Temporal Analysis

Temporal Visualization

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Objective

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Apply methods of temporal analysis

Linear Time

2D line graph with time on x-axis and value on y-axis

New Database Creates Time-Series Plots of Phrases in U.S. Supreme Court Opinions December 16, 2011 | Posted by: Scott C. Idleman: http://law.marquette.edu/facultyblog/2011/12/16/new-database-creates-time-series-plots-of-phrases-in-u-s-supreme-court-opinions/

“Intense, simple, wordlike graphics”

http://sparkline.org/

Theme River

1– S. Havre, E. Hetzler, P. Whitney, and L. Nowell. Themeriver: Visualizing thematic changes in large document collections. IEEE Transactions on Visualization and Computer Graphics 8(1):9-20, 2002.* - Theme River Image from: http://www.nytimes.com/interactive/2008/02/23/movies/20080223_REVENUE_GRAPHIC.html#

Sizing the Horizon

Jeffrey Heer, Nicholas Kong, and Maneesh Agrawala. 2009. Sizing the horizon: the effects of chart size and layering on the graphical perception of time series visualizations. In *Proceedings of the 27th international conference on Human factors in computing systems* (CHI '09). ACM, New York, NY, USA, 1303-1312.

Linear Vs. Cyclical

Trends are easily seen in a linear plot, but what about repeating patterns?

- Use spirals as they easily represent idea of repetition
- Finding periodicity may be easier than a bar chart

Spiral Graph

Archimedean Spiral

$$r = a + b\theta$$

Logarithmic Spiral

$$r = ae^{b\theta}$$

$$\theta = \frac{1}{b}\ln\left(\frac{r}{a}\right)$$

Spiral Graph

9 Day Spiral

7 Day Spiral

1 - John V. Carlis and Joseph A. Konstan, Interactive Visualization of Serial Periodic Data, Proceedings User Interface Software and Technology (UIST), pp. 29-38, 1998

2 - M. Weber, M. Alexa, and W. Mu¨ ller, “Visualizing Time-Series on Spirals,” Proceedings of the IEEE Symposium on Information Visualization (InfoVis ’01), pp. 7-14, Oct. 2001.

3 - Spirals for Periodic Data By Robert Kosara On August 7, 2011: http://eagereyes.org/techniques/spirals

Calendar Based Visualization

1 – J. J. Van Wijk and E. R. Van Selow. *Cluster and calendar based visualization of time series data*. Proceedings of the 1999 IEEE Symposium on Information Visualization, 1999.

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Calendar Visualization

Spiral Calendar

Empty spots on back wall show good times

Uses projected shadows on walls

Time Lattice

Mackinlay, J., Robertson, G. G., and DeLine, R., “Developing Calendar Visualizers for the Information Visualizer,” UIST 1994.

Time Wheel

C. Tominski, J. Abello, and H. Schumann, “Axes-Based Visualizations with Radial Layouts,” Proceedings of the ACM Symposium on Applied Computing, pp. 1242-1

People Gardens

Rebecca Xiong and Judith Donath. 1999. PeopleGarden: creating data portraits for users. In *Proceedings of the 12th annual ACM symposium on User interface software and technology* (UIST '99). ACM, New York, NY, USA, 37-44.

Arc Diagrams

1– M. Wattenberg, “Arc Diagrams: Visualizing Structure in Strings,” InfoVis 2002. http://www.bewitched.com/song.html

Ordered Time vs. Branching Time

- Ordered time domains consider things that happen one after another

- Branching time considers multiple what-if scenarios, allowing comparison of alternate scenarios

W. Aigner, S. Miksch, W. Muller, H. Schumann, C. Tominski, "Visual Methods for Analyzing Time-Oriented Data", IEEE Trans. On Visualization and Computer Graphics, Vol. 14, No. 1, Jan.-Feb. 2008, pp. 47-60.

World Lines

Creating new simulation tracks through temporal branching

Waser, J.; Fuchs, R.; Ribičič, H.; Schindler, B.; Blöschl, G.; Gröller, E.; , "World Lines," *IEEE Transactions on Visualization and Computer Graphics,* vol.16, no.6, pp.1458-1467, Nov.-Dec. 2010

Shehzad Afzal, Ross Maciejewski, and David S. Ebert. Visual Analytics Decision Support Environment for Epidemic Modeling and Response Evaluation. IEEE Conference on Visual Analytics Science and Technology (VAST), 2011.

Design Principles

- Show familiar visual representations whenever possible
- Provide side-by-side comparisons of small multiple views
- Spatial position is strongest visual cue
- Multiple views are more effective when coordinated through explicit linking
- Avoid abrupt visual change