

Towards Visualization Literacy

Jean-Daniel Fekete, INRIA

with the help of:

Jeremy Boy

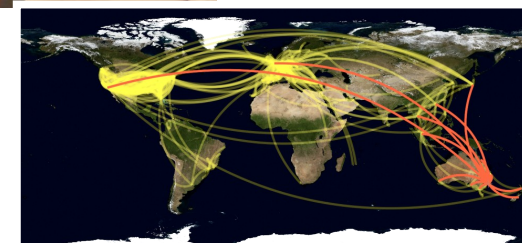
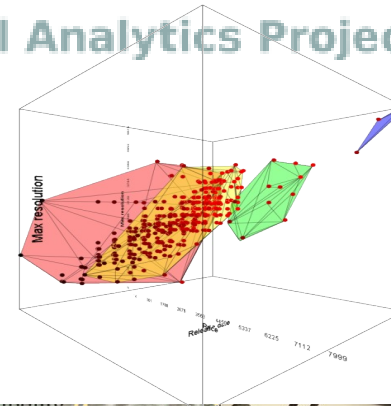
Luana Micallef

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- 4 INRIA Researchers
- 5 Post-docs
- 6 PhD students
- Lots of cool stuff



Natural-Language Interfaces - Used for command strings.

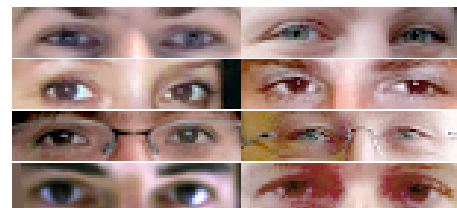
Voice user interfaces which accept input and provide output by generating voice prompts which are transmitted via a telephone network and heard by the user using a telephone. The user input is made by pressing keys on a keypad.

Natural-Language Interfaces - Used for command strings.

Voice user interfaces which accept input and provide output by generating voice prompts. The user input is made by pressing keys on a keypad, or responding verbally to the interface.

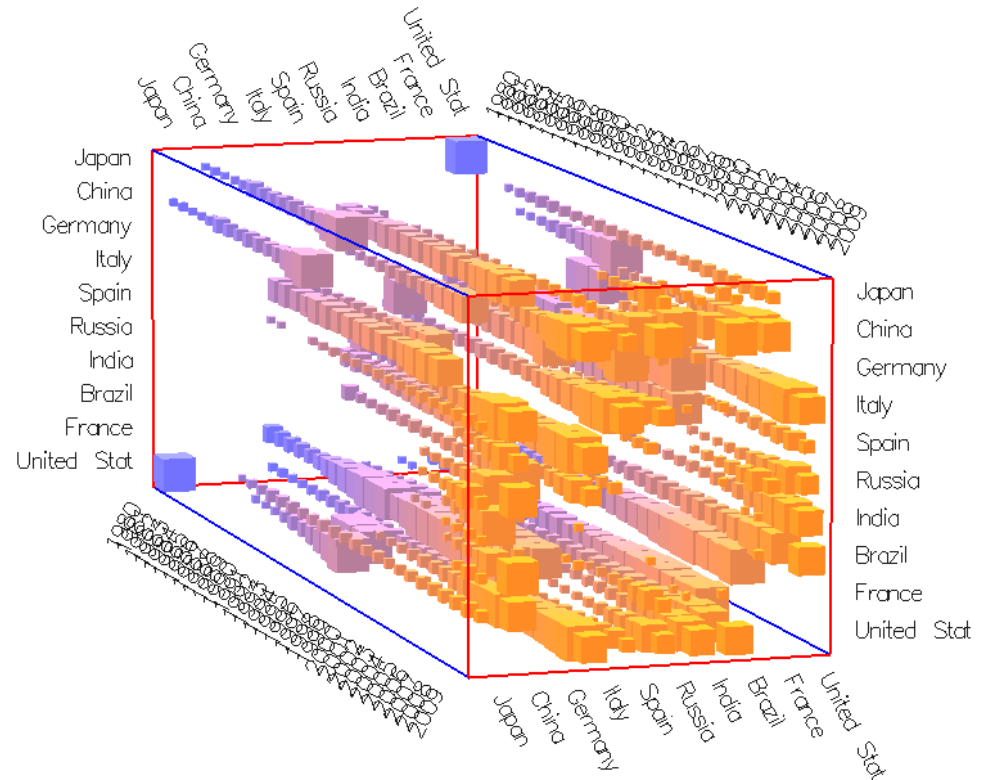
Natural-Language Interfaces - Used for command strings.

Voice user interfaces which accept input and provide output by generating voice prompts. The user input is made by pressing keys on a keypad, or responding verbally to the interface.



Visualization for Experts or Not?

- We have now two lines of research
- Visualizations for expert users
- Visualizations for non-expert users
- Both lines are fruitful
- But is it the way to go?



PhD defense

Connections, Changes, and Cubes: Unfolding Dynamic Networks for Visual Exploration

Benjamin Bach

9 May 2014

Advisors:

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Emmanuel Pietriga

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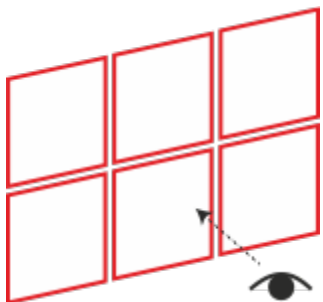
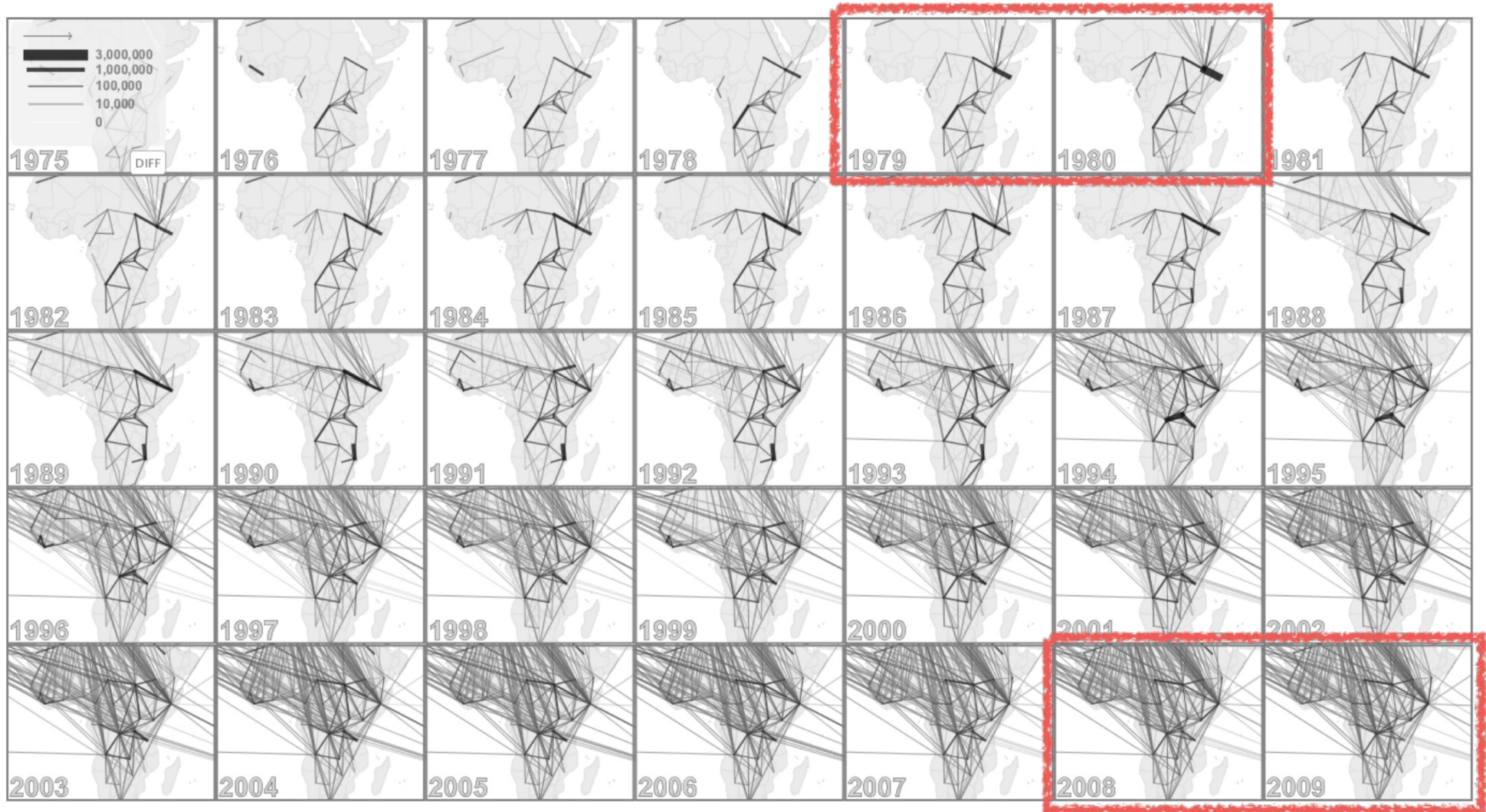
Chantal Reynaud

Jarke J. van Wijk

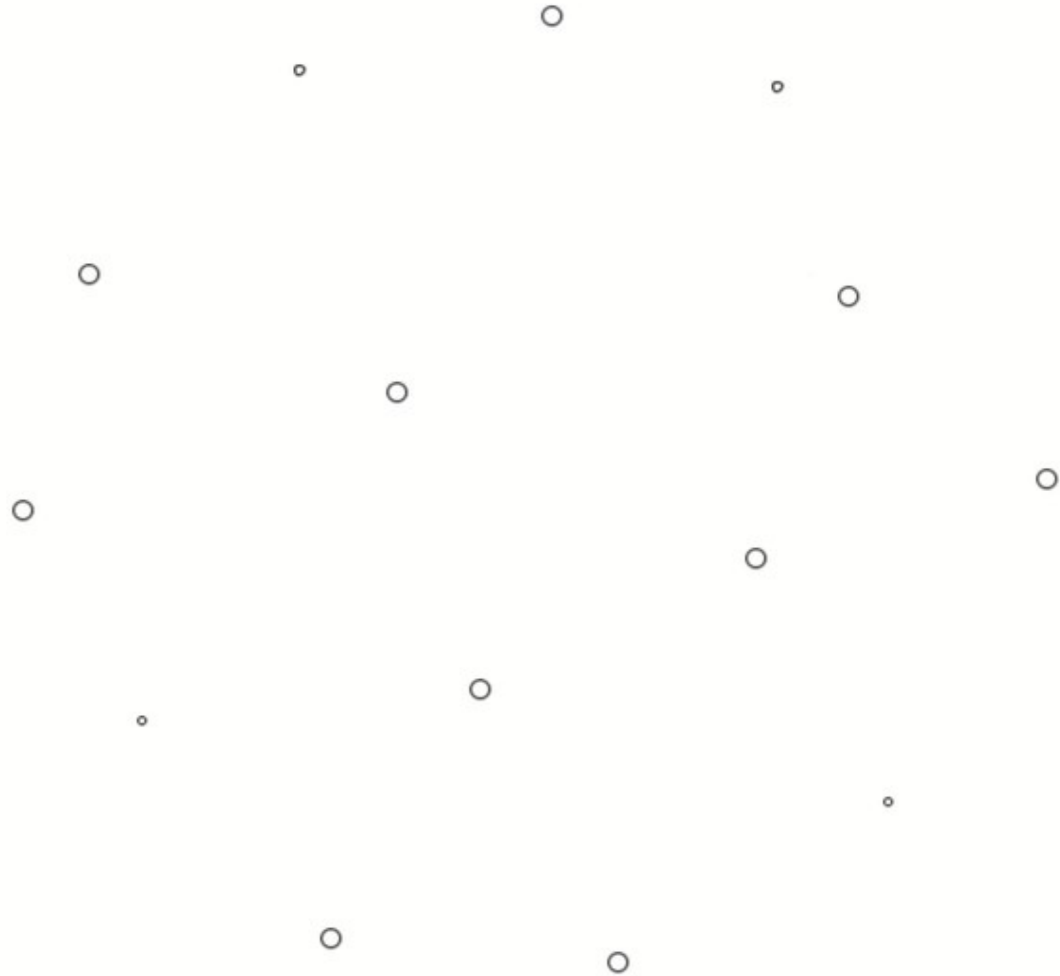
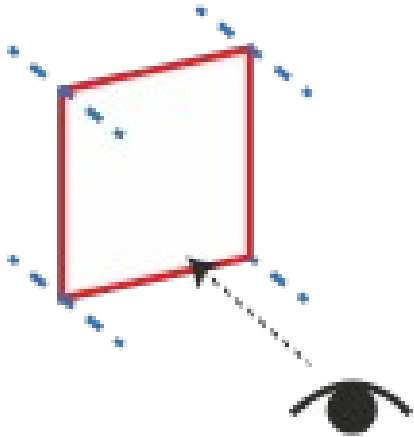
Tim Dwyer

Silvia Miksch

Guy Melançon

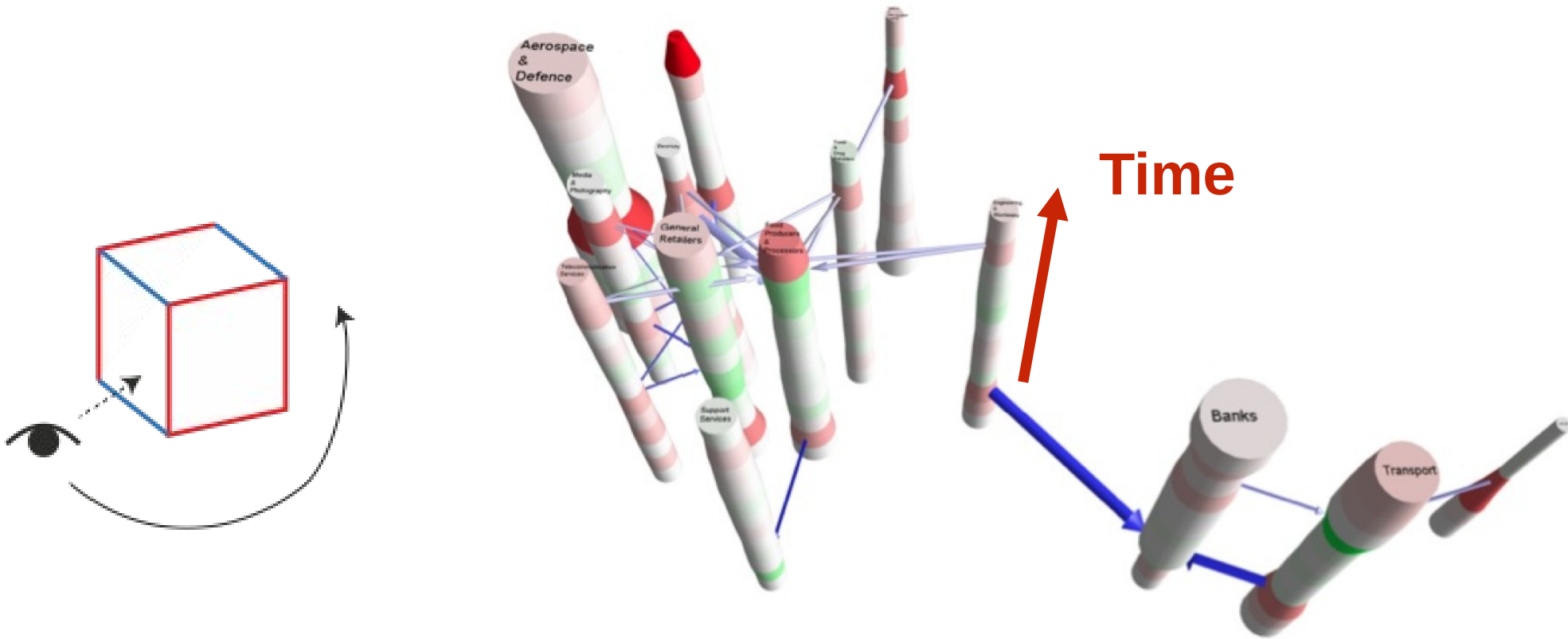


Boyandin et al.,
2012



Maray Friedrich and Eades, 2001

TempoVis Ahn et al, 2011

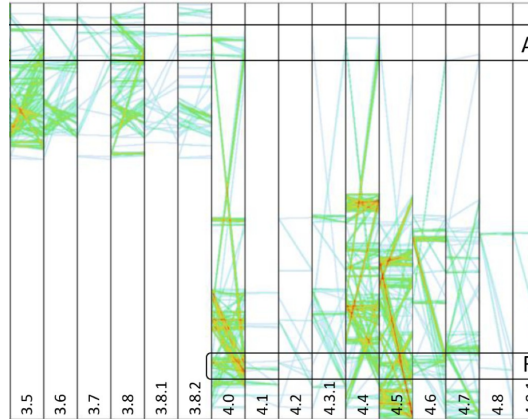
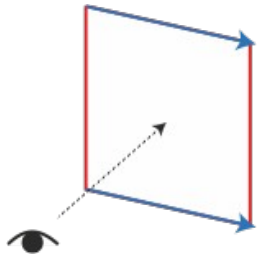


2.5D visualization Dwyer, 2004

Visual Unrolling Brandes & Corman, 2003

Gaertler & Wagner, 2005

Timelines



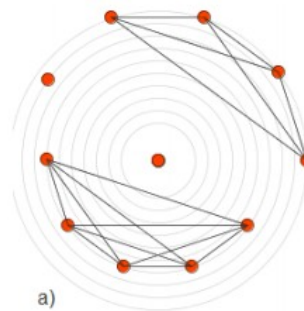
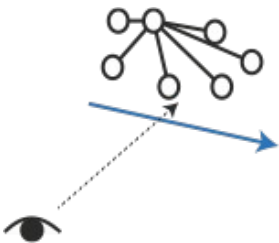
Parallel Edge Splatting Burch et al, 2011

Massive Parallel Sequence Views
Willems et al, 2012

GraphDice Bezerianos et al,
2010

Reda et al, 2012

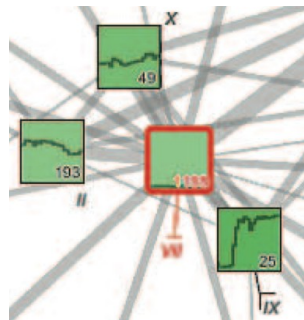
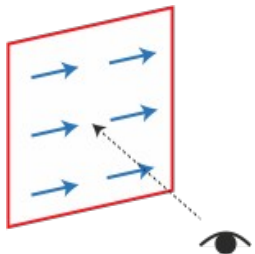
Ego Network Representations



1.5D Visualization Shi et al.,
2011

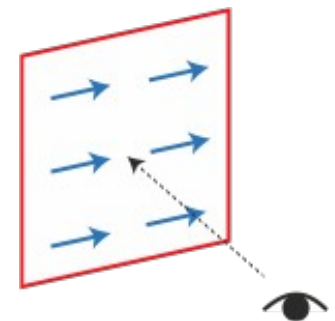
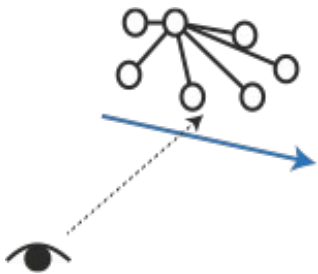
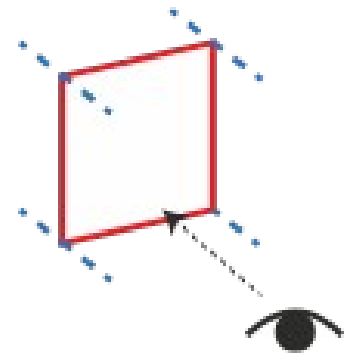
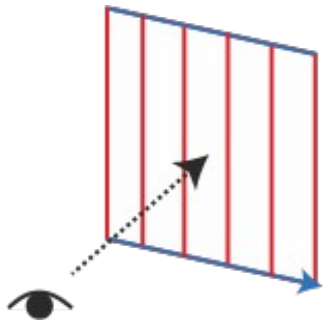
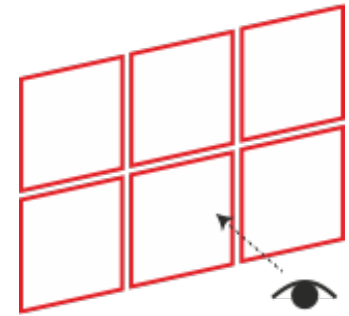
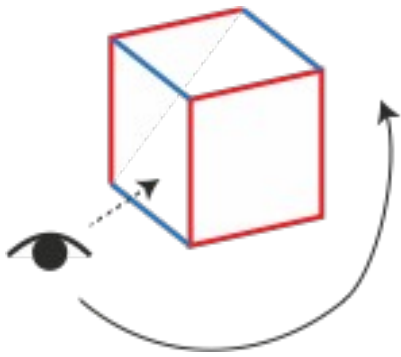
Dynamic Ego Networks
Farrugia et al., 2011

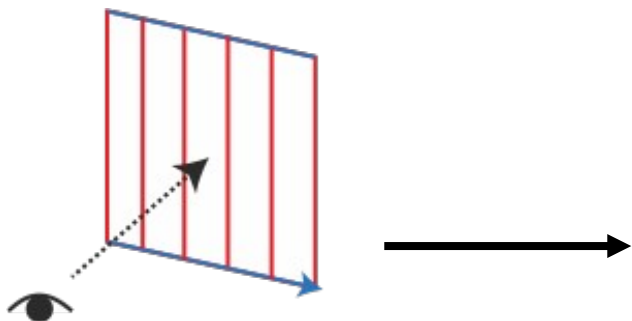
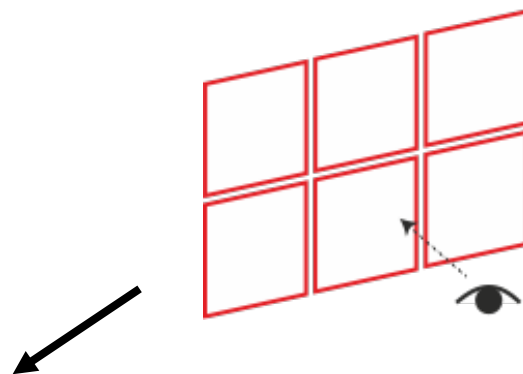
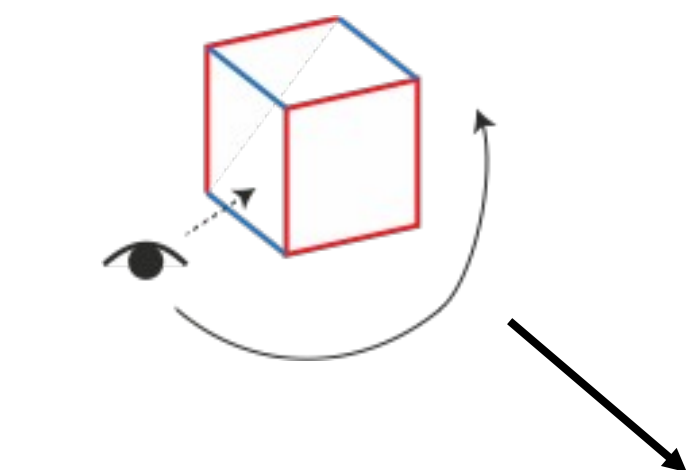
Temporal Aggregation



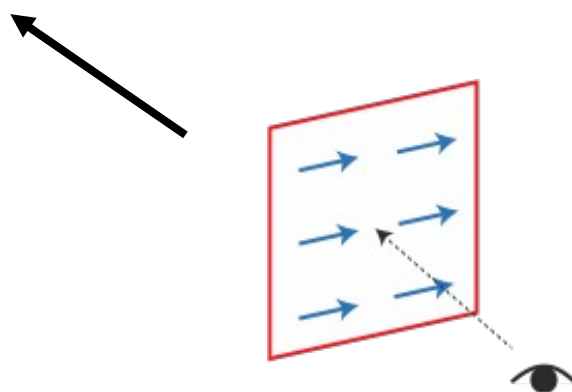
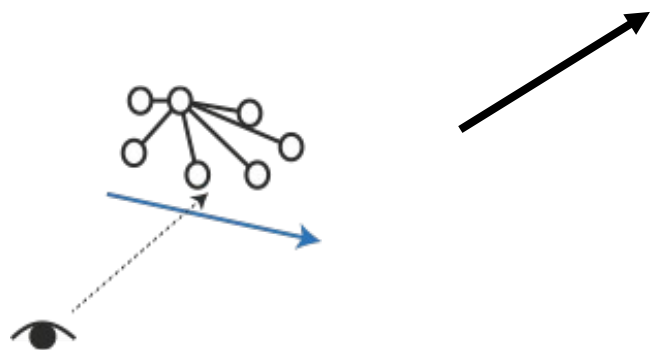
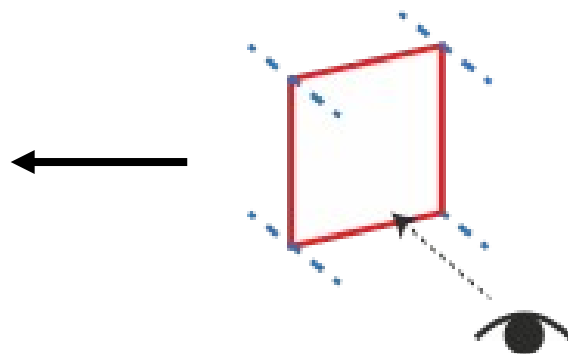
Collberg et al. 2003

Gestalt Lines Brandes & Nick, 2011

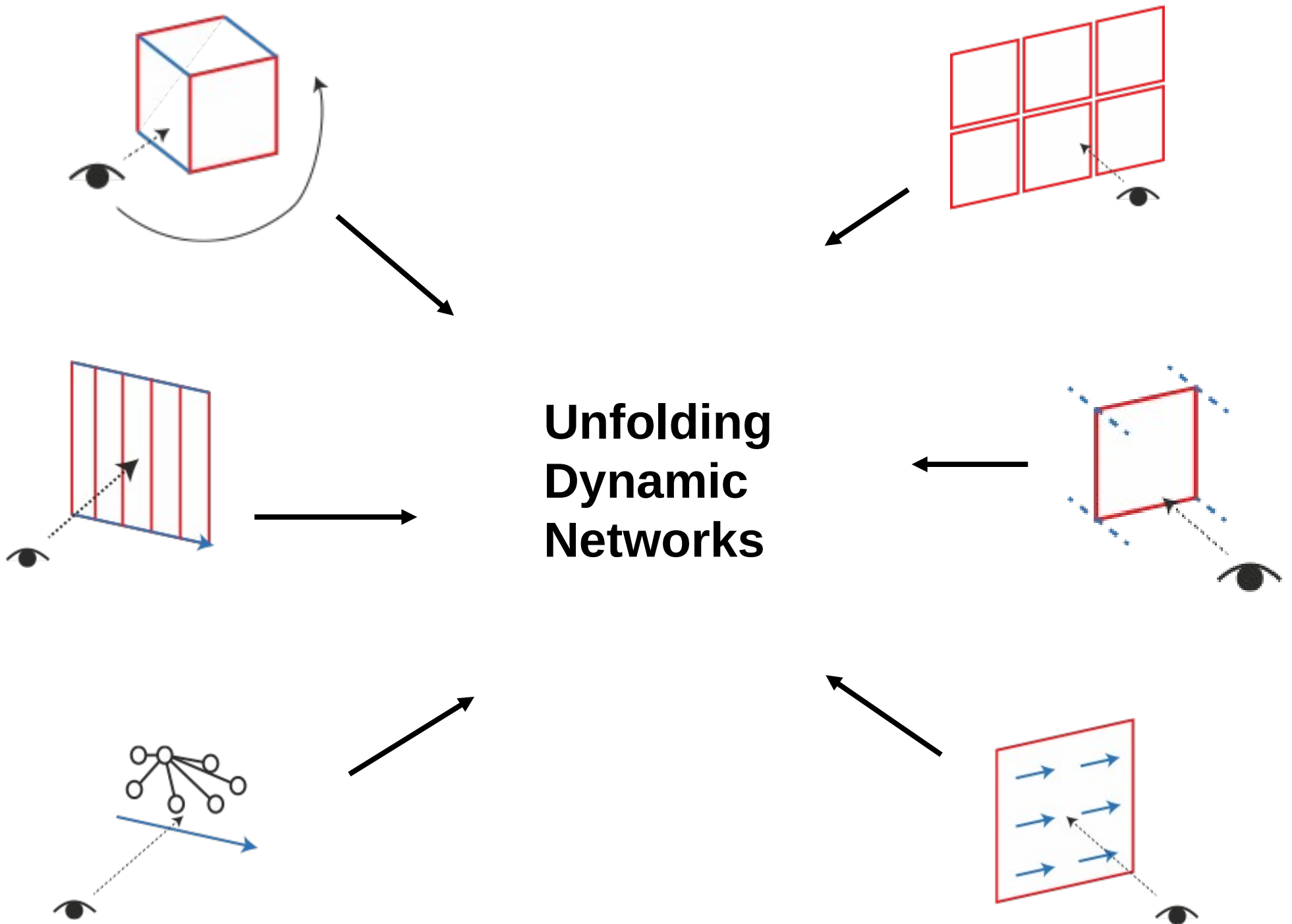


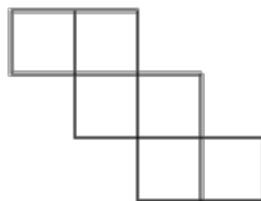
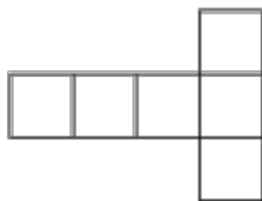
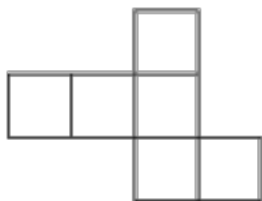
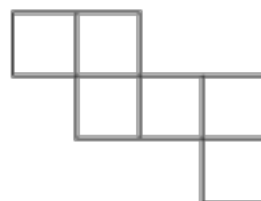
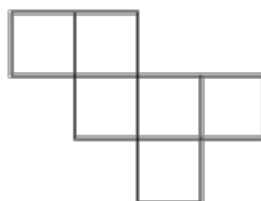
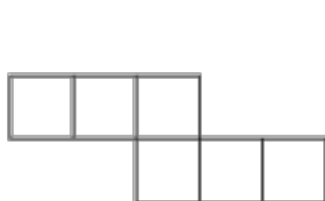
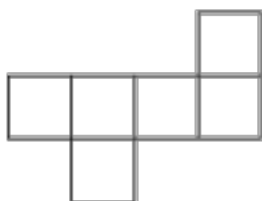
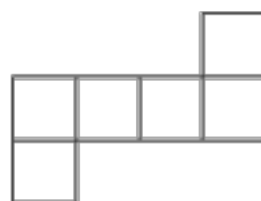
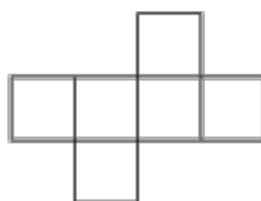
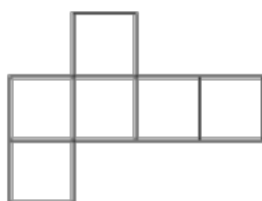
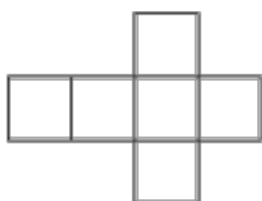
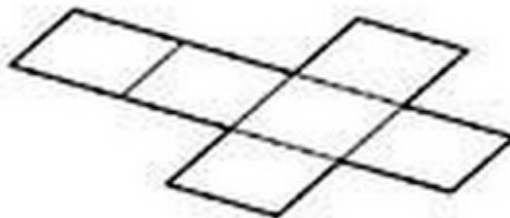
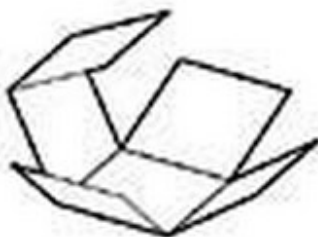
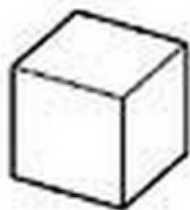


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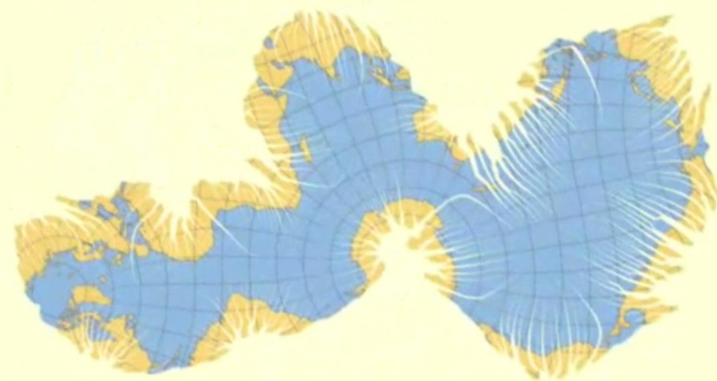
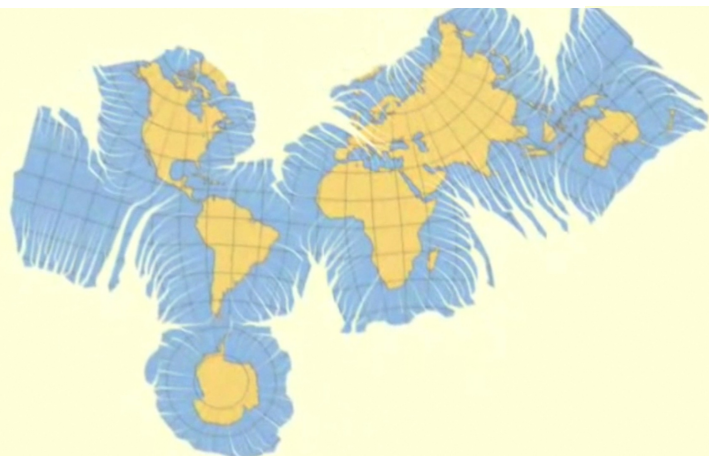
Unfolding Dynamic Networks





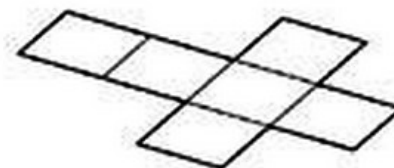
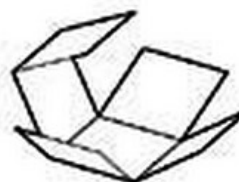
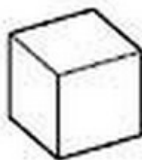
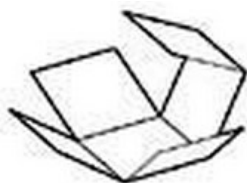
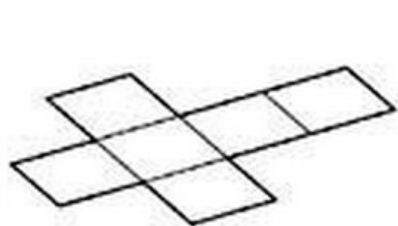


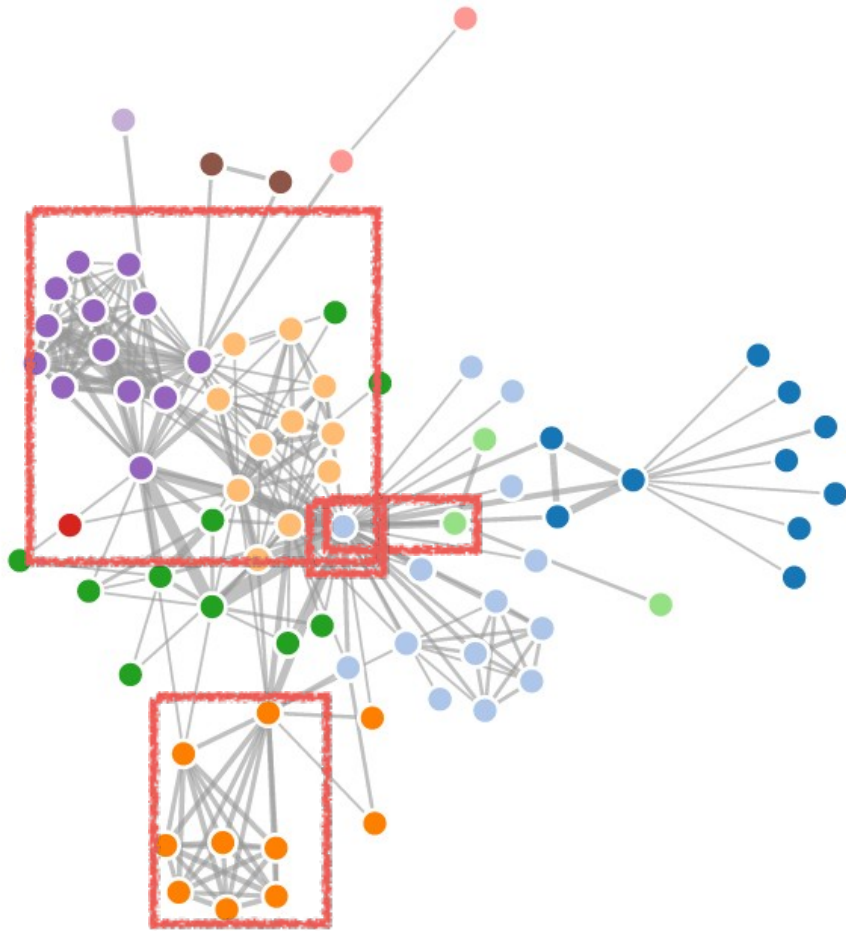
[Wijk
2008]



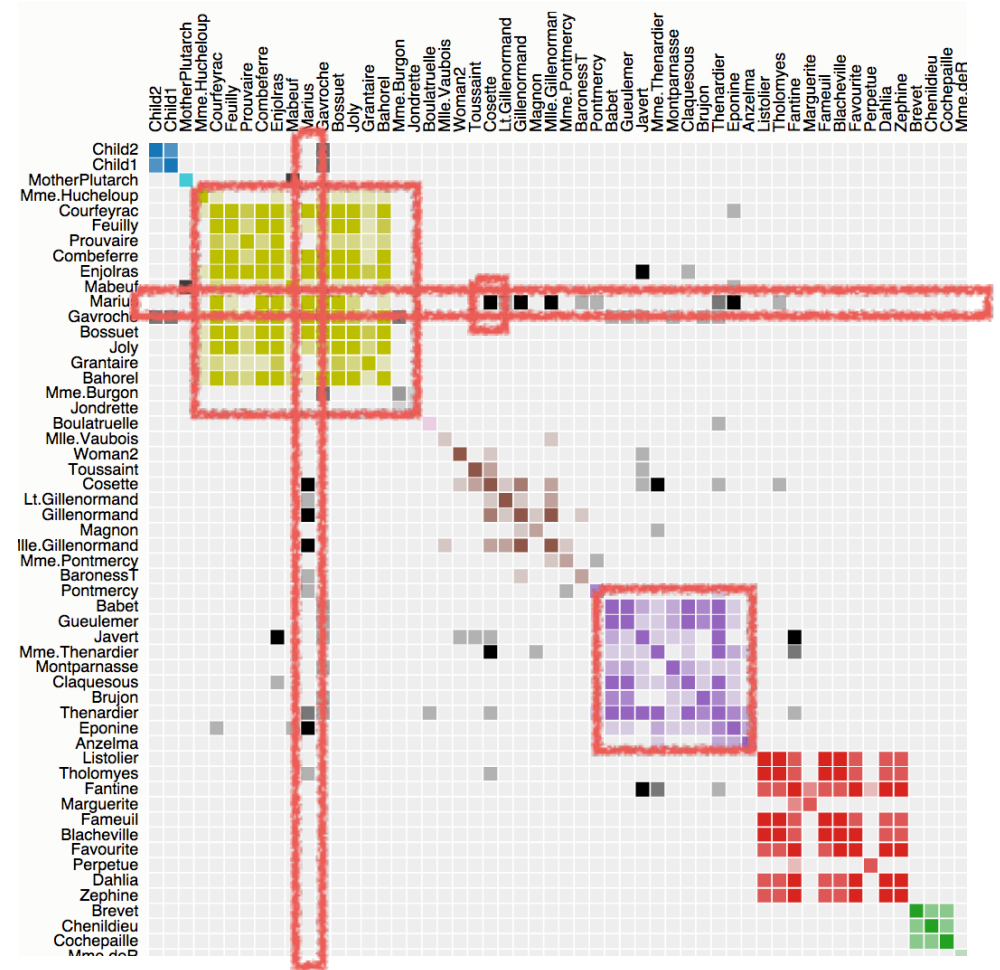
Central Model

Interactivity



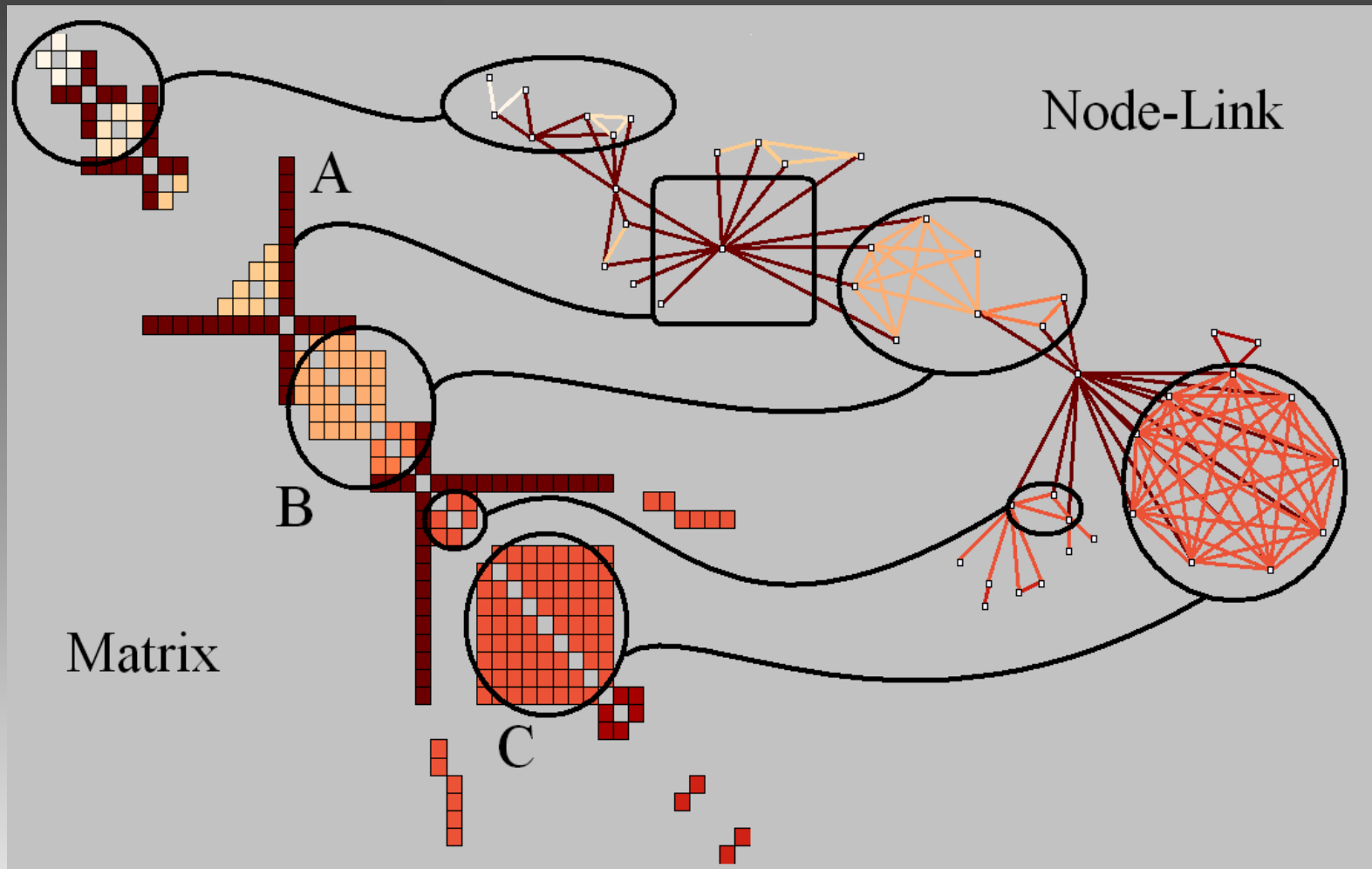


Node-Link
Diagrams



Matrix

Visual Patterns

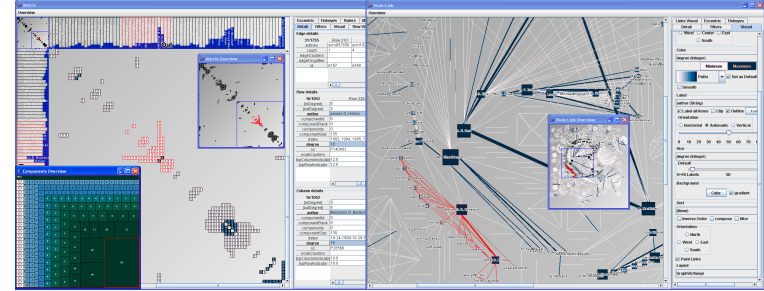


Breakthrough in Social Network Visualization: Improving Matrices (2007-2010)

Several representations:

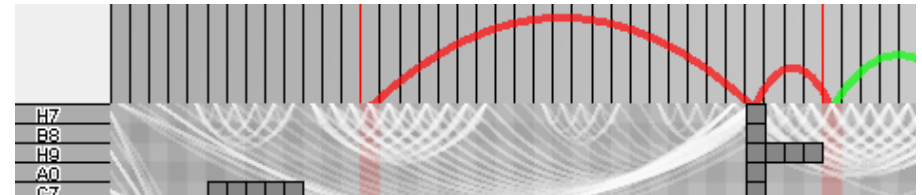
1. Combined

- MatrixExplorer
(Henry&Fekete InfoVis'06)



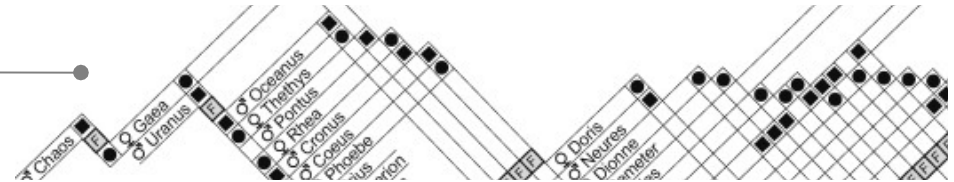
2. Augmented

- MatLink
(Henry&Fekete Interact'07, **Best Paper**)
- GeneaQuilts
(Bezerianos et al. InfoVis'10)



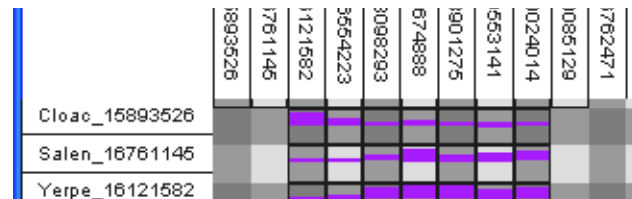
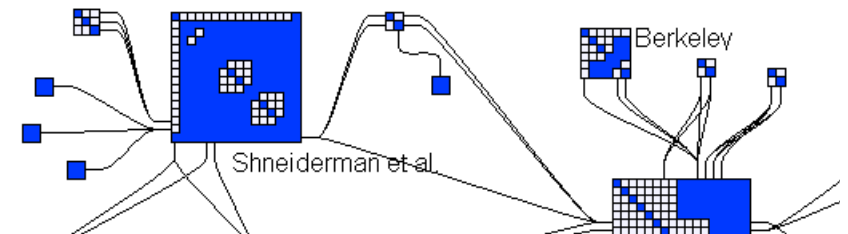
3. Hybrid

- NodeTrix
(Henry et al. InfoVis'07)
- CoCoNutTrix
(Isenberg et al. CG&A'09)

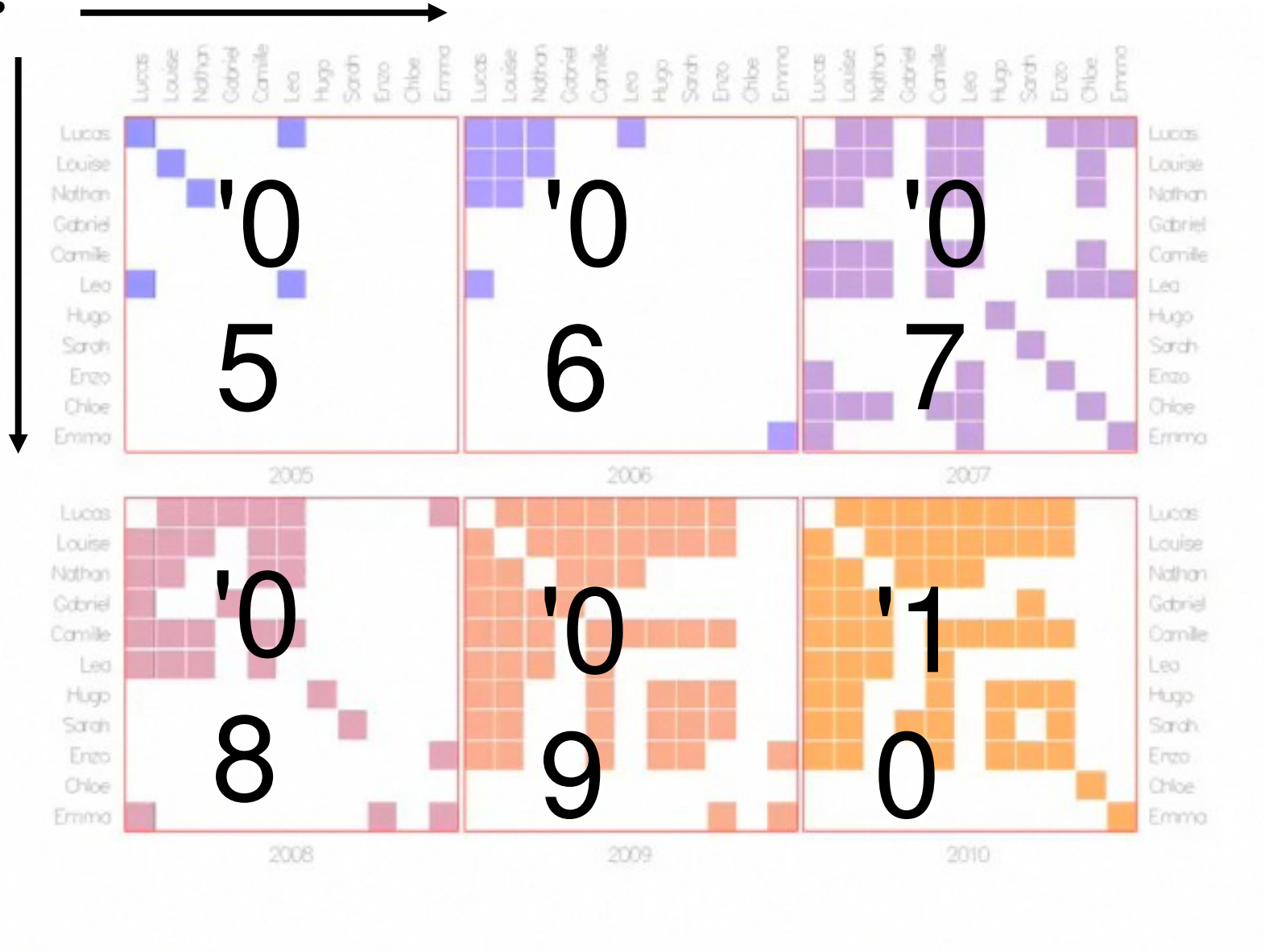


4. Multiscale

- ZAME
(Elmqvist et al. PacificVis'08)



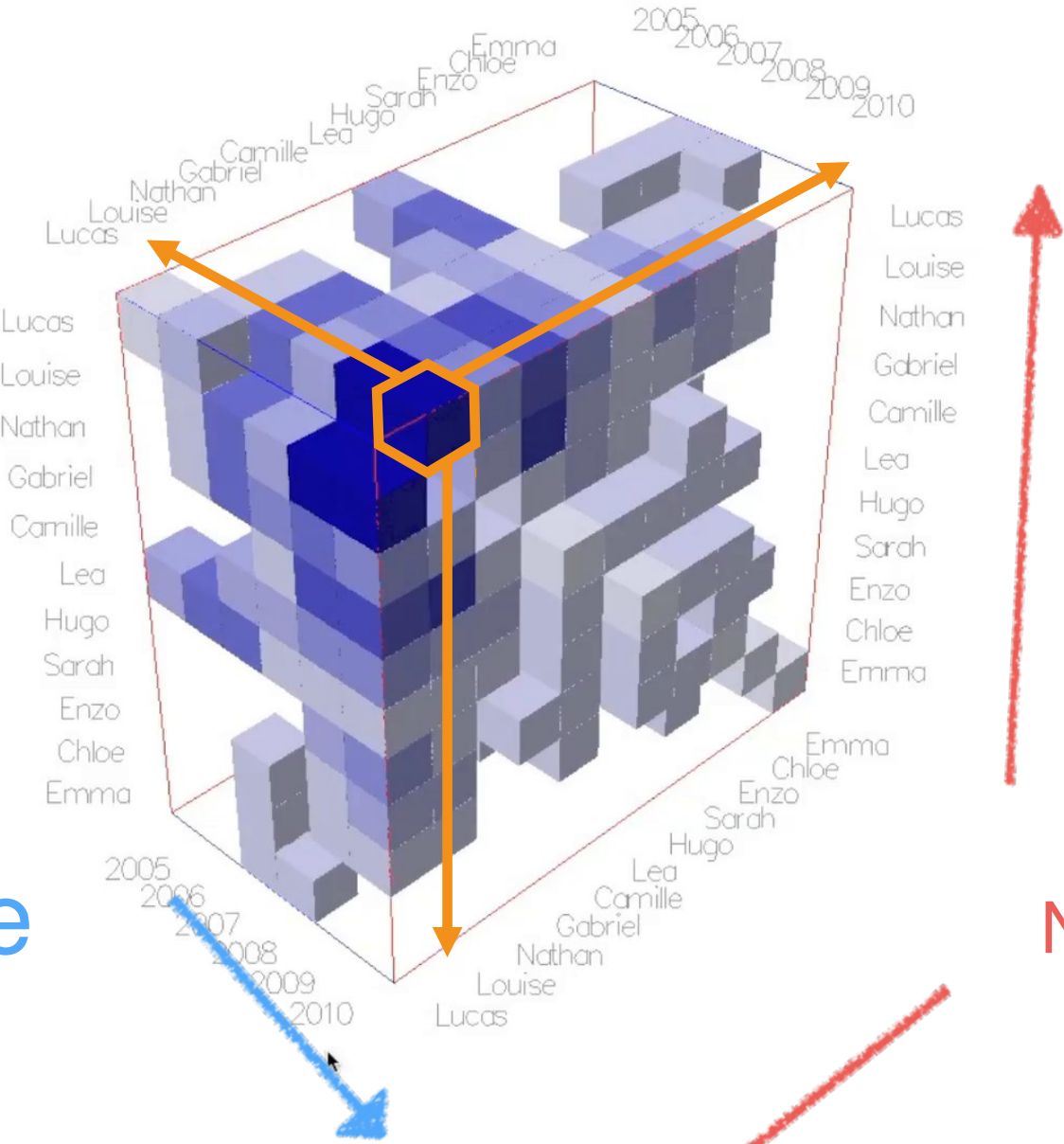
Nodes

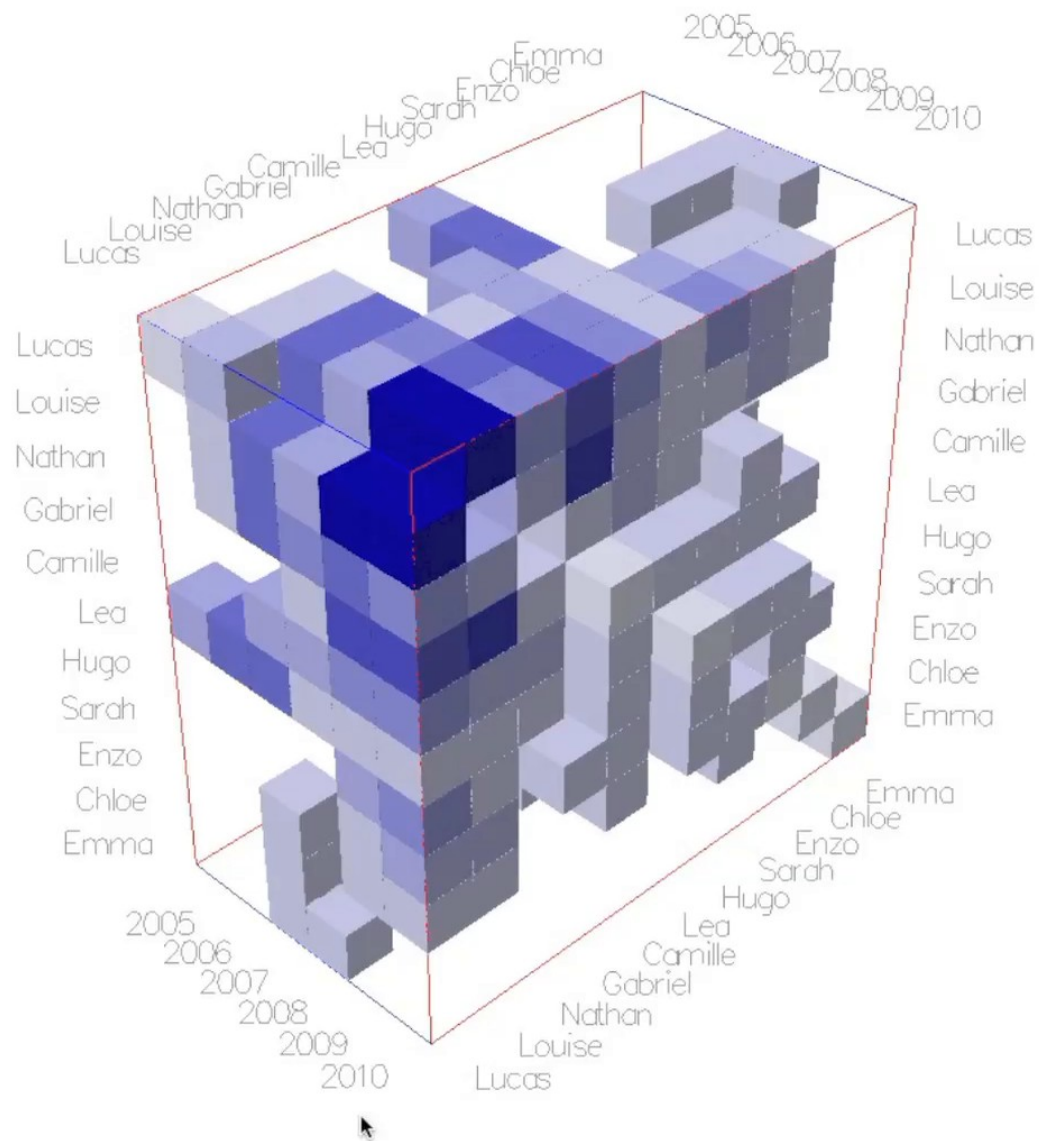


Connection

Time

Nodes





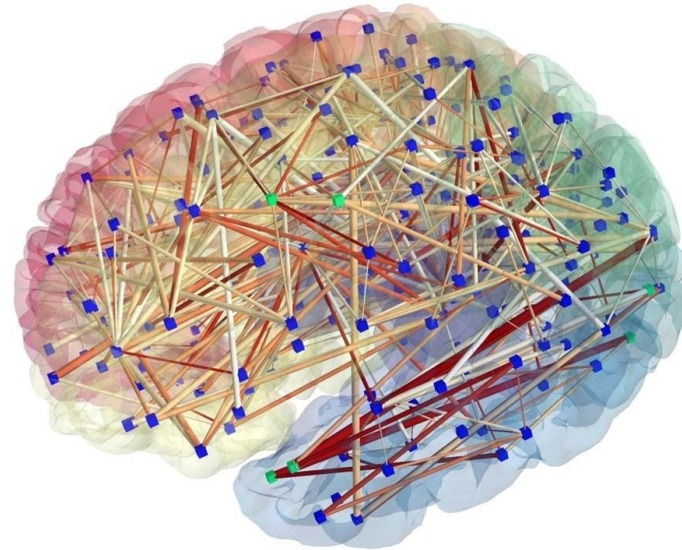
Ceci n'est pas une visualisation 3D

Visualizing Dynamic Networks with Matrix Cubes

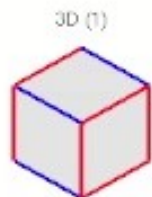
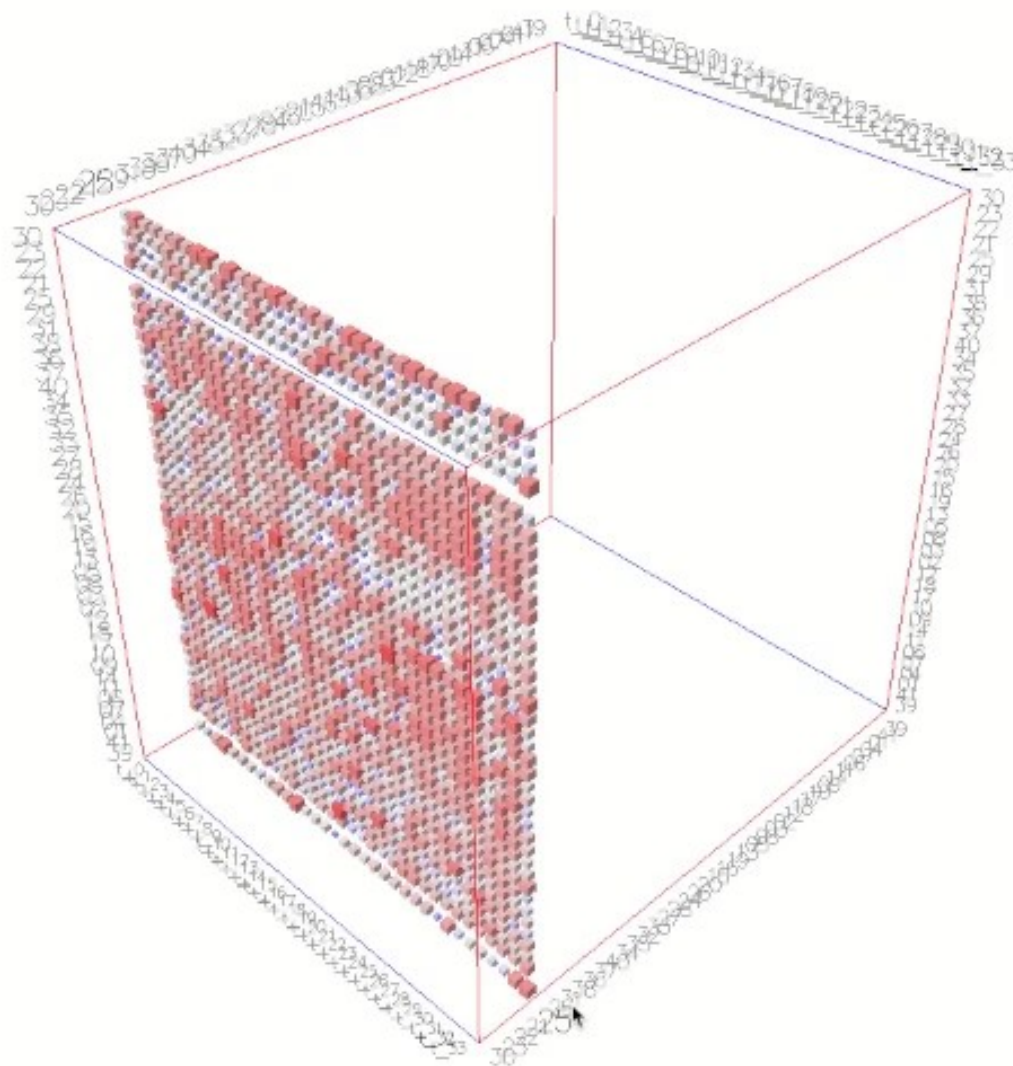
submitted to
CHI2014



ALMA



Brain Signals



Vertex Slices Time Slices

Cell Color Encoding:

- ☐ Edge Weight (light to blue)
- ☒ Edge Weight Diverging (re...
- ☐ Time (blue to orange)
- ☐ None (all same gray)

Cell Shape:

- ☒ Edge Weight 1 (small to la...
- ☐ Edge Weight 2 (small to la...
- ☐ None (equal size)
- ☒ Adapt Weight
- ☐ Logarithmic scale
- ☐ Diverging scale

Topological Order

Name Ordering

☐ Inverse Filter

Time Range:

0 34

Edge weight:



Cell Opacity:

0 1

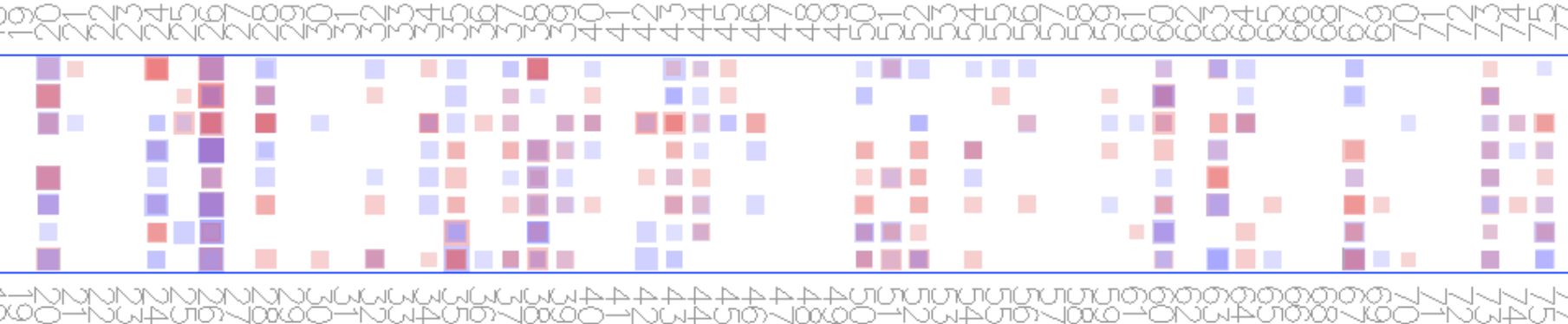
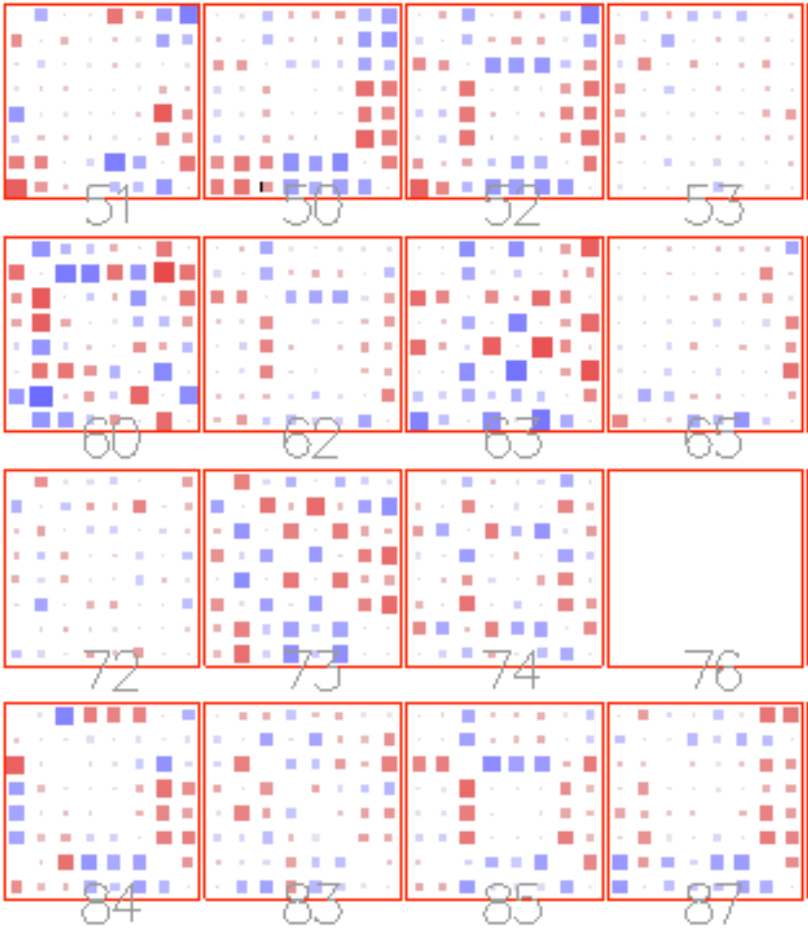
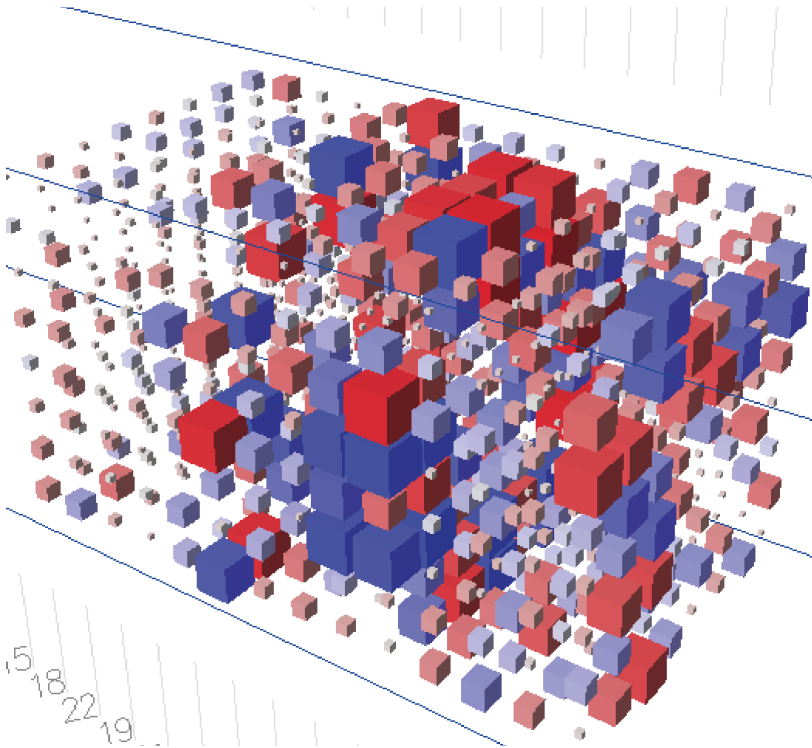
☒ Show Self Edges

☒ Show Non-Self Edges

Animation Speed:

Slow Fast

Brain Connectivity



Understanding Visualization Seems So Easy

Here's the beauty of charts. We all get it, right?
[Jason Oberholtzer, Forbes, April 2012]

- Unfortunately, no!
- Why is it so easy for some and so hard for others?
- Several of our experiments failed because we thought: “We all get it, right?”

Turkers don't get it (sometimes)

- We performed experiments on the reading of simple charts:
 - bar-charts, pie-charts, line-charts
- On almost simple tasks:
 - Retrieve min/max, compare 2 values, estimate mean
- Most turkers failed (answered at random) for the complex tasks

Some Findings

- Visualization are easy to understand when they use “congruent” encodings or simple metaphors:
 - The words used in data space are the same as the words used in visual space
- For a bar-chart:
 - What is the biggest value?
 - What is the biggest bar?
- When visualizations are “non-congruent”, people “don't get it” and don't try hard spontaneously.
- Many effective visualizations are non-congruent:
 - Parallel coordinates, Scatterplots, Treemaps to some extent, adjacency matrices

Visualization Literacy

1. Definition

Visualization literacy is the ability to *confidently* use a given visualization to *translate* questions specified in the data domain into visual queries in the visual domain, as well as interpreting visual patterns in the visual domain as properties in the data domain.

- Abilities and competencies

2. Assessment

3. Education

- Can we teach “all” visual representations together instead of each one individually?
- We don't want popular visualizations to remain limited to simple charts, we need to move forward!
- Is Interaction Literacy part of it?

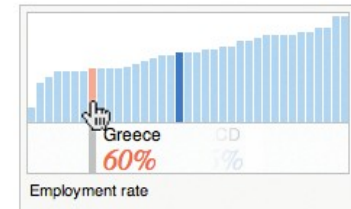
Suggested Interactivity Failure

- Visualizations are interactive
- How can we suggest this fact to novice users?
- We tried several methods
- None of the methods work!

Employment Rate

Across the OECD, nearly 66% of the working-age population aged 15 to 64 has a paid job. Employment levels are highest in Iceland (79%), Switzerland (79%) and Norway (75%), average in Portugal and Slovenia (66%) and lowest in Italy (57%), Hungary (55%) and Turkey (46%). Employment rates are generally higher for the better-off in society than the worst-off; across the OECD 83% of the top 20% of the population has a paid job, compared with 48% for the bottom 20%.

Despite a steady increase in female employment rates over the past 15 years, women are still less likely than men to have a job. In 2010, on average across OECD countries, 59% of women had jobs or were looking for work, compared with 72% of men. The gender difference is particularly high in Turkey and Mexico, and relatively small in Canada, Estonia and the Nordic countries. The increase in employment rates for women may be explained by cyclical factors but also by the provision of childcare facilities, which have made it easier for mothers with young children to return to work.



Conclusion

- Exploring complex data is possible with novel visualizations
 - To make sense of datasets, check for quality, etc.
- It requires a bit of time to understand the visual mapping
 - About 10mn to 1h
- It also requires a bit of time to learn the interactions
- Visualization Literacy is necessary to realize how much you will gain from investing this time

IEEE VIS 2014 à Paris!

General Chair: Jean-Daniel Fekete, INRIA
Dates: Nov. 9-14 2014