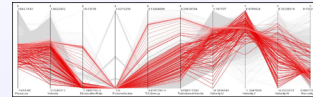


Axes-Based Visualizations for Time Series Data

Christian Tominski¹, James Abello², and
Heidrun Schumann¹

Time Series and Axes-Based Visualization

- The analysis of multidimensional time-series data is one of the most widely appearing problems in science, engineering, and business.
- Time plots are commonly used for representing simple time series. A variety of expressive time plots are known (Harris, 1996).
- Axes-based visualizations have proven their effectiveness for multidimensional datasets. Parallel Coordinates (Inselberg and Dimsdale, 1990; Inselberg, 1998) and Star Coordinates (Richards, 1995) are often used for multidimensional data analysis. Special Brushing techniques (e.g. Hauser, Ledermann, and Doleisch, 2002) can be used to improve the effectiveness of axes-based techniques.
- However, with regard to a visual analysis of multidimensional time series for time plots an extension is needed addressing multidimensionality and the temporal dimension has to be emphasized when using axes-based techniques.



Parallel Coordinates with Angular Brush
Hauser, Ledermann, and Doleisch, 2002.

Novel Axes Arrangements

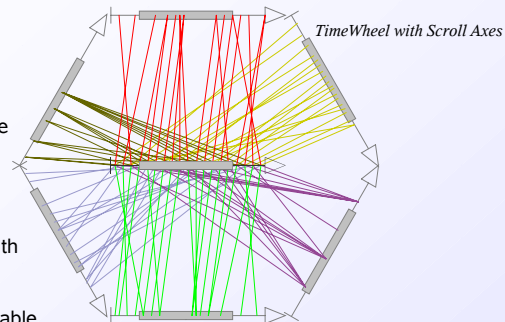
• TimeWheel - A novel arrangement of axes

Basic idea:

- Present the time axis in the center of the display.
- Circularly arrange the variable axes around the time axis.
- Line segments connect time values and the corresponding variable's value.

Interaction:

- By rotating the wheel each axis can be analyzed with respect to the time axis. By using rotation visual discontinuities are avoided.
- Time dependent variables can be mapped to a variable axis interactively.
- Interactive axes are provided.



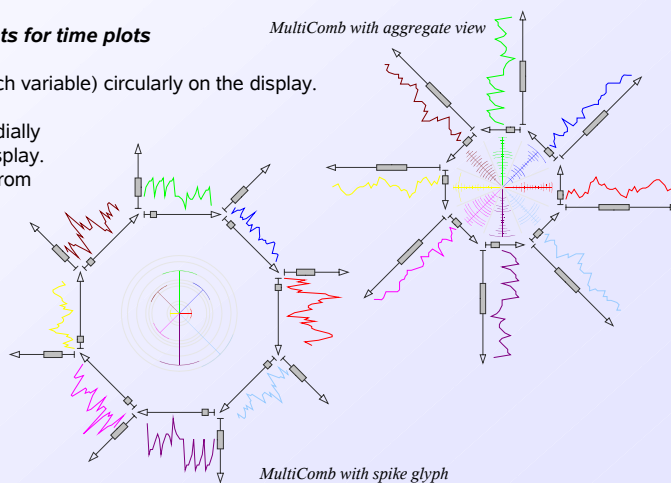
• MultiComb - Novel arrangements for time plots

Basic idea:

- Arrange time plots (one for each variable) circularly on the display.
- Two possible arrangements:
 - Time axes are arranged radially around the center of the display.
 - Time axes extend radially from the center.
- The center area can be used to draw additional information (e.g. a spike glyph for value comparison or an aggregated view of "past" values).

Interaction:

- The MultiComb can be rotated interactively.
- Axis-variable mapping can be altered interactively.
- Interactive axes are provided.



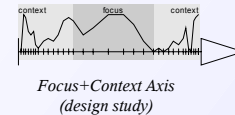
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Framework VisAxis

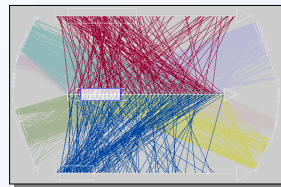
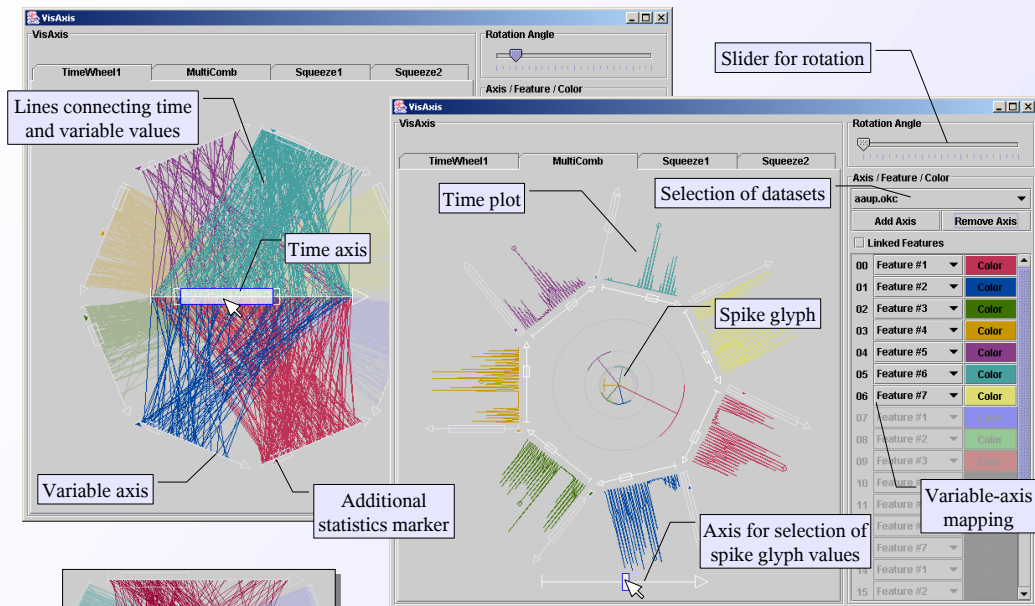
• Axis design

Different kinds of axes have been designed addressing different datasets and different exploration interactions.

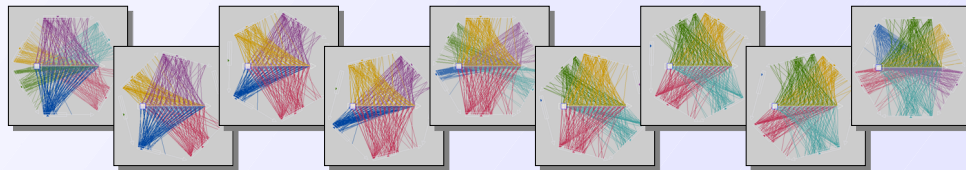


• The framework

VisAxis is a Java-based framework, which integrates TimeWheel and MultiComb to allow a visual analysis of multidimensional data with temporal dependencies.



In order to direct the viewers focus towards axes parallel with the time axis the lengths of the circular axes and color fading can be computed according to the angle formed by each axis with the central time axis.



While rotating the TimeWheel lines of variable axes are faded to background (here no length adjustment was applied).

