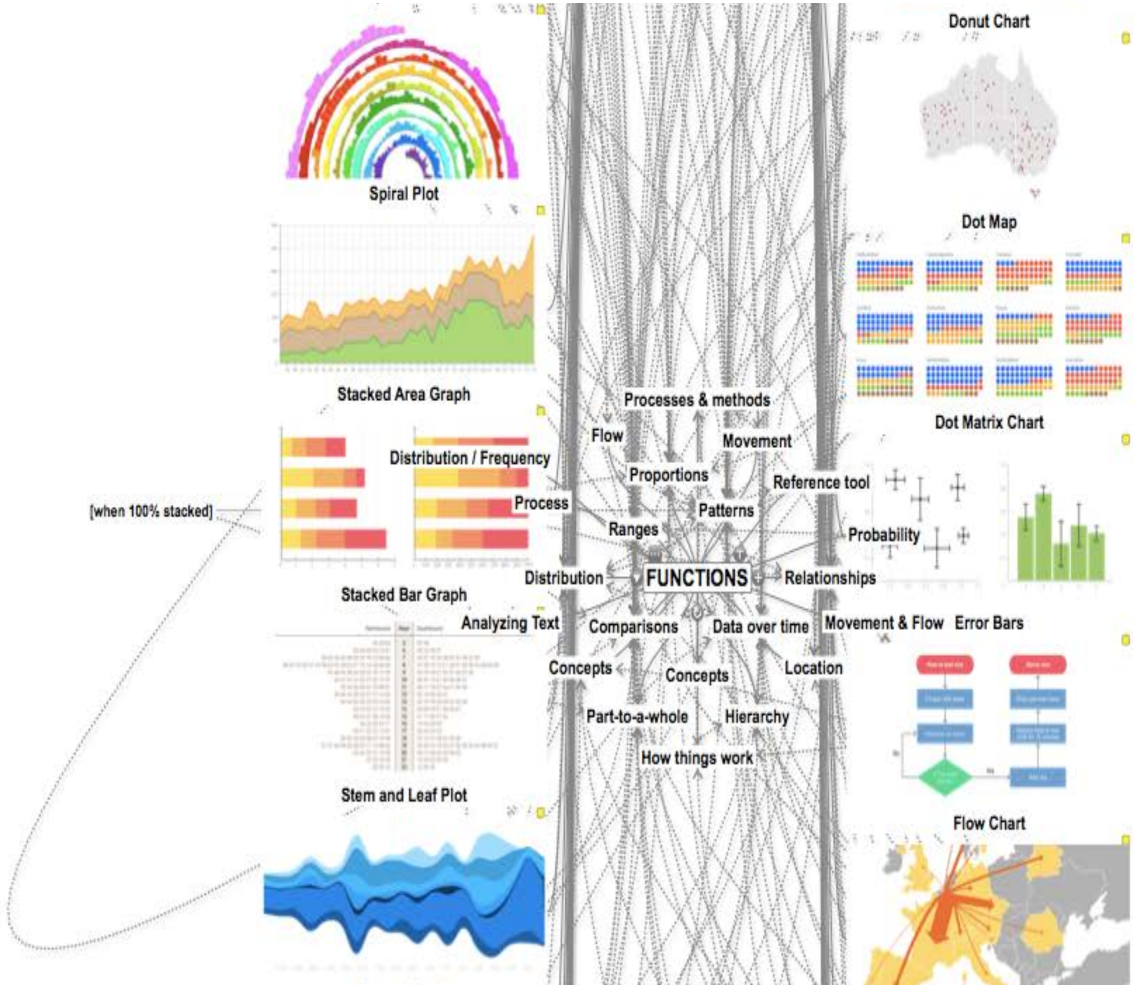
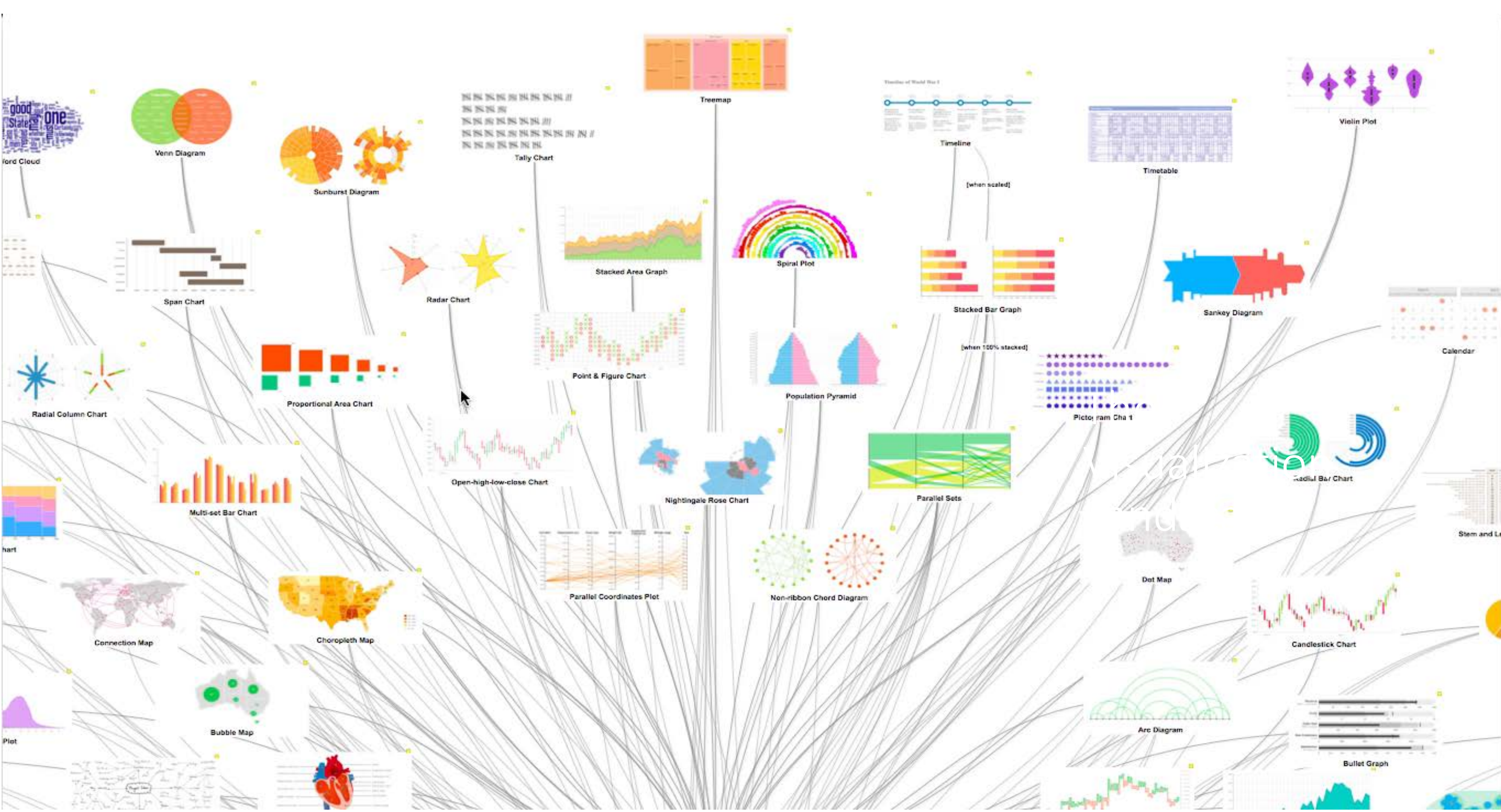
Image: iCity Visualization VAL Team: Marcus Gordon



VIZLAND Overview

The purpose of this project is to build a queryable and visual database of over 60+ data visualizations. The goal was to find the quickest and simplest way to expose our participants to the variety of data visualization options at their disposal. Most importantly, it was necessary for them to have an undesrtanding of the most common types out there, in order to facilitate decision making in their respective groups.

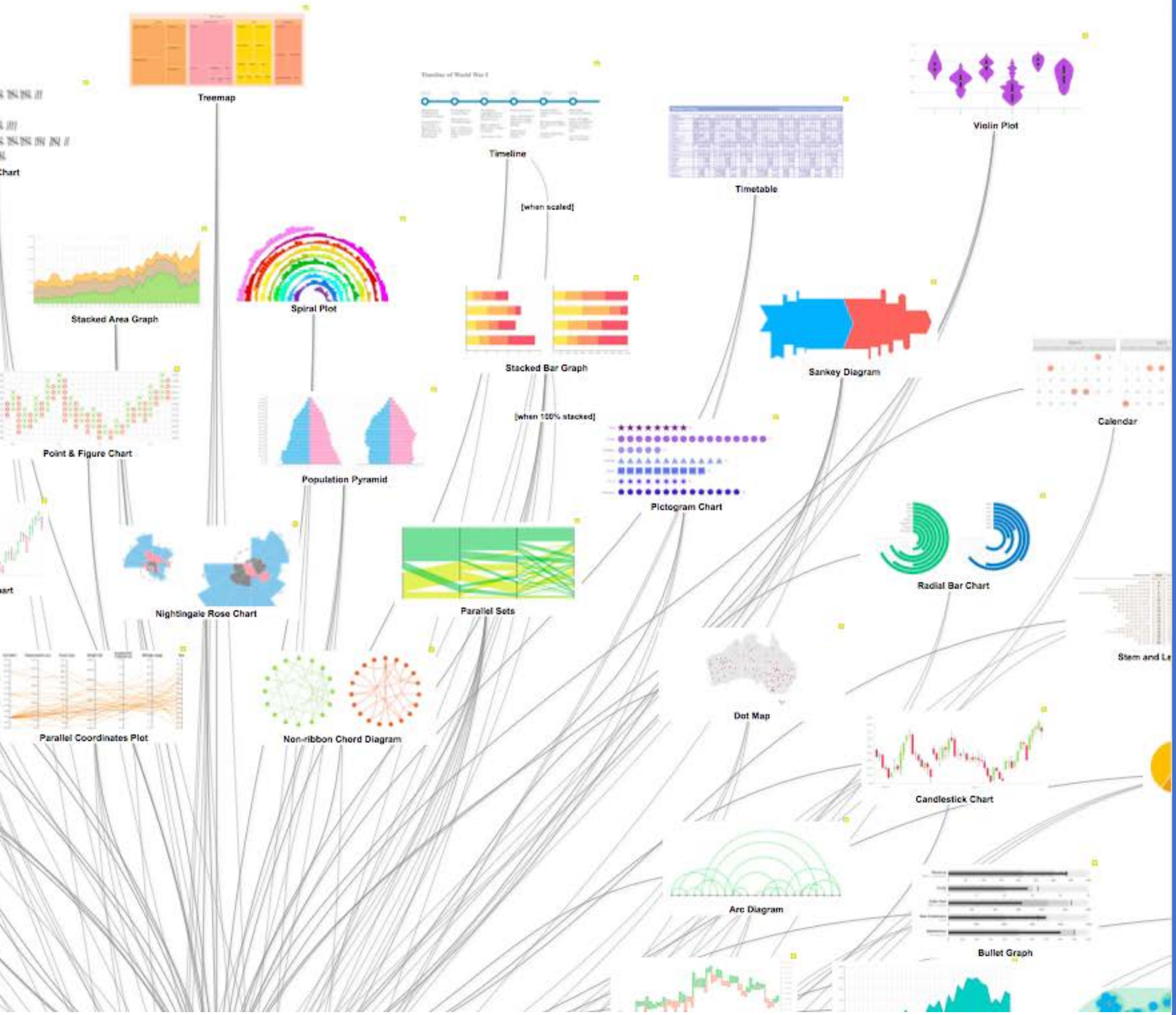
Image: iCity Visualization VAL Team: Marcus Gordon



The visualization landscape project (VIZLAND)

The ability to query keywords associated to these visualizations is to give the user quick access to matching keywords that relate to the visuals. This is done by the user typically matching functions that are prominent in selected visualizations.

Image **Data Source: VIZLAND development By Marcus Gordon**, VAL, **Severino Ribecca, Data Visualization Catalogue**



The Visualization Landscape

The ability to query keywords associated to these visualizations is to give the user quick access to matching keywords that relate to the visuals. This is done by the user typically to match functions that are prominent in selected visualizations.

Data Source:
Severino Ribecca
Data Visualisation Catalogue

Image: iCity Visualization VAL Team: Marcus Gordon

Steps

These are the high level steps to prototype VIZLAND.

Step 1

Locate a source for the info

In this case, I chose Severino Ribecca's Data Visualisation Catalogue. Why? Most specifically because he tasked himself to find to make a comprehensive descriptions of common visualization methods.

Step 2

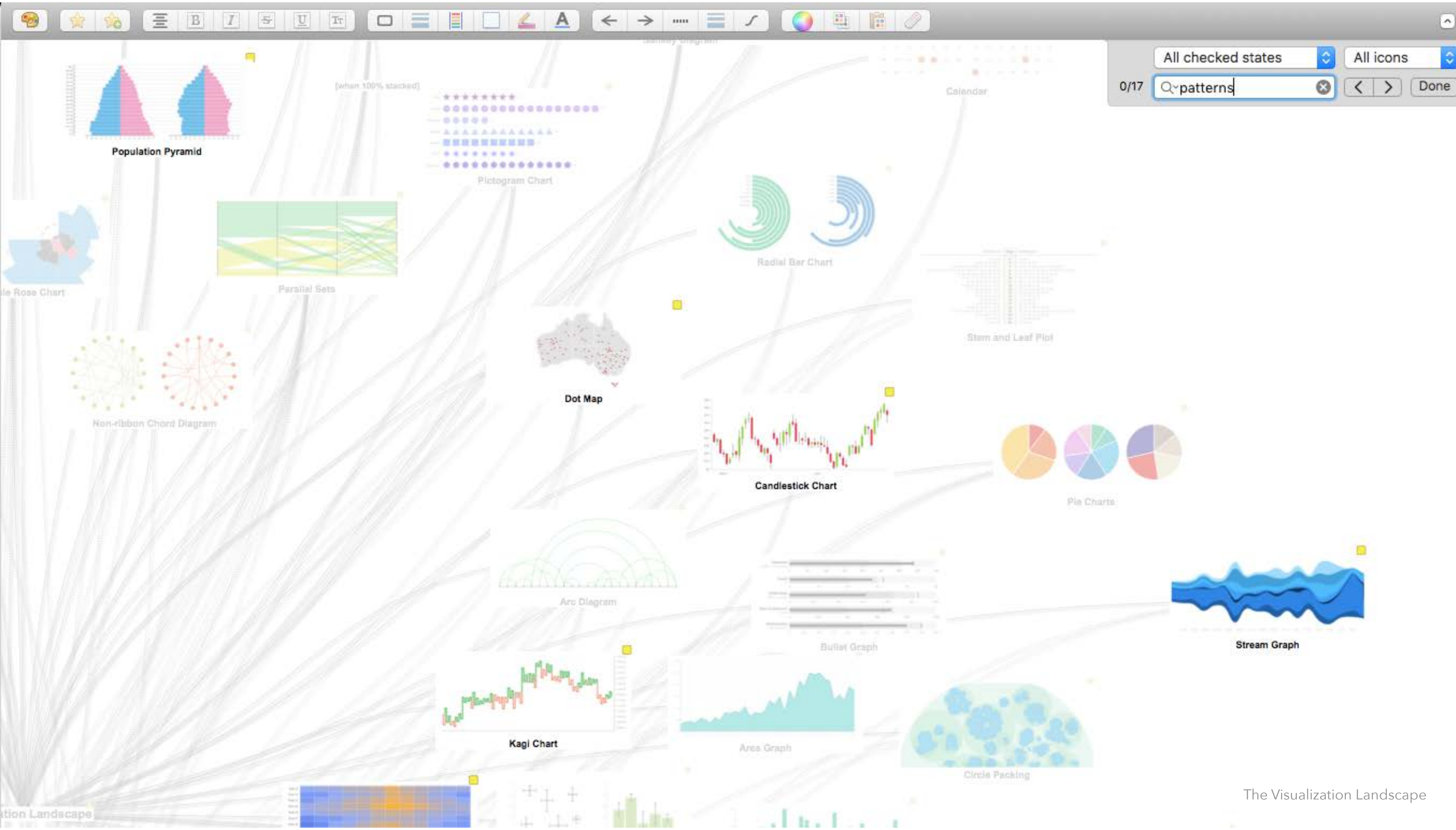
Create a dataset

This was manually done by transcribing all 60 definitions and include Ribecca's dataviz clip art.

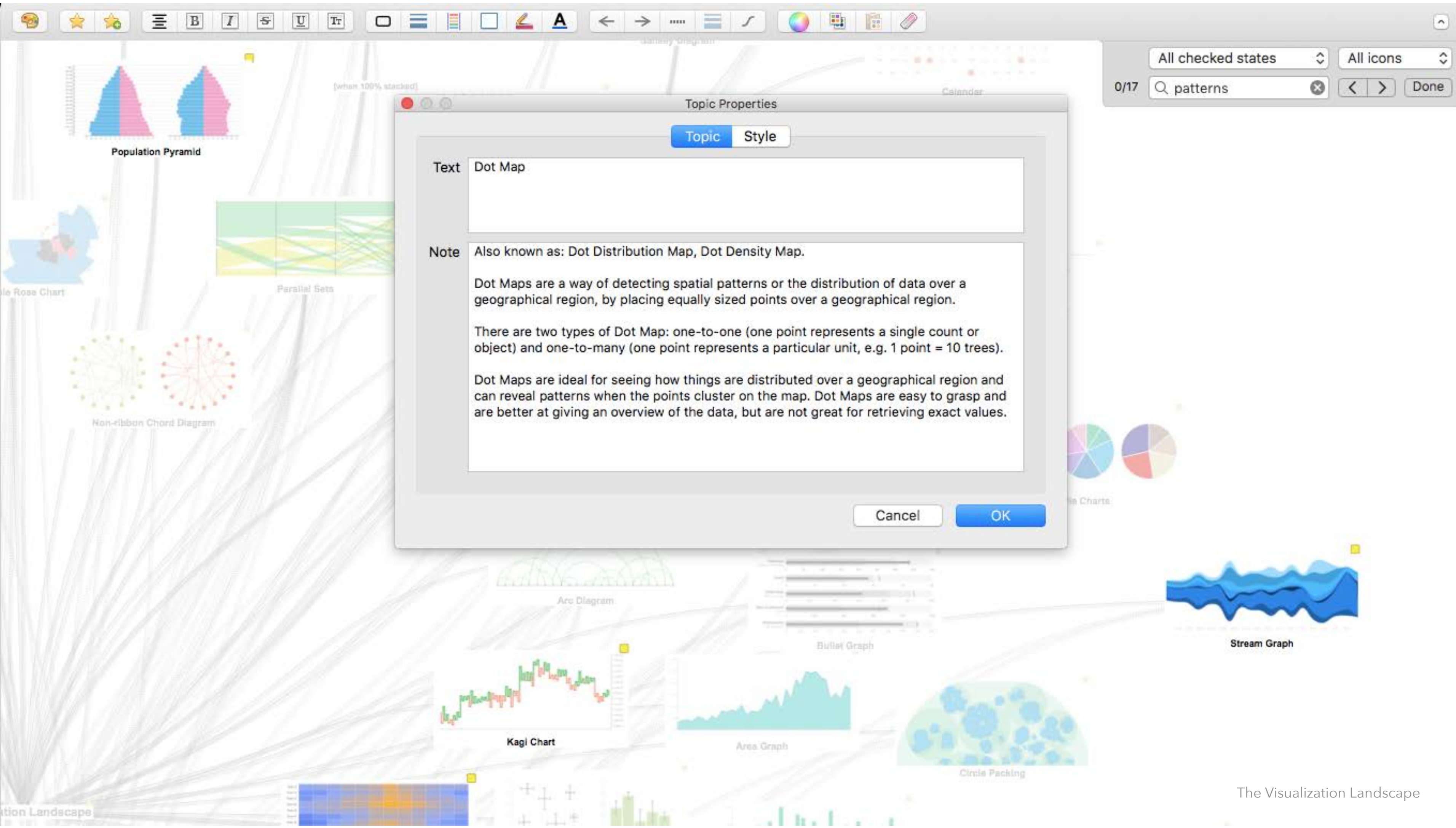
Step 3

Visualize the data

To visualize with a method that anyone can see and read, that was quick to absorb and quick enough to put together.

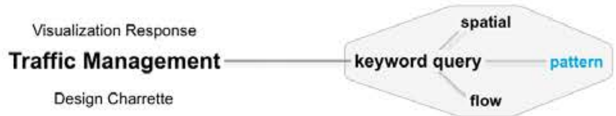


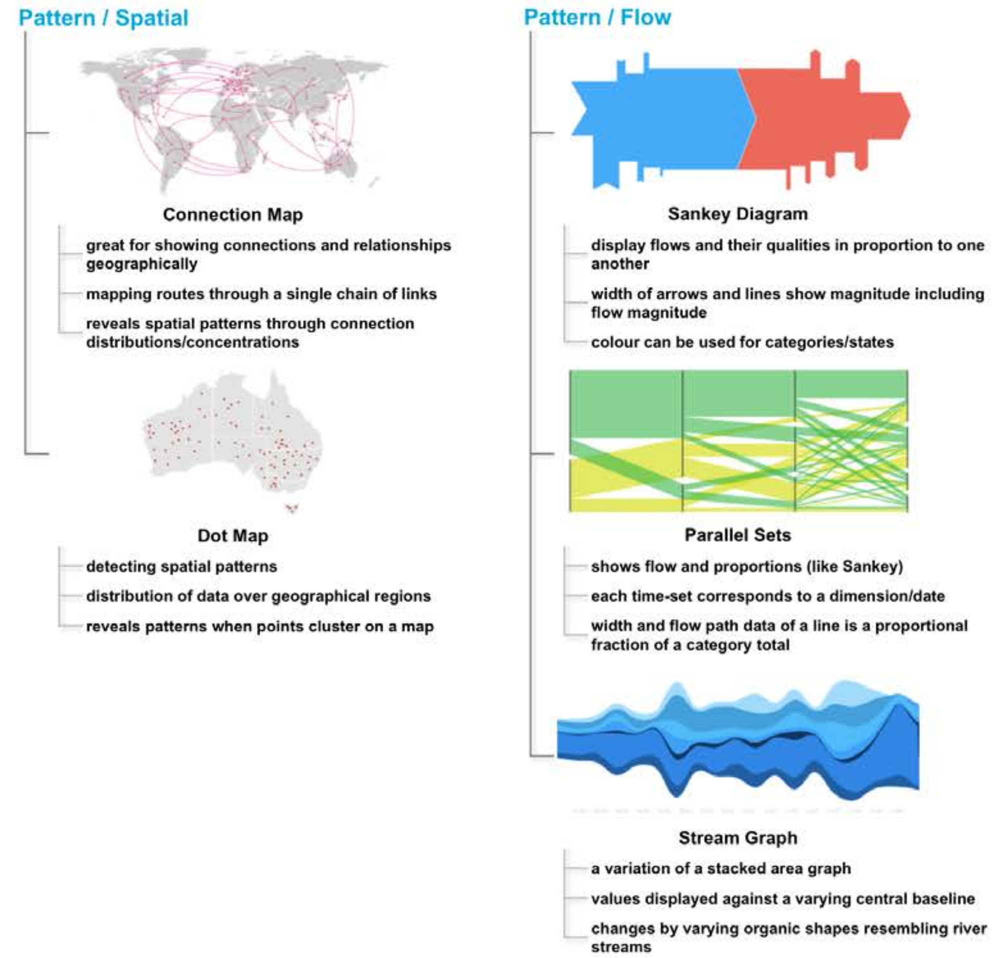
The Visualization Landscape



The Visualization Landscape

*based on using the visualization landscape concept map





The Visualization Landscape

Example of query made for Traffic Management group to consider the advantage of 5 visualization types that were derived by querying the keywords pattern spatial and flow.

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Next Steps

These are the high level steps to prototype VIZLAND. As a web app.

Step 4

Isolate prototype limitations

Thinking mostly in terms of navigation, selection, and deep dive capabilities.

Step 5

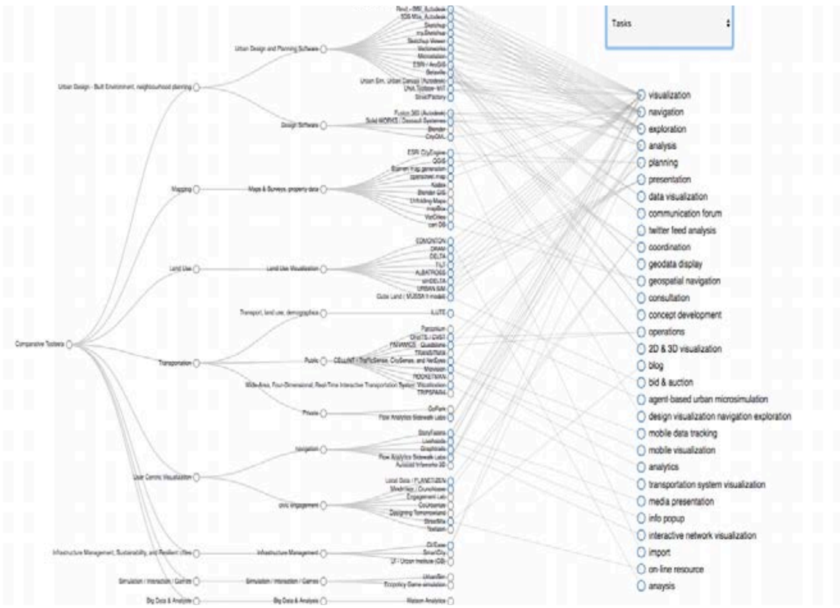
Design a web version

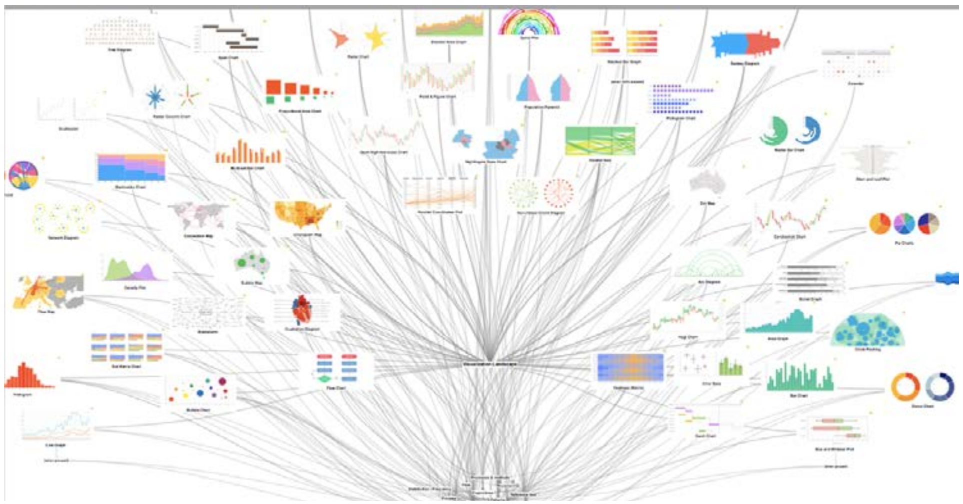
Determine web solutions to the listed limitations.

Step 6

Deploy new prototype

Learn enough about Node.js to create a self-sustained application for web and desktop platforms.





Project Compara

VIZLAND

Next Steps

The next steps would be to integrate **Compara and Vizland** into a dashboard that would allow users to access it.

The Visualization Landscape

Research process

Implement to dashboard

- Integrating into a dashboard prototype
- *COMPARA derives intelligence on toolsets and software that are mapped to their respective User Group and Domain specifications.*
- *VIZLAND (the VisualIZation LANDscape) provides the optimum representation techniques most suited for a particular use case.*

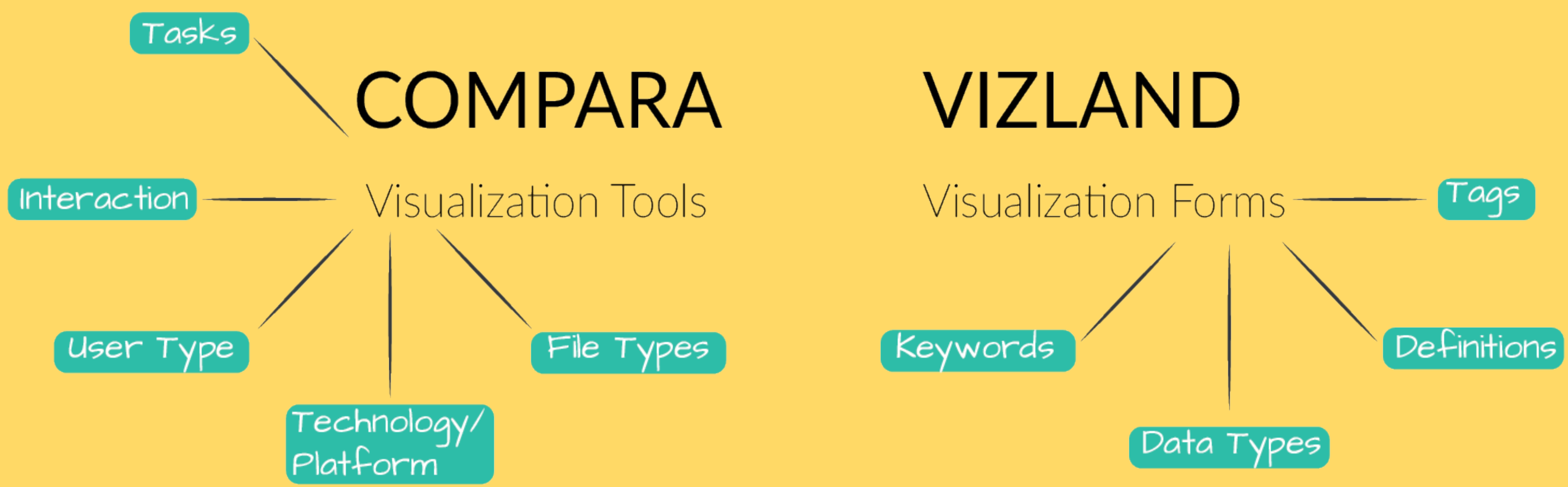


Image: **iCity Visualization; Jeremy Bowes, Manpreet Juneja**

Summarizing

- These findings focused our approach to establishing a visualization taxonomy focused on three areas: ***User Task***, ***Level of Interaction*** *or Engagement* and ***Data Type****,* and the detailed classification of interactive elements based on user tested needs for ***spatial and non-spatial data*** *types* within our research groups.

- The ***taxonomy*** prototype outlines a key framework to assess user visualization needs.

- ***Compara and Vizland*** *were* created as a series of ***interactive tools,*** *to be plugged into a dashboard* to provide the integration of these functional user elements as visualization support for a variety of users.

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Thank you
Questions ?

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https://ojs.library.queensu.ca/public/journals/6/content/gordon/index.html.

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