Information Visualization and Semantic Search

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Overview

- Motivations and challenges of information visualization for semantic search
- Useful visualization for search
- Towards meaningful, useful and KOS-based visualization for search and discovery.

Information Visualization

- Definitions:
  - "The use of computer-supported, interactive, visual representation of abstract data to amplify cognition." (Card, Mackinlay, and Shneiderman,1999)
  - Creation of visual approaches to conveying information in intuitive ways
  - Mapping of unstructured, linguistic data to structured visual space for easy understanding and discovery.

Motivations of Visualization

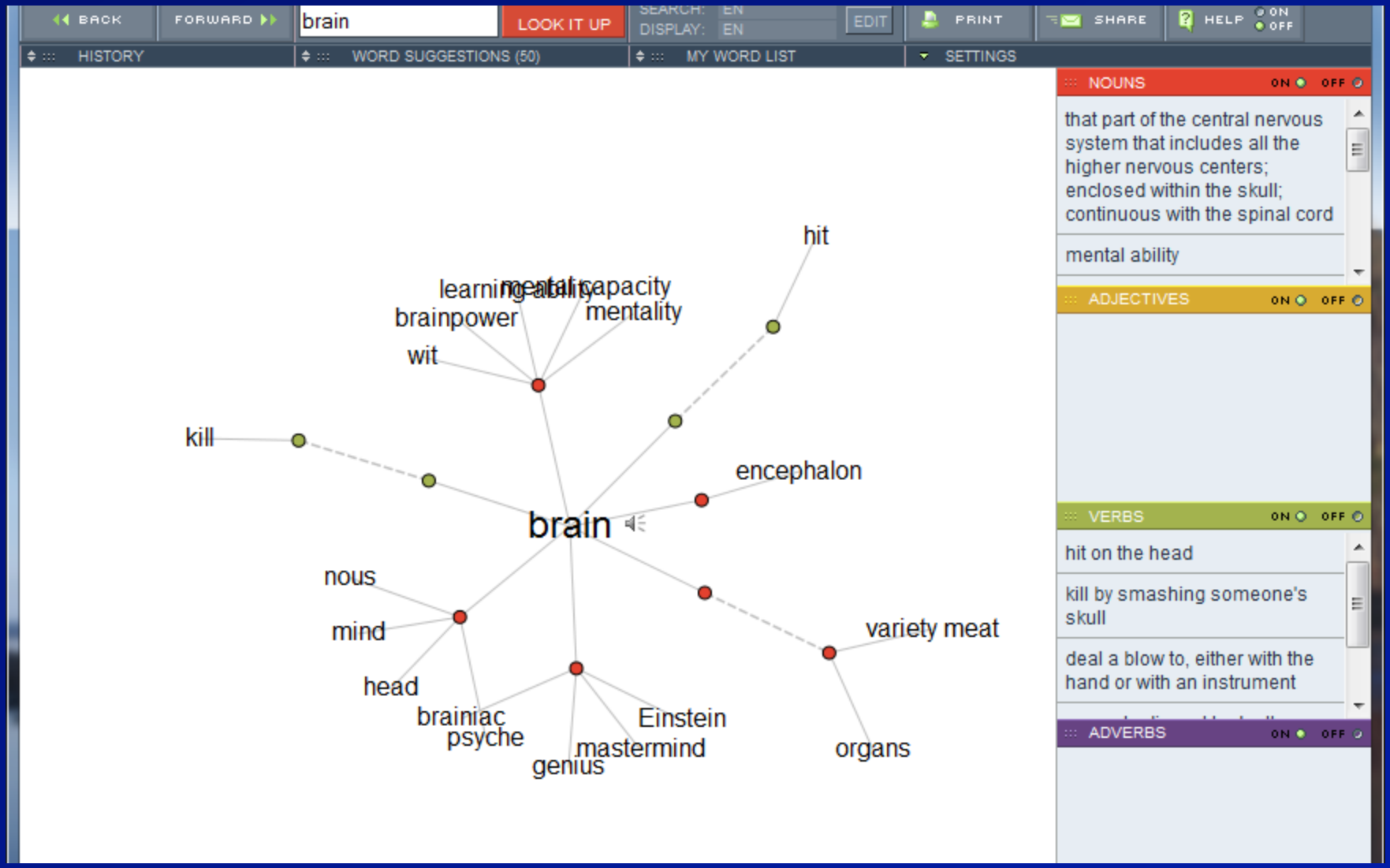
- Taking advantage of human cognitive capability for large amount of information processing, quickly and intuitively
  - Using visual representations to show large amount of information and enable visual inference.
  - Letting computer do mapping and analysis first and show only the most relevant associative information the user.
  - Moving information processing from the data/ linguistic level to the cognitive level.

Challenges of Visualization

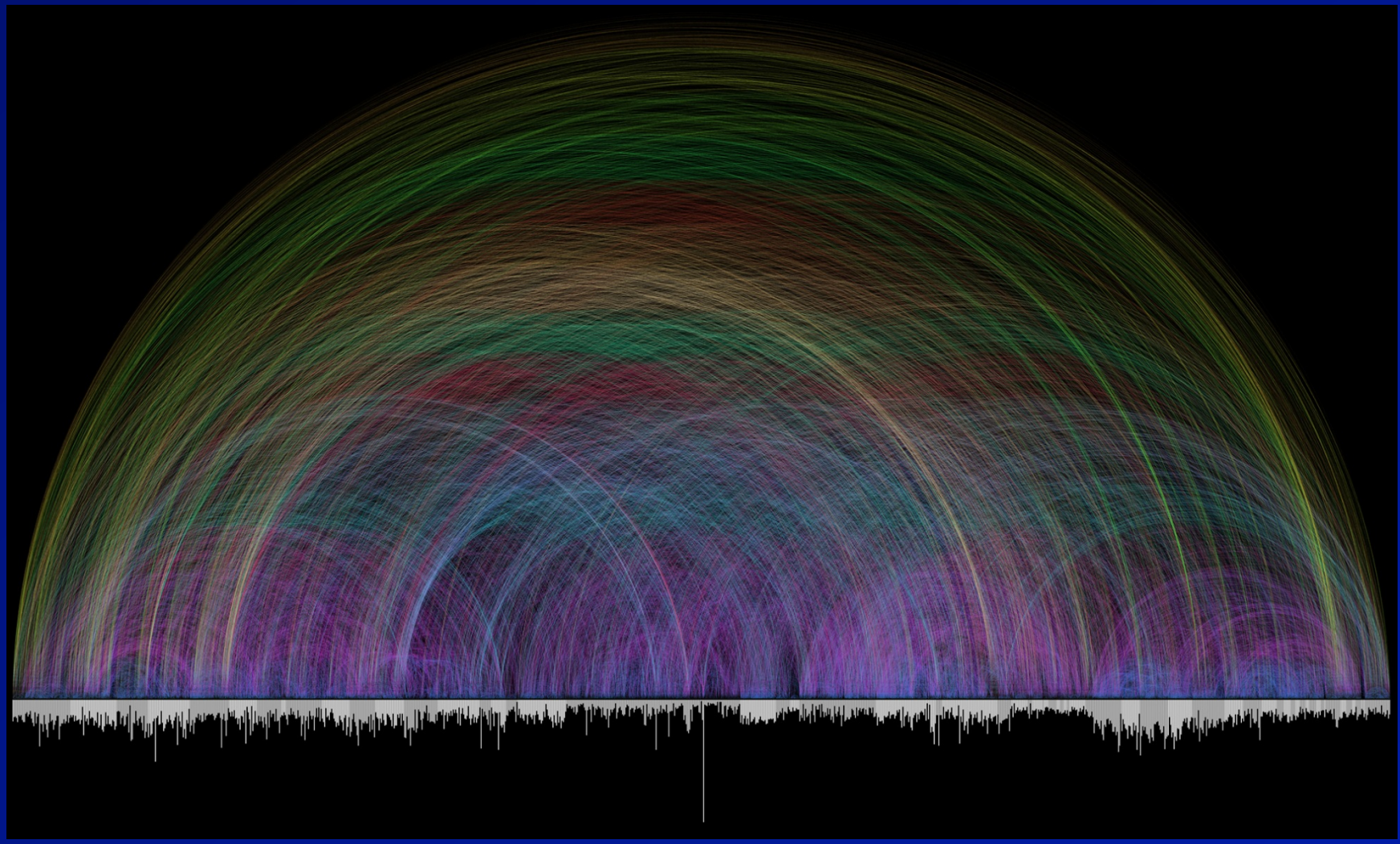
- "A picture is worth a thousand words" if
  - it is meaningful
    - The picture conveys semantic structures or relationships that the viewer can understand
  - It is trustful
    - The structures and relationships on the picture match the semantic structures of the underlying data.
  - It is useful
    - What users get from the picture will help them do something useful.

Meaningful?

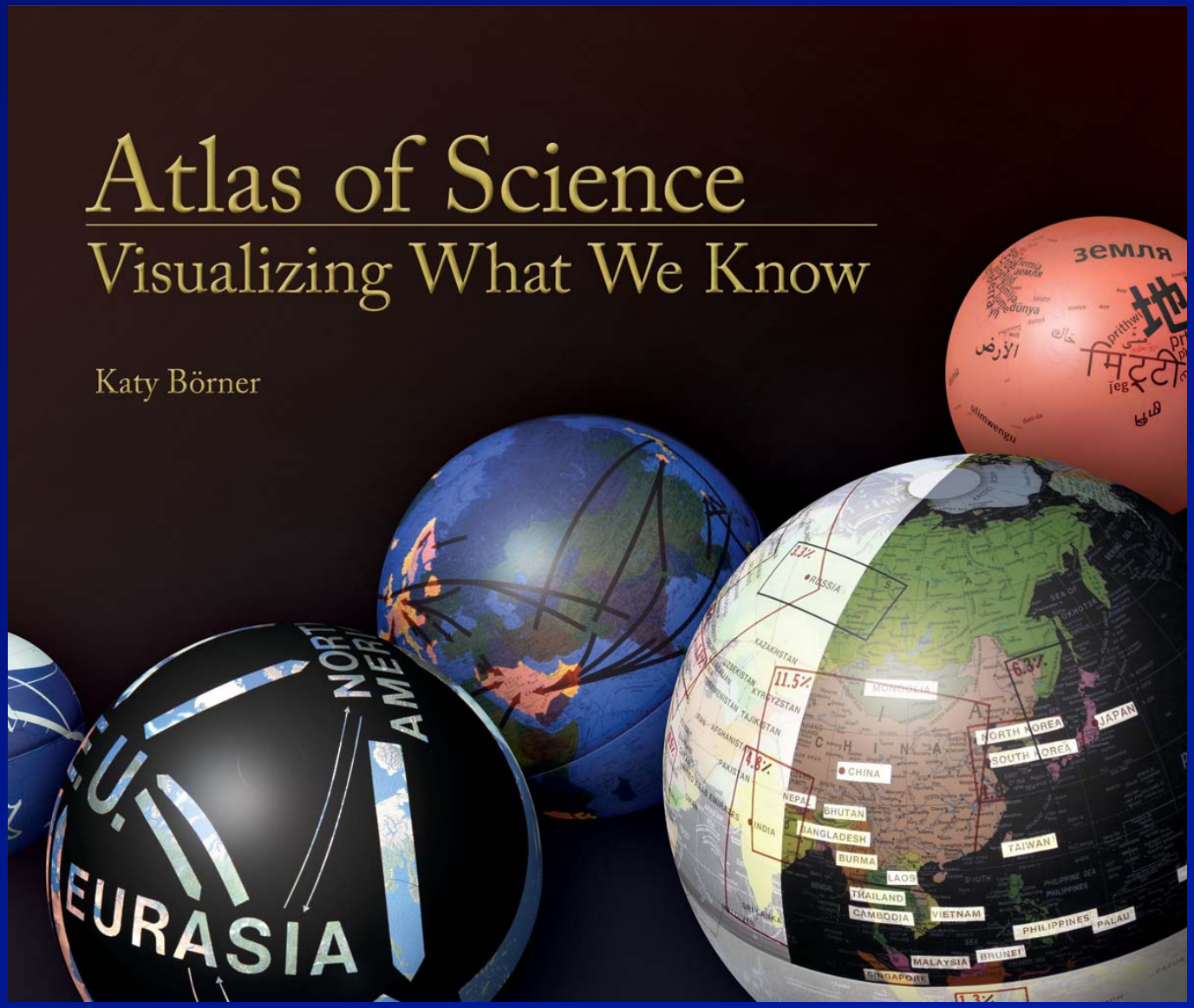
Meaningful!


BACK
FORWARD
brain
LOOK IT UP
SEARCH: EN
DISPLAY: EN
EDIT
PRINT
SHARE
HELP
ON
OFF
HISTORY
WORD SUGGESTIONS (50)
MY WORD LIST
SETTINGS
NOUNS
ON
OFF
that part of the central nervous system that includes all the higher nervous centers; enclosed within the skull; continuous with the spinal cord
mental ability
ADJECTIVES
ON
OFF
VERBS
ON
OFF
hit on the head
kill by smashing someone's skull
deal a blow to, either with the hand or with an instrument
ADVERBS
ON
OFF
hit
learning ability
mental capacity
brainpower
mentality
wit
kill
encephalon
brain
nous
mind
variety meat
head
brainiac
psyche
Einstein
mastermind
genius
organs

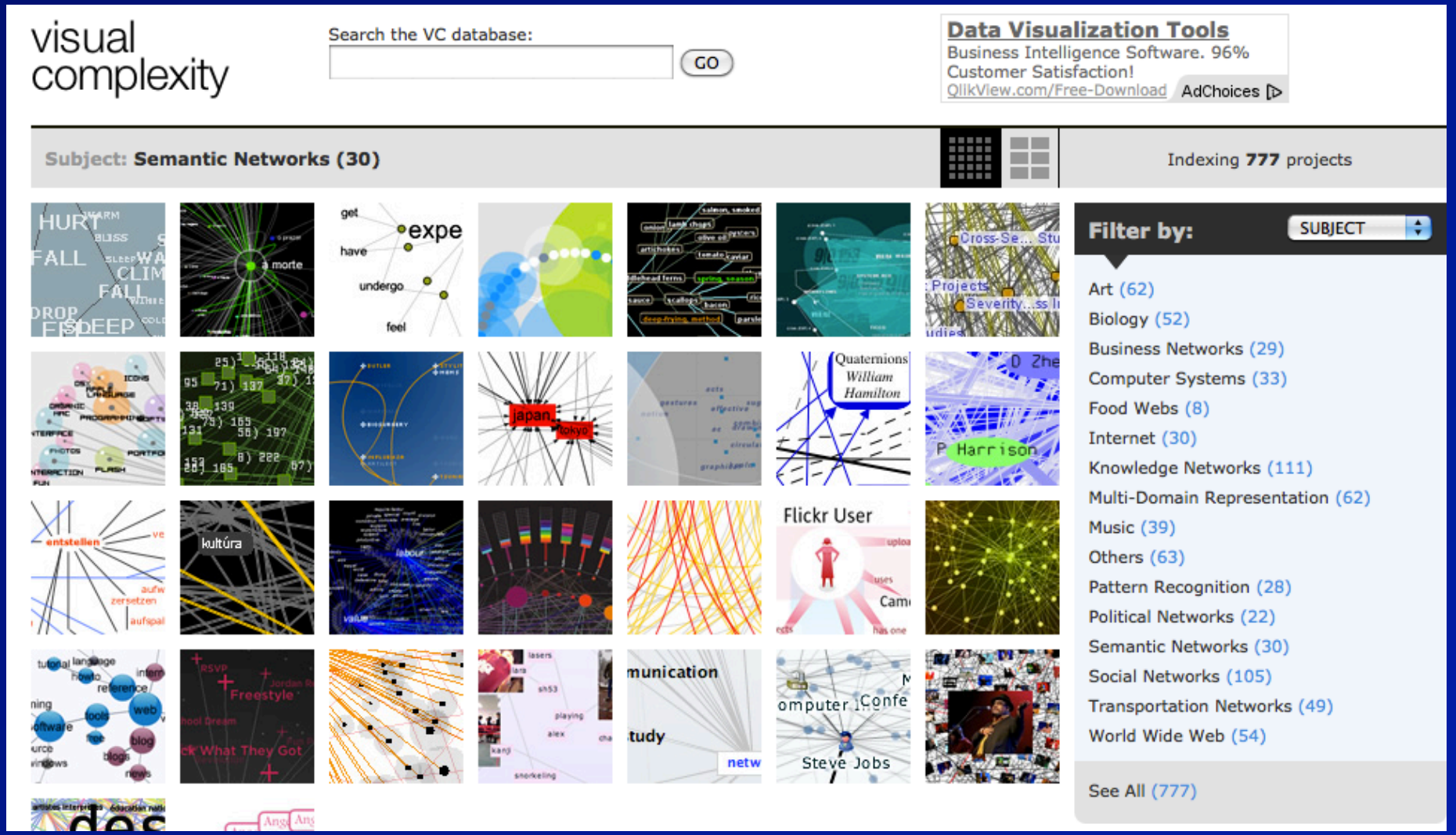
Useful?



Useful!


Atlas of Science
Visualizing What We Know
Katy Börner
EURASIA
RUSSIA
CHINA
INDIA
MONGOLIA
KAZAKHSTAN
NORTH KOREA
SOUTH KOREA
JAPAN
TAIWAN
BHUTAN
NEPAL
BANGLADESH
BURMA
LAOS
THAILAND
CAMBODIA
VIETNAM
PHILIPPINES
PALAU
MALAYSIA
BRUNEI
SINGAPORE
11.5%
6.3%
4.8%

More Examples



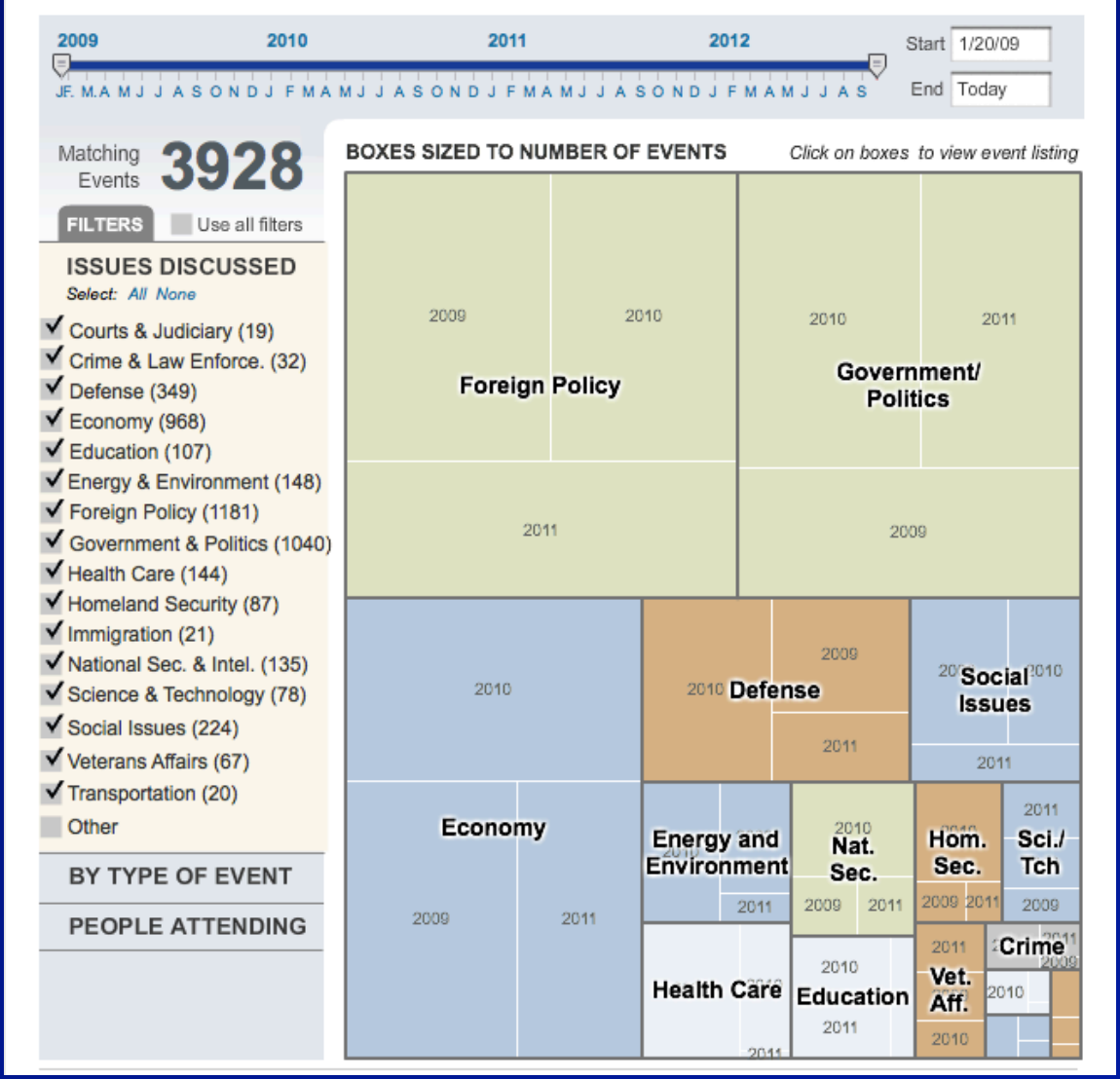
My Research Questions

- What functions are needed to make visualization useful?
- What characteristics of visualization displays will make the displays meaningful ?
- How to prepare the underlying data to make the visualization trustful and meaningful?

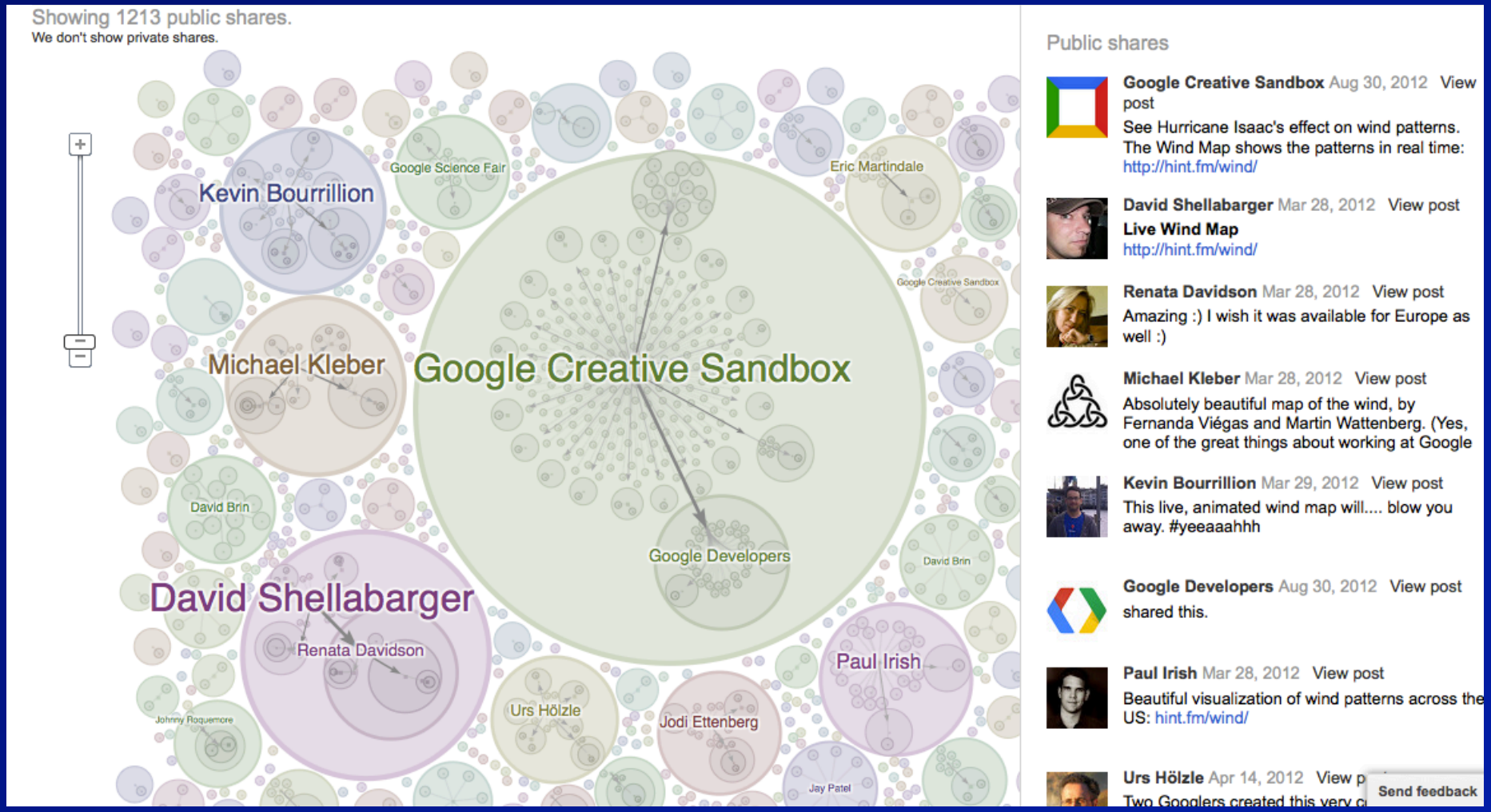
Useful Visualization Functions

- Overviews
  - Overview of large document space
  - Search result summary
- Dynamic Interactions
  - Network of documents, concepts, citations,
  - Neighborhood of the focused point
- Discovery
  - Visual analytics and discovery tools
  - Mapping of data to visual space

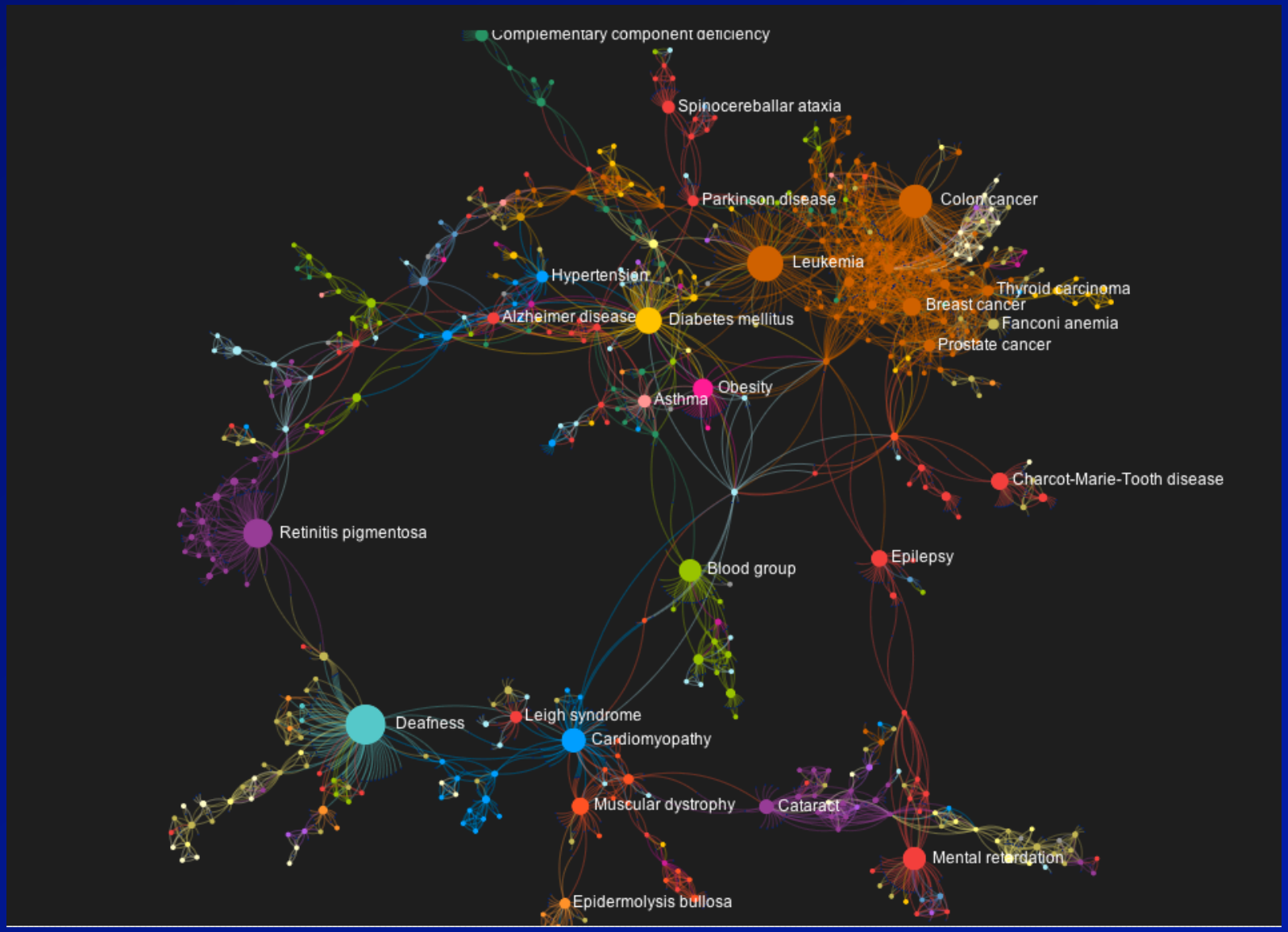
Washington Post – POTUS Tracker



Google+ ripples



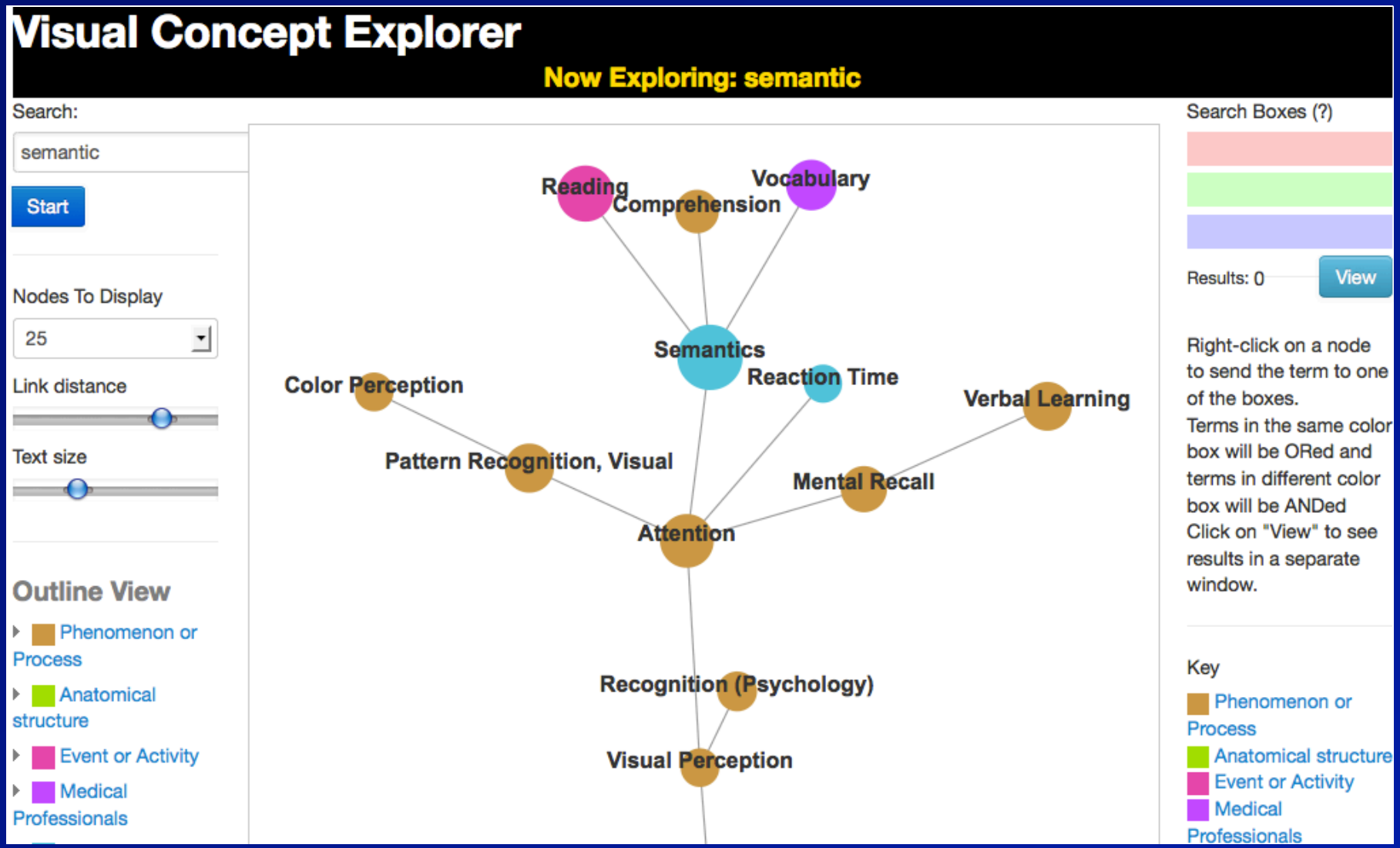
Human Disease Network Graph



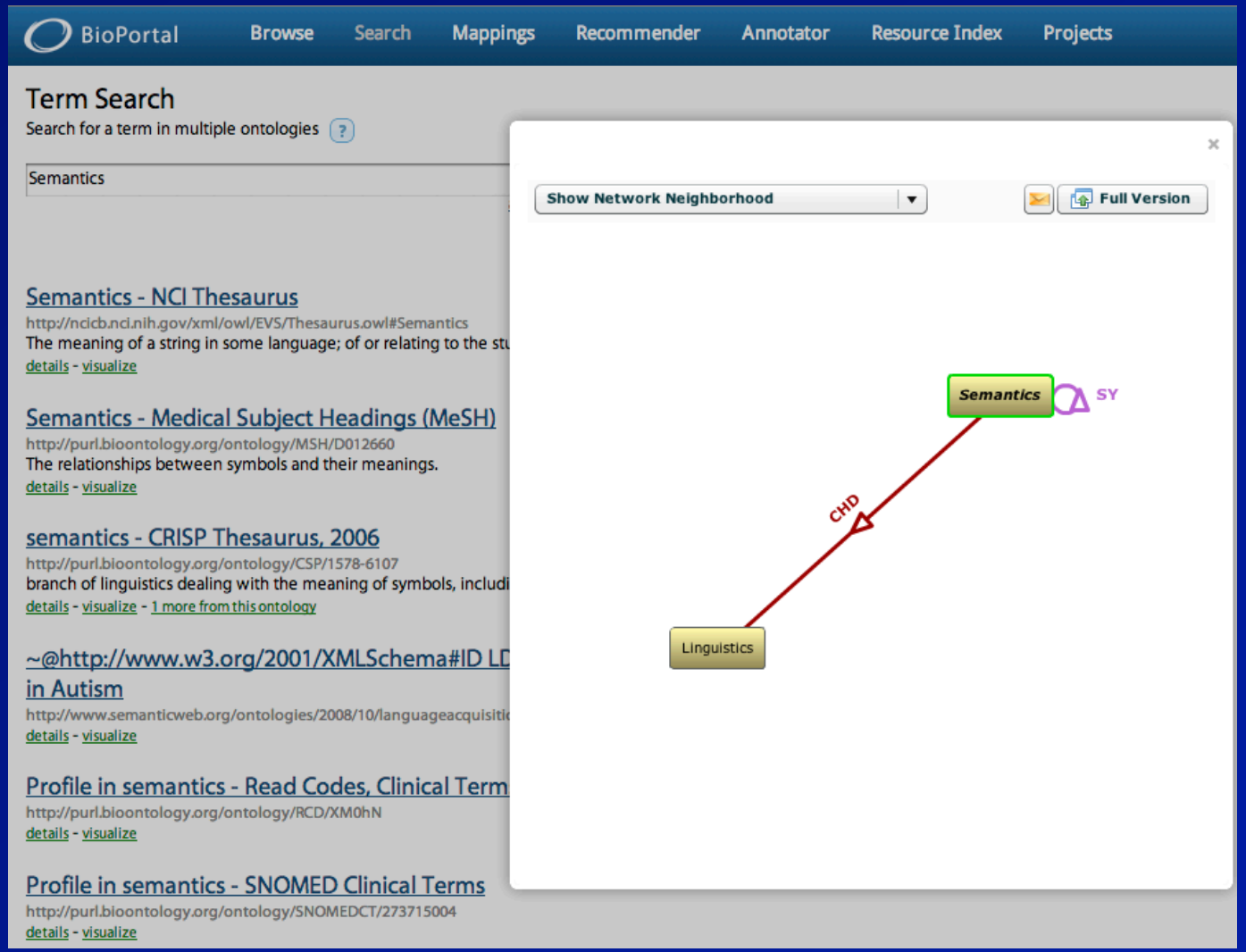
My Current Projects

- Visual Concept Explorer (VCE)
  - UMLS-based semantic vocabulary visualization and search
- Meaningful Concept Displays (MCD)
  - Getty-vocabulary based visual concept exploration and query expansion
- Visual Semantic Discovery Tools (VSDT)
  - Testbed: A million fulltext documents on neuroscience

Project 1- VCE2



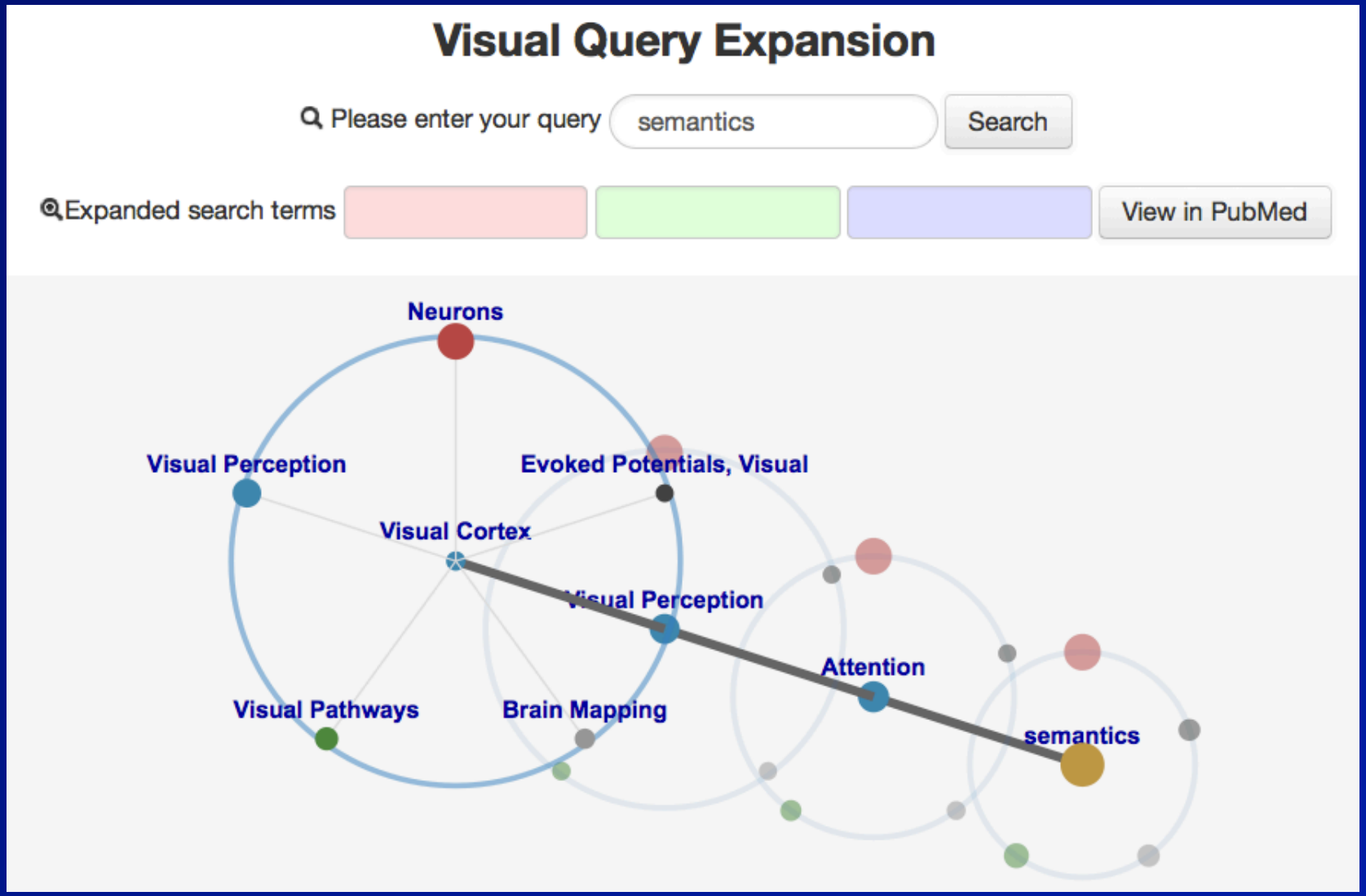
Comparing to …



Project 2 - MCD

- IMLS funded project
  - To develop a **Meaningful Concept Display (MCD) Appliance** aiming to improve user's searching, browsing, and learning experience with KOS and relevant content/collections.
  - To test the MCD appliance with ARTstor, Getty, and Indianapolis Museum of Arts (IMA) sites.
  - Collaborating with University of Buffalo, Getty, IMA, and ARTstor.

Demo 2 - VQE


Visual Query Expansion
Please enter your query
semantics
Search
Expanded search terms
View in PubMed
Neurons
Visual Perception
Evoked Potentials, Visual
Visual Cortex
Visual Perception
Attention
Visual Pathways
Brain Mapping
semantics

Project 3 -- VSDT

- Visual Semantic Discovery Tools
  - Develop a triple-store knowledge repository to store the semantic entities and relationships extracted from full-text.
  - Design and implement visual analytics methods and interfaces to enable searching and knowledge discovery.

Demo 3 – “Read” with Annotation

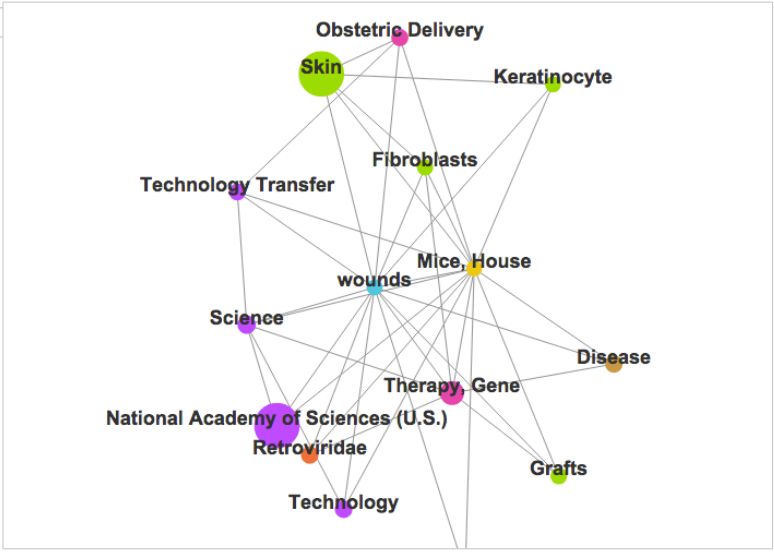
submit

Articel_1
Articel_2
Articel_3

CHAPTER 11.15 Gene Therapy (C0017296, T061, T063) in Tissue Engineering JEFFREY (C1018458, T002) R. MORGAN (C0582521, T081), MARTIN (C0313173, T116, T129) L. YARMUSH Center (C0205099, T082) for Engineering in Medicine (C0025118, T091), Massachusetts (C0024874, T083) General Hospita (C1197494, T007)~ Shriners Burns Institute (C0021622, T092) and Harvard (C0167523, T197) Medical School (C0036378, T073, T093), Boston (C0006037, T083), MA (C0812372, T028) 02115, USA Gene therapy (C0017296, T061, T063), the transfer (C0728827, T033) of genes to achieve a therapeutic effect, has numerous applications (C0185125, T058) in many areas of medicine (C0025118, T091), including tissue engineering. In this chapter, we review the properties and attributes of the various gene transfer technologies (C0242804, T170) and the gene delivery (C0872177, T045, T063) strategies (C0679199, T041) in which these technolo- gies (C0556636, T081) are being applied. In addition (C0332287, T169), we review the current research efforts (C0015264, T040) and in some cases, clinical efforts (C0015264, T040), which are using gene therapy (C0017296, T061, T063) technologies (C0039421, T090) to help achieve the goals (C0018017, T170) of tissue engineering. This merger of gene therapy (C0017296, T061, T063) and tissue engineering is being applied in multiple organ (C0178784, T023)/ tissue/ cell systems for a growing list of applications (C0185125, T058). The prominence (C0437936, T033) of gene therapy (C0017296, T061, T063) technologies (C0039421, T090) in tissue engineering will continue to increase as gene transfer technologies

graph here

Graphical Summary



Summary: Visualize Semantics!

- Where do the semantics come from?
  - KOS + context + usage patterns
  - Annotation from text/context
  - citations/co-citations
  - Links/linked data
- How do we present the semantics to the user?
  - Meaningful
  - Trustful
  - Useful