A Comparison of the Readability of Graphs Using Node-Link and Matrix-Based Representations

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Node Link

- Traditional graph representation
What do we want to know about a graph?
Motivation -- Examine 7 tasks

- Count Nodes
- Count Links
- Find Most Connected Node
- Find Specific Node
- Find Existence of Link
- Find Neighbor
- Find Path
Quick Experiment
20 Nodes, 100 Edges (60%)
Example Graph 2
50 Nodes, 230 Edges (20%)
Example Graph 3
100 Nodes, 2500 Edges (60%)
Connectivity Matrix

- Vertices along rows and columns
- $i,j$th entry indicates existence of edge between vertex $i$ and vertex $j$
Connectivity Matrix
50 nodes, 400 edges
Experimental Comparison

- 36 Users
- 9 Random Graphs
  - 20, 50, 100 vertices
  - 20%, 40%, 60% edge density
- 7 Tasks
  - Time to answer
  - % correct
Predictions

- Connectivity Matrix better for:
  - Count Links
  - Most Connected
  - Find Specific Node
  - Find Link
  - Find Neighbor
  - Larger graphs

- Node–Link better for:
  - Find Path
  - Small graphs

- Similar for:
  - Counting Nodes
Results

• Connectivity Matrix better for:
  – Count Nodes*
  – Most Connected
  – Find Specific Node
  – Find Link
  – Find Neighbor
  – Larger graphs

• Node–Link better for:
  – Find Path
  – Small graphs

• Similar for:
  – Counting Links*

* Unexpected result
Summary of Results

- **Effect of Graph size**
  - Node-Link quickly deteriorates as node count increases.
  - Connectivity Matrix deteriorates more slowly as node count increases.

- **Effect of Edge density**
  - similar, but less pronounced

- **Exceptions**
  - Link count similar for both visualizations
Critique

- Only node count and density analyzed
  - Each of 9 graphs not considered individually
- Effect of lack of familiarity with Matrix
- Random graph configurations unrealistic
  - many real world graphs have high node count, low density
    - Social networks, computer networks, etc