UNIVERSITÄT BERN

Software Visualization

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Wednesday, December 14, 11

Roadmap



- > Information Visualization
- > Designing Visualizations
- > Visualizing Software
 - Structure
 - Evolution
 - -Behavior
- > Discussion

Roadmap



> Information Visualization

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Deciduous shrub, glabrous or nearly so, with weak, trailing sub-glaucous, often purpletinted stems, either decumbent and forming low bushes 50 - 100 cm high, or climbing over other shrubs, rarely more erect and reaching 2 m. Prickles hooked, all +- equal. L'flets 2-3 pairs, 1-3.5 cm, ovate or ovateelliptic, simply, rarely double serrate, glabrous on both sides or pubescent on the veins (rarely all over) beneath, rather thin; petiole usually with some stalked glands; stipules narrow, auricles straight. Flowers 1-6, white 3-5 cm diam.; pedicels 2-4 cm with stalked glands, rarely smooth; buds short... etc. etc.

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Orientation	Line Length	Line Width	Size
Shape	Curvature	Added Marks	Enclosure

	Line Length	Line Width	Size
Shape	Curvature	Added Marks	Enclosure















Preattentive Processing: Color

87893640823764031287645329847329847320948732908453 89274-0329874-32874-2319847509834098340983240983204 9823-0984903281453209481-0839393947896587436598

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Gestalt Psychology

- > The law of simplicity
- > The Gestalt Laws
 - Closure
 - Similarity
 - Proximity
 - Continuity



"Reality is organized and reduced to the simplest form possible"

Law of Closure

> The mind completes missing parts so it can see a simple image



Similarity

> The mind groups similar elements together



Proximity

> Spatial (or temporal) proximity induces the mind to see a totality





Law of contiuity

> Lines follow the smoothest and simplest path.



Why Use Information Visualization?

- > Supports analysis
- > Allows discovering emergent properties that one didn't think about
- > Allows problems with the data set to become aparent
- > Allows communication
- > Supports thinking

Visualization supports analysis





John Snow

The lines on the buildings are proportional to the number of deaths due to cholera from those buildings.

Do you know how did Snow realize which was the cause of cholera by looking at this map?

Visualization allows discovering emergent properties that one did not think about



* pockmarks* linear ripples

Visualization allows communication



Visualization supports thinking





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Good information visualization is based on thinking, style, and respect.

> Principles

- > Minimize Non-Data Ink
- > Have Integrity
- > Design Counts



The Visual Display of Quantitative Information Edward R. TUFTE

Minimize Non-Data Ink



Removing ink from your graph should remove meaning from it.

Minimize Non-Data Ink



Removing ink from your graph should remove meaning from it.



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Have Integrity

This cluster of type emphasizes and stretches out the low value for 1966– 1967, encouraging the impression that recent years have shot up from a small, stable base. Horizontal arrows provide similar emphasis.



This squeezed-down block of type contributes to an image of small, squeezed-down budgets back in the good old days. Estimated Recommended Arrows pointing straight up emphasize recent growth. Compare with horizontal arrows at left.

Step 1: Eliminate Chart Junk


Step #2: Adjust for inflation...



Design Counts

Estimates of relative survival rates, by cancer site

	% survival rates and standard errors									
	5 year		10 year		15 year		20 ye	ar		
Prostate	98.8	0.4	95.2	0.9	87.1	1.7	81.1	3.0		
Thyroid	96.0	0.8	95.8	1.2	94.0	1.6	95.4	2.1		
Testis	94.7	1.1	94.0	1.3	91.1	1.8	88.2	2.3		
Melanomas	89.0	0.8	86.7	1.1	83.5	1.5	82.8	1.9		
Breast	86.4	0.4	78.3	0.6	71.3	0.7	65.0	1.0		
Hodgkin's disease	85.1	1.7	79.8	2.0	73.8	2.4	67.1	2.8		
Corpus uteri, uterus	84.3	1.0	83.2	1.3	80.8	1.7	79.2	2.0		
Urinary, bladder	82.1	1.0	76.2	1.4	70.3	1.9	67.9	2.4		
Cervix, uteri	70.5	1.6	64.1	1.8	62.8	2.1	60.0	2.4		
Larynx	68.8	2.1	56.7	2.5	45.8	2.8	37.8	3.1		
Rectum	62.6	1.2	55.2	1.4	51.8	1.8	49.2	2.3		
Kidney, renal pelvis	61.8	1.3	54.4	1.6	49.8	2.0	47.3	2.6		
Colon	61.7	0.8	55.4	1.0	53.9	1.2	52.3	1.6		
Non-Hodgkin's	57.8	1.0	46.3	1.2	38.3	1.4	34.3	1.7		
Oral cavity, pharynx	56.7	1.3	44.2	1.4	37.5	1.6	33.0	1.8		
Ovary	55.0	1.3	49.3	1.6	49.9	1.9	49.6	2.4		
Leukemia	42.5	1.2	32.4	1.3	29.7	1.5	26.2	1.7		
Brain, nervous system	32.0	1.4	29.2	1.5	27.6	1.6	26.1	1.9		
Multiple myeloma	29.5	1.6	12.7	1.5	7.0	1.3	4.8	1.5		
Stomach	23.8	1.3	19.4	1.4	19.0	1.7	14.9	1.9		
Lung and bronchus	15.0	0.4	10.6	0.4	8.1	0.4	6.5	0.4		
Esophagus	14.2	1.4	7.9	1.3	7.7	1.6	5.4	2.0		
Liver, bile duct	7.5	1.1	5.8	1.2	6.3	1.5	7.6	2.0		
Pancreas	4.0	0.5	3.0	1.5	2.7	0.6	2.7	0.8		



Design Counts

Estimates of relative survival rates, by cancer site



Estimates of relative survival rates, by cancer site

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Why Software Visualization?

- > To communicate
- > To analyze the "as is" as opposed to "as designed" system
- > To support in debugging
- > When reading all the source code is not an option

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Inheritance in ArgoUML with Polymetric Views

Polymetric Views

- > Make use of the preattentive processing features
 - -Size
 - Color
 - Connectedness
- > Implemented in various tools
 - Mondrian
 - -XRay, Plugin for Eclipse



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FAMDOModelRoot

UML is not visualization! It is a visual modeling ge

3D "city" metaphor showing CodeCity





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JBoss Application Server 500KLOC

CodeCity allows communicating information about the locality of design problems





Showing Containment with Treemaps and Relationships

Relationship visualization supports pattern detection





Circular Containment and Hierarchical Edge Bundles



Voronoi Treemaps are just awesome

But do they support visual analysis?



Structure

> Visualized Aspects

- Inheritance
- Containment
- -Calls
- > Challenges
 - Displaying both structure and containment

> Techniques

- Space filling techniques
- -Circular Containment Layout

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SeeSoft was the first visualization to present evolutionary information



Example: CVS shows activity



Who did this?



Alphabetical order is no order

Kuhn



Ownership Map orders histories

Girba etal, 2006



Evolution

> Time can be mapped on

- -color
- an axis
- -time (not recommended)

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Zinsight visualization is targeted at analyzing large event traces



Massively reliant on visual pattern recognition



Semantic Zooming

Visual detection of bugs



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Algorithm Animation

- > The first software visualization were algorithm animations
- > The transilvanian dances
- > Animation is usually inferior to static visualization

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Some successfull visualization techniques will make themselves obsolete.

Besides every successful visualization there is a tool.

Besides every successful visualization there is a **use case**.

Further Reading

http://scg.unibe.ch/scgbib?query=sde-visualization


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