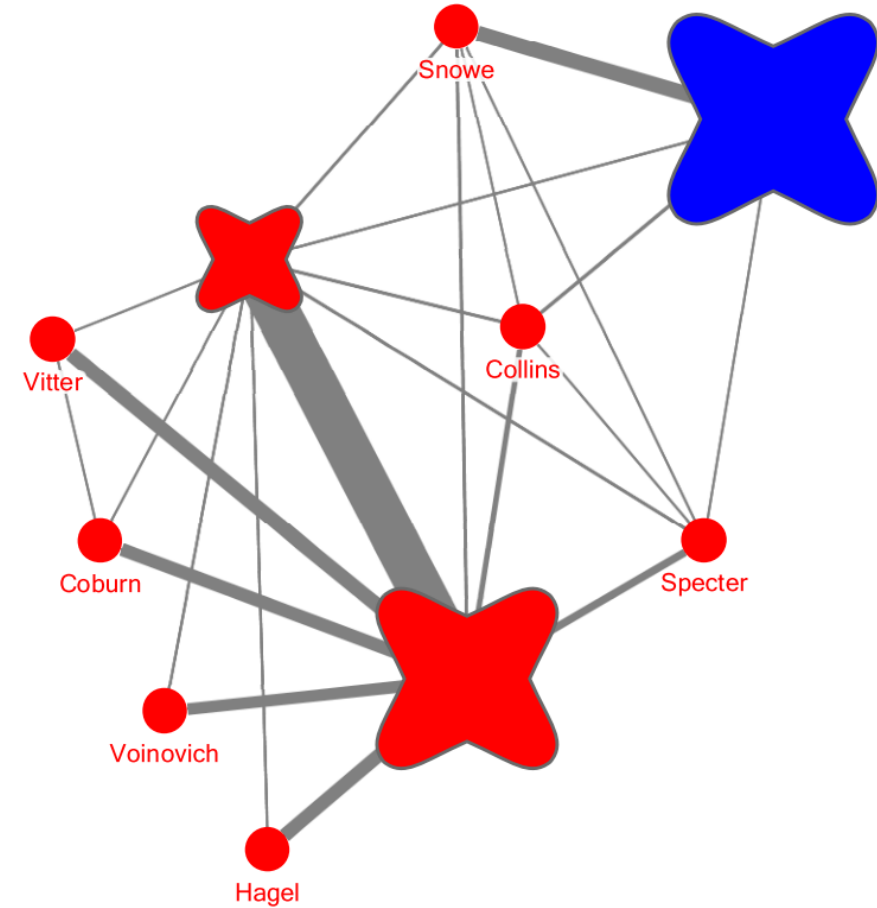
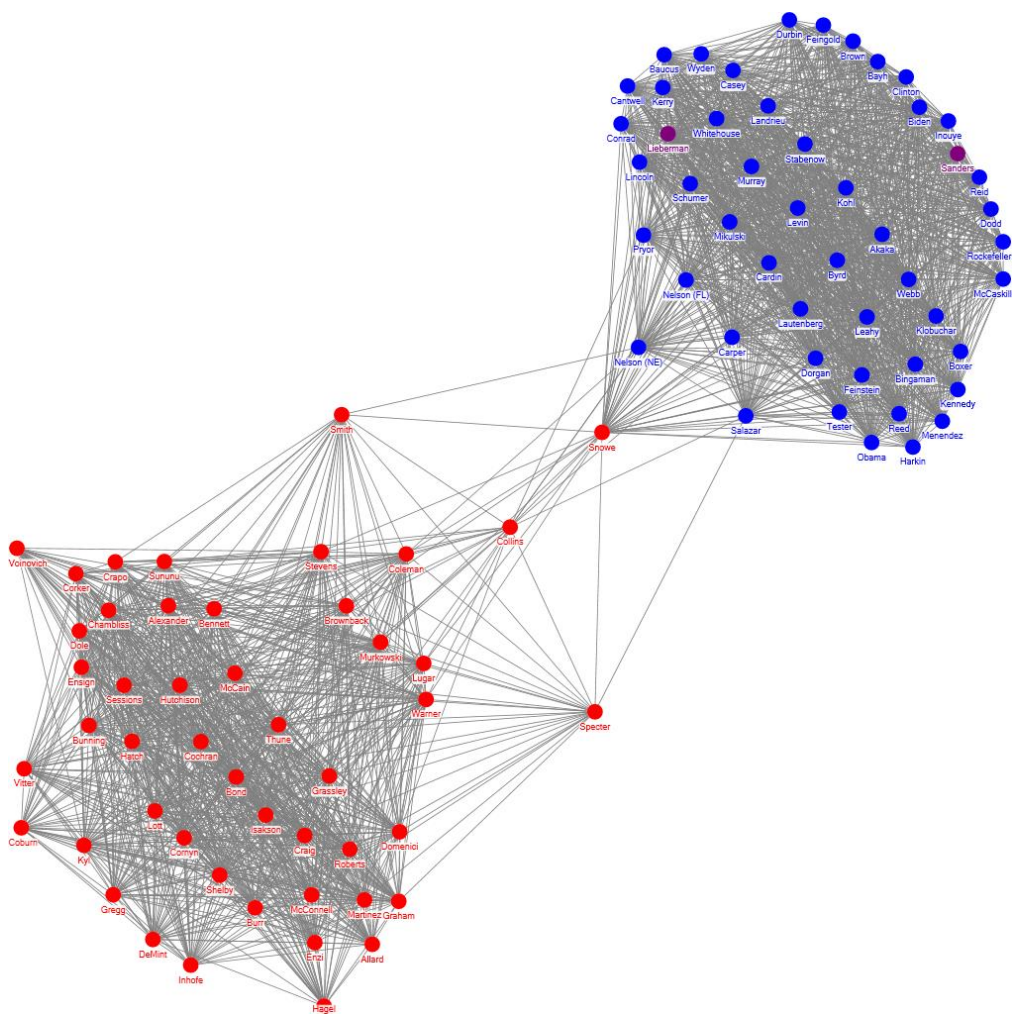


CS 7280-03 Special Topics on Visualization in Network Science



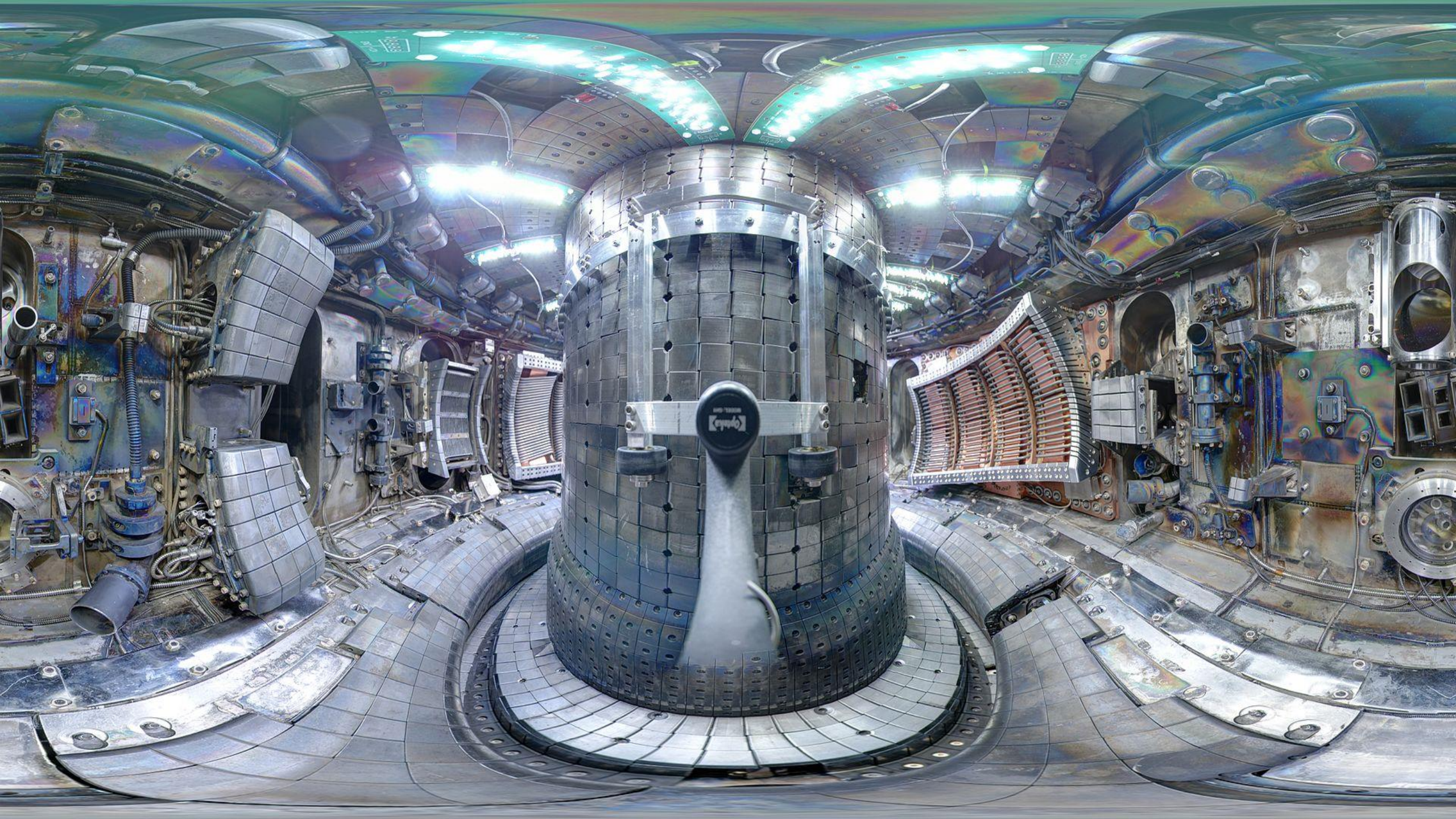
Professor Cody Dunne

<https://codydunne.github.io/cs7280-f16/>
c.dunne@northeastern.edu

Visualization

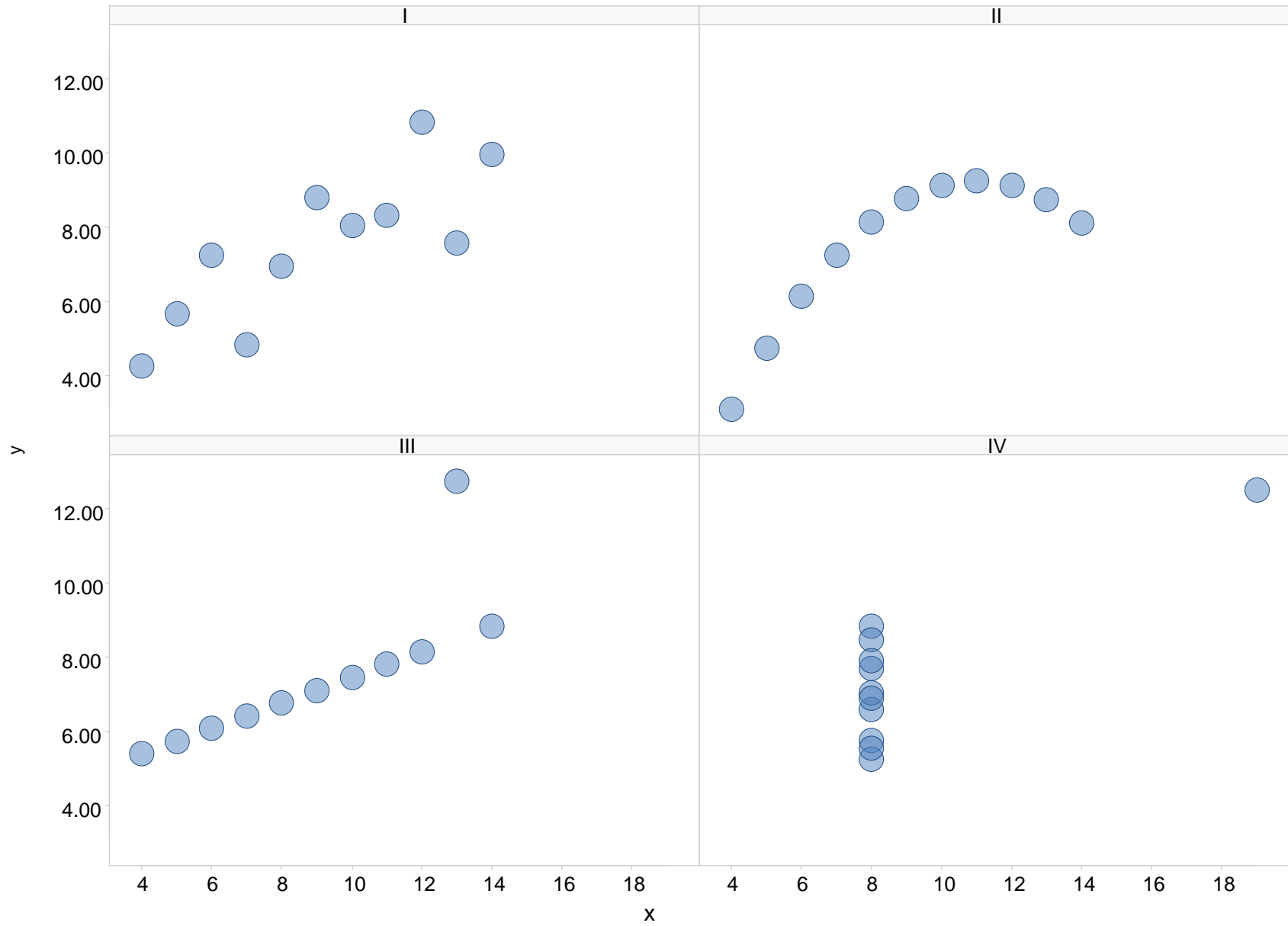
The Data Problem





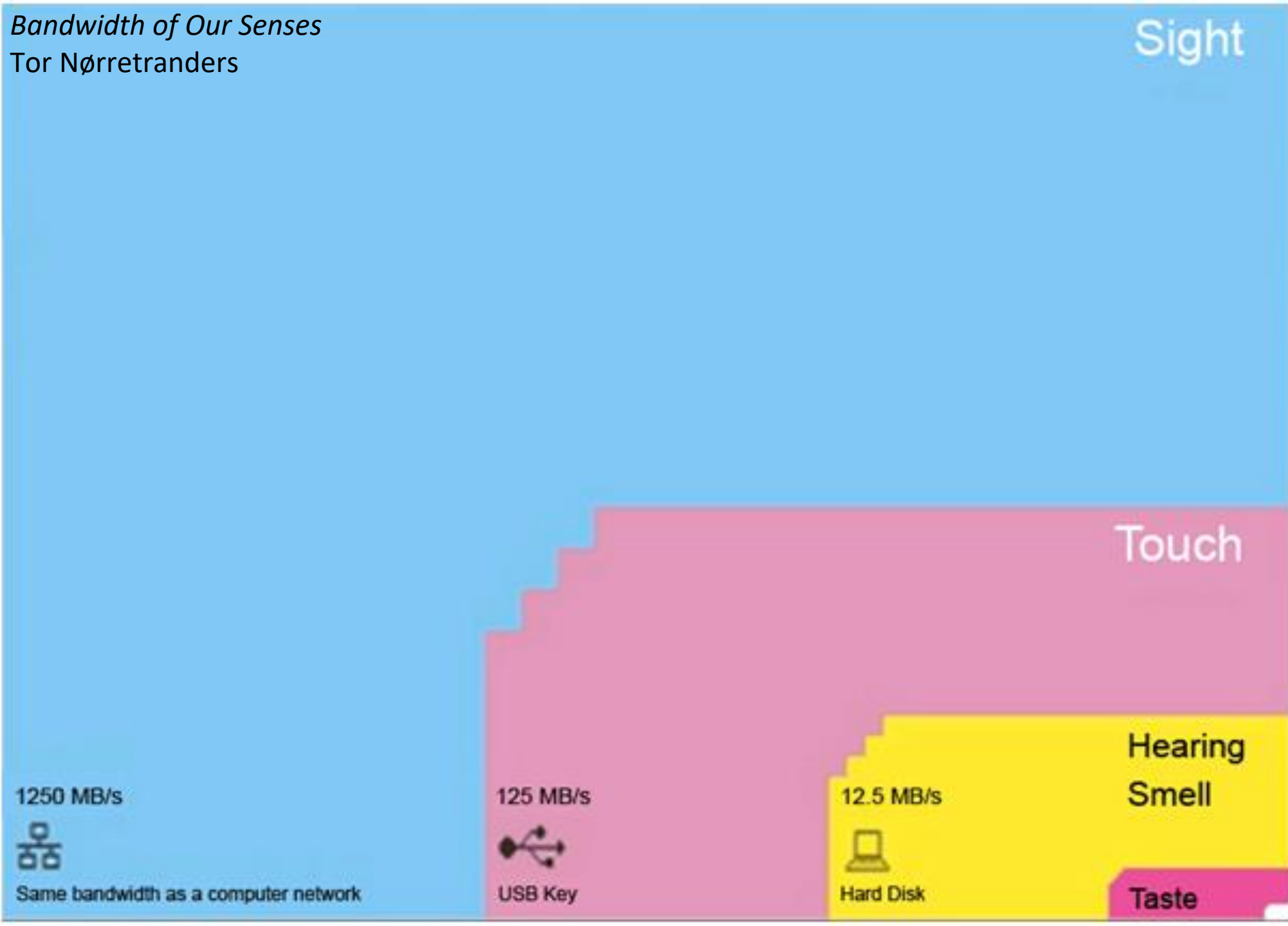
I		II		III		IV	
x	y	x	y	x	y	x	y
10.00	8.04	10.00	9.14	10.00	7.46	8.00	6.58
8.00	6.95	8.00	8.14	8.00	6.77	8.00	5.76
13.00	7.58	13.00	8.74	13.00	12.74	8.00	7.71
9.00	8.81	9.00	8.77	9.00	7.11	8.00	8.84
11.00	8.33	11.00	9.26	11.00	7.81	8.00	8.47
14.00	9.96	14.00	8.10	14.00	8.84	8.00	7.04
6.00	7.24	6.00	6.13	6.00	6.08	8.00	5.25
4.00	4.26	4.00	3.10	4.00	5.39	19.00	12.50
12.00	10.84	12.00	9.13	12.00	8.15	8.00	5.56
7.00	4.82	7.00	7.26	7.00	6.42	8.00	7.91
5.00	5.68	5.00	4.74	5.00	5.73	8.00	6.89

Measure	Value	Difference
Mean of x	9	=
Variance of x	11	=
Mean of y	7.50	.00#
Variance of y	4.122 or 4.127	.000#
Correlation between x & y	0.816	.000#
Linear regression line	$y = 3.00 + 0.500x$.00#, .000#



Bandwidth of Our Senses

Tor Nørretranders



No catalogue of techniques can convey a willingness to look for what can be seen, whether or not anticipated. Yet this is at the heart of exploratory data analysis. ... the picture-examining eye is the best finder we have of the wholly unanticipated.

– Tukey, 1980

Visualization Goals

- Record
- Analyze/explore
- Communicate

Napoleon's March on Moscow

Charles Joseph Minard (1869)

Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Chiers, de Legur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davoust qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

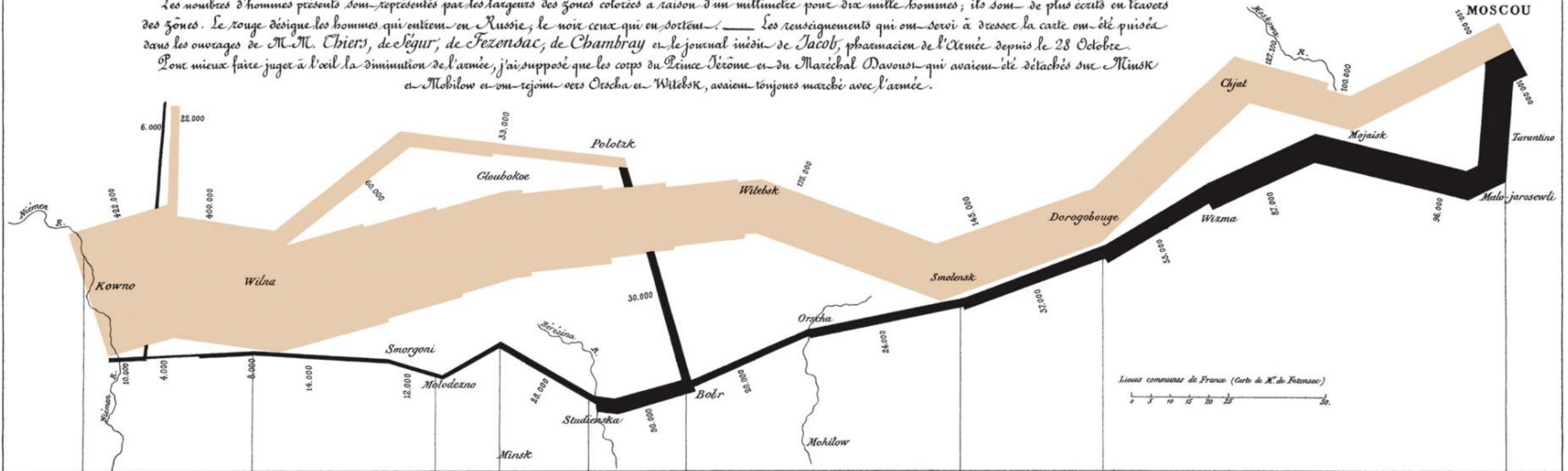
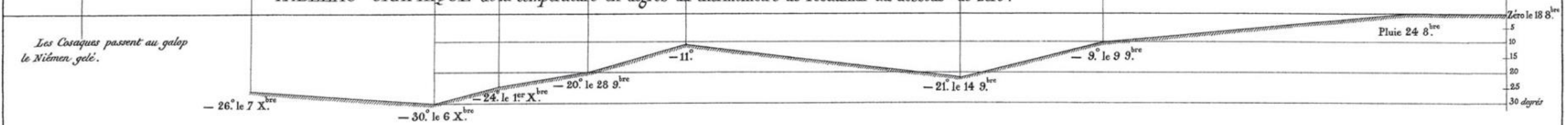


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.



Les Cosaques passent au galop le Niémen gelé.

London Cholera Map

John Snow (1854)



wind map

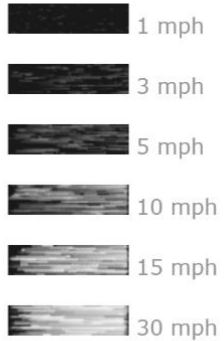
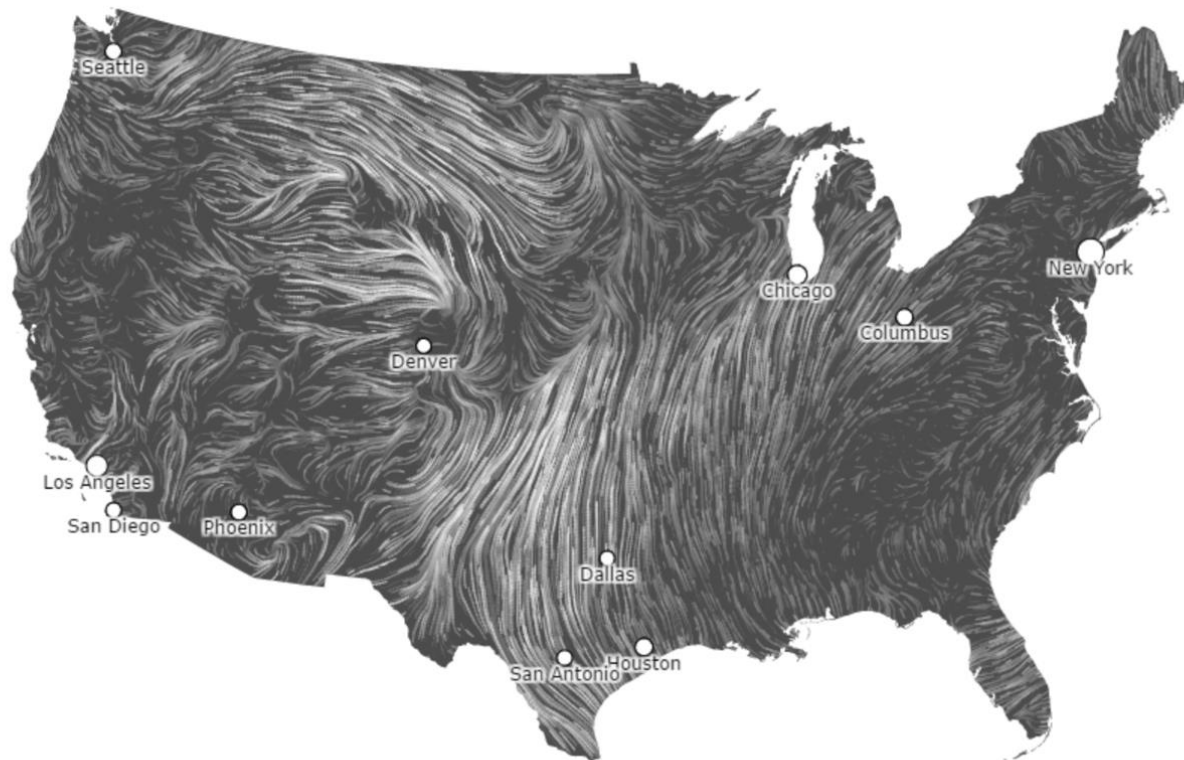
Sept. 7, 2016

6:37 pm EST

(time of forecast download)

top speed: **25.2 mph**

average: **7.3 mph**



Gallery



An invisible, ancient source of energy surrounds us—energy that powered the first explorations of the world, and that may be a key to the future. This map shows you the delicate tracery of wind flowing over the US.

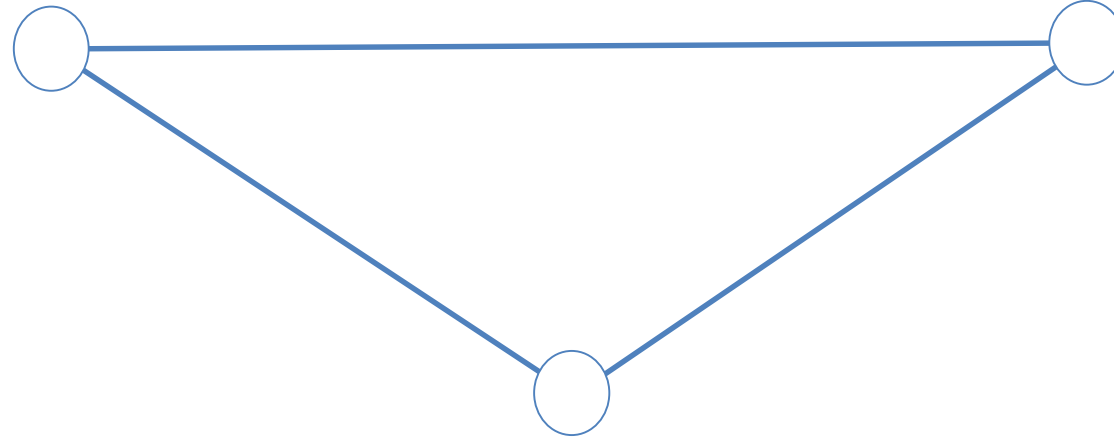
Wind map prints are available from [Point.B Studio](#).

Read more about [wind](#) and about [wind power](#).

Visualization Space

From Data to Information, and from Information to Knowledge.

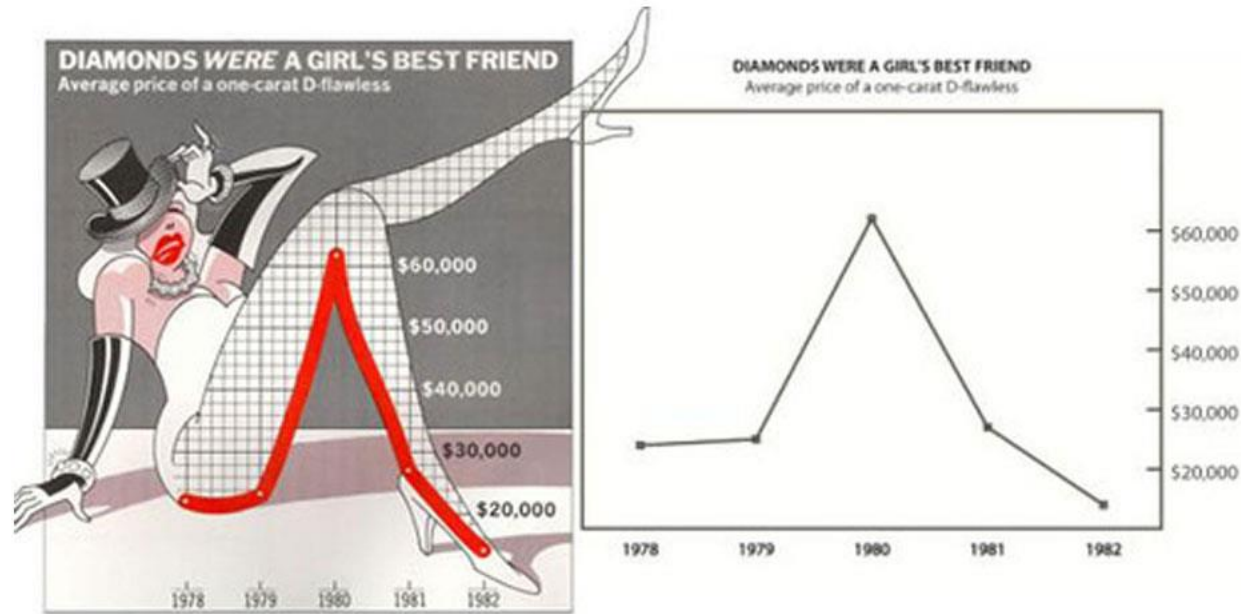
Analytical
(Data
Visualization)
Science



Narrative
(Infographic)
Media

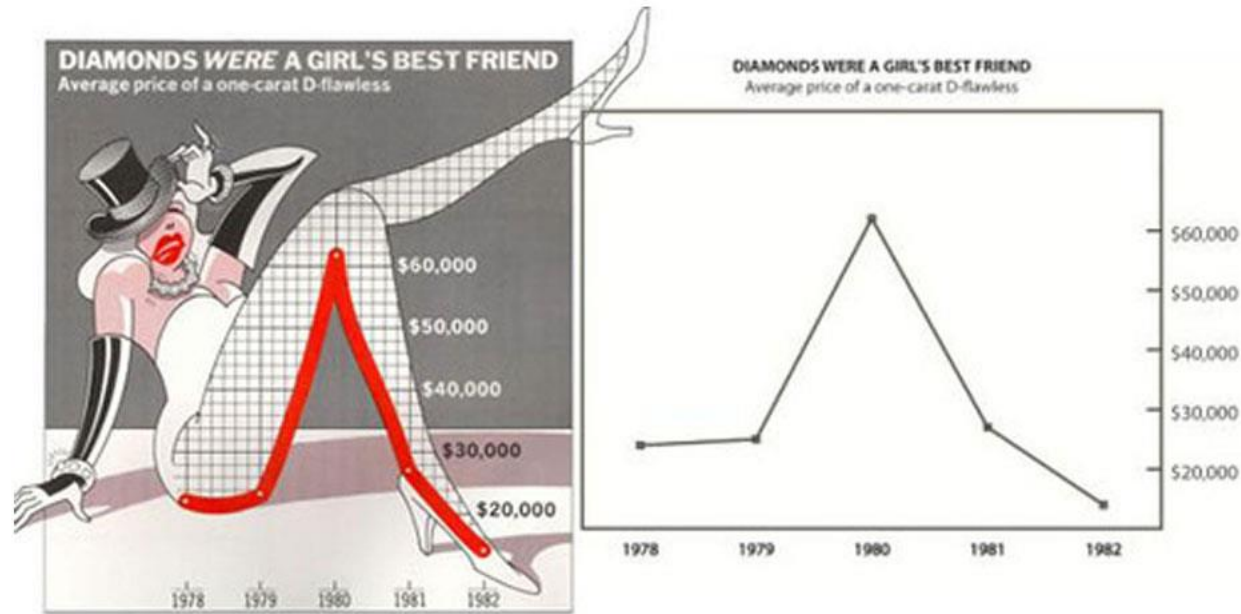
Art
Museum

Charm and Direct Appeal



Clarity and Power

Nigel Holmes



Edward Tufte



Hans Rosling:

The best stats you've ever seen

TED2006 · 19:50 · Filmed Feb 2006

48 subtitle languages ?

View interactive transcript



Watch later



Favorite



Download



Rate

Share this idea



Facebook LinkedIn Twitter Link Email Embed

10,840,961 Total views

You've never seen data presented like this. With the drama and urgency of a sportscaster, statistics guru Hans Rosling debunks myths about the so-called "developing world."

Playlists to watch

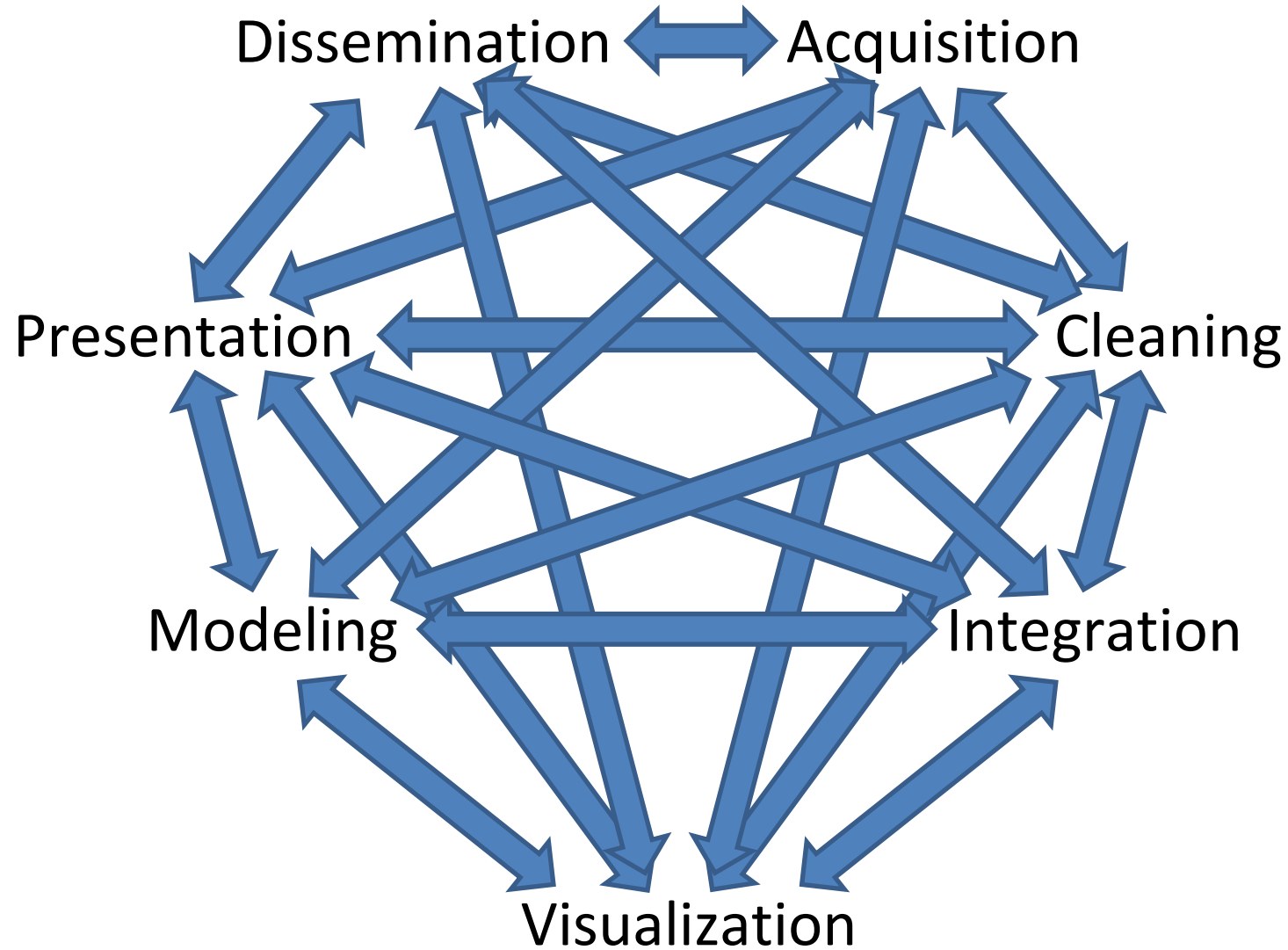
[Browse all](#)



Data Analysis Process

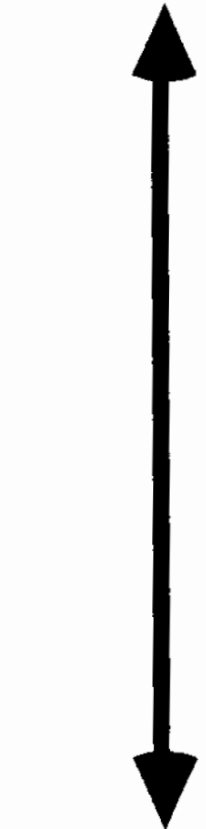
Kandel et al., 2012	Heer, 2013 (unpublished)
Discovery	Acquisition
Wrangling	Cleaning
	Integration
Profiling	Visualization
Modeling	Modeling
Reporting	Presentation
	Dissemination

Data Analysis Process

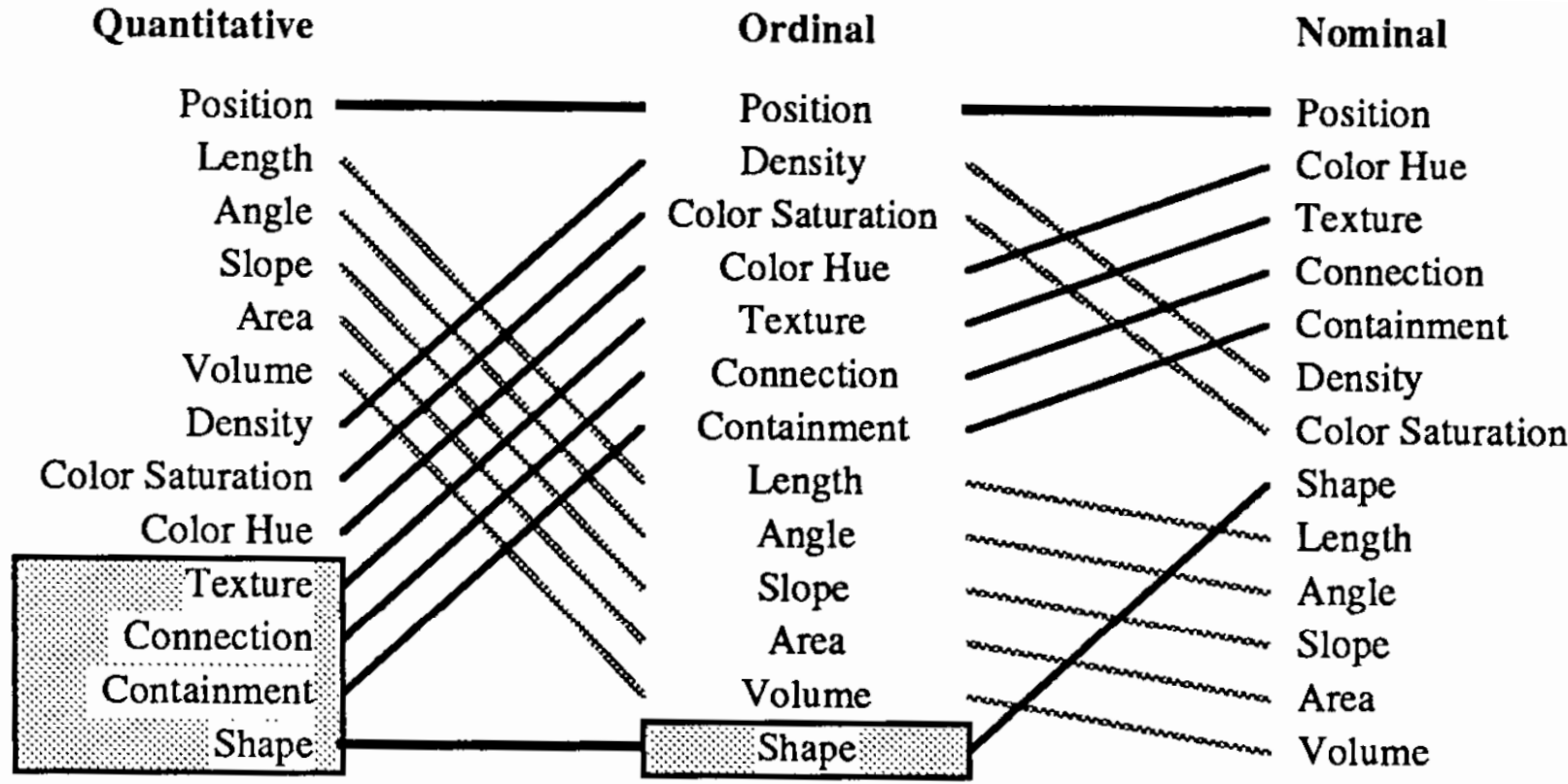
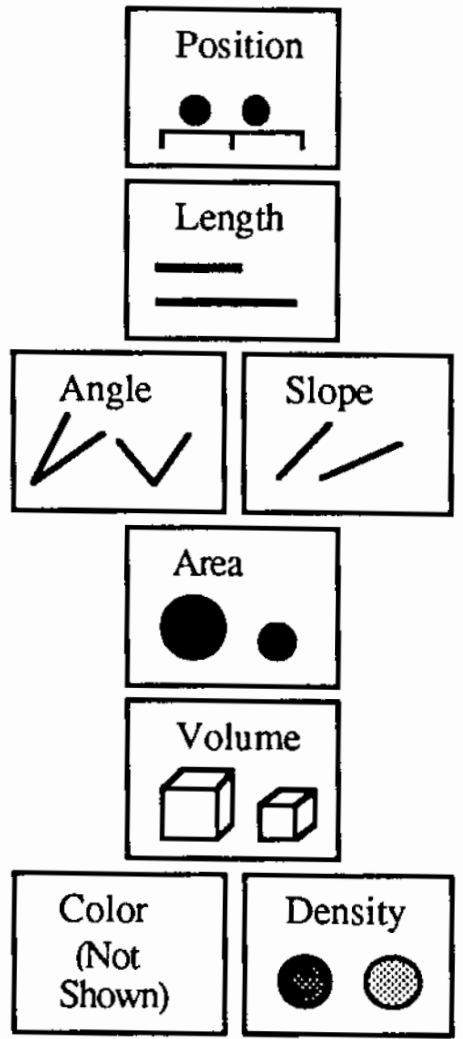


Quantitative Tasks

More accurate



Less accurate

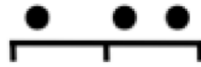


Most Efficient



Least Efficient

Position



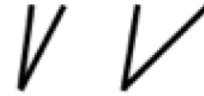
Length



Slope



Angle



Area



Intensity



Color



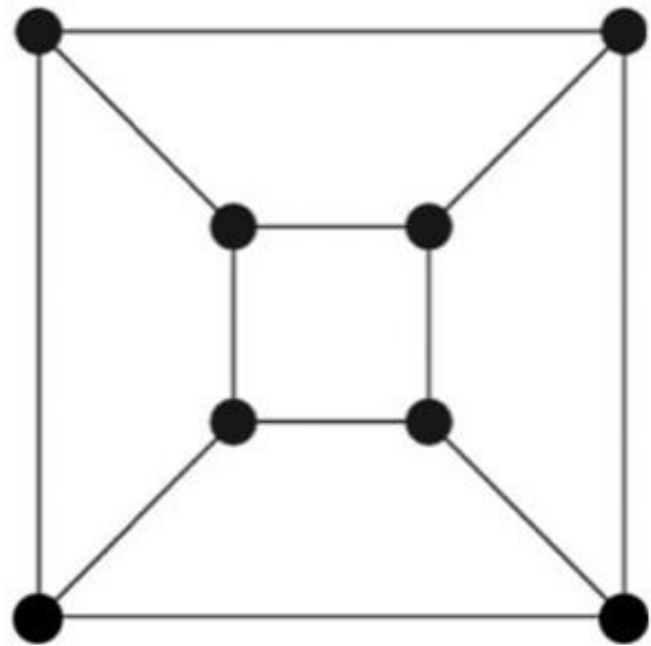
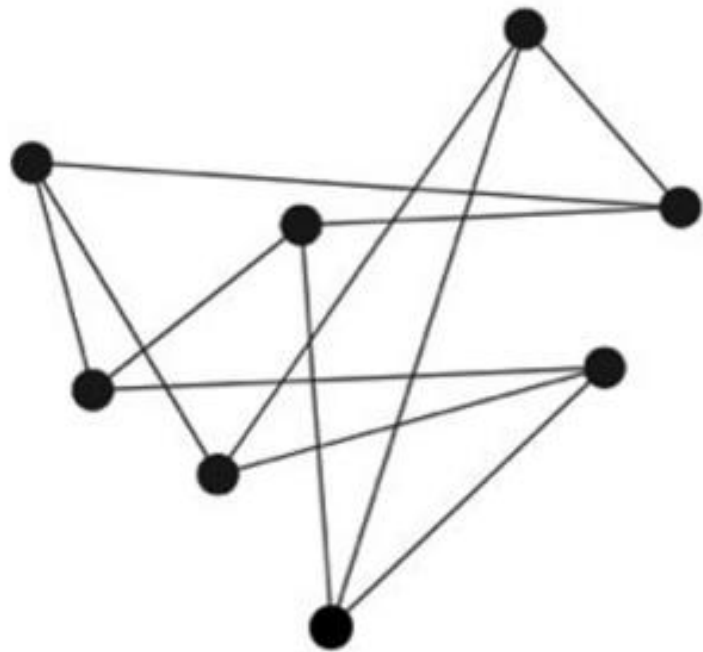
Shape



Quantitative

Ordinal

Nominal



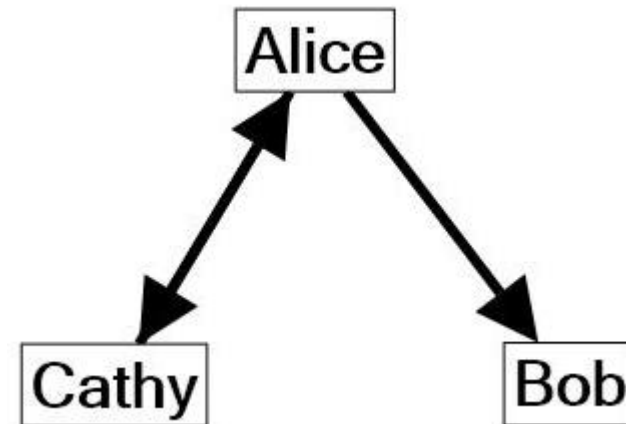
Networks

Graph \approx Network

Node \approx Vertex \approx Entity

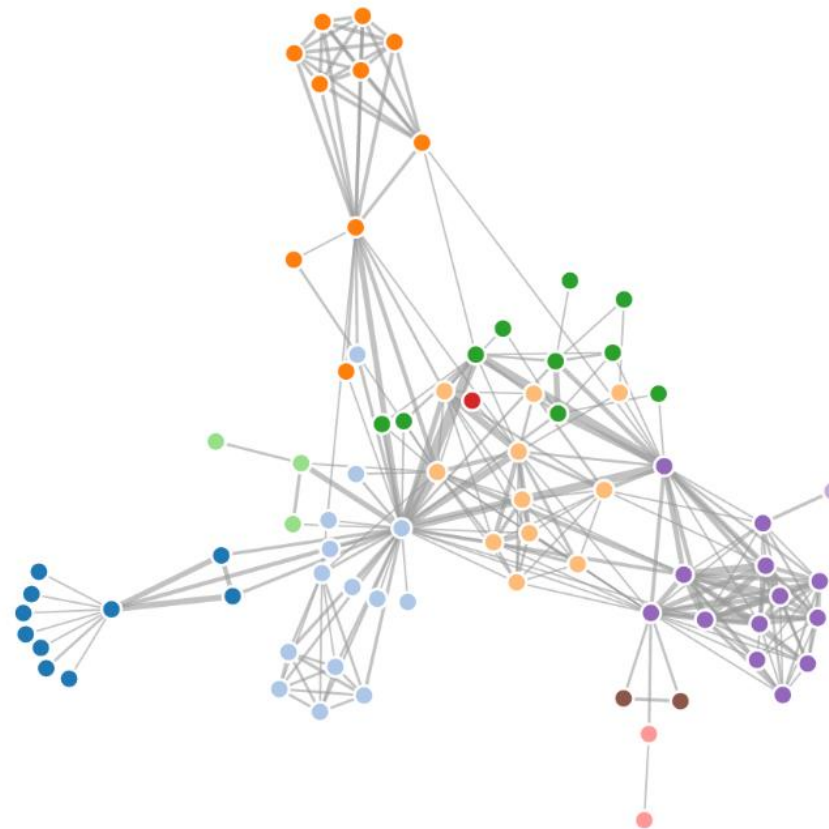
Edge \approx Link \approx Relationship

Node 1	Node 2
Alice	Bob
Alice	Cathy
Cathy	Alice





Force-Directed Graph



Choose Graph:

FAVORITE GRAPHS

HB/blckhole

Bai/rw5151

HB/bcsstm13

HB/jagmesh6

HB/watt_1

HB/lshp1882

HB/plat1919

HB/bcsstk26

Bai/dw256A

Bai/tols2000

Bai/dw1024

Bai/rdb2048

Pajek/CSphd

GHS_indef/laser

BAI

bfwa398

bfwa62

bfwb398

bfwb62

bfwb782

bwm200

cdde1

cdde2

cdde3

cdde4

cdde5

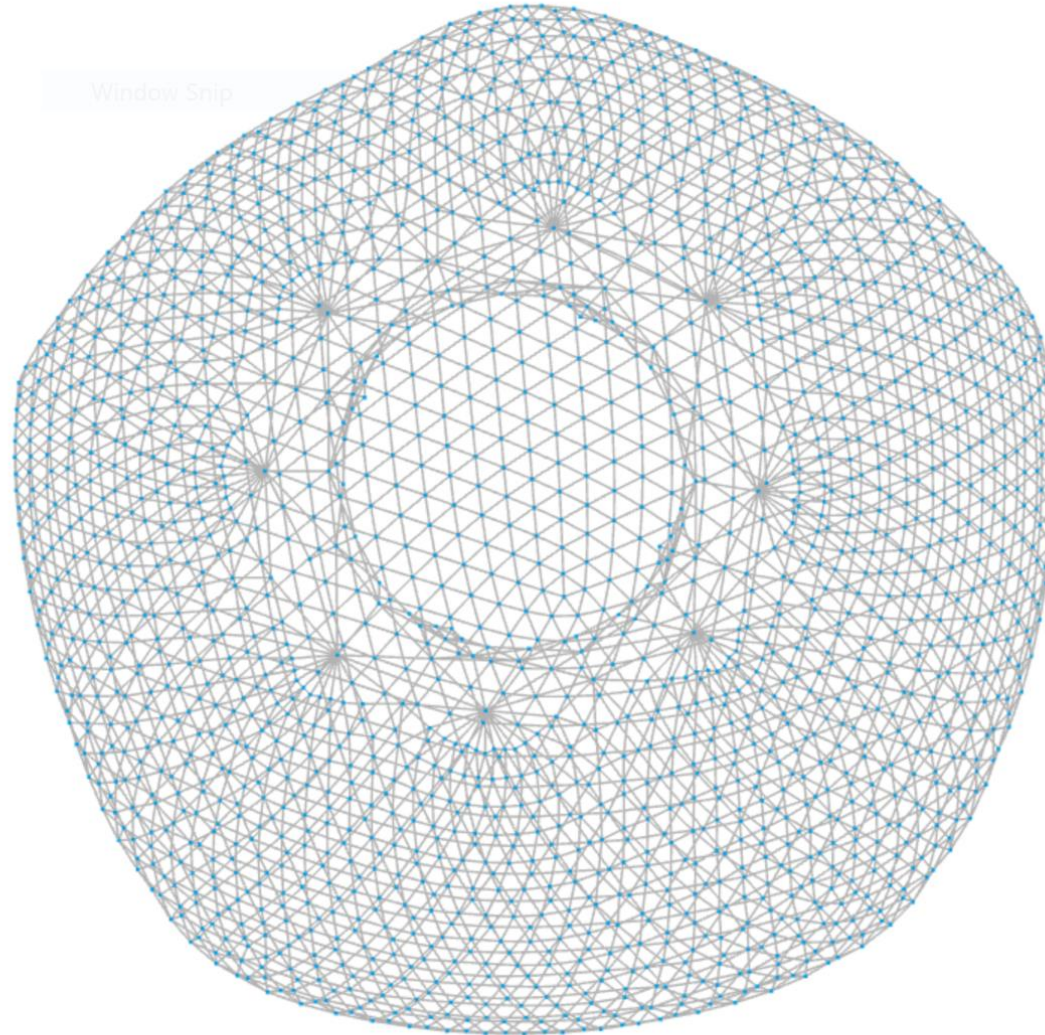
cdde6

ck104

ck400

ck656

dw256A



Window Snip

Layout Settings

- Spring Coeff:
- Spring Length:
- Gravity Coeff:
- Drag Coeff:
- Theta Coeff:

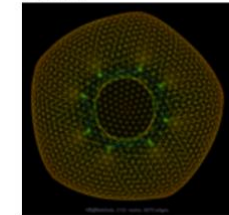
Reset to default

HB/blckhole

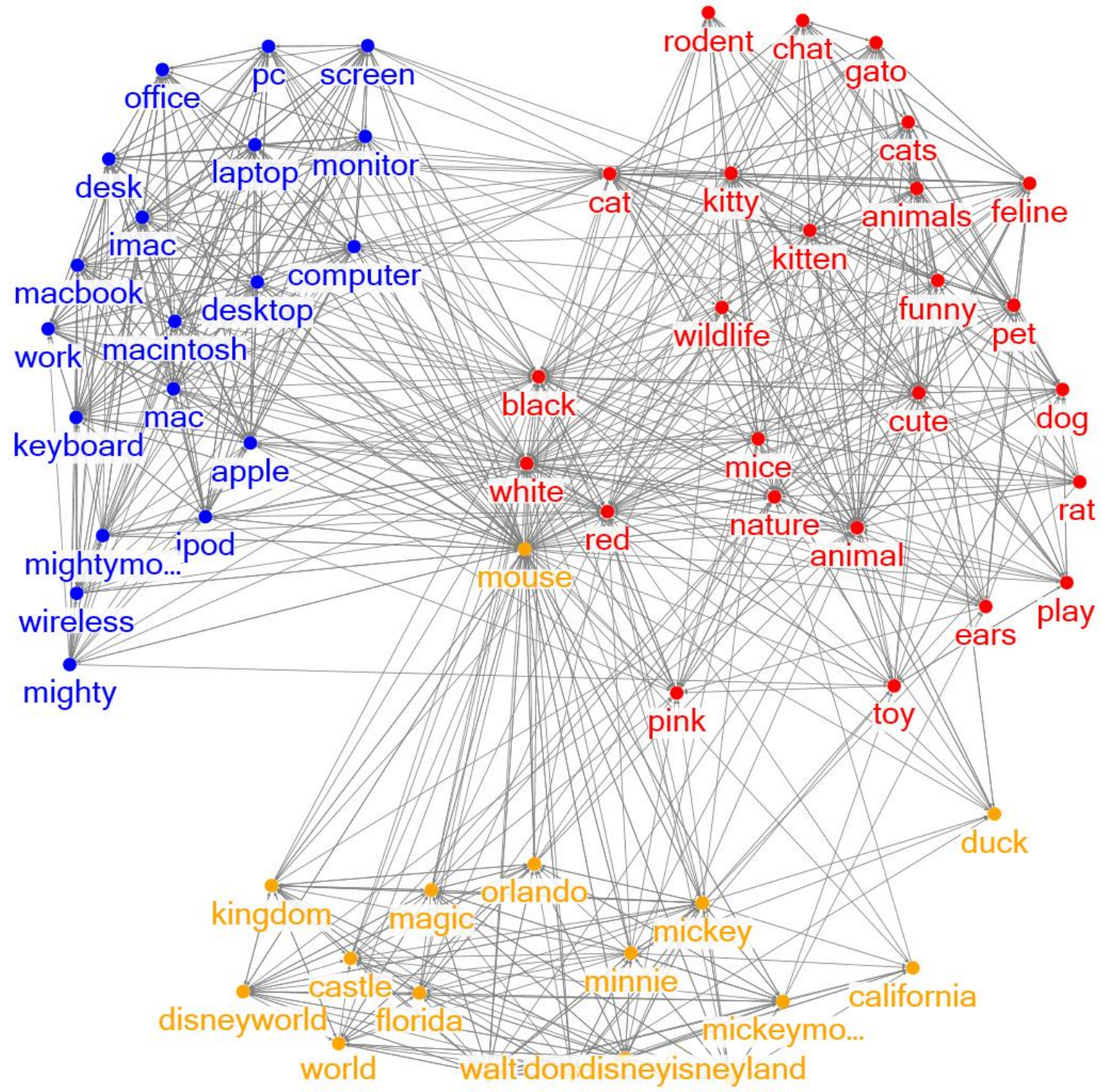
Nodes: 2121

Edges: 6370

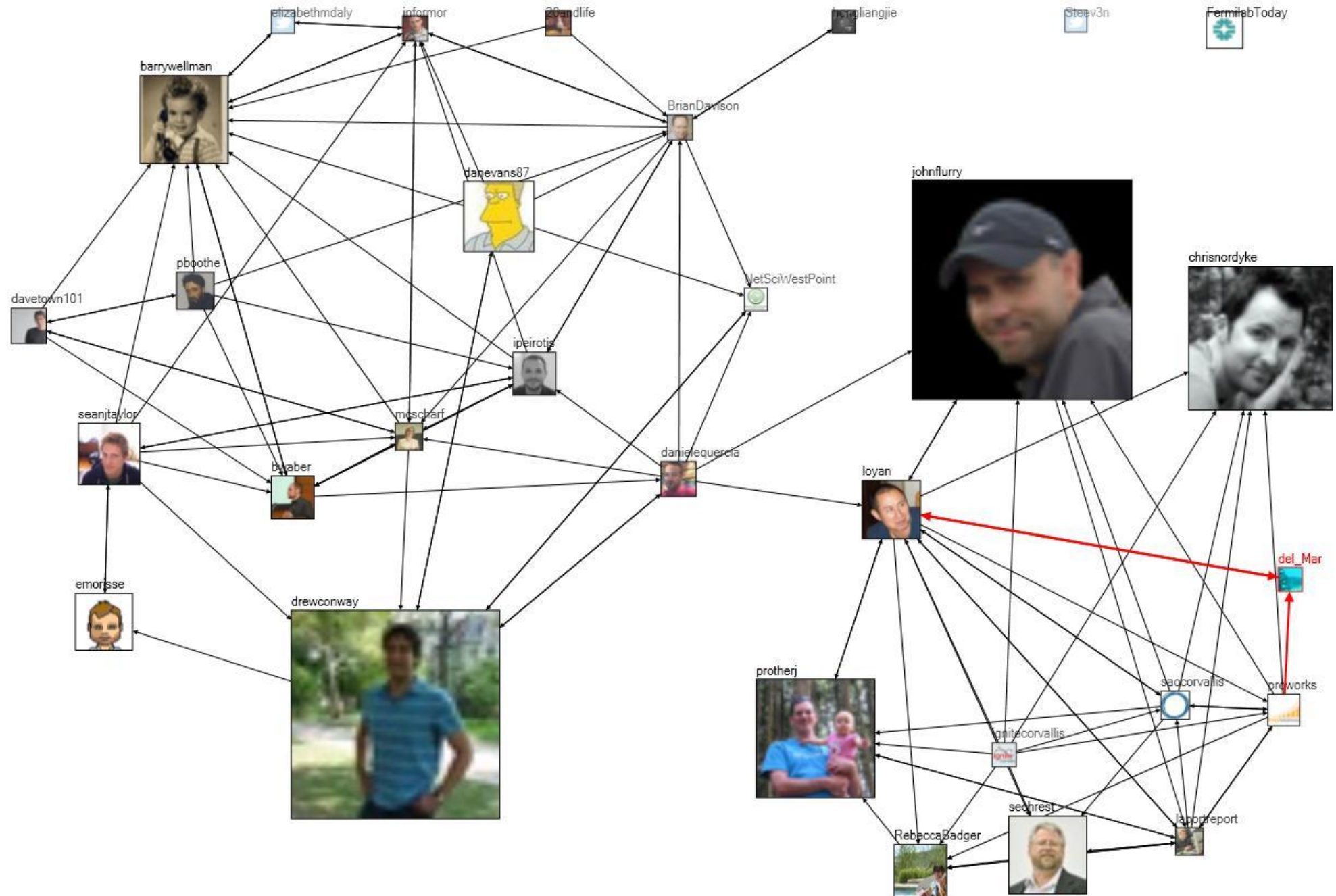
Image:

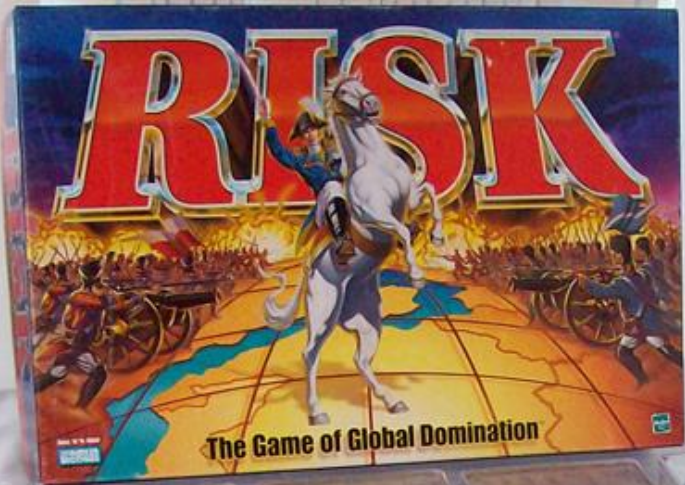


Flickr Query for "Mouse"



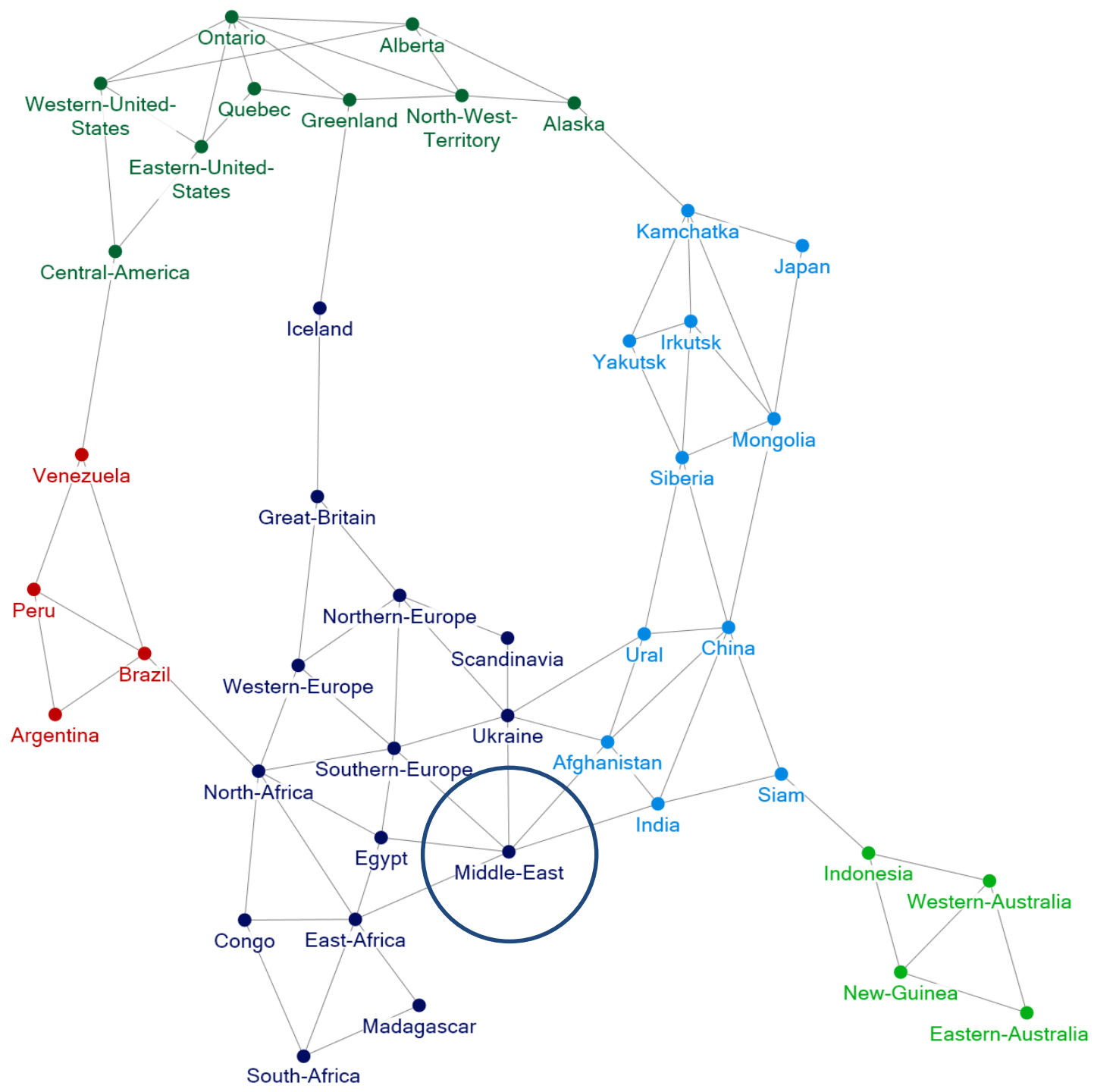
Tweets of the #Win09 Workshop





Risk Movements

Plain Layout with Clusters

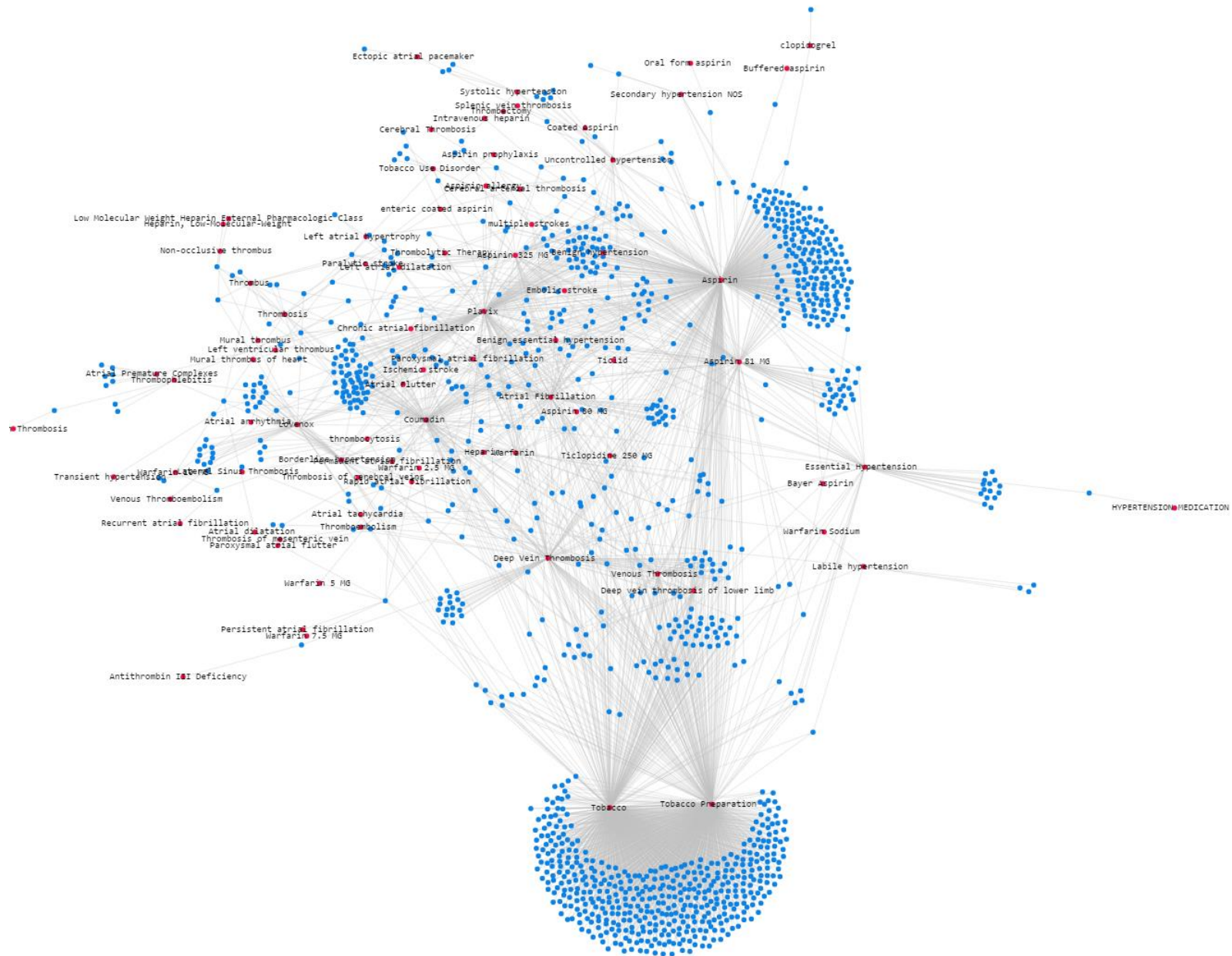


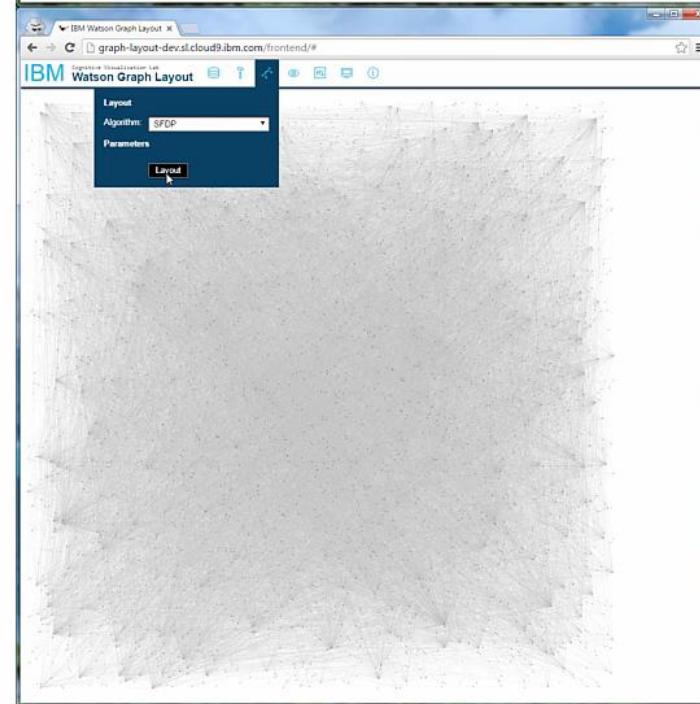
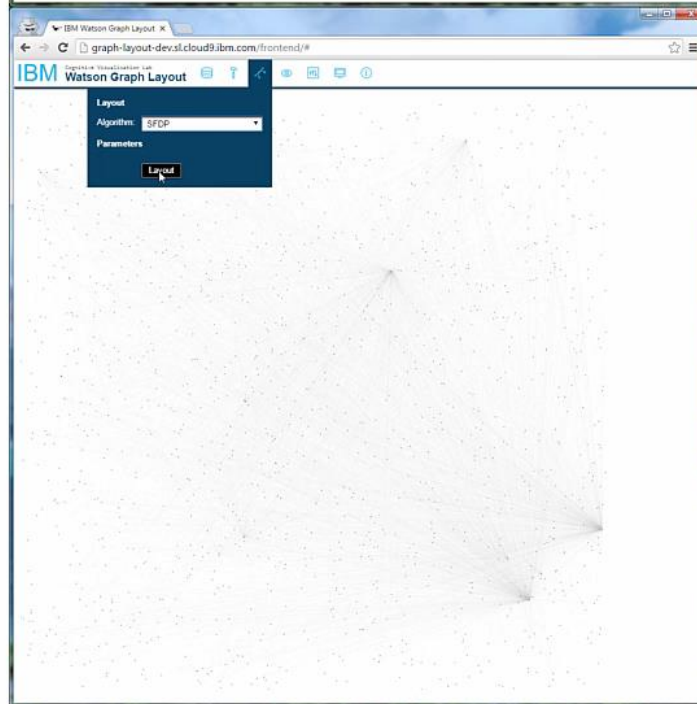
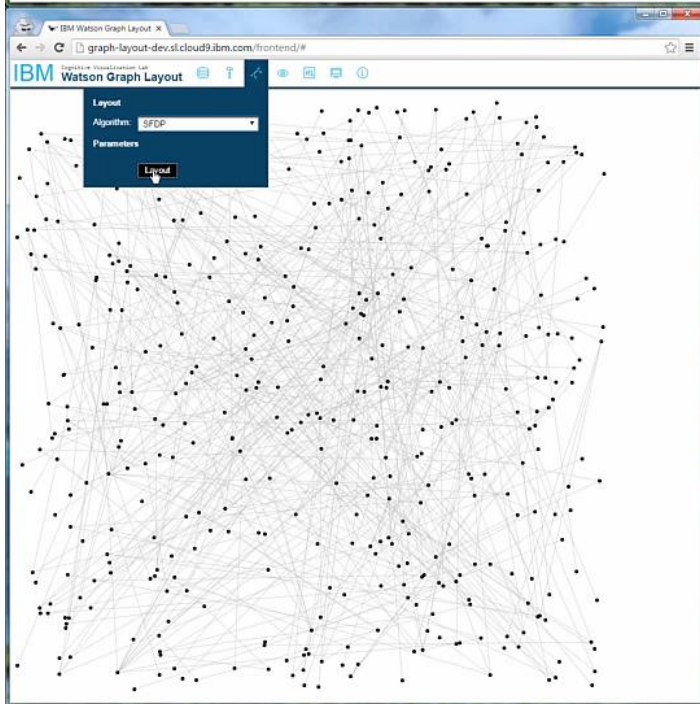
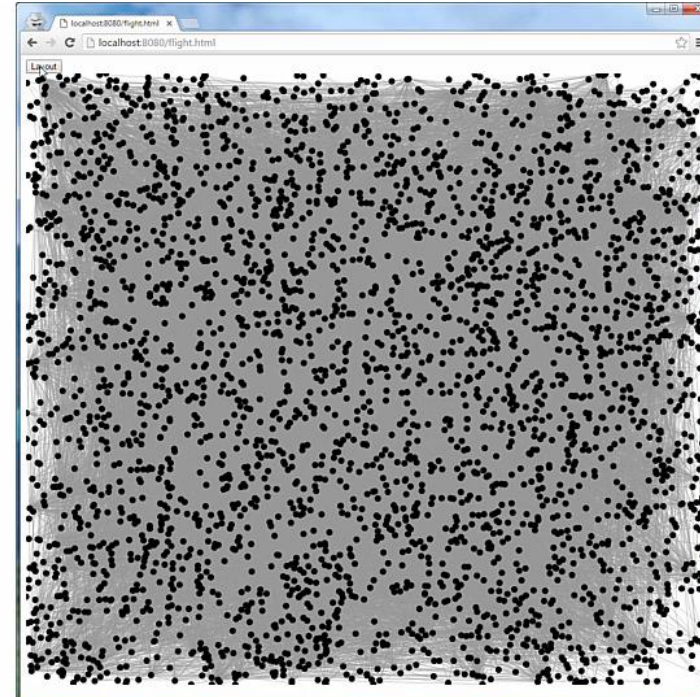
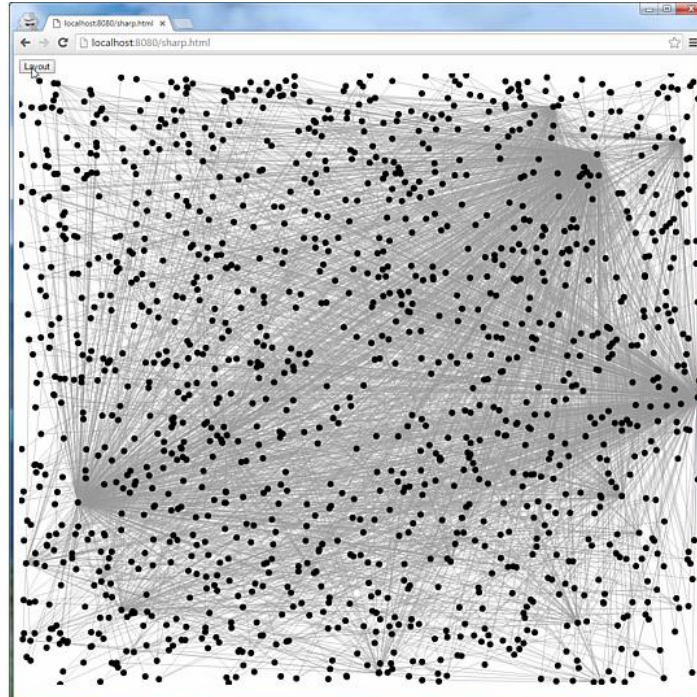
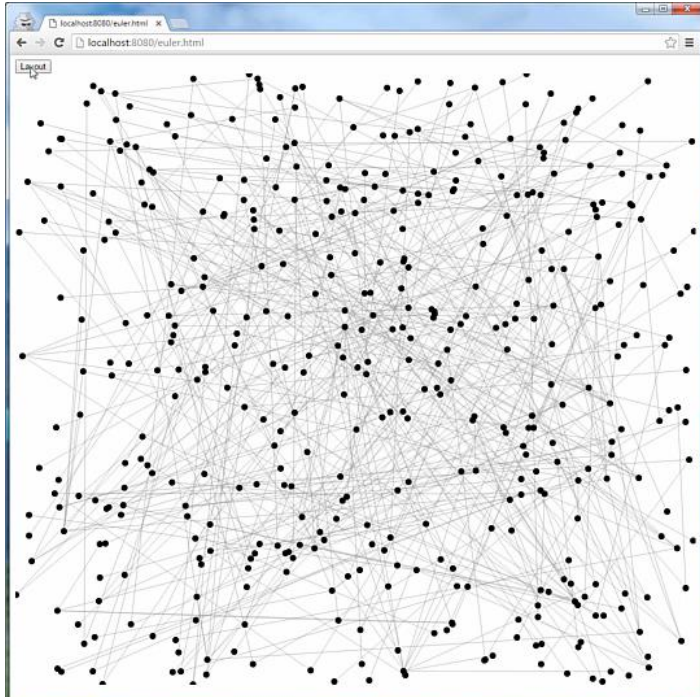
almost equal before stimulation with IL-2, the expression of IL-2R β was induced only in transgenic thymocytes after stimulation with IL-2. Immunoblot analysis demonstrated that the expression of p56^{lck} of transgenic thymocytes was not down-regulated at 4 hr after stimulation with IL-2, whereas p56^{lck} of control ones were not detectable any more at 4 hr after stimulation with IL-2. Moreover, *in vitro* kinase assay substantiated such unchanged expression of p56^{lck} in the thymocytes from transgenic mice: the kinase activities of p56^{lck} did not decrease in thymocytes from transgenic mice after stimulation with IL-2, while kinase activities of control ones were significantly down-regulated by stimulation of IL-2. These results suggested that **a significant proliferative response found in the thymocytes from *lck*-transgenic mice after the stimulation with IL-2 was caused by a constitutive expression of p56^{lck} in these thymocytes even after the stimulation. Our findings, therefore, support a possibility that p56^{lck} may play a role in the IL-2R-mediated signaling system in CD4⁺8⁻ thymocytes.**

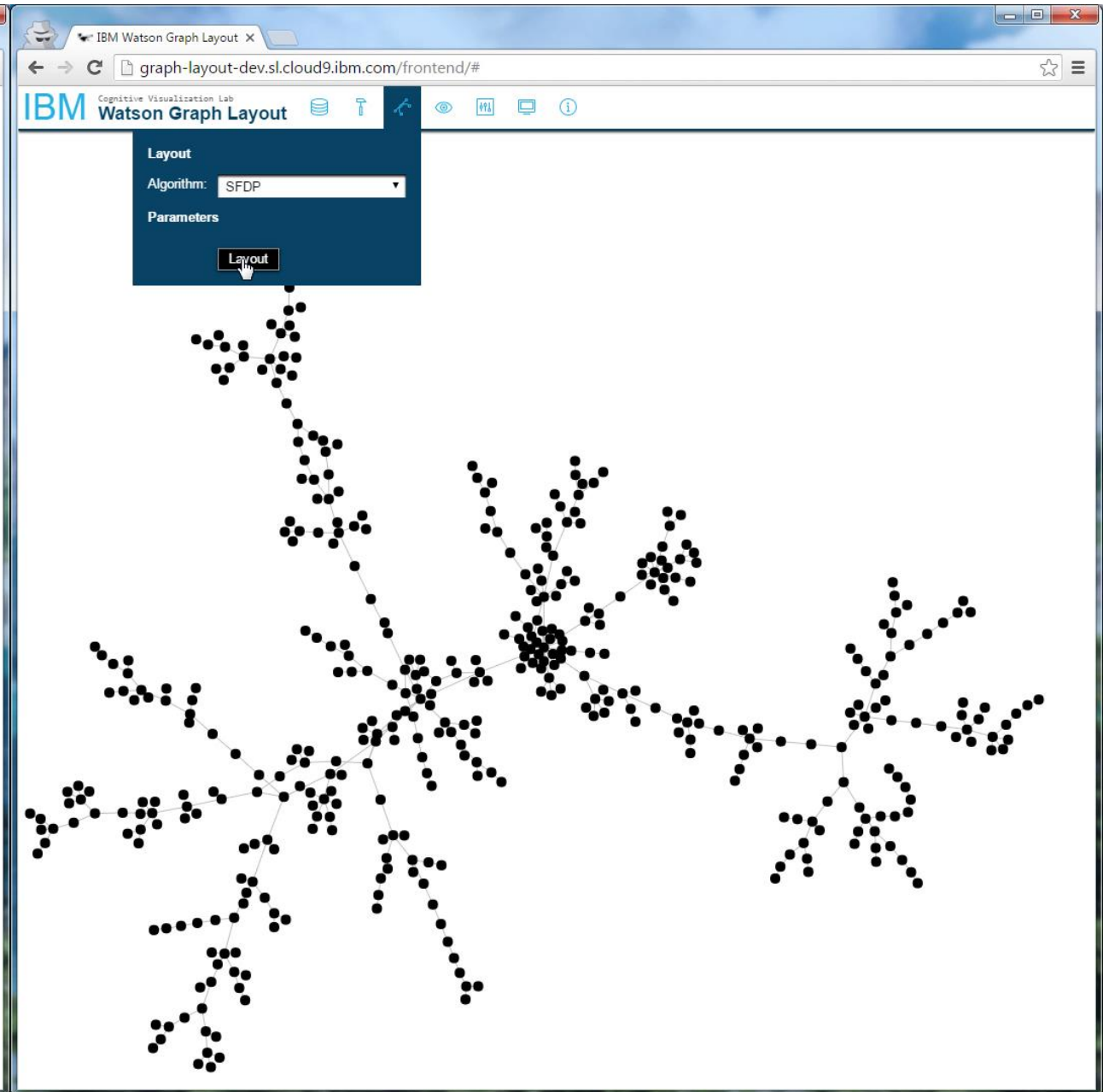
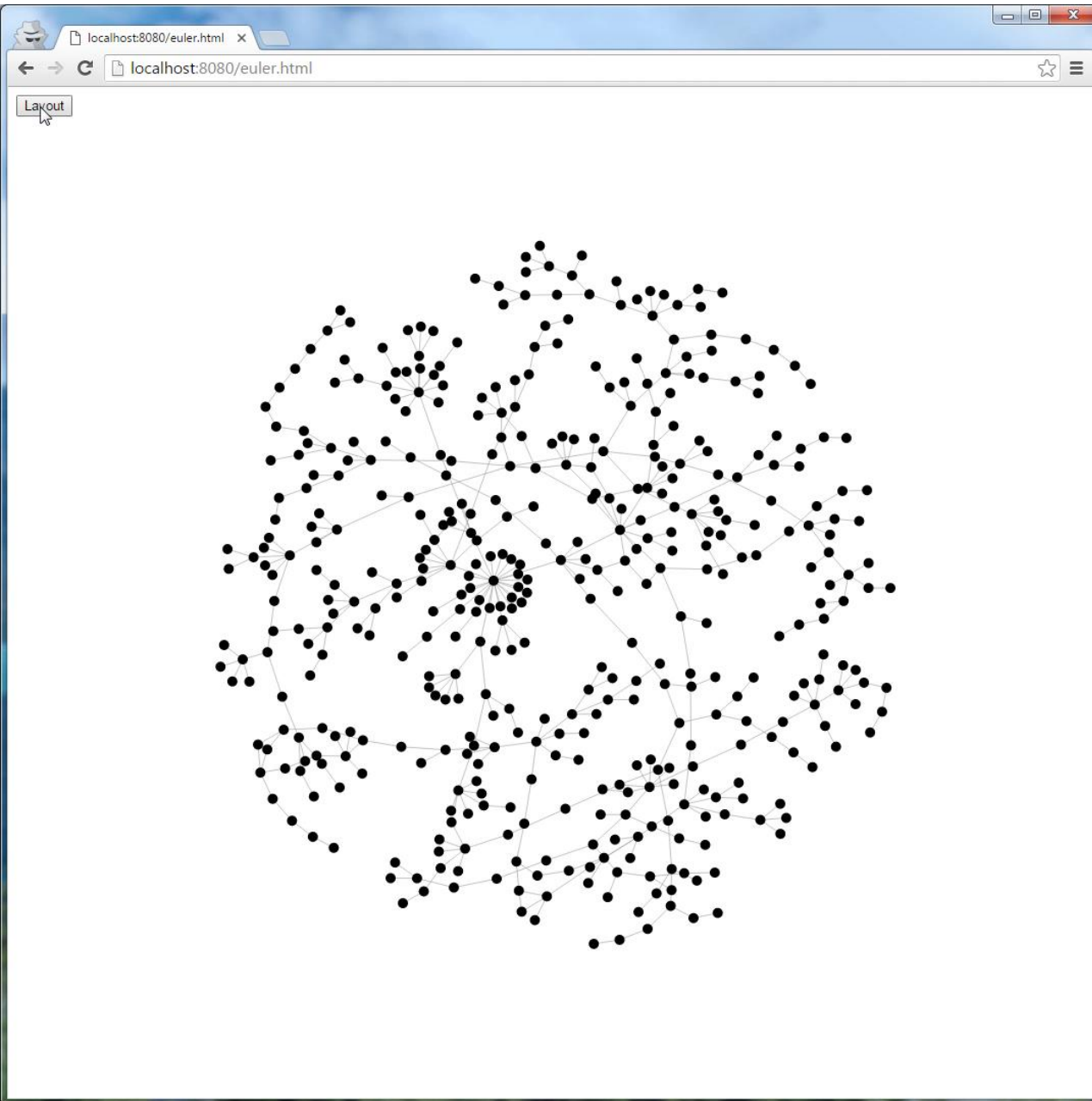
Key words: Transgenic mice, p56^{lck}, Interleukin 2 response, Thymocytes

The *lck* gene encodes a membrane-bound protein tyrosine kinase (PTK) that is expressed in cells of lymphoid lineage, predominantly in T cells (19, 24, 51). The physical association of p56^{lck}, a

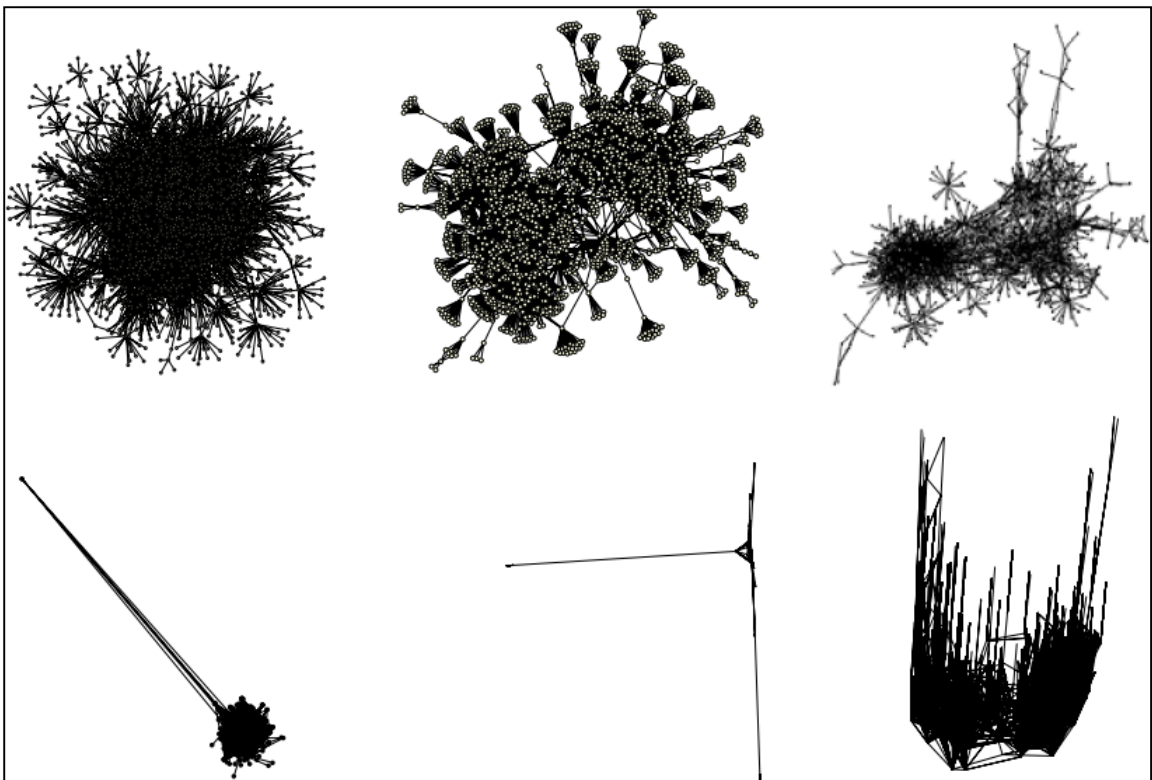
Recently it has been demonstrated activation of PTK precedes the sequential breakdown of phosphatidylinositol (PI) breakdown when activated through the TcR-CD3 complex.



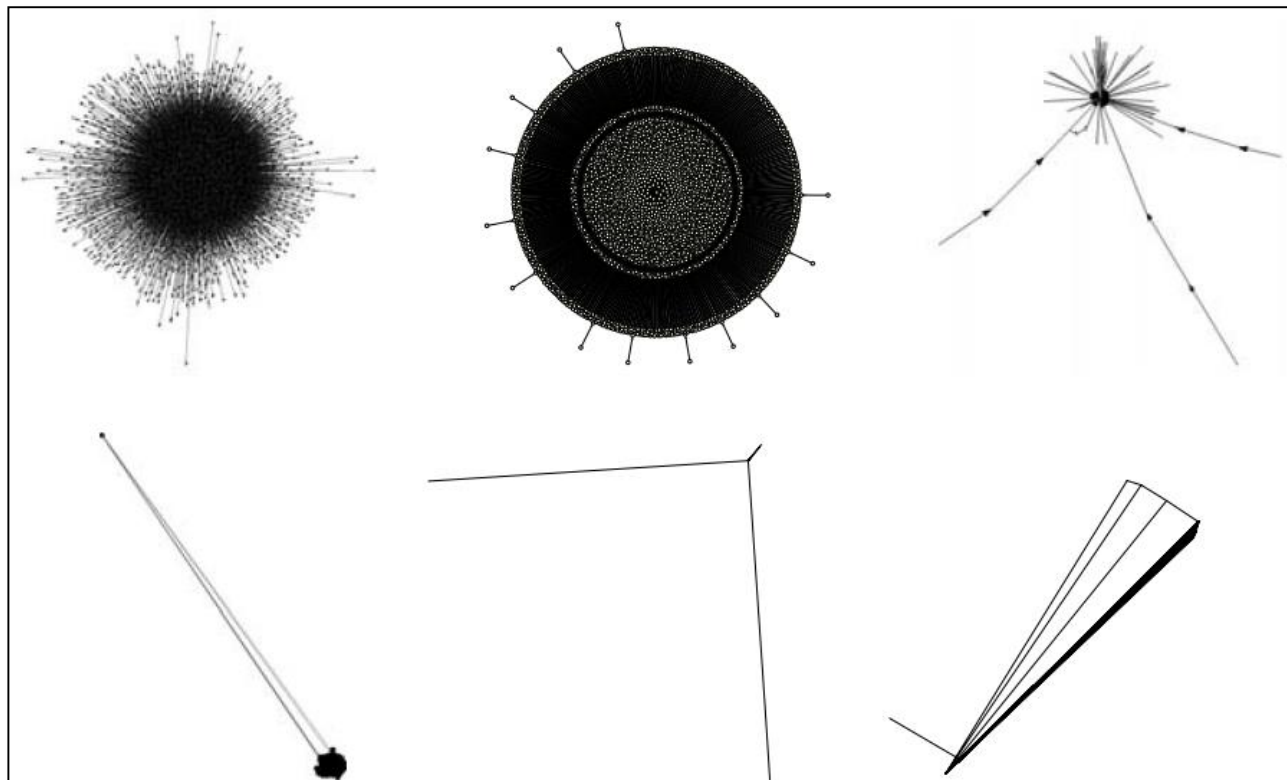




Graph A



Graph B



User performance

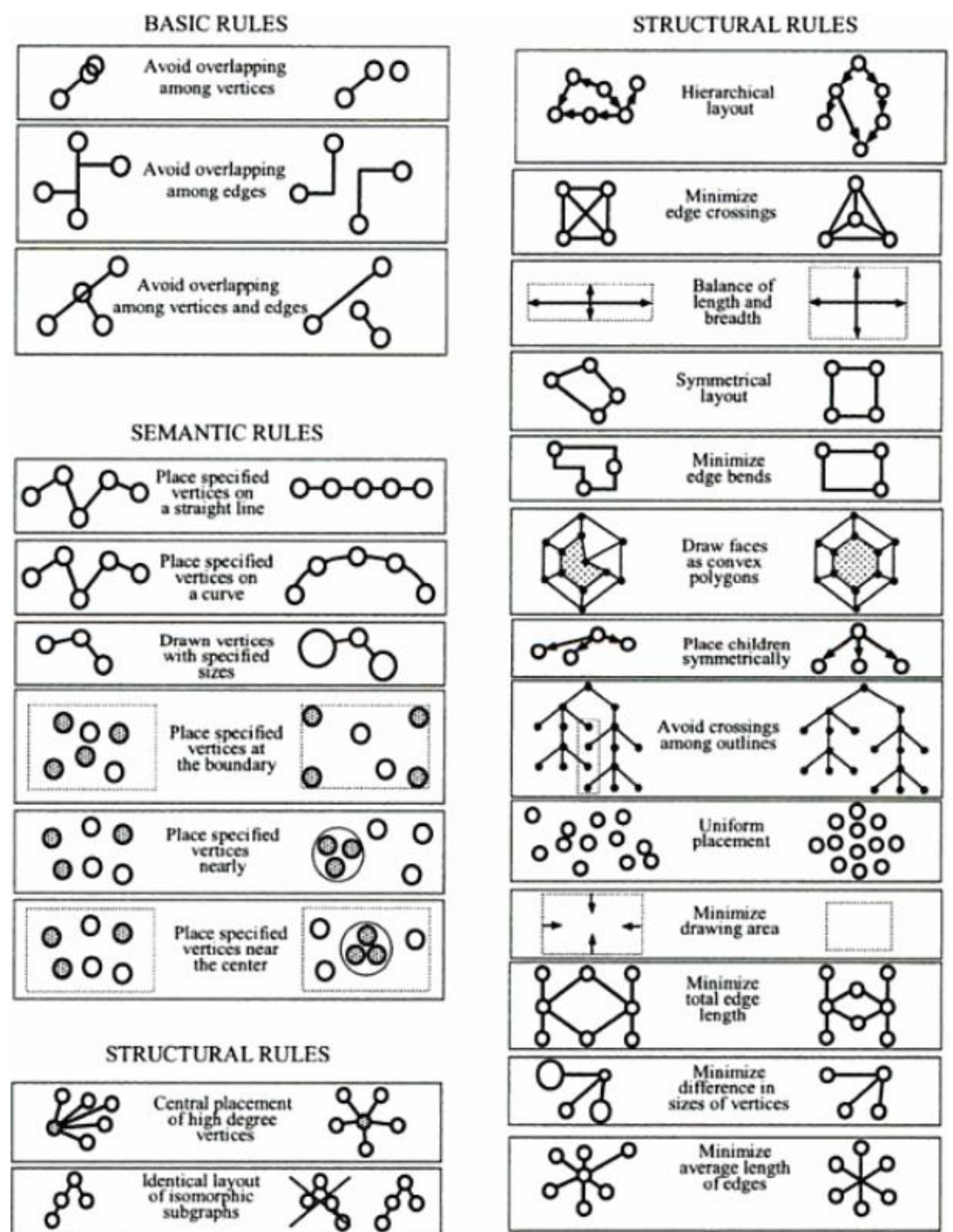
Huang et al., 2007, etc.

Simple rules or heuristics

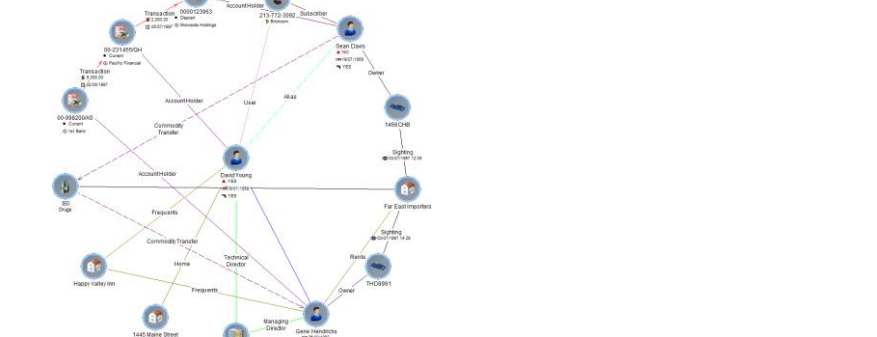
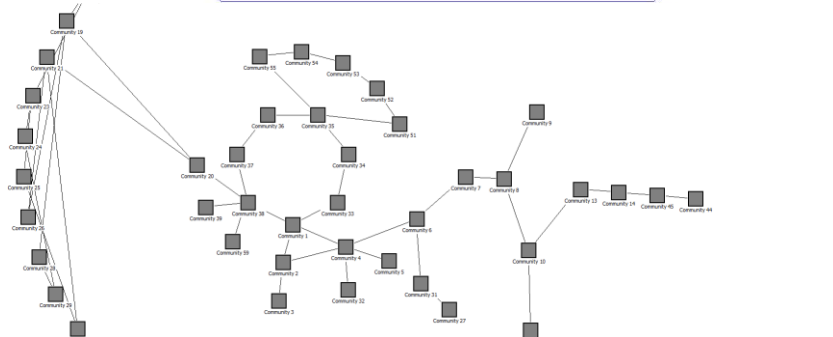
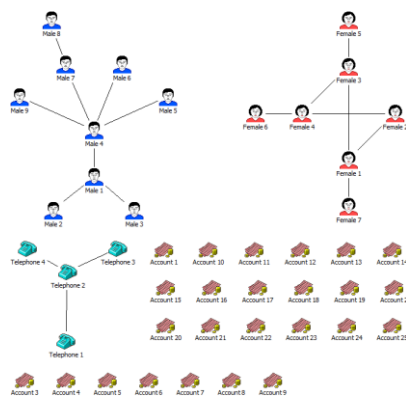
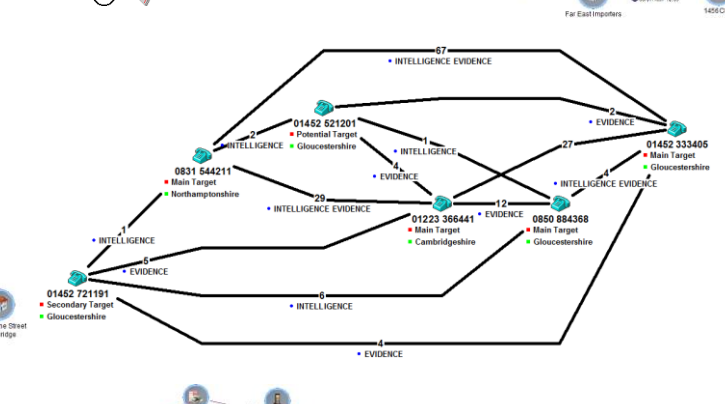
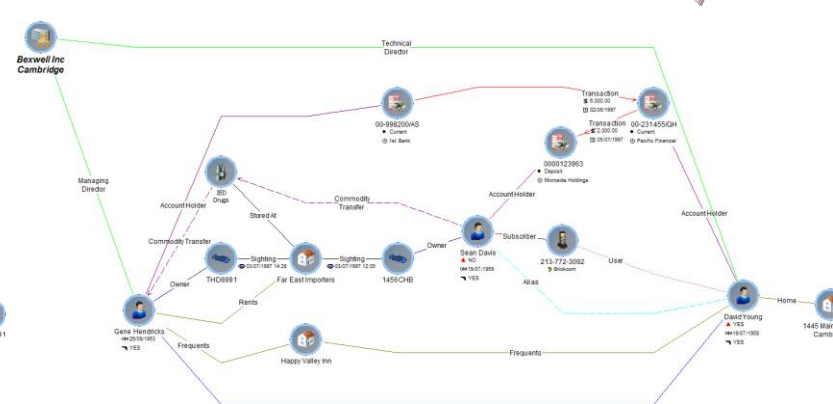
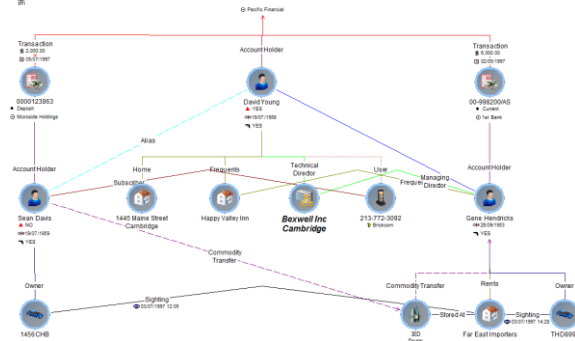
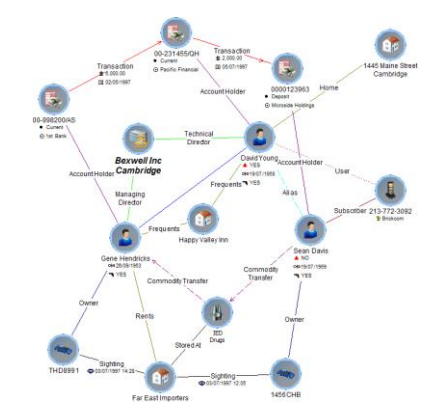
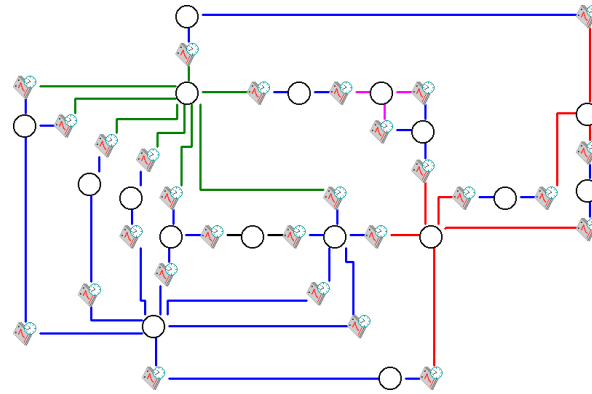
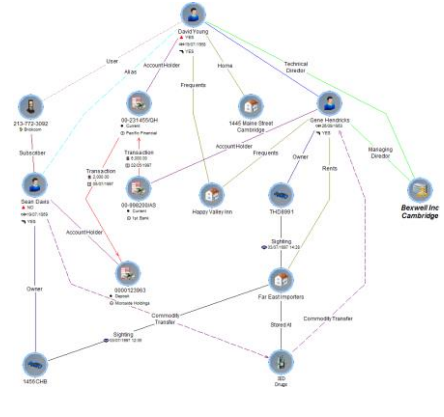
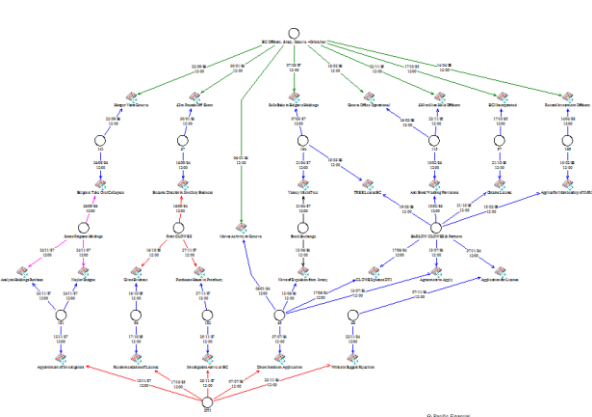
Davidson & Harel, 1996

Global readability metrics

Purchase, 2002



i2 Nugraph



Course Expectations

<https://codydunne.github.io/cs7280-f16/>