visone - Analysis and Visualization of Social Networks

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CREEN-Meeting June 2005

Overview

What Is visone?

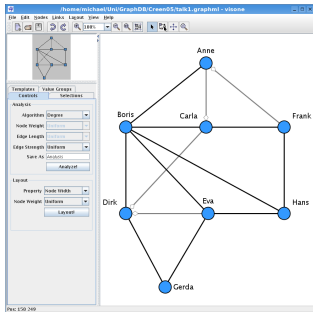Example: Centrality Analysis

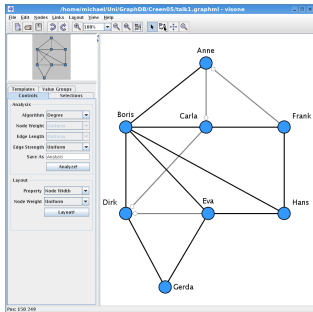Design
Model
Analysis
Visualization
Graph Generators

Planned Features

What Is visone?

- ▶ interactive
  analysis and visualization
  of social networks
- ▶ provide new methods
- ▶ be easy to use

What Is visone?

present focus on

- ▶ social science
- ▶ small and medium size networks
- ▶ element level analysis
- ▶ interaction, not dynamics

Example: Centrality Analysis

Aquarius Corp.

- ▶ supplies horoscopes for magazines
- ▶ 8 employees: Anne, Boris, Carla, Dirk, Eva, Frank, Gerda, and Hans
- ▶ examine the collaboration
- ▶ means: questionnaire

Question 1: Who Are Your Friends?

► symmetric binary relation

Result:

► Anne: Boris, Frank
► Boris: A, C, D, E, H
► Carla: B, F
► Dirk: B, E, G
► Eva: B, G, H
► Frank: Carla, Hans
► Gerda: D, E
► Hans: B, F, E

Question 1: Who Are Your Friends?

Result:

- ▶ symmetric binary relation
- ▶ inconsistencies are possible:
  - ▶ Anne names Frank
  - ▶ Frank doesn't name Anne

- ▶ Anne: Boris, Frank
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Question 1: Who Are Your Friends?

Result:

- Anne: Boris, Frank
- Boris: A, C, D, E, H
- symmetric binary relation
- Carla: B, F
- inconsistencies are possible:
  - Anne names Frank
  - Frank doesn't name Anne
- Dirk: B, E, G
- Eva: B, G, H
- how to represent relations?
- Frank: Carla, Hans
- how to handle inconsistencies?
- Gerda: D, E
- Hans: B, F, E

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Question 1: Who Are Your Friends?

- ▶ classical representation:
  - ▶ 8×8-matrix
  - ▶ correction needed

	A	B	C	D	E	F	G	H
A	·	1	0	0	0	1	0	0
B	1	·	1	1	1	0	0	1
C	1	1	·	0	0	1	0	0
D	0	1	1	·	1	0	1	0
E	0	1	0	0	·	0	1	1
F	0	0	1	0	0	·	0	1
G	0	0	0	1	1	0	·	0
H	0	1	0	0	1	1	0	·

Question 1: Who Are Your Friends?

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E	0	1	0	0	·	0	1	1
F	0	0	1	0	0	·	0	1
G	0	0	0	1	1	0	·	0
H	0	1	0	0	1	1	0	·

Question 1: Who Are Your Friends?

- ▶ classical representation:
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  - ▶ correction needed
- ▶ analysis:
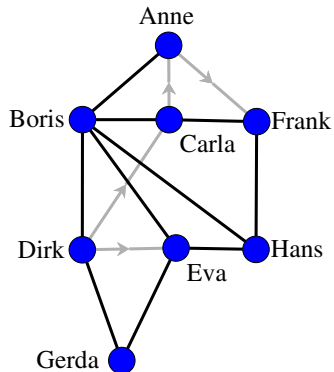 - ▶ degree
  - ▶ betweenness

	degree	betw.
A	1	0
B	5	52
C	2	6
D	2	6
E	2	15
F	3	2
G	2	2
H	3	15

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Question 1: Who Are Your Friends?

- ▶ classical representation:
  - ▶ 8×8-matrix
  - ▶ correction needed
- ▶ analysis:
  - ▶ degree
  - ▶ betweenness
- ▶ disadvantages:
  - ▶ modified data
  - ▶ little descriptive
    presentation

	degree	betw.
A	1	0
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E	2	15
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Question 1: Who Are Your Friends?

- ▶ representation in visone:
  - ▶ undirected graph
  - ▶ node attribute confirmation

Question 1: Who Are Your Friends?

- ▶ representation in visone:
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  - ▶ node attribute
    confirmation
- ▶ analysis through layout:
  - ▶ degree
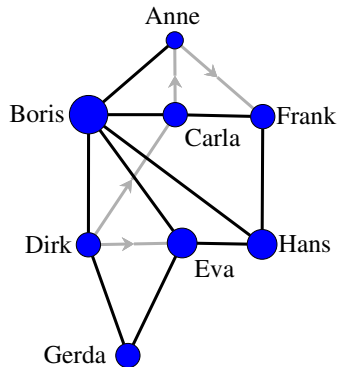
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- ▶ advantages:
  - ▶ all-in-one data
  - ▶ visualization of results
  - ▶ customizable analysis

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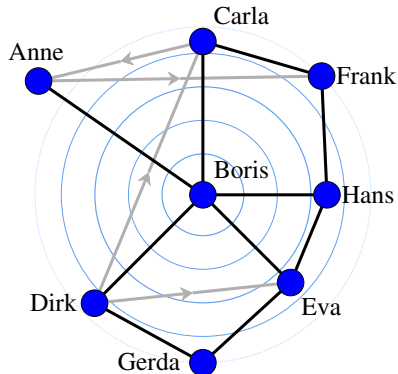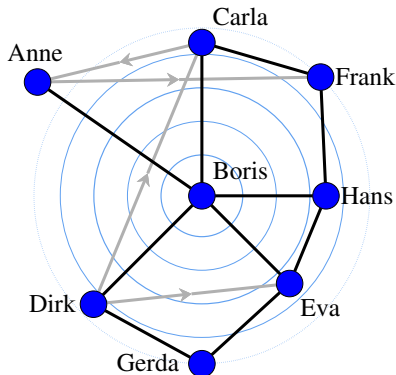
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Question 2: To Whom Do You Give Advice?
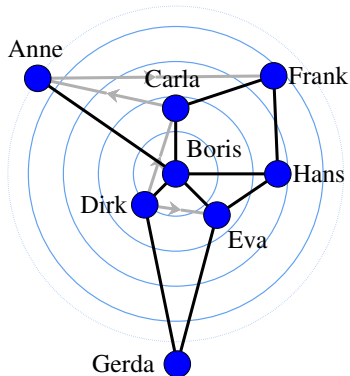
► asymmetric binary relation

I give advice to · :
- ► Anne: C
- ► Boris: C, D, H
- ► Carla:
- ► Dirk: C, E, G
- ► Eva: D, H
- ► Frank: C, H
- ► Gerda: E
- ► Hans: B, F

Question 2: To Whom Do You Give Advice?

- ▶ asymmetric binary relation
- ▶ verification by inverse question:
  From whom do you get advice?

I get advice from · :

- ▶ Anne:
- ▶ Boris: H
- ▶ Carla: A, B, F
- ▶ Dirk: B, E
- ▶ Eva: G
- ▶ Frank: A, H
- ▶ Gerda: D
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Question 2: To Whom Do You Give Advice?

- ▶ asymmetric binary relation
- ▶ verification by inverse question:
  From whom do you get advice?
- ▶ combined relation:
  - ▶ Who gives advice to whom?

I get advice from · :

- ▶ Anne:
- ▶ Boris: H
- ▶ Carla: A, B, F
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- ▶ Eva: G
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Question 2: To Whom Do You Give Advice?

- ► asymmetric binary relation
- ► verification by inverse question:
  From whom do you get advice?
- ► combined relation:
  - ► Who gives advice to whom?
  - ► inconsistencies are possible

inconsistency

- ► Dirk: "I give advice to Carla."
- ► Carla: "I get no advice from Carla!"

Question 2: To Whom Do You Give Advice?

- ▶ representation in visone:
  - ▶ directed graph
  - ▶ node attribute
    confirmation
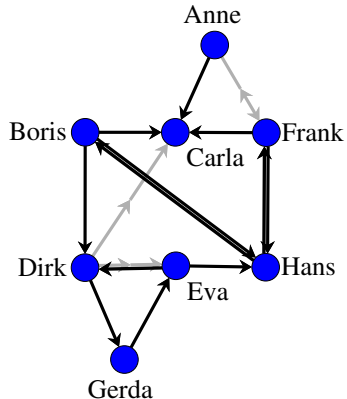
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  - ▶ node attribute confirmation
- ▶ analysis through layout:
  - ▶ closeness
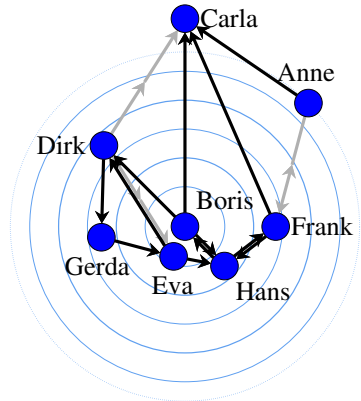
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Example: Centrality Analysis
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Planned Features

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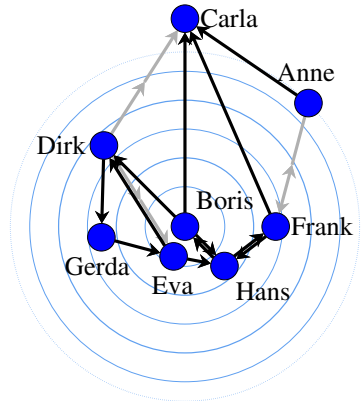
Model

- a social network consists of
    - set of actors, i.e., persons, organizations, etc.
    - binary relations between actors
- different types of relations
    - directed, undirected
    - confirmed, unconfirmed
- various attributes of actors and relations
    - strings (i.e., actor names)
    - numerical values (i.e., weights for relations)

Model – GraphML

- ▶ XML-based graph file format
- ▶ main features
    - ▶ undirected, directed, and mixed graphs
    - ▶ hierarchical graphs
    - ▶ application-specific attribute data
    - ▶ extensible
- ▶ meets visone's demands
- ▶ prefered file format

```xml
<?xml version="1.0" ?>
<graphml>
   <graph id="G">
      <node id="n3"/>
      <node id="n2"/>
      <node id="n1"/>
      <node id="n0"/>
      <edge id="e5" source="n1
      <edge id="e4" source="n3
      <edge id="e3" source="n1
      <edge id="e2" source="n0
      <edge id="e1" source="n3
      <edge id="e0" source="n2
```

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Example: Centrality Analysis
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Analysis

- ▶ mainly at element level
- ▶ structural indices for actors
    - ▶ assign one value to each actor
    - ▶ evaluate only relations
    - ▶ same structural properties result in same value

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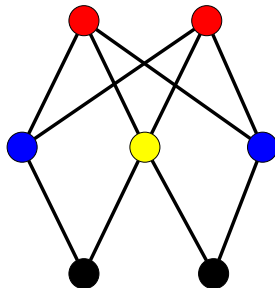
Analysis – Three Types of Structural Indices

- ▶ degree, in- and outdegree
- ▶ shortest paths based
    - ▶ closeness - sum of distances
    - ▶ betweenness - number of shortest paths
    - ▶ graph, stress, radiality
- ▶ eigenvector based
    - ▶ PageRank
    - ▶ Hubs & Authorities
    - ▶ eigenvector, Katz' status

Analysis – Modifications

- ▶ adjustments to fit visone's network model
- ▶ standardization of values
    - ▶ only non-negative values
    - ▶ unit sums
- ▶ probability distribution
- ▶ share of a node in total importance

Visualization

objectives:

- ▶ suit the analysis
- ▶ emphasize the importance
- ▶ visualize the graph structure

three analysis layout methods

Layout 1: Node Size

importance corresponds
to node size

- ▶ multi-purpose, generic
- ▶ neutral
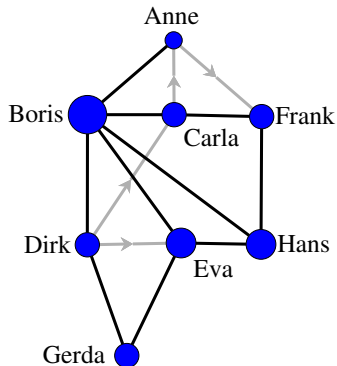
Layout 2: Radial

important nodes
are more central

- ▶ suits centrality indices
- ▶ very suggestive
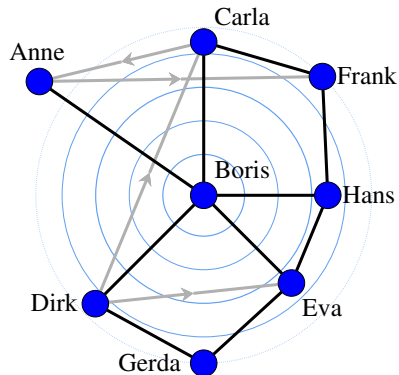
Layout 3: Layered

important nodes
have higher status

- ▶ suits status indices
- ▶ very suggestive

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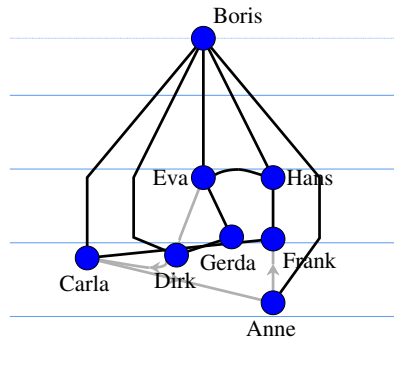
Visualisation – General

- ▶ force-directed, organic
- ▶ circular
- ▶ spectral
- ▶ label placement
- ▶ edge routing
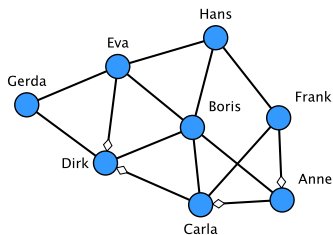
Graph Generators

- random, $G_{n,p}$
- preferential attachment
- small world
- planar
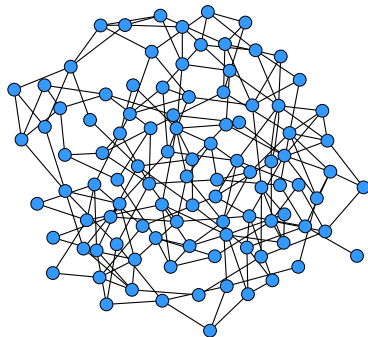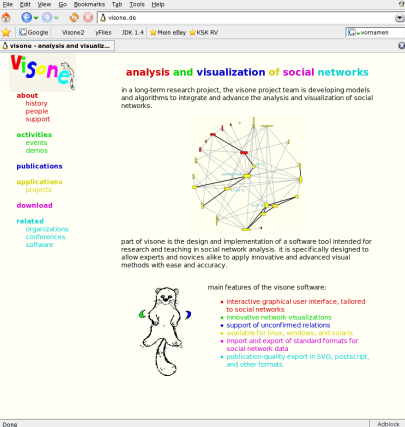
Planned Features

- improvements
    - advanced structural indices
    - nicer layouts
- new functions
    - grouping, clustering
    - structural equivalence
- focus on
    - larger networks
    - dynamics
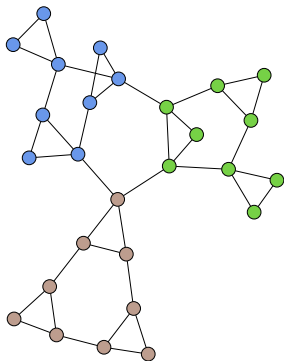
More Informations

- ▶ visit the homepage www.visone.de
- ▶ and ask us
  - Thomas
  - Michael