Social Networks Vis

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Presentation for CSE591

3rd May, 2007

Overview

- What are social networks?
- Key concepts in social networks
- Growth of social networks visualization
- Techniques used in social networks visualization
- Alternatives to the traditional methods
- Some applications: *Vizster, Flink*

What are social networks?

- A social network is a social structure made of nodes that are tied by one or more specific types of relations, such as financial exchange, friends, kinship, airline routes etc.
- The nodes are generally individuals or organizations
- Social network analysis (SNA) has emerged as a key technique in modern sociology, anthropology, sociolinguistics, geography, social psychology, information science and organizational studies

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Measures in SNA

- **Betweenness** : The extent to which a node is directly connected only to those other nodes that are not directly connected to each other.
- **Centrality Closeness** : The degree an individual is near all other individuals in a network. It is the inverse of the sum of the shortest distances between each individual and every other person in the network.
- **Centrality Degree** : Its simply the degree of the node.
- **Flow betweenness Centrality** : The degree that a node contributes to sum of maximum flow between all pairs of nodes (not that node).
- **Centrality Eigenvector** : It is a measure of the importance of a node in a network. It assigns relative scores to all nodes in the network based on the principle that connections to nodes having a high score contribute more to the score of the node in question.

Measures in SNA cont.

- **Centralization** : The difference between the n of links for each node divided by maximum possible sum of differences.
- **Clustering Coefficient :** The clustering coefficient is a measure of the likelihood that two associates of a node are associates themselves.
- **Structural Equivalence** : Refers to the extent to which actors have a common set of linkages to other actors in the system. The actors don't need to have any ties to each other to be structurally equivalent.
- **Radiality** : Degree an individual's network reaches out into the network and provides novel information and influence.
- **Reach** : The degree any member of a network can reach other members of the network.

Social Network Vis.

In his early works, Moreno (1934) introduced five important ideas about the proper construction of images of social networks:

- Draw graphs
- Draw directed graphs
- Use colors to draw multigraphs
- Vary the shapes of points to communicate characteristics of social actors
- Variations in the locations of points can be used to stress important structural features of the data.

The last idea is used frequently by rural sociologists and geographers.
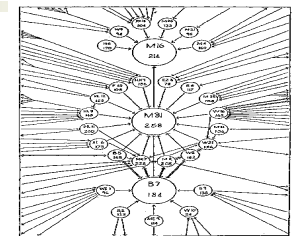
Moreno's ideas illustrated

△ Boys   ○ Girls
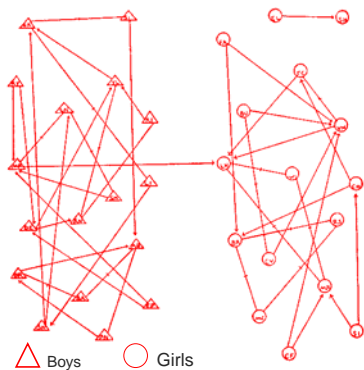
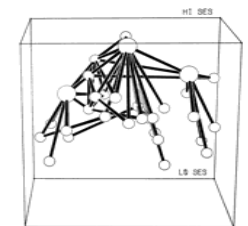**Friendship Choices among 4th graders**
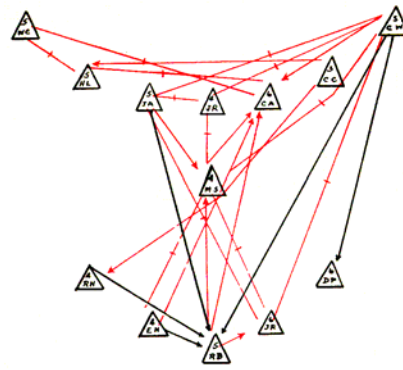
Positive and Negative Choices in a Football Team

Lady bountiful (Lundberg & Steele

- One structural feature that was of great interest to early investigators was the *sociometric status* of each point.
- The sociometric status of a point was defined as the number of choices, or the strength of the choices, received by that point.
- Lundberg and Steele (1938), for example, specified the *nuclei* of a network as those actors with high sociometric status . They constructed their famous "lady bountiful" image by making the nuclei larger than other points and by placing them near the middle of their drawing
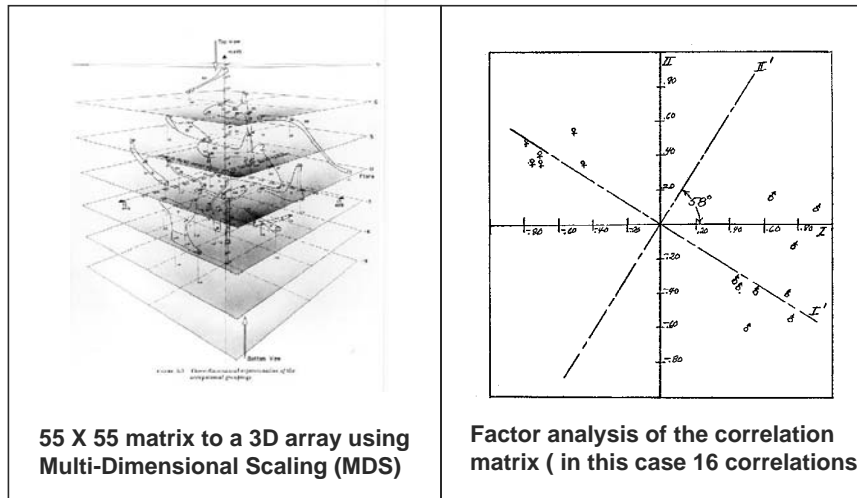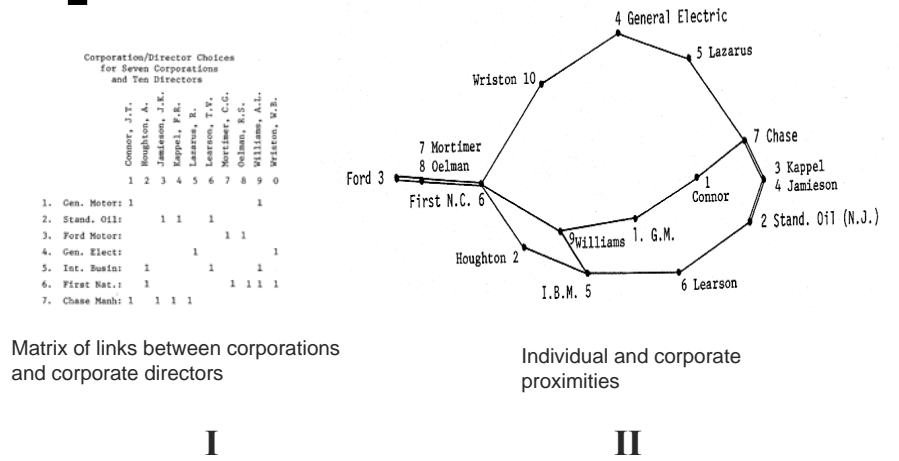

Original

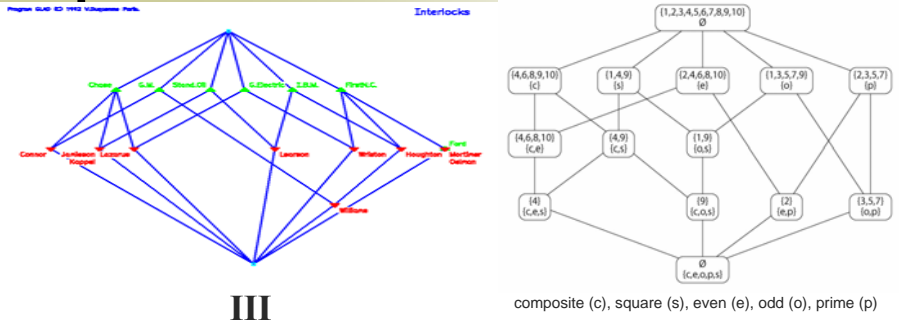**Computer based 3-D rendering**

Line Images Grounded in Computation

55 X 55 matrix to a 3D array using Multi-Dimensional Scaling (MDS)

Factor analysis of the correlation matrix (in this case 16 correlations)

Evolution of ways of representation

Matrix of links between corporations and corporate directors

Individual and corporate proximities

I

II

Representation as a Galois Lattice

**III**

composite (c), square (s), even (e), odd (o), prime (p)

- Here lattice means an order
- To create it, the matrix is taken as an input, and the "natural" *object* clusters and "natural" *property* clusters are deduced

Interactive images in the era of web browsers

- One way is to use java applets
- A second browser-based way of handling images is provided by *VRML* (Virtual Reality Modeling Language)
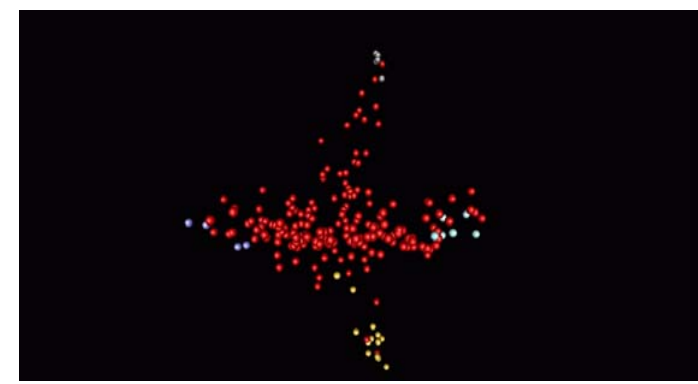
This image is a 3-D representation of data on friendship ties collected at a residential college at an Australian university

Force-directed algorithms : A graph layout scheme used in social networks vis.

- Force-directed algorithms are a class of algorithms for drawing graphs in an aesthetically pleasing way.
- Their purpose is to position the nodes of a graph so that all the edges are of more or less *equal length* and there are as *few crossing* edges as possible.
- They achieve this by assigning forces amongst the set of edges and the set of nodes; the most straightforward method is to assign forces as if the edges were springs and the nodes were electrically charged particles .
- The forces are applied to the nodes, pulling them closer together or pushing them further apart. This is repeated iteratively until the system comes to an equilibrium state; i.e., their relative positions do not change anymore from one iteration to the next.
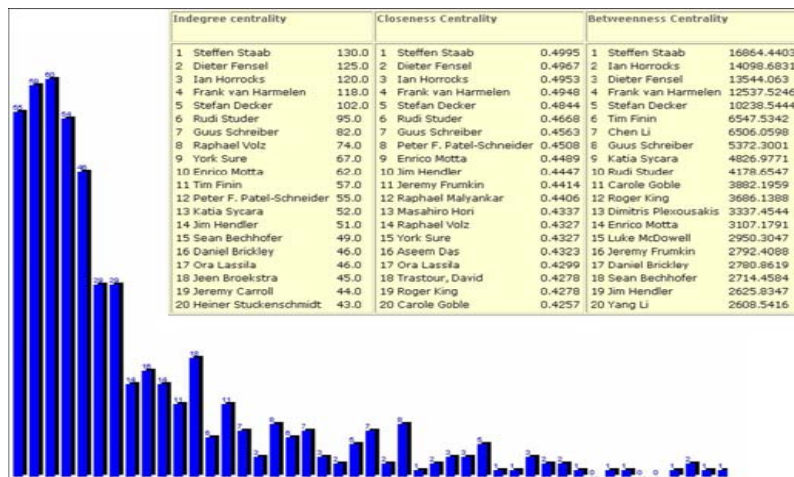
Going beyond the graph?

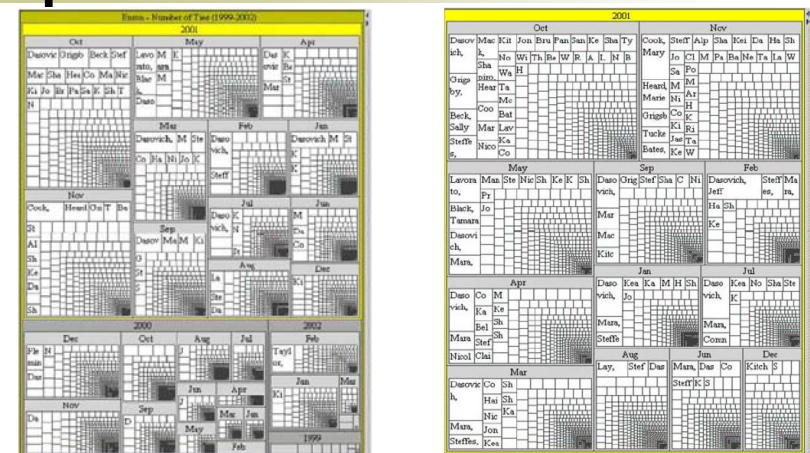Alternative representations have mostly been used to augment the node-link graphs

- Histograms
- Treemaps
- Etc.

Connectivity: Well known graph

From FLINK: The who is who of the Semantic Web

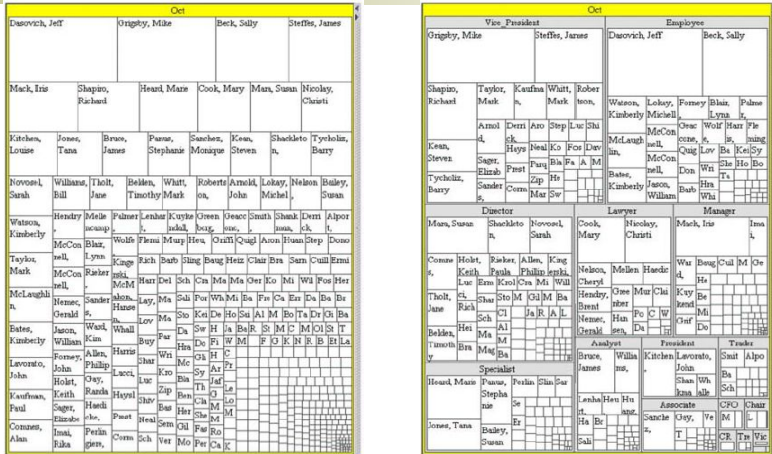## Treemaps as a Tool for Social Network Analysis

Node Degrees, by Year & Month

2001 Node Degrees, by Month

The ENRON dataset

Tree Maps

Oct 2001 Node Degrees, by Name | Oct 2001 Node Degrees, by Title, & Name

The ENRON dataset

PostHistory: interface with calendar

PostHistory is a visualization that focuses on time and rhythm, where the variations in long-term email exchange are revealed to the user.

1. Left panel:
   - (a) Size of square: traffic
   - (b) Color of square : directedness
2. Right panel (vertical / circular version)
   - (a) At the top/centre : ego
   - (b) Most frequent contacts closer to the ego.

Vizster

- Vizster is an interactive visualization tool for online social networks, allowing exploration of the community structure of social networking services such as friendster.com, tribe.net, and orkut.
- The networks are presented as egocentric networks: networks consisting of an individual and their immediate friends. Users can expand the display by selecting nodes to make visible others' immediate friends as well.
- In pursuing this design, they chose to violate Shneiderman's mantra of "overview first, zoom and filter, then details-on-demand", instead opting for a philosophy of "start with what you know, then grow."
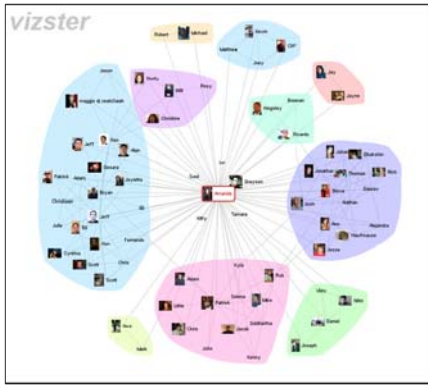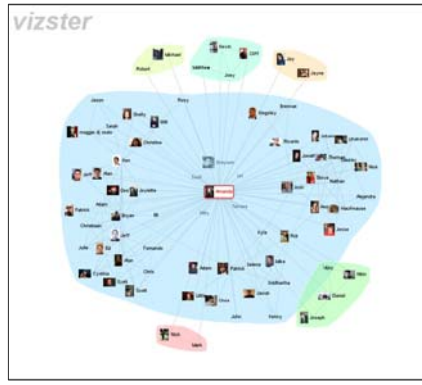
Vizster
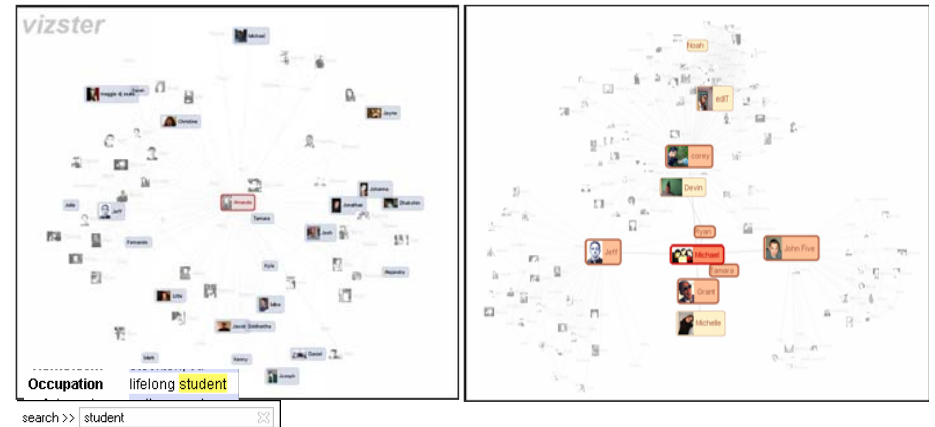
Visualized search results for the query "student".

Focus+Context view by inflating highlighted nodes

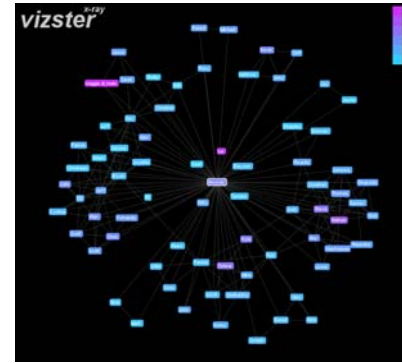## Vizster: Community structure

Community structure visualization using algorithmically determined optimum.
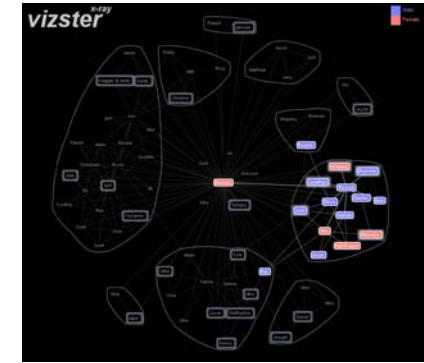

Community structure visualization after the community slider has been dragged to the right
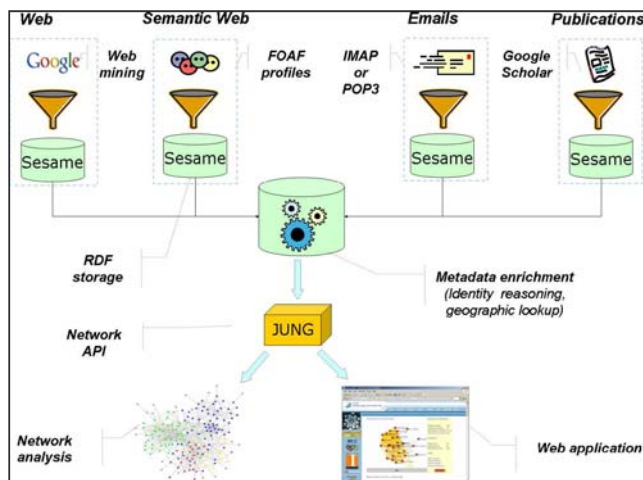
Vizster: X-ray mode

X-ray mode visualizing the number of friends.

X-ray Mode visualizing genders, search hits, mouse-over highlight and community structures.

Flink : Semantic Web Technology for the Extraction and Analysis of Social Networks
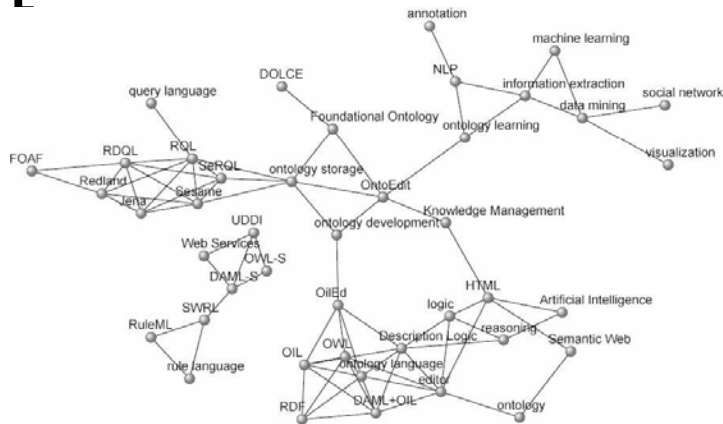

Flink

- The visualization is simple, though the data source is interesting
- As of now, uses researchers active in the field of semantic web. (includes Prof I.V. and some of his students)
- Calculates interesting things like degree, closeness, betweenness, and impact.

Flink : Ontology of research topics

A link between 2 topics means that there are at least a certain minimum researchers interested in both.

Mark Lombardi

- Lombardi's drawings purport to document financial and political frauds by power brokers.
- His 1999 drawing, entitled *George W. Bush, Harken Energy and Jackson Stephens, ca 1979-90*, shows the proven connections between James Bath, the Bush and bin Laden families, and business deals in Texas and around the world.

An interesting link

- http://www.visualcomplexity.com/vc/index.cfm?domain=Social%20Networks
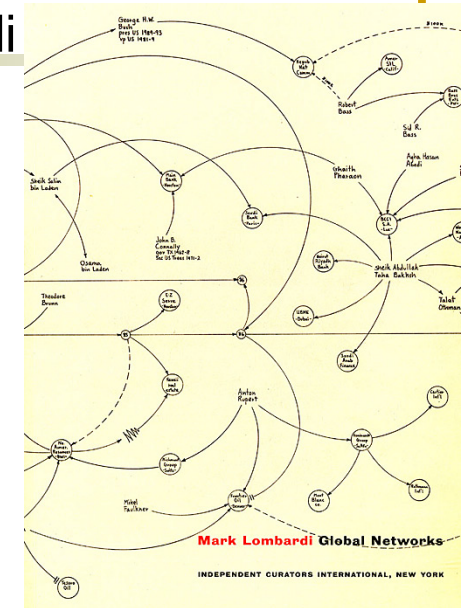
References

- "*Visualizing Social Networks*". By Linton C. Freeman, University of California, Irvine (link)
- "*Treemaps as a Tool for Social Network Analysis*". CASOS Technical Report. By Terrill L. Frantz & Kathleen M. Carley, September 2005.
- "*Flink: Semantic Web Technology for the Extraction and Analysis of Social Networks*". By Peter Mika, Vrije Universiteit Amsterdam (VUA)
- "Digital Artifacts for Remembering and Storytelling: *PostHistory* and *Social Network Fragments*". Proc. of the 37th Hawaii International Conference on System Sciences – 2004. By Fernanda B. Viégas, Danah Boyd, David H. Nguyen, Jeffrey Potter, Judith Donath
- http://en.wikipedia.org/wiki/Social_network
- http://en.wikipedia.org/wiki/Force-based_algorithms