

MatrixExplorer: a Dual-Representation System to Explore Social Networks

Nathalie Henry* & Jean-Daniel Fekete

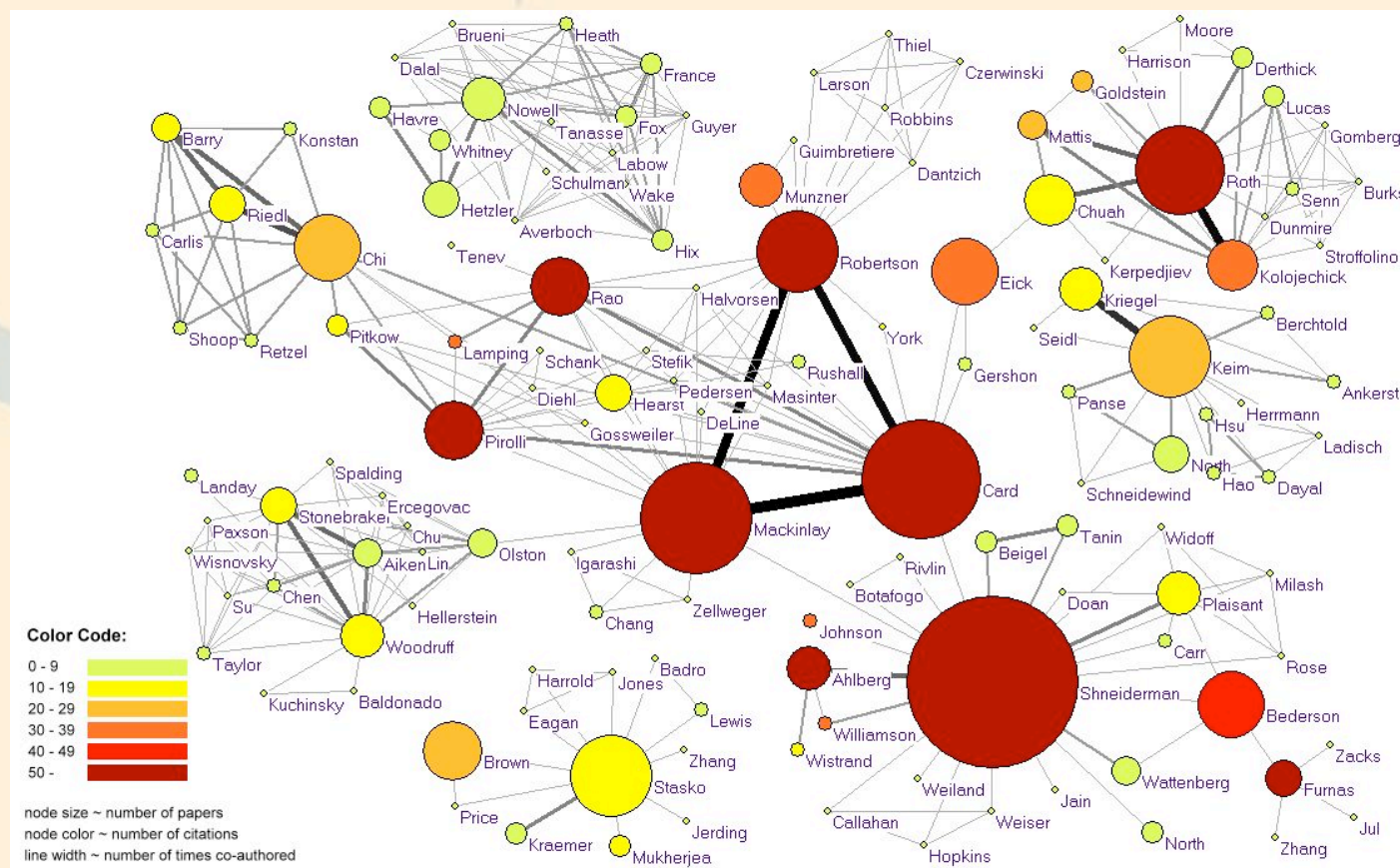
IN|SITU Lab.

INRIA / Laboratoire de Recherche en Informatique

*University of Sydney

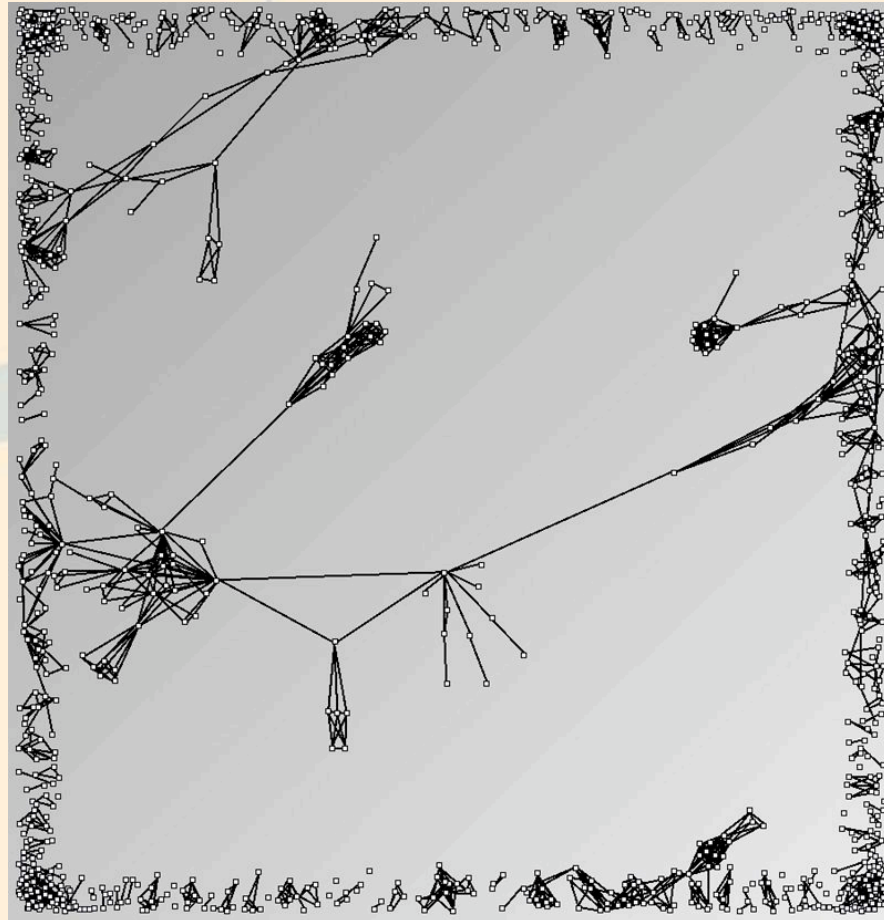
Nathalie.Henry@lri.fr, Jean-Daniel.Fekete@inria.fr

What social scientists want



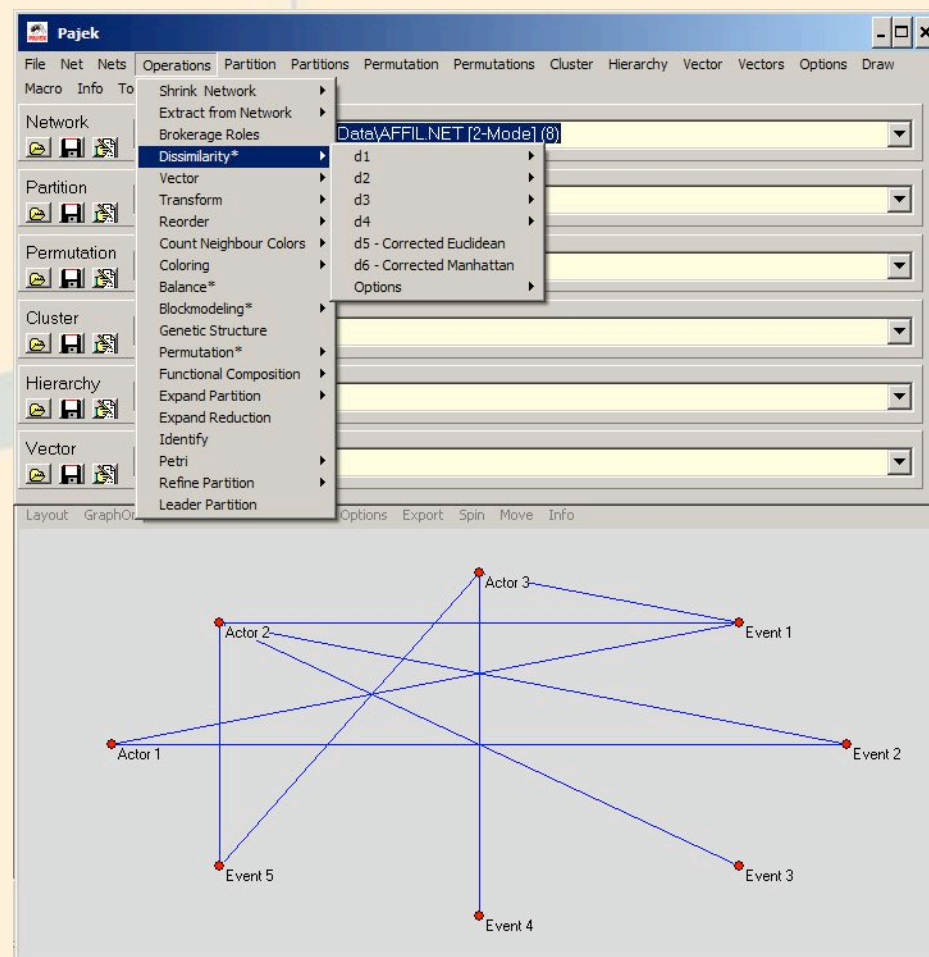
Infovis Co-authoring [Ke et al. 2004]

What they start with



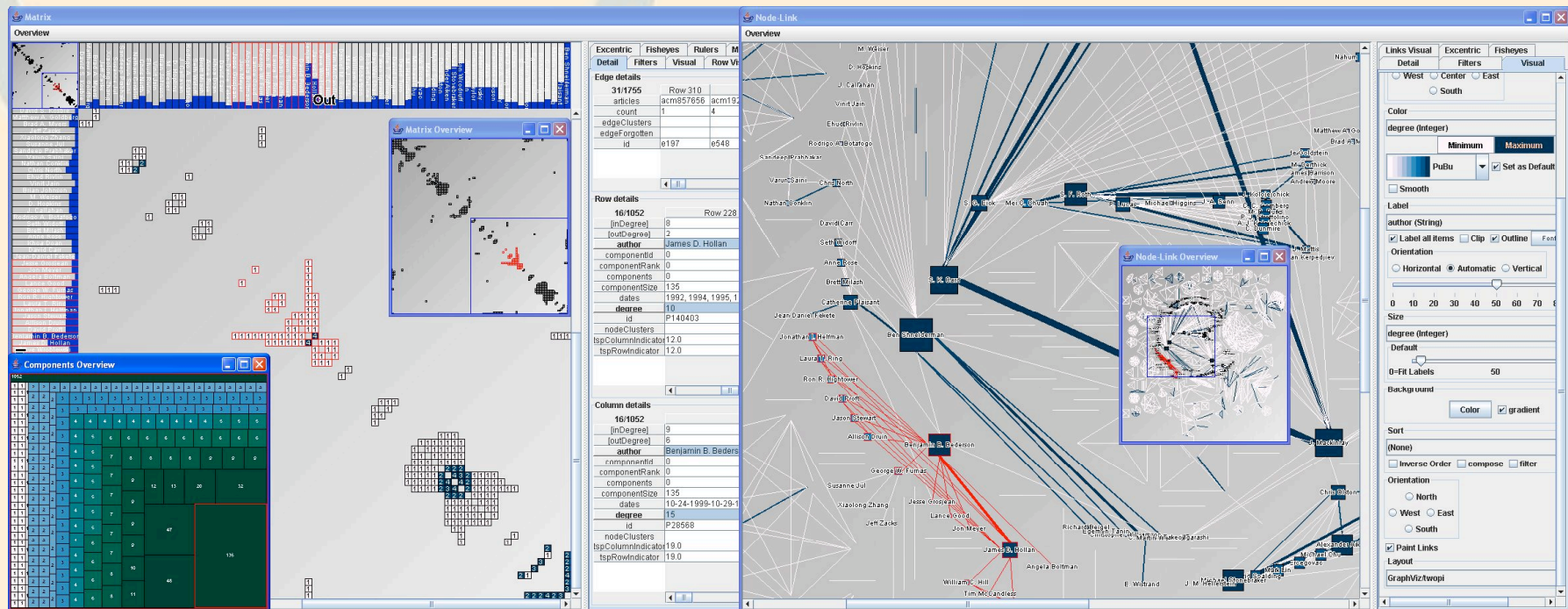
Infovis co-authoring network

What they have to explore



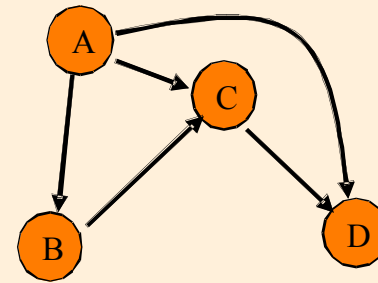
Pajek [de Nooy
et al. 2006]

What we propose: MatrixExplorer

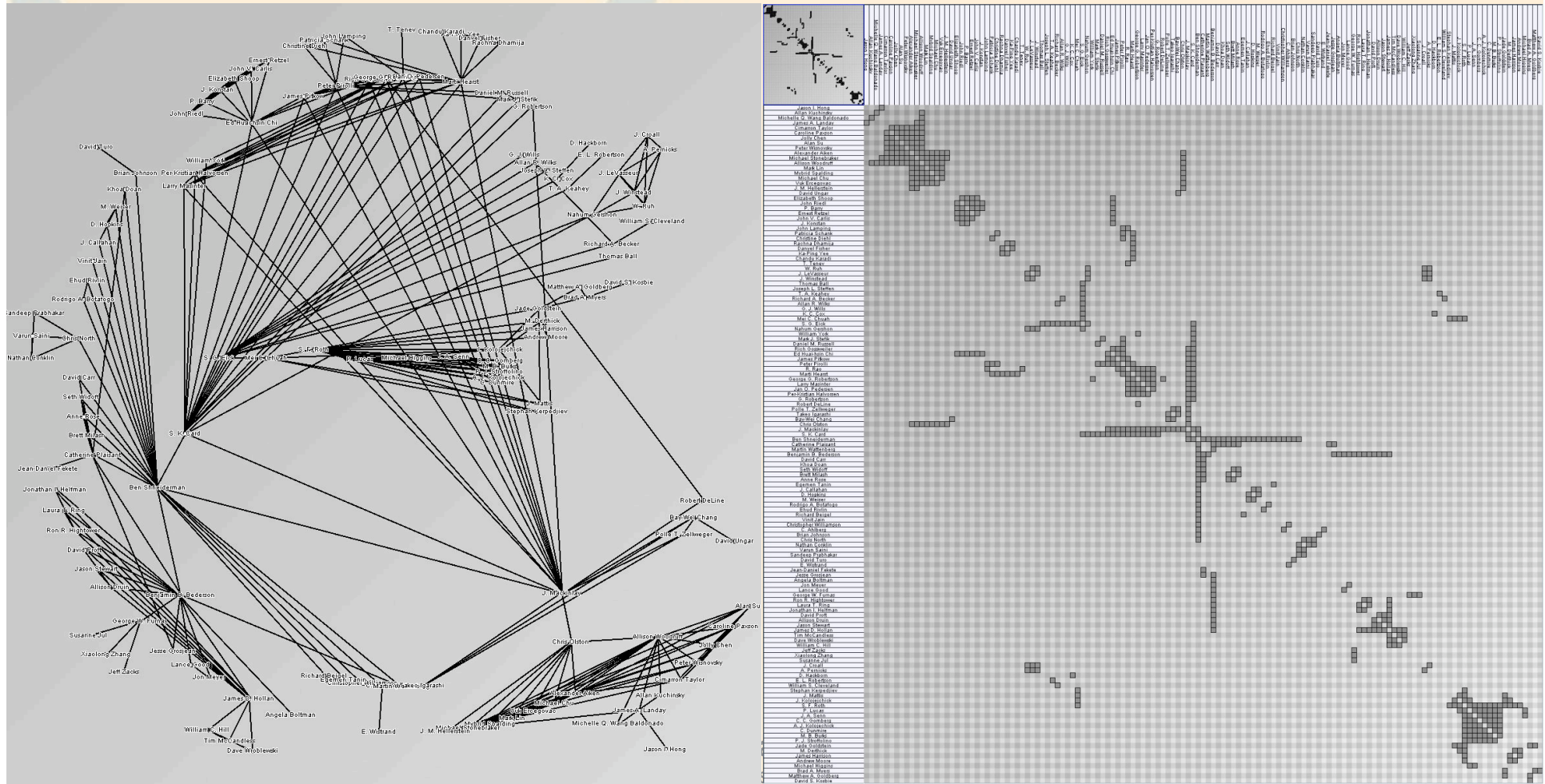


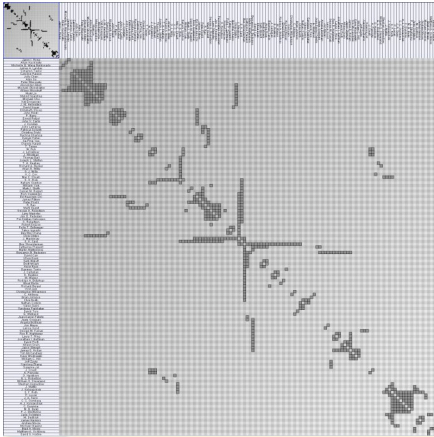
VIDEO

Matrix Visualization

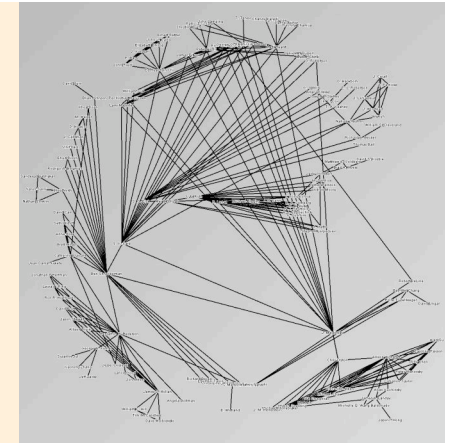


	A	B	C	D
A		X	X	X
B			X	
C				X
D				





Matrix vs NodeLink



- Usable without reordering
- No node overlapping
- No edge crossing
 - ➔ Readable for dense graphs
- Fast navigation
- Fast manipulation
 - ➔ Usable interactively
- More readable for some tasks



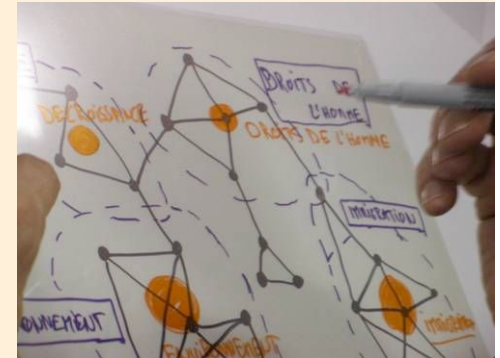
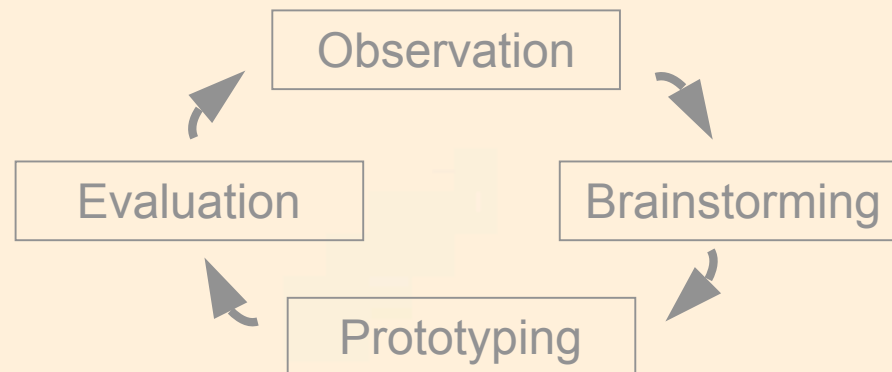
- Less intuitive
- Use more space
- Weak for path following tasks

- Intuitive
- Compact
- More readable for path following
- More effective for small graphs
- More effective for sparse graphs

- Useless without layout
- Node overlapping
- Edge crossing
 - ➔ Not readable for dense graphs
- Manipulation requires layout computation

Participatory Design

- What Social Science researchers
 - Use? (*representations, software*)
 - Analyze? (*datasets*)
 - Do? (*tasks, exploration process*)
 - Want? (*aspiration*)

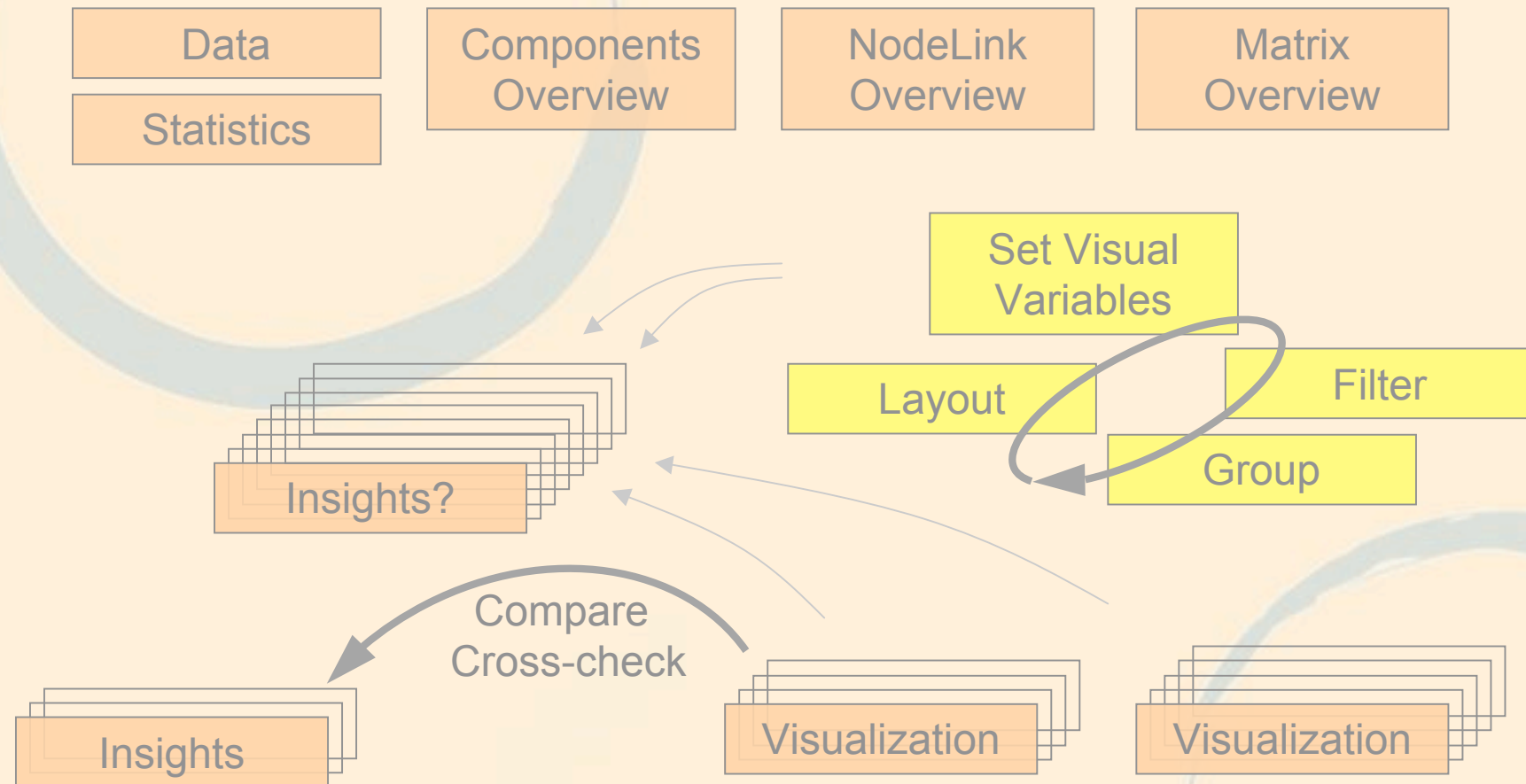



<http://insitu.lri.fr/~nhenry/MatrixExplorer>

Participatory Design Outcomes

- They ask for matrices !
 - Used in social network analysis since the 40's (Forsyth)
- Multiple representations
- Interaction... instead of parameter tuning

Exploration Process

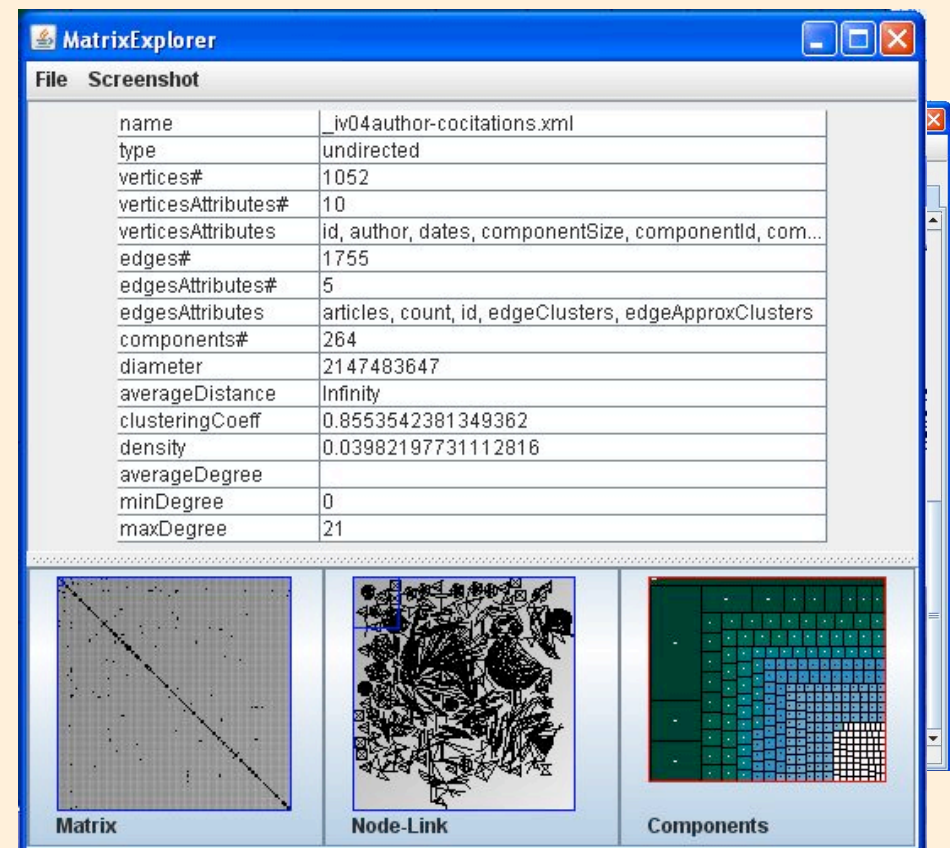




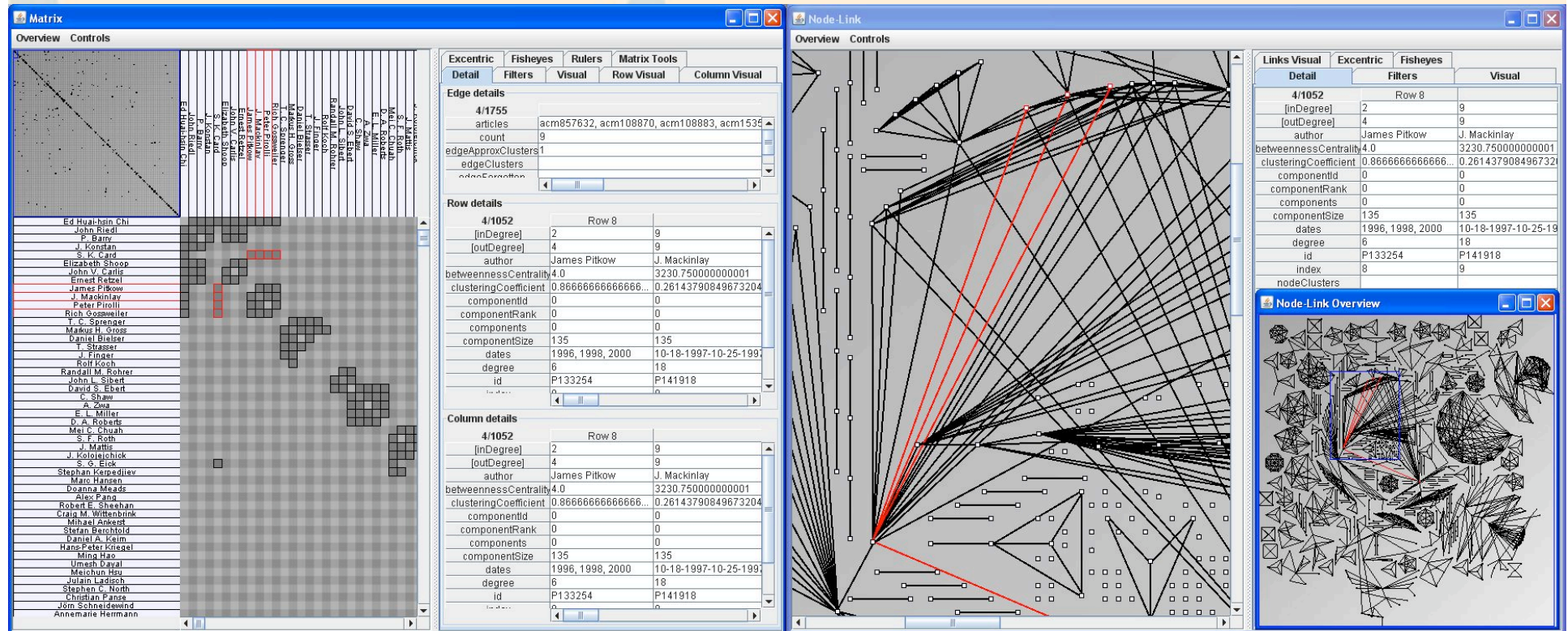
What happen when I load a new
social network?

Overview and Data

- Overview
 - Connected components
 - Matrix
 - NodeLink
- Data !
 - Data Information
 - Graph Information
 - Raw data



Accessible Data



What do I want to see?

- Something!
- Quickly!

➔ Fast and Good layout

What is a good layout?

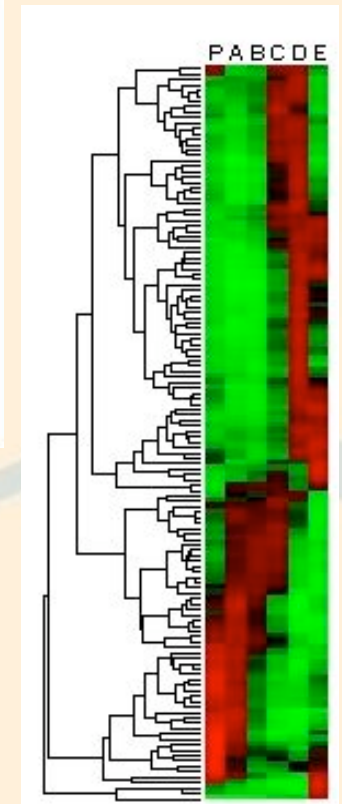
- Can I trust it?
 - Landmarks: see what I already know about the data
 - Data: see the raw data and attributes
- Is it good?
 - Network Structure
 - Communities and their organization
 - Central actors
 - Outliers
 - Insights

Layout

- Node Link
 - Useless without layout !
 - Graph drawing [Battista et al. 1998]
 - We use: GraphViz, LinLog [Noak 2005]
 - Matrix
 - Readable without layout
 - Previous Work
 - Graph linearization
 - Table ordering
 - Objective function optimization
 - Heuristics
 - Block Modeling
- [Survey in Progress]

- Why?

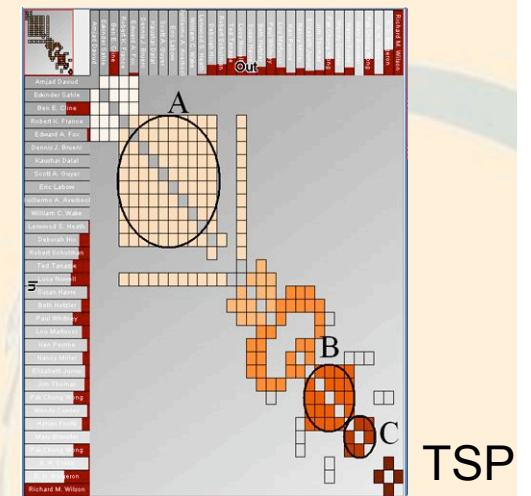
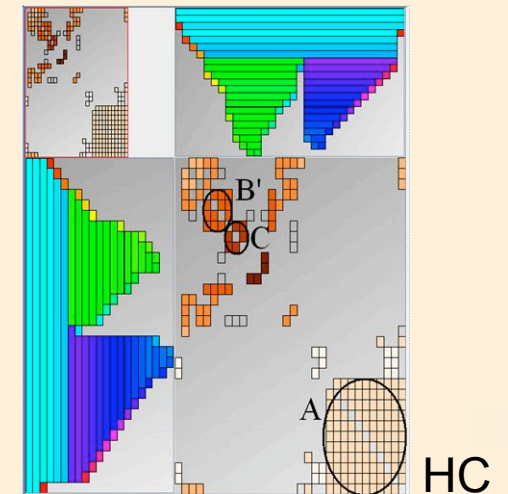
- Fast & Robust
- Initial order
- Bioinformatics
 - Microarray data reordering



[Eisen et al 1998]

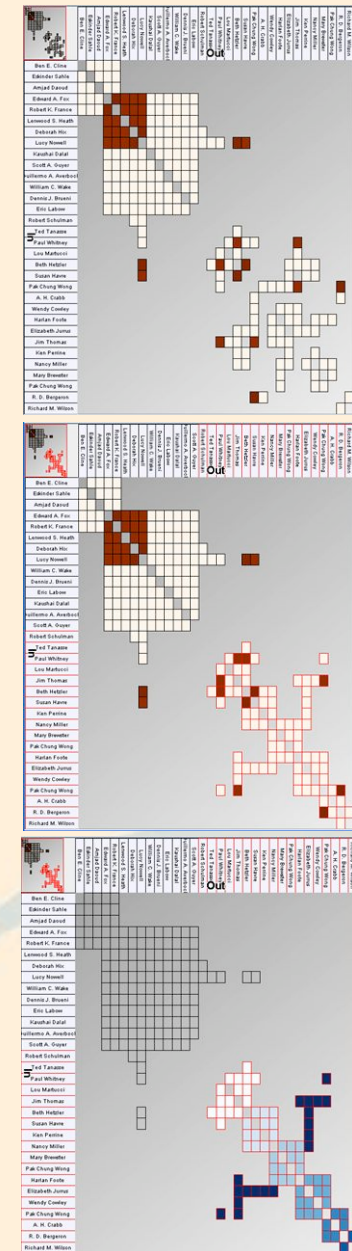
Reordering Matrices

- Transform the matrix in a table
 - Give as much information as possible
 - Avoid parameter tuning
- ➔ Matrix of shortest paths
- Hierarchical Clustering
 - Leaf-Ordering Heuristic [Bar-Joseph 2003]
- Traveling Salesman Heuristic
 - Lin-Kernigan Heuristic, Concorde



Can it reorder that part?

- Adding interaction
 - Moving a row or a column
 - Moving a set of rows or columns
 - Sorting according to an attribute
 - Human-guided reordering
 - Reordering a submatrix
 - Forgetting some relations
 - Locking some rows/columns together



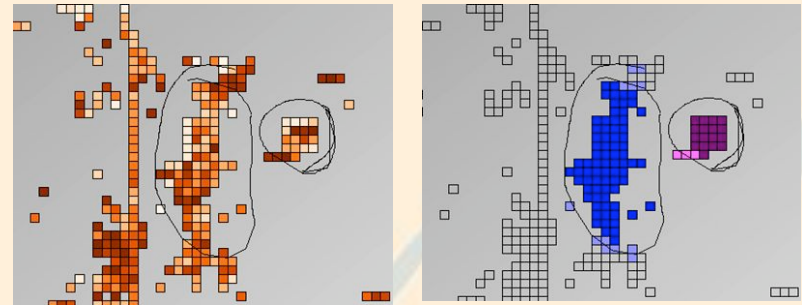


How do I compare my 20
layouts?

Avoid Visualization Artefacts

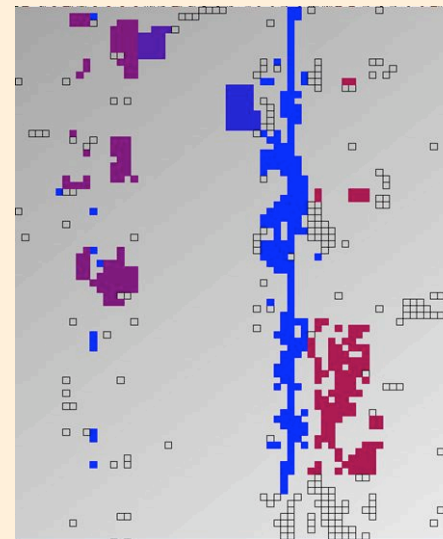
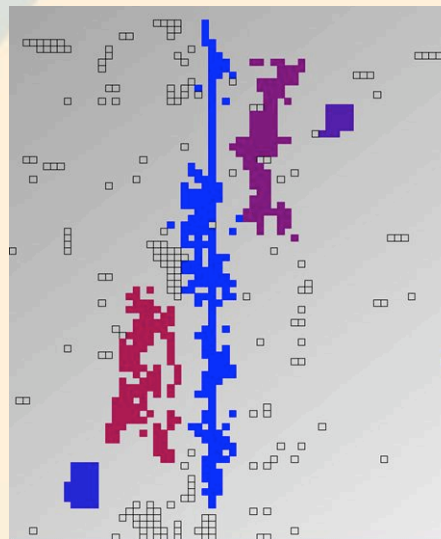
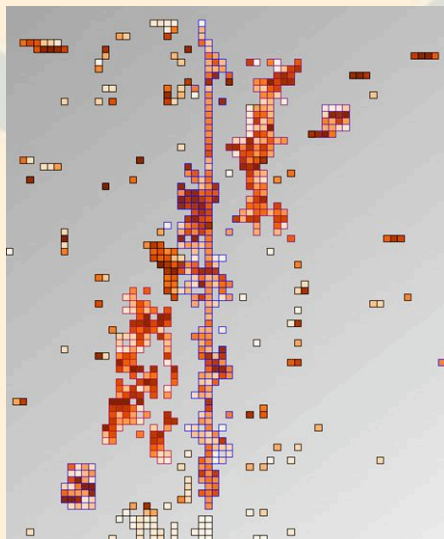
« It looks like a community in this layout
but I can't see it in this one. »

- Interactive clustering
 - Approximative
 - Multiple clusterings



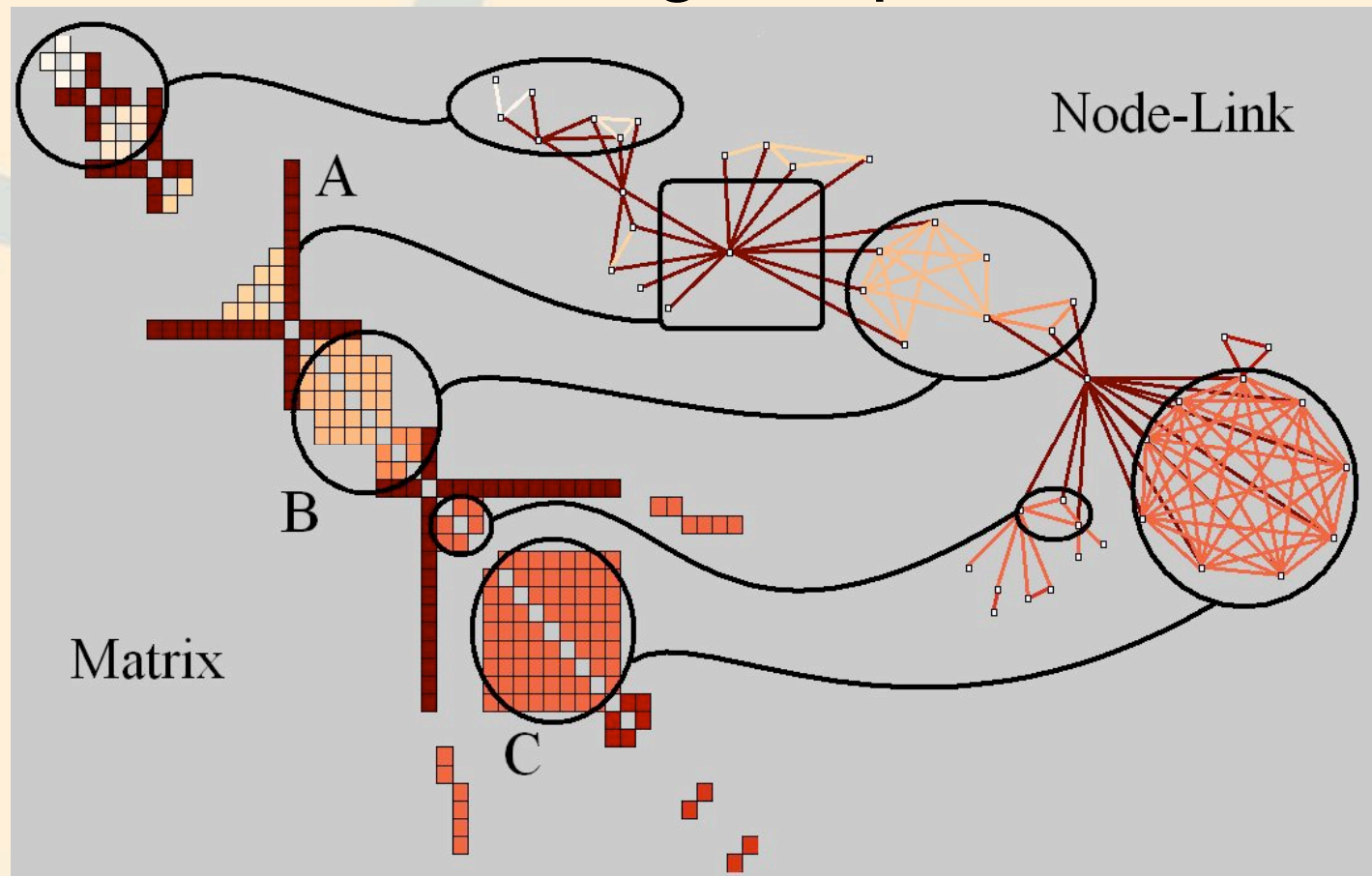
Find a consensus

- Interactive clustering + Reordering



Find a consensus

- Interactive clustering + representations





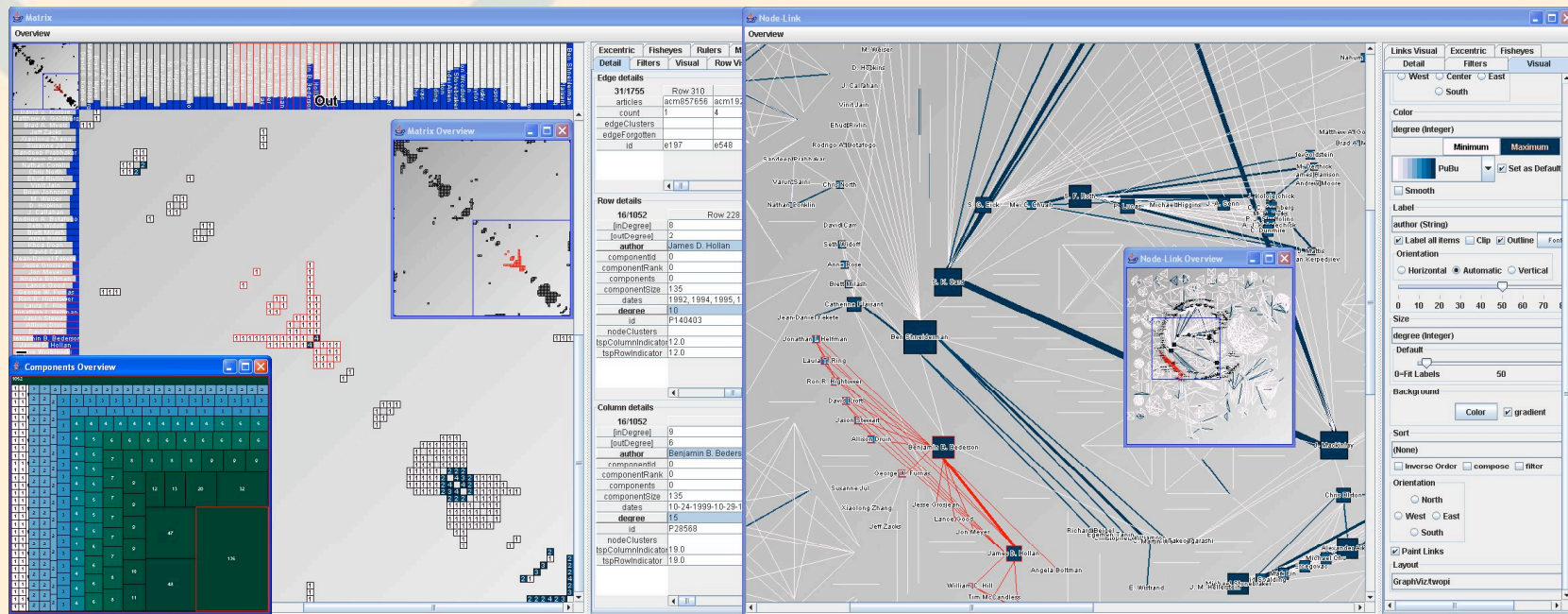
What's next?

Future Work

- Consensus - comparison
 - Compare insights, networks
- Aggregation [Abello et al. 2006]
 - Communication & navigation
- Longitudinal study
 - How people use dual-representations?

Conclusion & Questions

Dual-Representation
to Explore Visually and Interactively



Matrix or NodeLink?

- Most Connected
 - Communities
 - Clique
- Following a path
 - Communities
 - Finding articulation points

Ordering with TSP

BELIV workshop, 2006



Alphabetical order



TSP