

# Visualization & Visual Analytics 1

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[creativecommons.evl.uic.edu/courses/cs424](https://creativecommons.evl.uic.edu/courses/cs424)

# What is this class about?

## Information Visualization

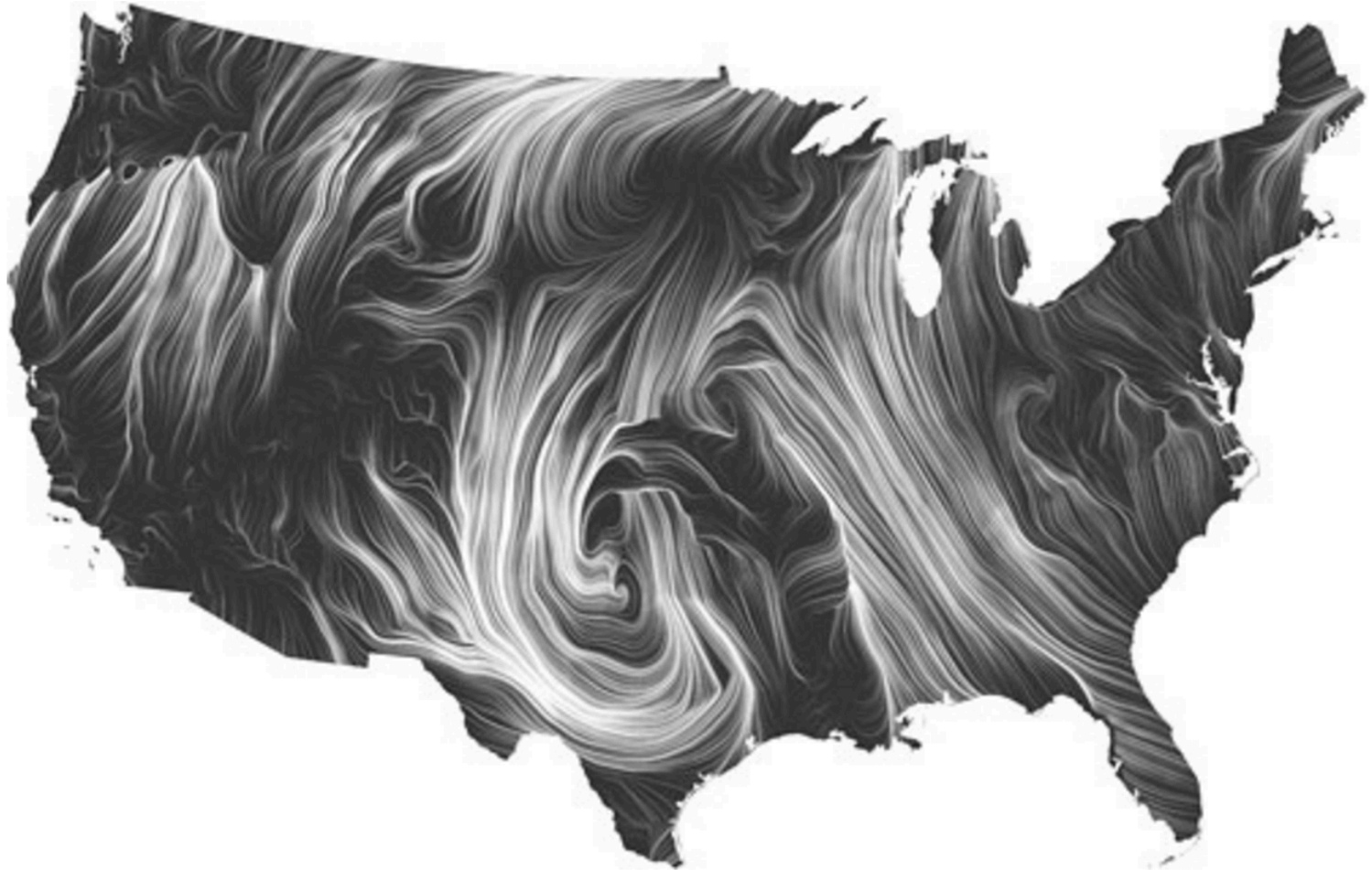
Effective ways to interact with and represent different types of data – often involves designing new techniques that can be applied in many contexts

## Visual Analytics

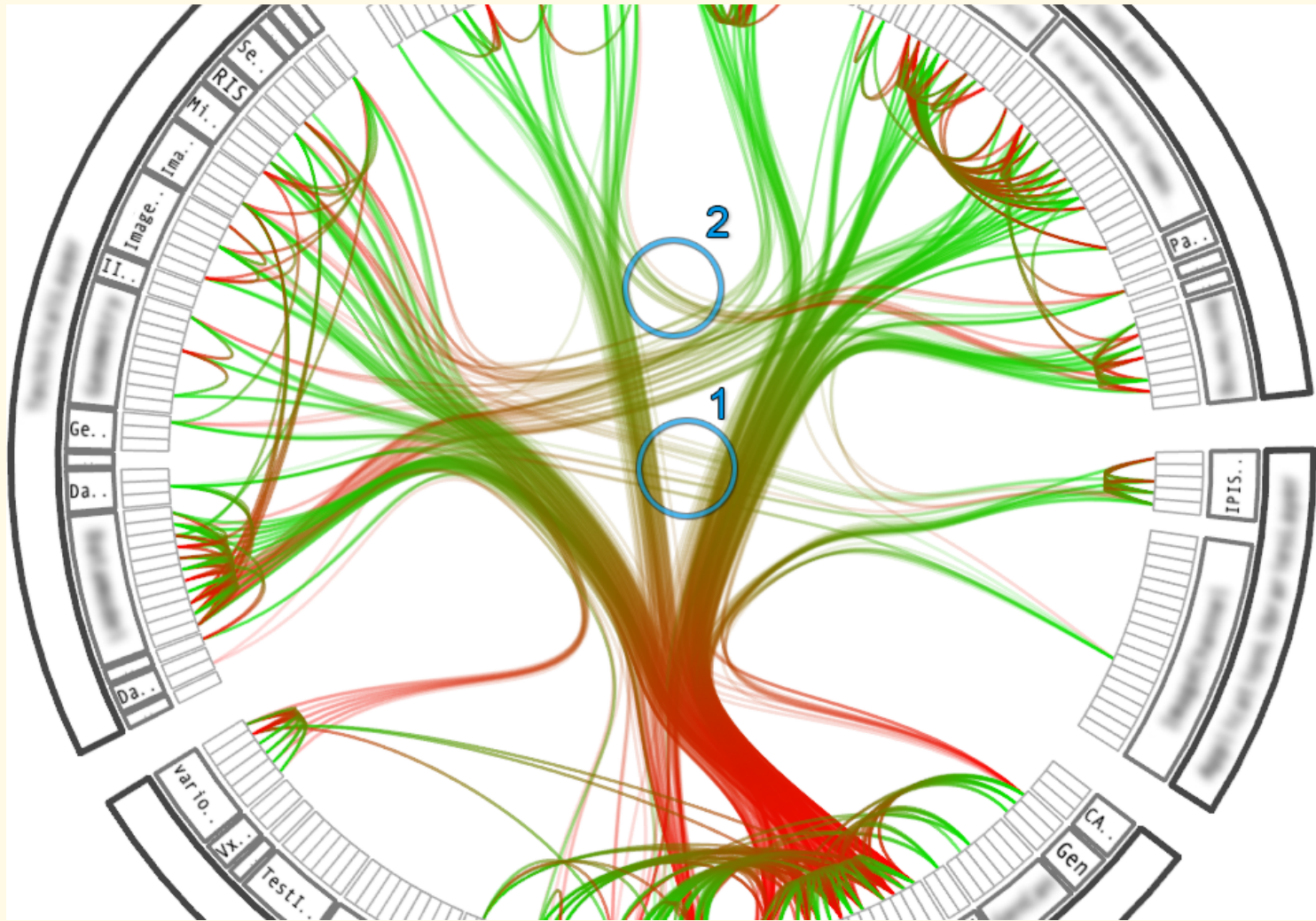
Effective use of visual interfaces to solve complex problems - often involves a combination of techniques specific to a particular industry or domain

# Viegas and Wattenberg, 2012

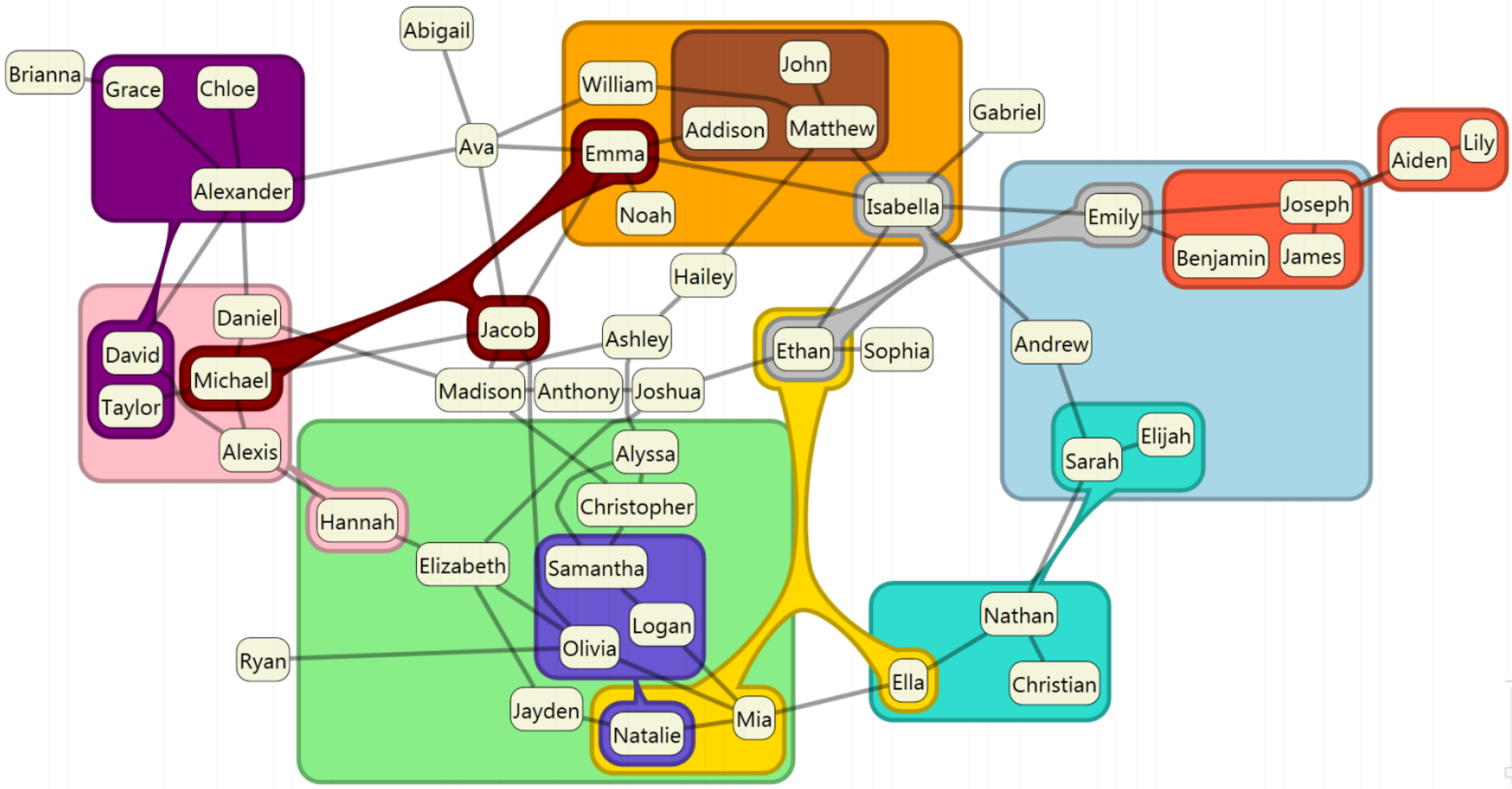
## *"Wind Map"*



# Holten, 2006 "Hierarchical Edge Bundling"



# Riche and Dwyer, 2012 "Compact Rectangular Euler Diagrams"

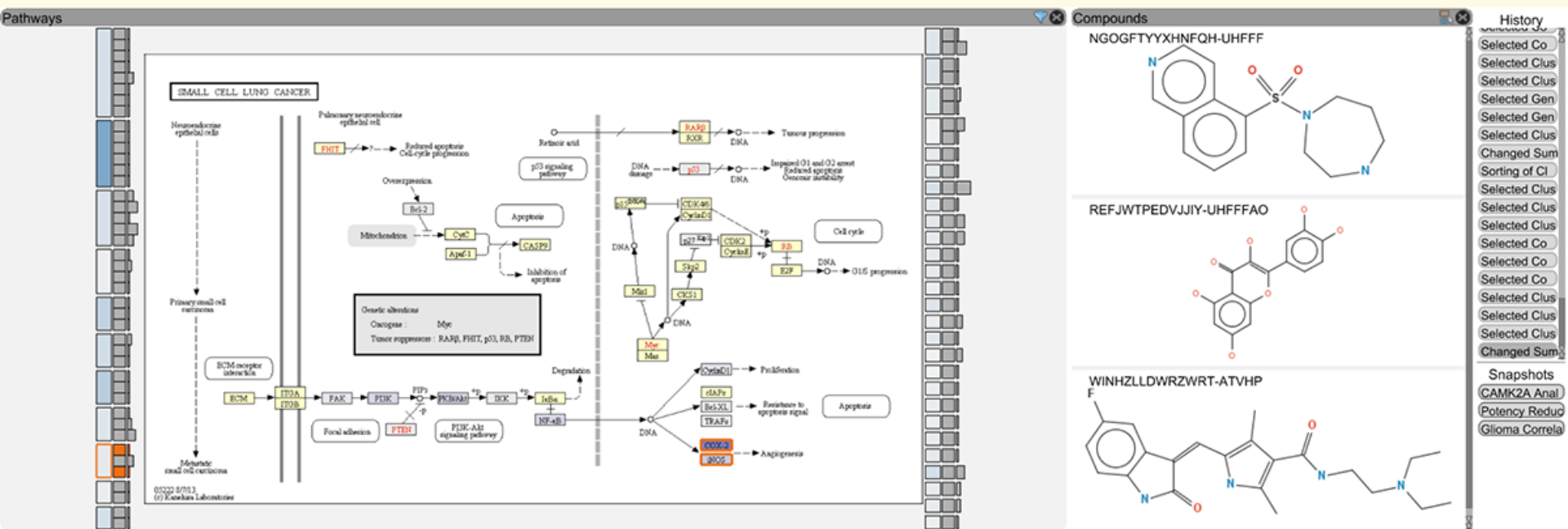




# Shneiderman, 1992 "Treemaps"



# Partl et al., 2014 "ConTour"



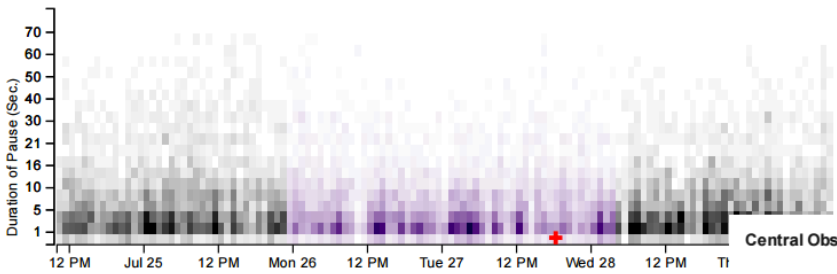
Pathways	Genes	Genes	Activities	Compounds	Activities	Clusters	Fingerprints	Therapeutic Group	Compounds
Pathways in cancer	+	CACNA1G	-	REGFWZVTTFGQJ	+	30	+	Adrenocortical D	+
Arginine and proline	+	CACNA1H	-	HYAFETHCAUJAY-	+	52	+	Treatment of Hyp	+
Calcium signaling pa	+		-	SEEPANYCNGTZFQ	+	12	+	Treatment of Pag	+
PI3K-Akt signaling p	+		-	BSYNYRMUTXBXSQ	+	13	+	Treatment of Mu	+
Serotonergic synaps	+	CACNA1I	-	ZPEIMTDSQAKGNT-	+	21	+	Antinephrotoxic	+
Estrogen signaling p	+	CACNA1S	-	KTUFNOKKBVMGR	+	11	+	Wilson Disease,	+
AGE/RAGE pathway	+		-		+	25	+	Fibrosis, Treatme	+
Drug metabolism - c	+	CACNB3	-		+		+	Esophageal Dise	+
Chemical carcinogen	+		-		+		+	Antidiarrheal Age	+
HIF-1 signaling path	+	CAMK1	-		+		+	Pituitary Disorde	+
Prostate cancer (KEG)	+		-		+		+	Psoriatic Arthriti	+
Myometrial Relaxatio	+		-		+		+	Laxatives	+

- Filters**
- Activities
  - Pathways
  - Clusters
  - Fingerprints
  - Genes
  - Pathways

# Kamaleswaran et al., 2016

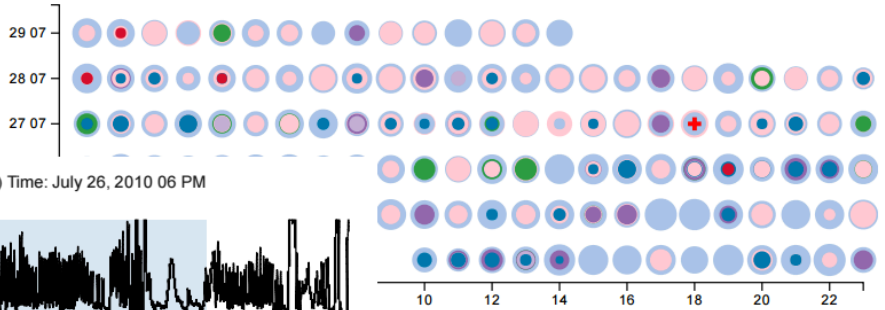
## "PhysioEx"

Respiratory Impedance Graph



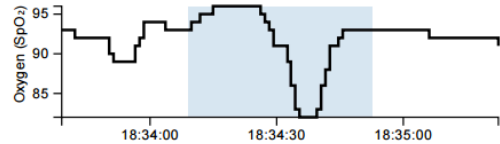
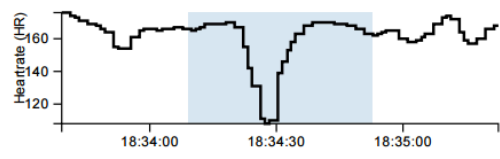
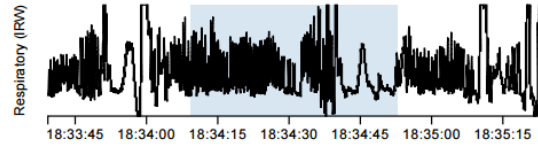
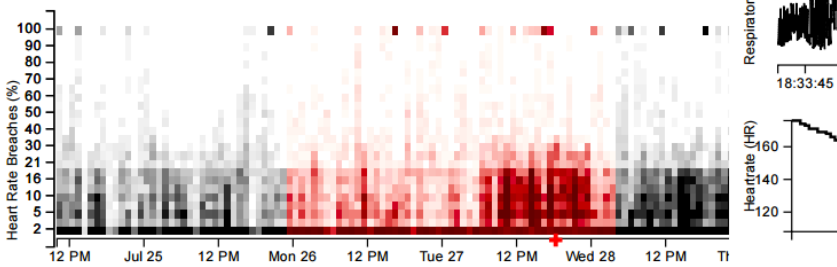
Spells Classification

- Central
- Central Obs.
- Vagal
- Iso Brady
- Pos. Iso. Brady
- Iso. Desat
- Pos. Iso. Desat

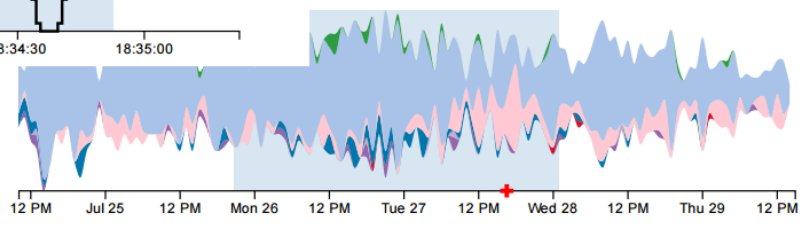
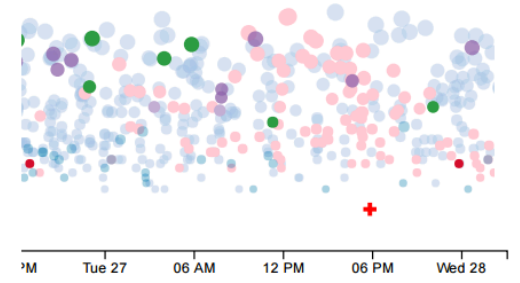
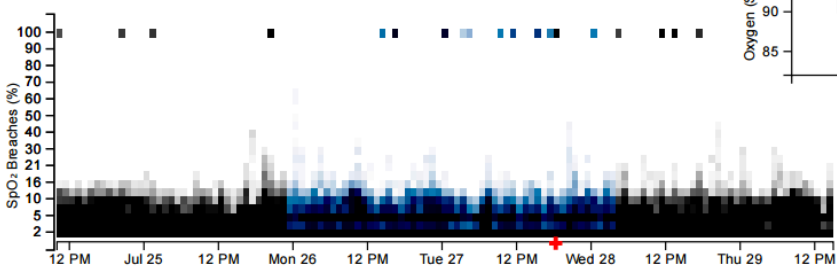


Central Obs. (44 Secs.) Time: July 26, 2010 06 PM

Heart Rate Flux Graph

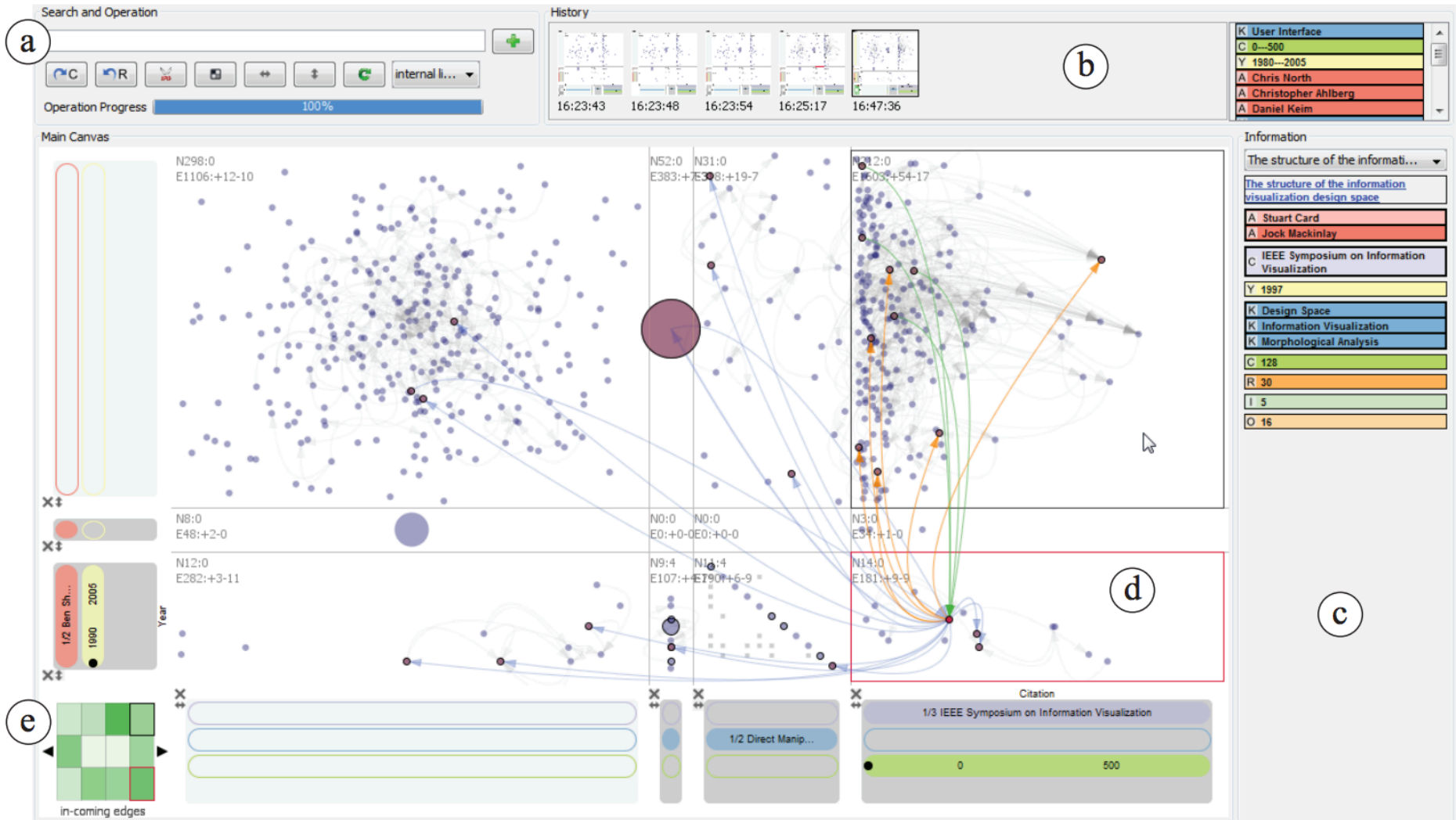


Oxygen Flux Graph

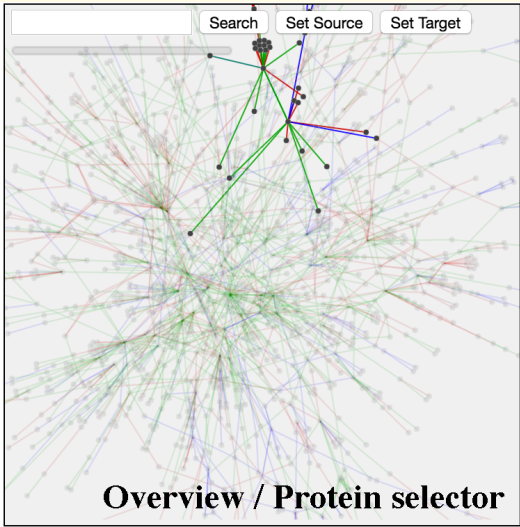




# Zhao et al., 2016 "PivotSlice"

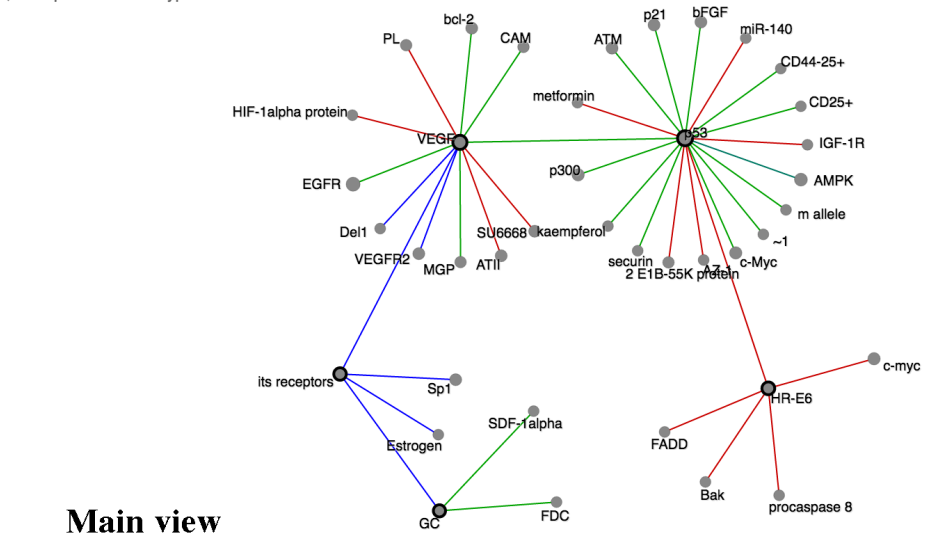


# Dang & Forbes, 2016 "BioLinker"



- increases\_activity
- decreases\_activity
- translocation
- binds
- Multiple interaction types

Conflicting examples:



**Interaction types**

- increases\_activity
- decreases\_activity
- binds
- adds\_modification

**Context-Species**

- women
- Transgenic mice
- Mouse
- ?
- Red junglefowls
- Zitter rats
- Mums

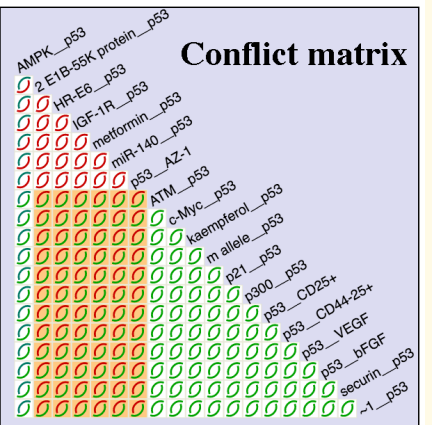
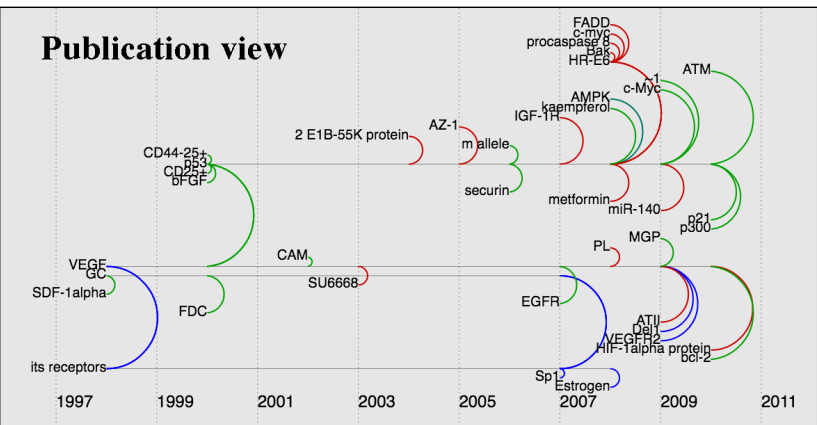
**Context-CellType**

- ?
- fibroblasts
- immune cell
- B cell
- B cells
- hairs

**Context-Organ**

- ?
- Breasts
- Oropharynx
- Bloods
- Kidney
- Colons
- Corneas
- Thymuses
- Tonsils
- Lungs
- Foreskins
- Conus ermineus
- Skins

**Context view**



# (Interactive) Infographics

- Generally static or have a limited set of interactions
- Often highlight particular elements to encode a specific narrative
- Normally utilize a minimalist palette in order to help viewer focus on important concepts

# Minard, 1869 "Napoleon's 1812 Invasion of Russia"

*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. Thiers, de Ségur, 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 Davout qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

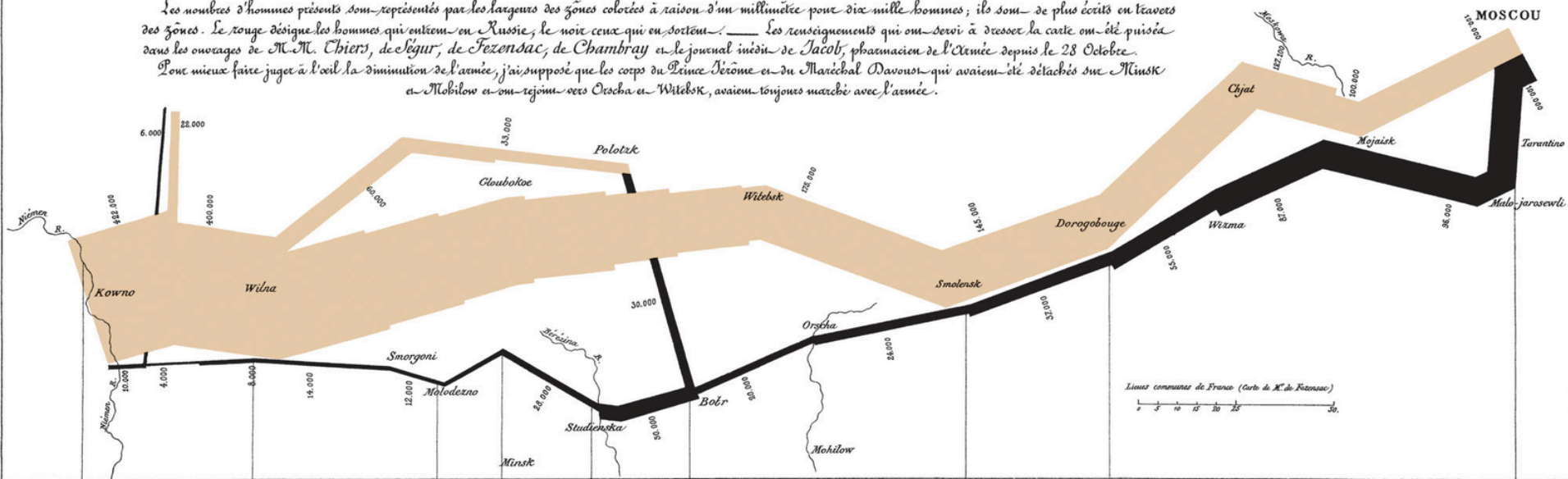
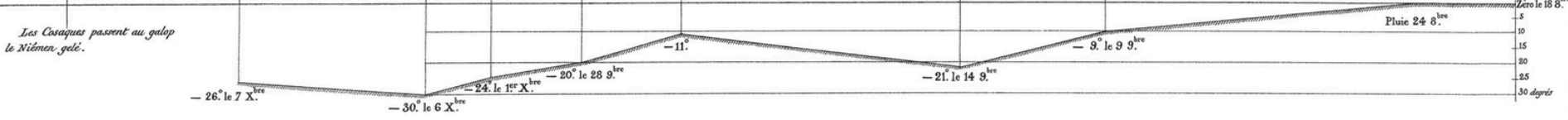


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.



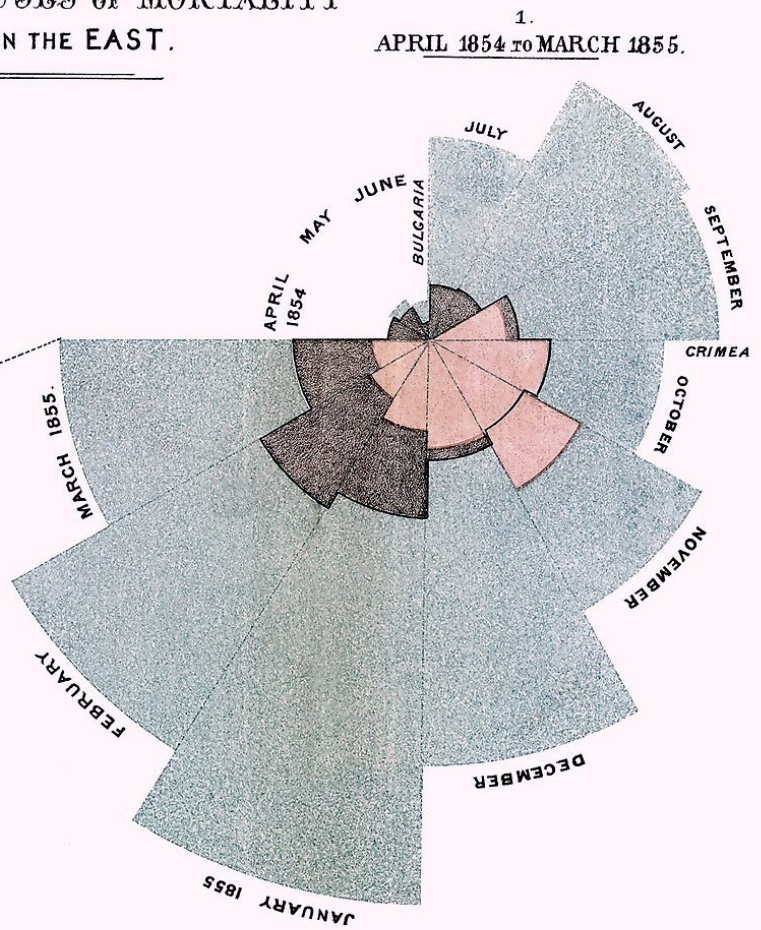
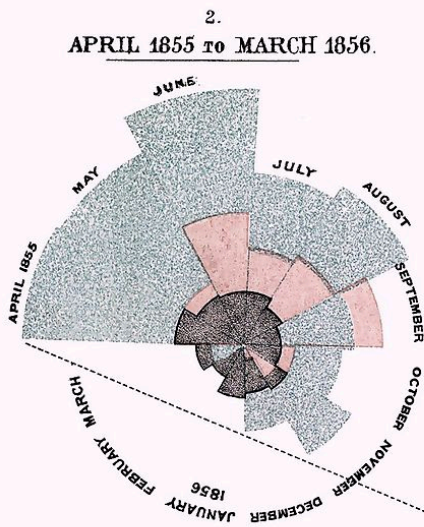
Autog. par Regnier, 8, Par. 5<sup>me</sup> Marie St G<sup>de</sup> à Paris.

Imp. Lit. Regnier et Drouot.



# Nightingale, 1858 "Diagram of the Causes of Mortality in the Army.."

## DIAGRAM OF THE CAUSES OF MORTALITY IN THE ARMY IN THE EAST.



The Areas of the blue, red, & black wedges are each measured from the centre as the common vertex.

The blue wedges measured from the centre of the circle represent area for area the deaths from Preventible or Mitigable Zymotic diseases; the red wedges measured from the centre the deaths from wounds, & the black wedges measured from the centre the deaths from all other causes.

The black line across the red triangle in Nov: 1854 marks the boundary of the deaths from all other causes during the month.

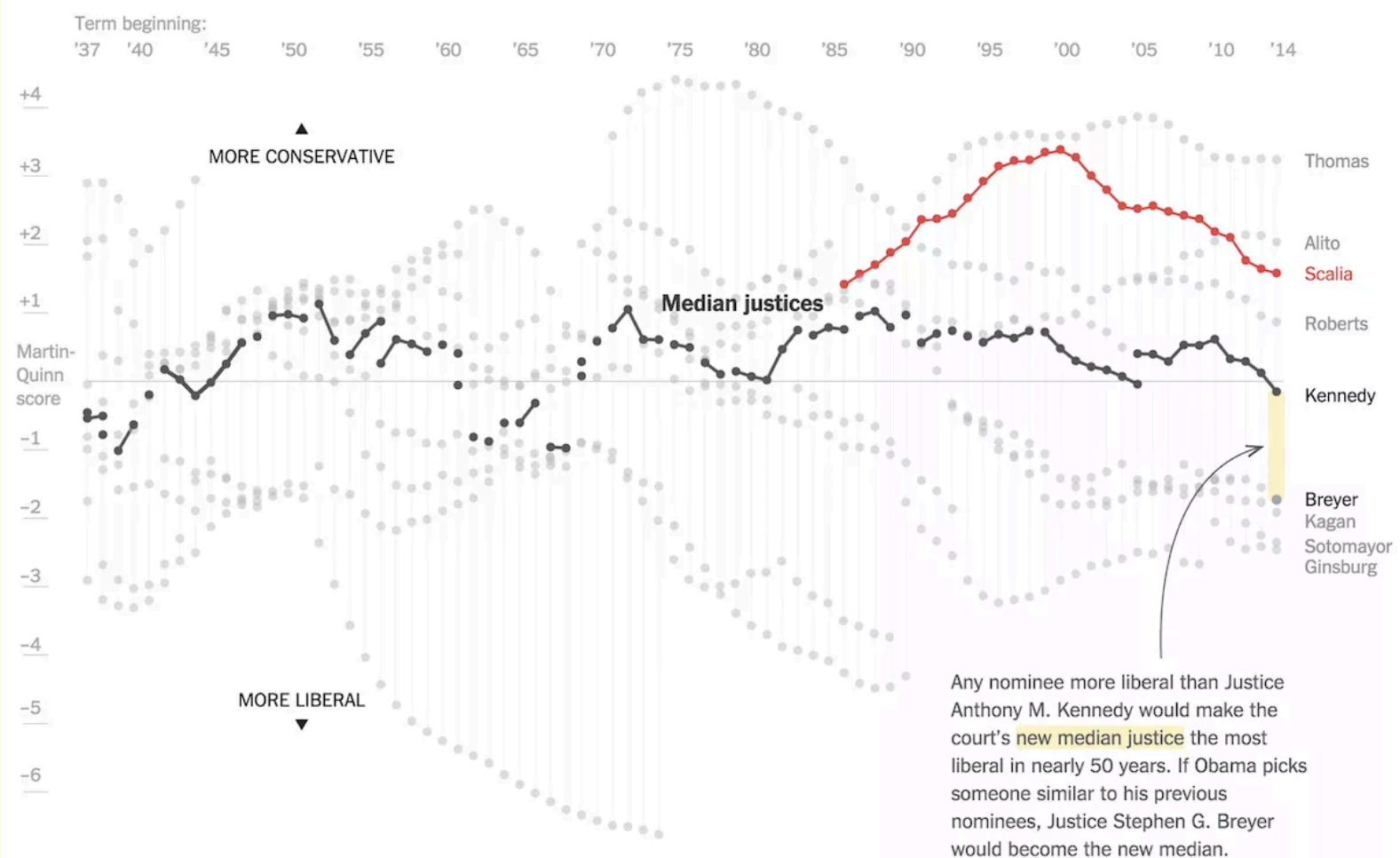
In October 1854, & April 1855; the black area coincides with the red; in January & February 1856; the blue coincides with the black.

The entire areas may be compared by following the blue, the red & the black lines enclosing them.



# Parlapiano & Sanger-Katz, 2016

## "Shifts in Power"



# What will you learn?

## Science

Data science: Extracting insight from data, especially "big data"

Scientific method: Observation, data collection, hypothesizing, experimenting, testing, analyzing, communicating

## Engineering

Coding + software development, D3.js, Javascript, working in teams

# What will you learn?

## Visualization

- How to creatively and effectively choose visual encodings (*color, shape, motion, etc.*) for different types of data (*tabular, network, textual, geographic, temporal, etc.*);
- How to develop tools to support a range of visualization tasks (*analysis, annotation, exploration, comparison, etc.*);
- How to think of visualization projects in terms of the larger context of the needs and goals of the intended audience

# How will you learn?

## Projects & Presentations

P1, "Quantified Self" – Test out different visual techniques for a (relatively) straightforward dataset - Individual project

P2, "Integrated Datasets" – Explore how to integrate multiple techniques to find relationships between data from multiple datasets – Group project

P3, "Unsolved Problems" – Develop new techniques to represent complex data to solve complex problems – Group project

# How will you learn?

## Assignments & Quizzes

Read textbook and articles + study contemporary programming techniques for information visualization

## Participation

Learn from and teach each other; make sure you understand the material; find ways to make the material meaningful to you



# Homework for Thursday

- Bring in an example of a data visualization that you have seen that you like. Be ready to explain to your classmates what you find to be interesting about it.