GLO-STIX
Graph-Level Operations for Specifying Techniques and Interactive Exploration

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Low Level

JUNG
High Level
What might graph visualization building blocks look like?
Semantic Substrates

PivotGraph

Semantic Substrates to PivotGraph?
Semantic Substrates to PivotGraph?

- Substrate on X
- Aggregate
- (Size Nodes by Count)
- Display All Links
- Show X Axis
- Show Y Axis
Graph-Level Operations
Graph-Level Operations (GLOs)
Graph-Level Operations

https://openclipart.org/detail/184889/lego-blocks-by-eggib-184889
Graph-Level Operations

Encapsulated Manipulations of Graph Visualizations

https://openclipart.org/detail/184889/lego-blocks-by-eggib-184889
Force-Directed to PivotGraph?
Force-Directed to PivotGraph?

- Substrate on X
- Substrate on Y
- Show Links as Curved
- Aggregate
- (Size Nodes by Count)
- Show X Axis
- Show Y Axis
Force-Directed to PivotGraph?

- Substrate on X
- Substrate on Y
- Show Links as Curved
- Aggregate
- (Size Nodes by Count)
- Show X Axis
- Show Y Axis
Identifying GLOs
Identifying GLOs

Circle Plot
Identifying GLOs
Identifying GLOs
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Identifying GLOs

1. Align Nodes
2. Evenly Distribute Nodes
3. Evenly Distribute Nodes by Attribute
4. Substrate Nodes by Attribute
5. Evenly Distribute Nodes within Substrates
6. Position Nodes Relatively
7. Evenly Distribute Nodes Radially by Attribute
8. Evenly Distribute Nodes Radially
9. Position Nodes Radially by Attribute
10. Substrate Nodes Radially by Attribute
11. Evenly Distribute Nodes Along Plot Radius
12. Evenly Distribute Nodes Along Plot Radius
13. Position Nodes Along Plot Radius by Attribute
14. Substrate Nodes Along Plot Radius
15. Position Nodes Along Plot Radius by Constant
16. Apply an Algorithm to the Nodes
17. Size Nodes by a Constant
18. Size Nodes Relatively by a Continuous Attribute
19. Display All Links
20. Display Selected Links
21. Hide Links
22. Display Links as Straight
23. Display Links as Curved
24. Display Links as Circles
25. Clone Active Generation
26. Select Generation k
27. Set Source Generation k
28. Set Target Generation k
29. Remove Generation k
30. Aggregate by Attribute
31. Aggregate by Attribute and Attribute
32. Deaggregate Generation k
33. Show Axis
34. Hide Axis
1. Align Nodes
2. Evenly Distribute Nodes
3. Evenly Distribute Nodes by Attribute
4. Substrate Nodes by Attribute
5. Evenly Distribute Nodes within Substrates
6. Position Nodes Relatively
7. Evenly Distribute Nodes Radially by Attribute
8. Evenly Distribute Nodes Radially
9. Position Nodes Radially by Attribute
10. Substrate Nodes Radially by Attribute
11. Evenly Distribute Nodes Along Plot Radius
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29. Remove Generation k
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33. Show Axis
34. Hide Axis

34 Operations
Identifying GLOs

1. Align Nodes
2. Evenly Distribute Nodes
3. Evenly Distribute Nodes by Attribute
4. Substrate Nodes by Attribute
5. Evenly Distribute Nodes within Substrates
6. Position Nodes Relatively
7. Evenly Distribute Nodes Radially by Attribute
8. Evenly Distribute Nodes Radially
9. Position Nodes Radially by Attribute
10. Substrate Nodes Radially by Attribute
11. Evenly Distribute Nodes Along Plot Radius
12. Evenly Distribute Nodes Along Plot Radius
13. Position Nodes Along Plot Radius by Attribute
14. Substrate Nodes Along Plot Radius
15. Position Nodes Along Plot Radius by Constant
16. Apply an Algorithm to the Nodes
17. Size Nodes by a Constant
18. Size Nodes Relatively by a Continuous Attribute
19. Display All Links
20. Display Selected Links
21. Hide Links
22. Display Links as Straight
23. Display Links as Curved
24. Display Links as Circles
25. Clone Active Generation
26. Select Generation k
27. Set Source Generation k
28. Set Target Generation k
29. Remove Generation k
30. Aggregate by Attribute
31. Aggregate by Attribute and Attribute
32. Deaggregate Generation k
33. Show Axis
34. Hide Axis

34 Operations
Card-Sorting
Identifying GLOs

1. Align Nodes
2. Evenly Distribute Nodes
3. Evenly Distribute Nodes by Attribute
4. Substrate Nodes by Attribute
5. Evenly Distribute Nodes within Substrates
6. Position Nodes Relatively
7. Evenly Distribute Nodes Radially by Attribute
8. Evenly Distribute Nodes Radially
9. Position Nodes Radially by Attribute
10. Substrate Nodes Radially by Attribute
11. Evenly Distribute Nodes Along Plot Radius
12. Evenly Distribute Nodes Along Plot Radius
13. Position Nodes Along Plot Radius by Attribute
14. Substrate Nodes Along Plot Radius
15. Position Nodes Along Plot Radius by Constant
16. Apply an Algorithm to the Nodes
17. Size Nodes by a Constant
18. Size Nodes Relatively by a Continuous Attribute
19. Display All Links
20. Display Selected Links
21. Hide Links
22. Display Links as Straight
23. Display Links as Curved
24. Display Links as Circles
25. Clone Active Generation
26. Select Generation k
27. Set Source Generation k
28. Set Target Generation k
29. Remove Generation k
30. Aggregate by Attribute
31. Aggregate by Attribute and Attribute
32. Deaggregate Generation k
33. Show Axis
34. Hide Axis

34 Operations
5 Categories
Categories: Modifying Display Properties
Categories: Modifying Display Properties

Show Axis
Hide Axis
Categories: Positioning Nodes
Categories: Positioning Nodes

Evenly Distribute Nodes Radially by Attribute
Categories: Positioning Nodes

Substrate Nodes by Categorical Attribute
Positioning Nodes Relatively by Continuous Attribute
Categories: Modifying Element Properties

Size Nodes by Constant
Categories: Modifying Element Properties

Size Nodes by Attribute
Categories: Modifying Element Properties
Categories: Modifying Element Properties

Display Links as Straight
Categories: Modifying Element Properties

Display Links as Curved
Categories: Cloning Nodes
Categories: Aggregating Nodes and Edges
Categories: Aggregating Nodes and Edges
So why do this?
Benefits: Specifying Techniques
Benefits: Specifying Techniques
Benefits: Specifying Techniques

How did we get here?
Benefits: Specifying Techniques
Benefits: Specifying Techniques

Substrate Nodes on $x$ by $attribute0$
Substrate Nodes on $y$ by $attribute1$
Aggregate Nodes
(by $attribute0$ and $attribute1$)
Size Nodes by Count
Show $x$ Axis
Show $y$ Axis
Display Links as Curved
Display All Links
Set Target Generation 1
Set Source Generation 1
Benefits: Specifying Techniques
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Benefits: Specifying Techniques
Benefits: For Engineers…

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Benefits: For Engineers…

Fixed Implementation Target
Get the Techniques “For Free”

https://openclipart.org/detail/184889/lego-blocks-by-eggib-184889
Benefits: For Analysts...
Benefits: For Analysts…

New Method of Graph Exploration

“Between Techniques”
Benefits: For the Visualization Community...
Benefits: For the Visualization Community…

Identify New, Effective Techniques?
Benefits: For the Visualization Community...

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Where to go from here…
Future Work: Data
Future Work: Data
Future Work: Data

Distance from Root

Future Work: Data

Degree of Interest

Future Work: Subgraphs
Future Work: Subgraphs

Future Work: **Subgraphs**

van den Elzen and van Wijk. “Multivariate Network Exploration and Presentation: From Detail to Overview via Selections and Aggregations”. Infovis 2014. (Or, right before this talk).
Future Work: Interaction
Wrapping Up…
Wrapping Up…

- Graph-Level Operations (GLO)
Wrapping Up…

- Graph-Level Operations (GLO)
- Potential Benefits of GLOs
Wrapping Up…

- Graph-Level Operations (GLO)
- Potential Benefits of GLOs
- GLO-STIX Application
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Questions?

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