BRUNEL: Cognitive Visualization

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What do we mean by “Cognitive” Visualization?

• There are hundreds of books on “how to make good visualizations”. We need to build a system that **does not require an expert** to read 100 books or consult a panel of 42 experts.

• Need a **structured language** to reason about visualizations – the visualization language forms an interface cognitive systems and the human user.

• Must work with **all domains**; once a cognitive system has been trained on a domain, it should not also need to be taught about how to visualize it.

• Works with **meta knowledge** that exists for the data to decide which chart features are critical.
Conversational experience powered by Cognition

I have a question.....

System smarts helps the user to...

...find relevant data

...and surface relevant relationships...

...shapes it...

...and "shapes" it...

...for the user to interact with and reshape...

...user applies experience

...system applies analytic

I've got the answer. I know what to do. I've made the decision.
Brunel: A Cognitive Language for DataViz

- A high-level language that describes visualizations in terms of composable actions
- Drives a visualization engine that performs the actual rendering and interactivity
  - Releasable: D3, RAVE
  - Trial: JFreeCharts
  - Future: ggplot, matplotlib
- Goal is to reason about visualizations in a way that can be used in existing solutions
  - Web pages
  - Ipython/Jupyter/Zeppelin
  - Apache Spark / Hadoop services
  - RStudio
Why Yet Another Language?

- **Chart-type** systems are massively limiting — rule based systems for reasoning work, but are hard to extend and very limiting
- **Grammar of Graphics** systems are very close, but …
  - The building blocks are inter-dependent
  - Difficult for machine reading / writing

**Brunel** has been inspired by:

- **Grammar of Graphics (GPL driving IBM’s VizML)**

- **Jock Mackinlay’s Composition Logic**

- Machine Learning / Predictive “Atomicity”
- Human and Machine Readable / Writeable
- Simplicity of Deployment (D3, IPython Notebooks)
Language Examples

\textbf{x(winter)} \textbf{y(summer)}

\textbf{bar color(region)} \textbf{y(#count) polar stack}

\textbf{x(region)} \textbf{y(summer)} \textbf{bin(summer)} \textbf{color(#count) label(#count) style('symbol:rrect')}

\textbf{y(region,summer, winter)} \textbf{bin(summer,winter) treemap color(winter)}

\textbf{x(summer)} \textbf{y(region)} \textbf{bin(summer)} \textbf{size(#count) chord color(region)}

\textbf{bar x(summer)} \textbf{y(#count) bin(summer)} \textbf{label(State) sum(state)} \textbf{color(region)} \textbf{legends(none) axes(x) stack style('.label {font-size:8}')}

\textbf{bar x(region)} \textbf{y(#count) transpose style('fill:#aaa') axes(x) > text color(state) pack legends(none) style('.text {font-size:11}')}

\textbf{text x(#row) y(winter) label(#row) color(#row)}

\textbf{x(person)} \textbf{y(density) at(0,0,100,100) color(region) | polar stack bar y(#count) color(region) at(65,10,100,35) legends(none)
Cognitive Visualization
Demo 1: Simple Web App


Demo 2: Jupyter (ipython notebook)

Cognitive Vis using Brunel: Cognitive Applications

- How Brunel commands can be used as components of a genetic algorithm to automatically build and improve visualizations
- How to use text analysis to determine what sort of chart someone actually wants
- How to determine the emotional impact of a chart
- How to build and score predictive models for visualizations efficiently in the cloud
- How to score and analyze systems of visualizations
- How to score and analyze transitions between visualizations
- How to crowdsource visualization recommendations
- How to modify visualizations using natural speech
P(Open Source) = 0.8
P(Open Source | Partners) = 1.0

• IBM doesn’t make money from selling software at this level of use
• Big drive to open source (Hadoop, Spark, R)
• No proprietary tech in Brunel
  • Git hosted, standard (friendly) license

• We need PARTNERS
  • Low commitment partnership
  • We are committed; will do the grunt work
  • Looking for people to
    • use it
    • modify source
    • add other visualization drivers
  • No long-term commitment required. If it doesn’t work out, quit!

• Cognitive Visualization tech based on it to appear soon …