Karlsruhe Institute of Technology

Algorithms for Graph Visualization

Introduction to Practical Task

INSTITUT FÜR THEORETISCHE INFORMATIK · FAKULTÄT FÜR INFORMATIK

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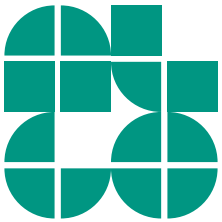
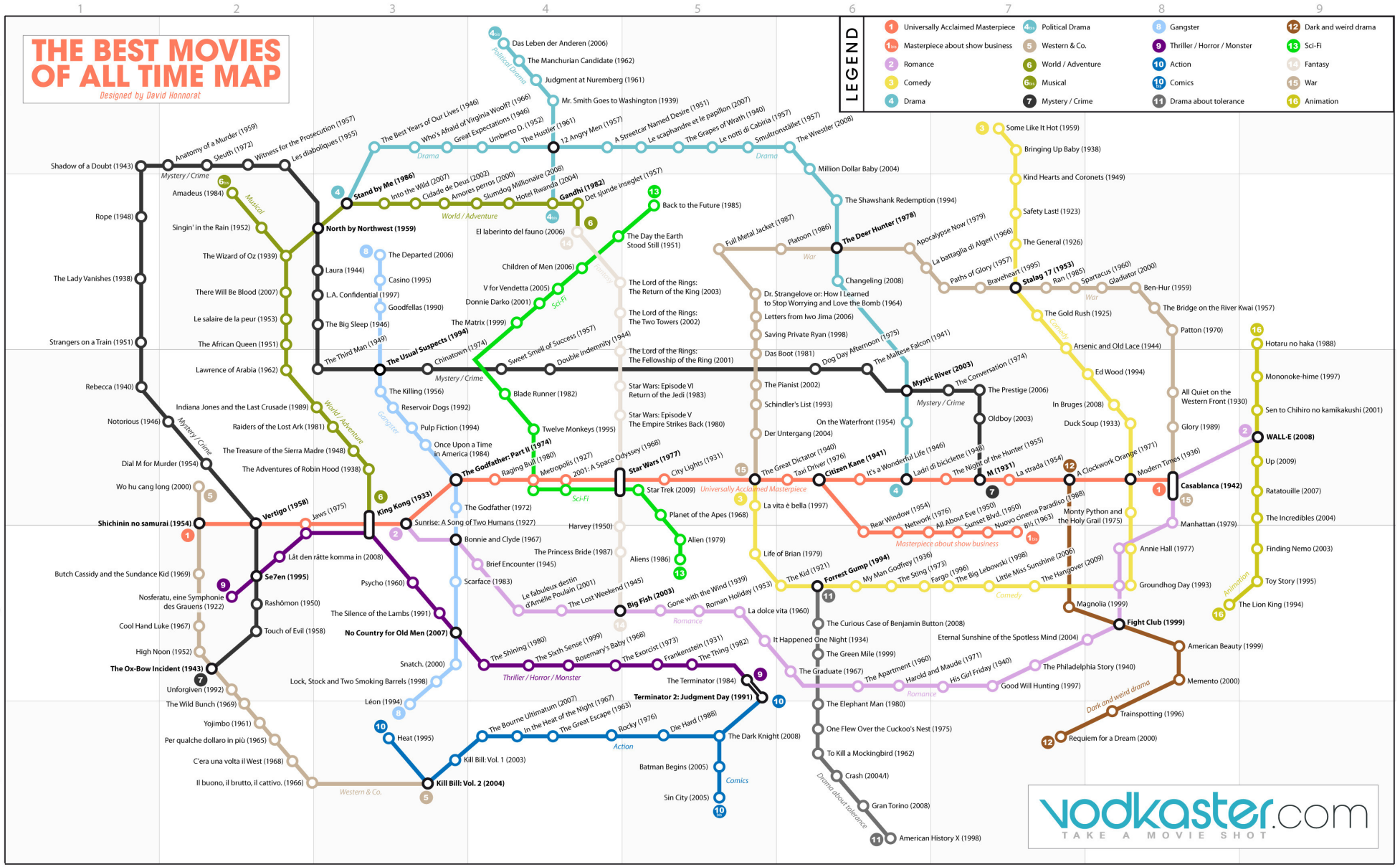


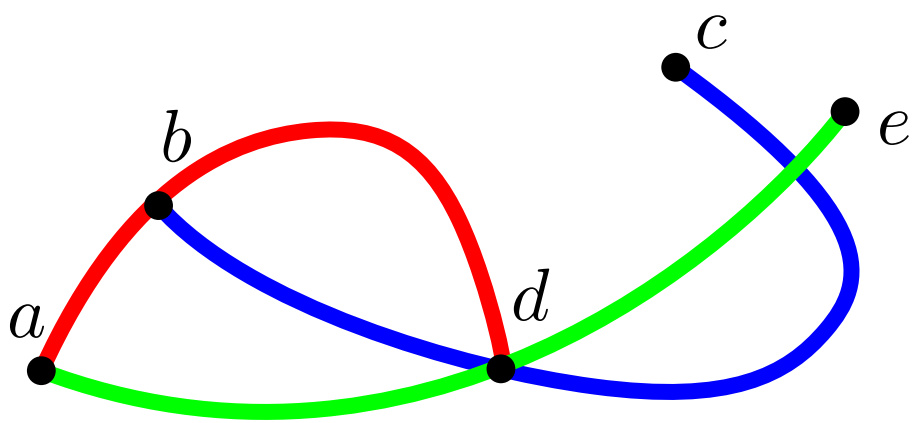
Metro Map Metaphor



Metro Map Metaphor

Definition: $H = (V, \mathcal{E})$ a hypergraph.
Line-representation of H:

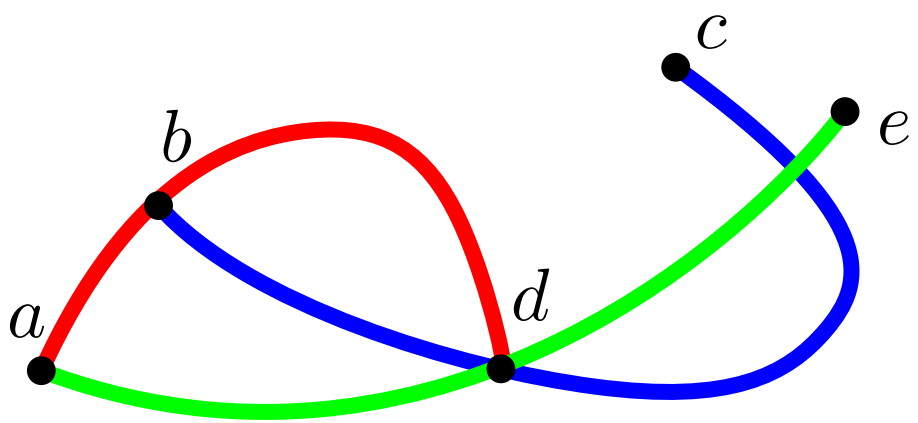
- V is depicted by a set of points on the plane,
- E as a set of curves such that the curve corresponding to $E \in \mathcal{E}$ passes through all vertices in E.



Hypergraph $H = (\{\{a, b, c, d, e\}, \{\{a, b, d\}, \{b, c, d\}, \{a, d, e\}\})$

Metro Map Metaphor

Your Task: Heuristic approaches for line-representations



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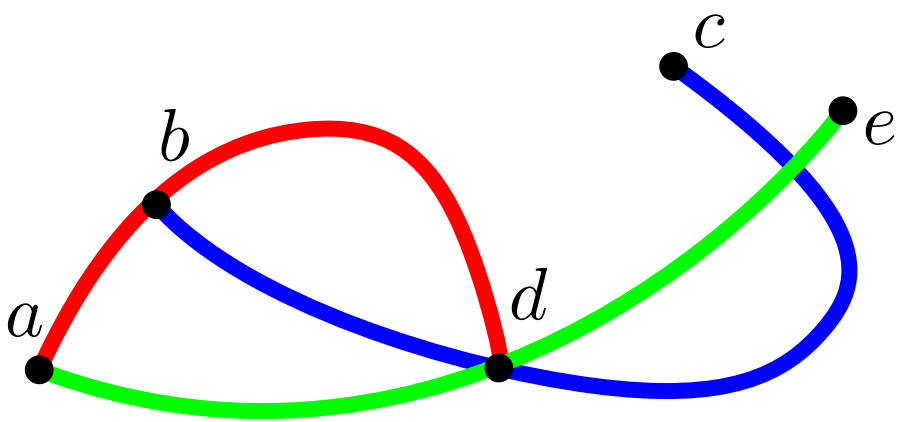
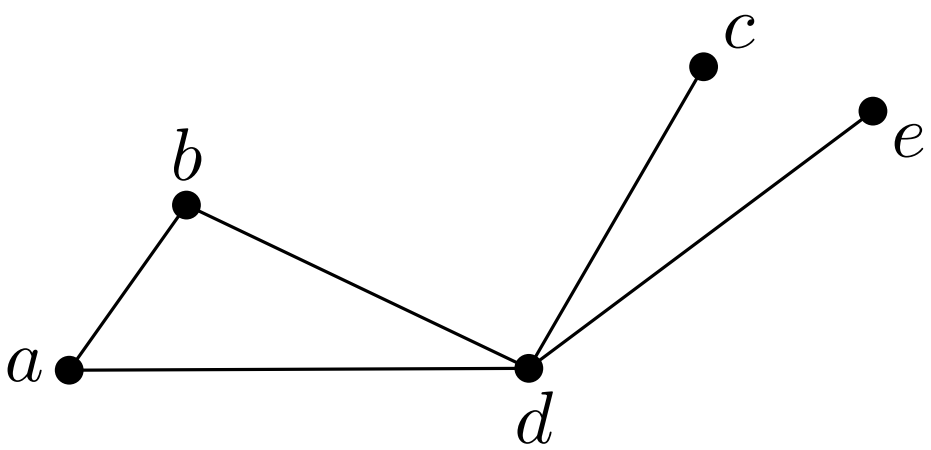
Some Theory

- The graph $G = (V, E)$, $E = \{$set of segments connecting two consequent stations$\}$ is called a **path-based support** graph of hypergraph H



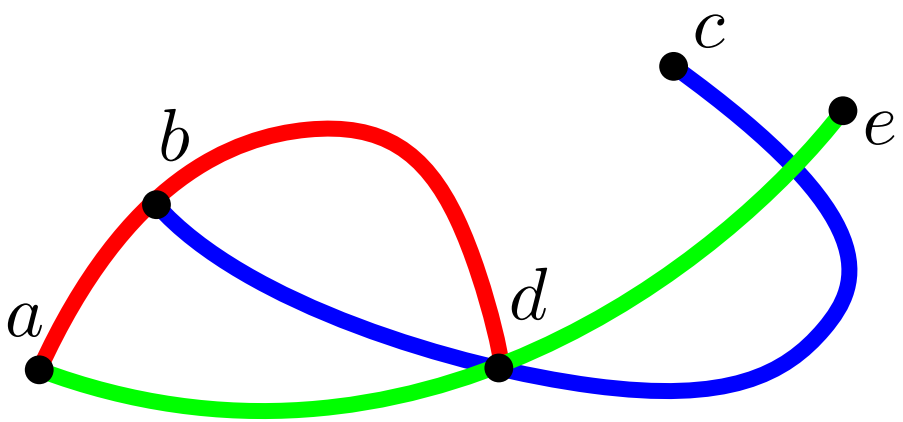
Path-based support of H



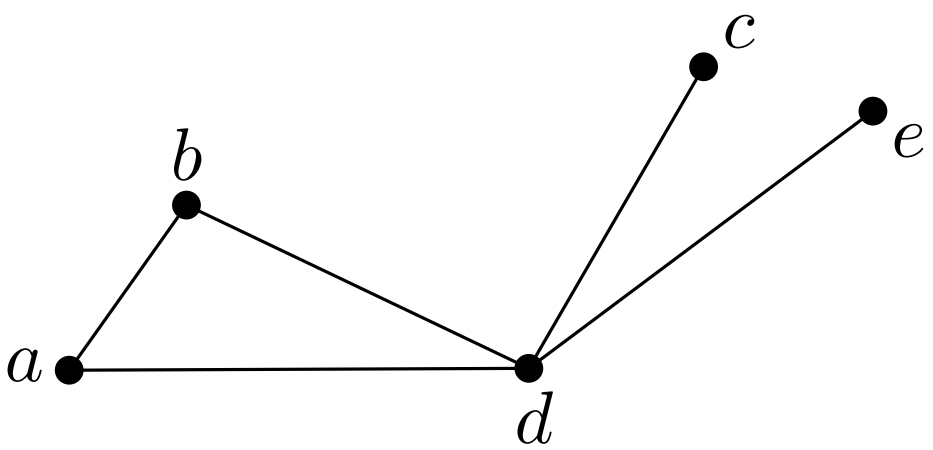
Hypergraph $H = (\{\{a, b, c, d, e\}, \{\{a, b, d\}, \{b, c, d\}, \{a, d, e\}\})$

Some Theory

- The graph $G = (V, E)$, $E = \{$set of segments connecting two consequent stations$\}$ is called a **path-based support** graph of hypergraph H
- It is **path-based** support, because each hyperedge is represented by a path (not necessarily induced)
- More generally in a **support** graph of H, each hyperedge induces a connected graph



Path-based support of H



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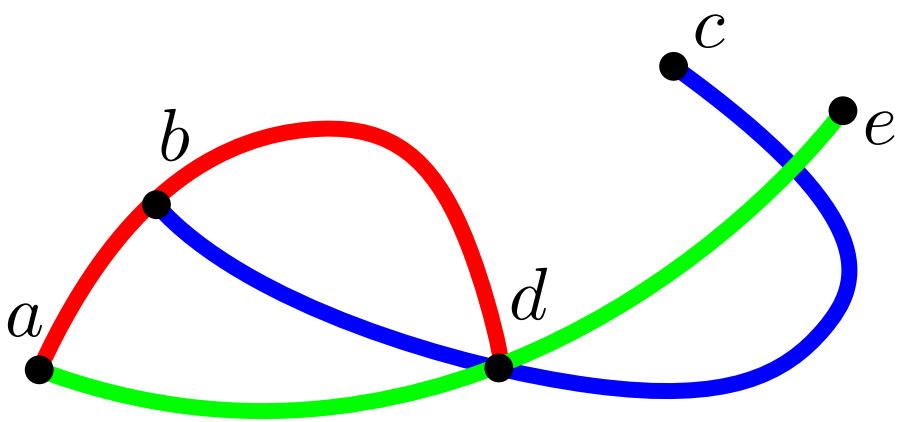
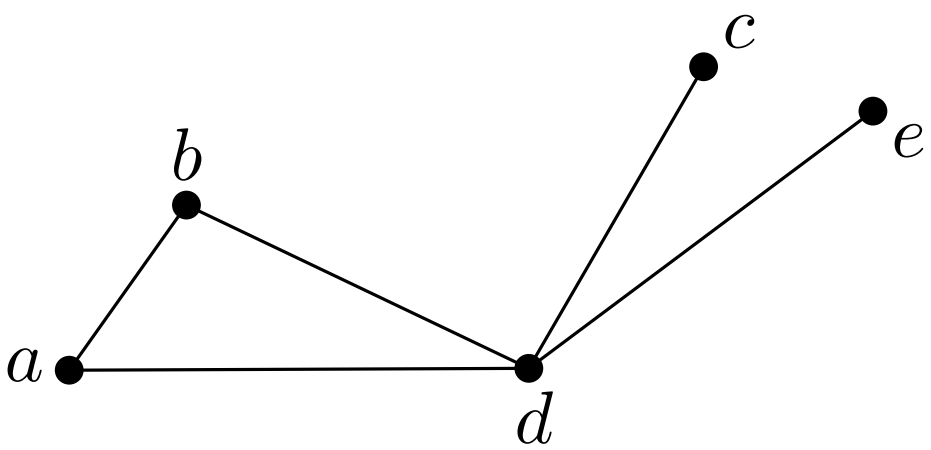
Some Theory

- Given a hypergraph H it is NP-complete to compute a path-based support with the minimum number of edges
- or to decide whether there is a planar path-based support

[Brandes et al., Path-based supports for hypergraphs. J. Disc. Alg., 2012]





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Task

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Your Task: Heuristic approaches for line-representations

Part A:

- Compute a path-based support, that has a reasonable visualization: not necessarily planar, with minimum edges, etc.
- You can also formalise the problem and study it theoretically.
- Provide a heuristic and implement it.
- Or formally prove some bounds on the performance of the heuristic.

Task

Your Task: Heuristic approaches for line-representations

Part B:

- Draw the path-based support using existing or modified algorithms (e.g. force-directed).
- The target is to draw the graph so that each path is readable.
- How can we formalise the readability?
- What are aesthetic measures?

Task

Your Task: Heuristic approaches for line-representations

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- Draw the path-based support using existing or modified algorithms (e.g. force-directed).
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Part C: Implement the display the paths.

Task

Your Task: Heuristic approaches for line-representations

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- Draw the path-based support using existing or modified algorithms (e.g. force-directed).
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- How can we formalise the readability?
- What are aesthetic measures?

Part C: Implement the display the paths.

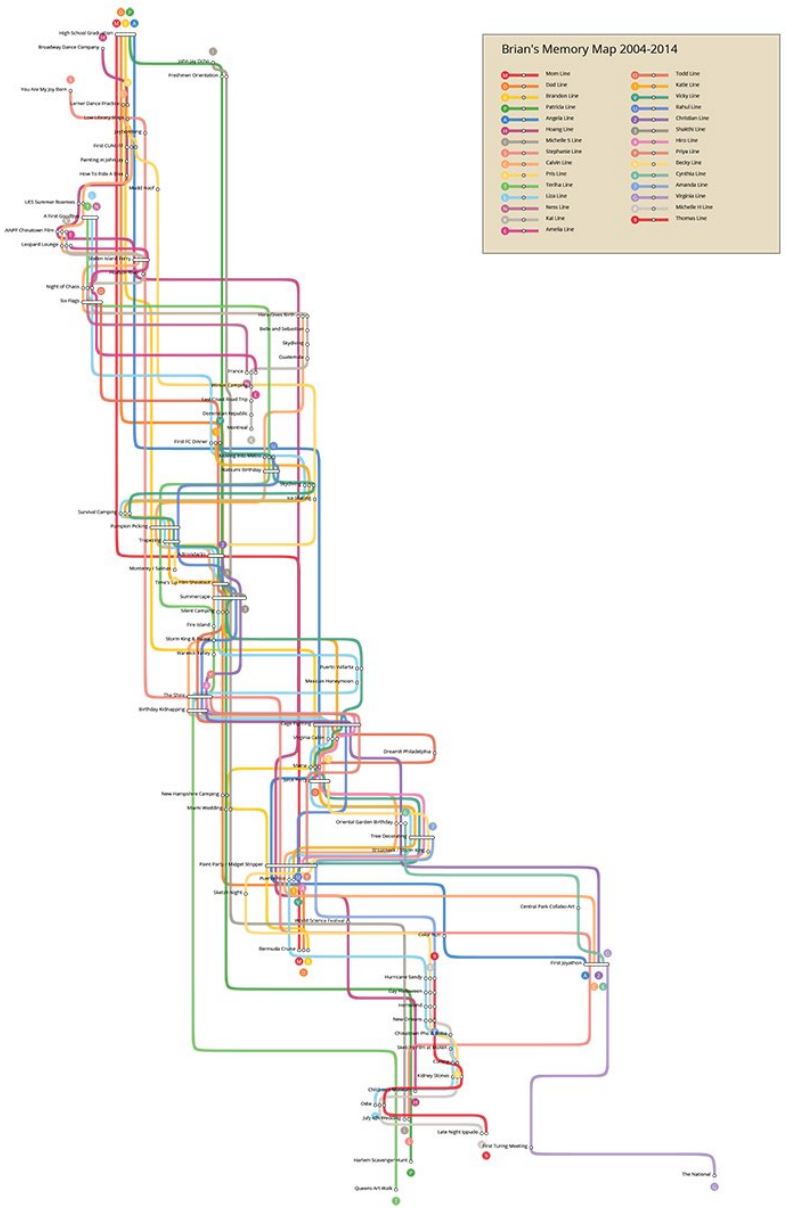
Options:

- Give priority to either part A or part B
- Think of an integrated approach

Relevant Material

Building a memory transit map

- http://memoryunderground.com
- Brian Foo
- The input assumes a sequence of events, i.e. vertices within a hyperedge are ordered

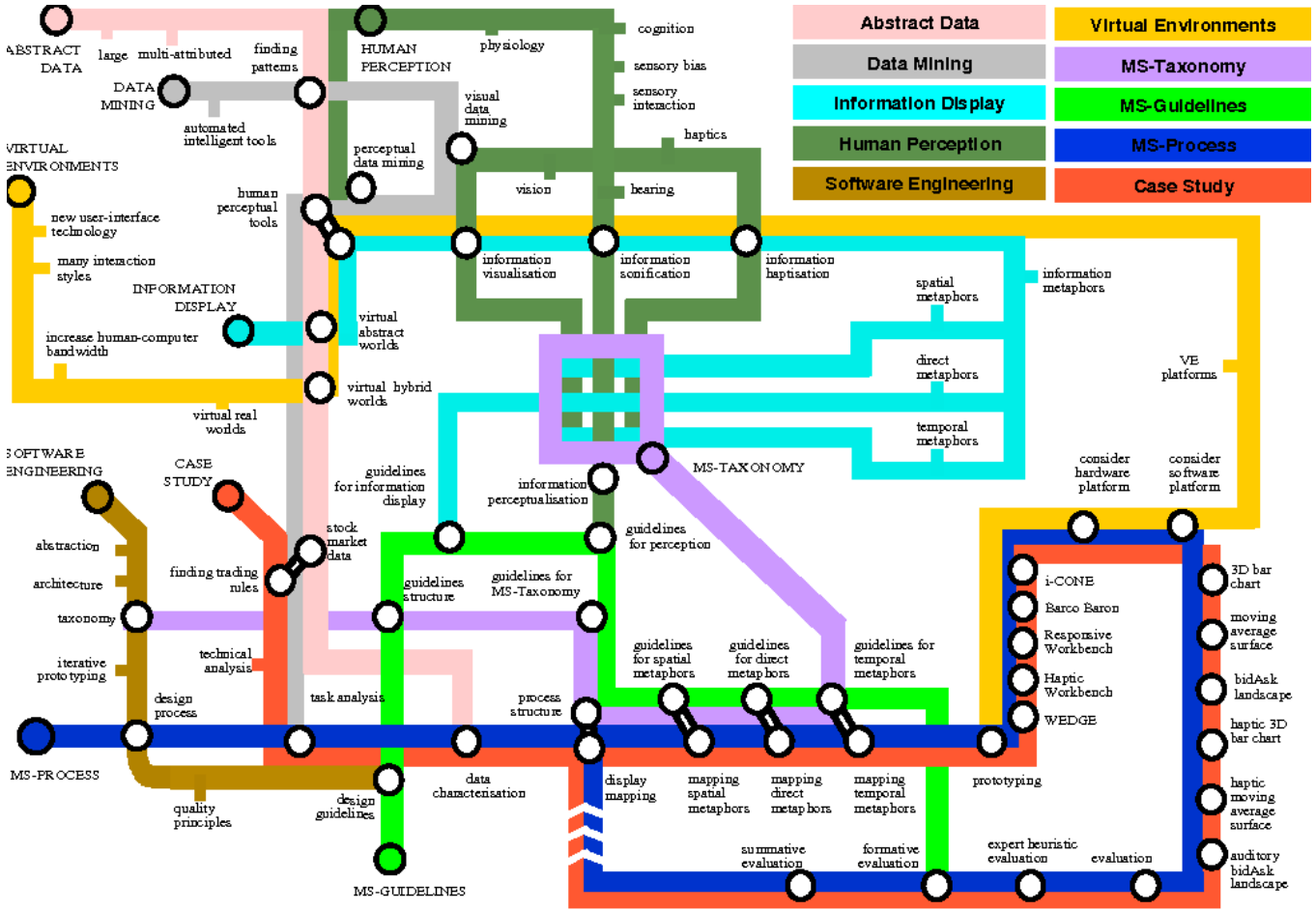


Relevant Material

“Getting to more abstract places using the metro map metaphor”

Keith Nesbitt

InfoVis 2004



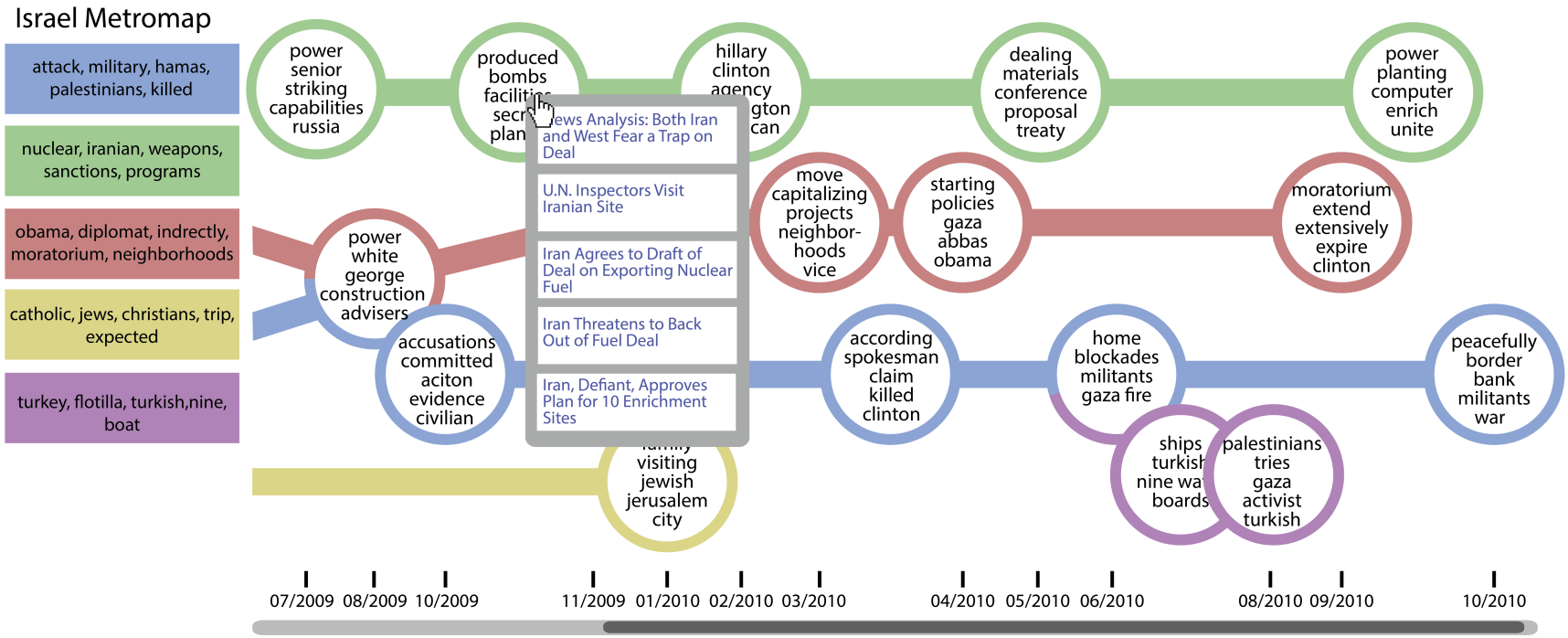
Relevant Material

Metromaps of historical events

"Information Cartography: Creating Zoomable, Large-Scale Maps of Information"

Jure Leskovec et al.

KDD 2013



Relevant Material

- “Automatic Layout of Project Plans Using a Metro Map Metaphor” Stott et all, InfoVis 2005.

- “A metro map metaphor for guided tours on the Web: the Webvise guided tour system”, Sandvad et al, WWW 2001.