Axes-Based Visualizations with Radial Layouts

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Outline

- ## Introduction

- ## Axes-Based Visualization

  - ### Interactive Axes

  - ### Radial Axes Arrangements

- ## VisAxes Framework

  - ### Demonstration

- ## Conclusion & Future Work

Introduction
Visualization

- Multivariate data sets are everywhere: business data, scientific data, census data, human health data, etc.

- Data must be analyzed in order to make it valuable

- Visual analysis have proved to be an effective means
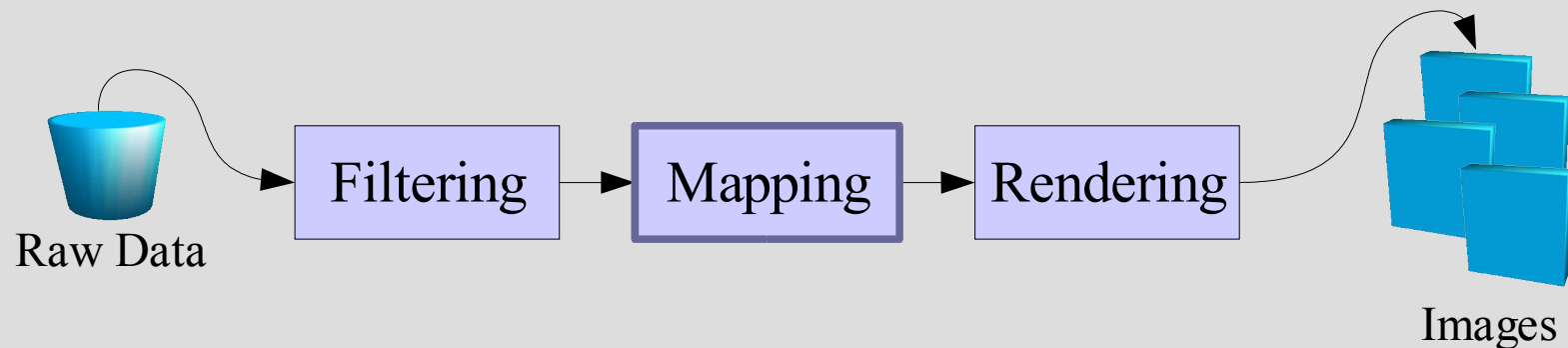
Introduction
Motivation

- Data often inherit a dependency on one dimension of reference
- Task: Depict the dependency of multiple variables on the dimension of reference
- Approaches:
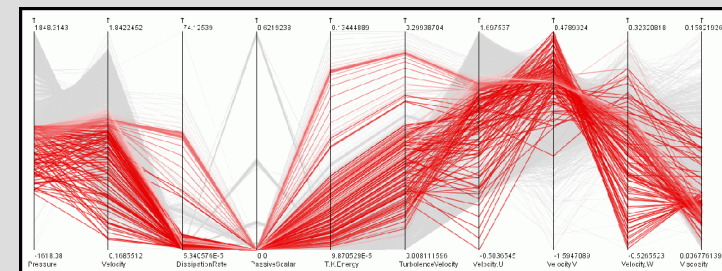 - Standard techniques like *line charts*
    + Expressive for depicting this dependency,
    - Difficult to visualize multiple variables
  - Special techniques like *Parallel Coordinates*
    + Expressive for visualizing multiple variables
    - Hard to comprehend dependency for all variables
- Idea: Join the efficiency of both approaches

Axes-Based Visualization
General Approach and Requirements

- General approach
  - Variables of a data set are mapped to axes
  - Axes are appropriately scaled and arranged on screen

  A conceptual distinction of axes design and
 axes arrangement is necessary

- Requirements
  - Development of general axes-based framework
  - Provide different axes for different visualization tasks and different data types
  - Allow for a direct variable-axis-mapping manipulation
  - Examine expressiveness of different axes arrangements
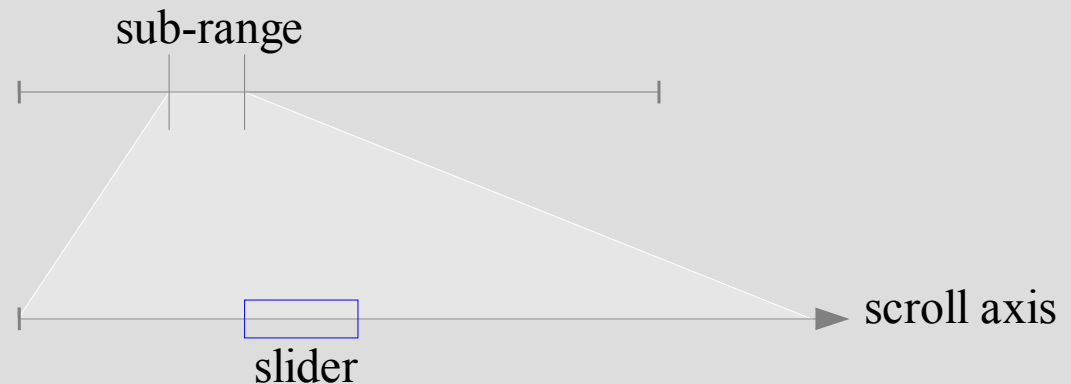
Axes-Based Visualization
Axes Design

- ## Simple Axis
  - Constitutes a min-max-mapping of a variable

min   max

variable range

simple axis
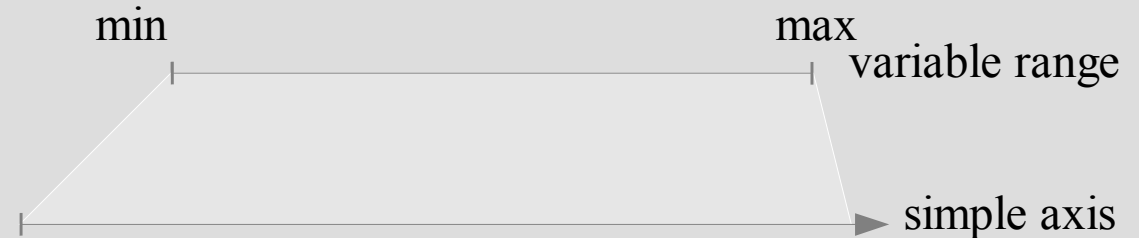
- ## Scroll Axis
  - Sub-range of a variable is mapped onto the axis
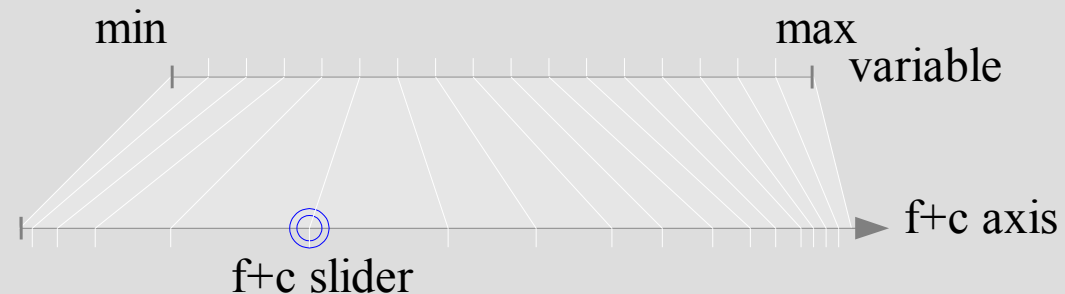 - Slider depicts sub-range and can be used to interactively adjust the sub-range

sub-range

scroll axis

slider

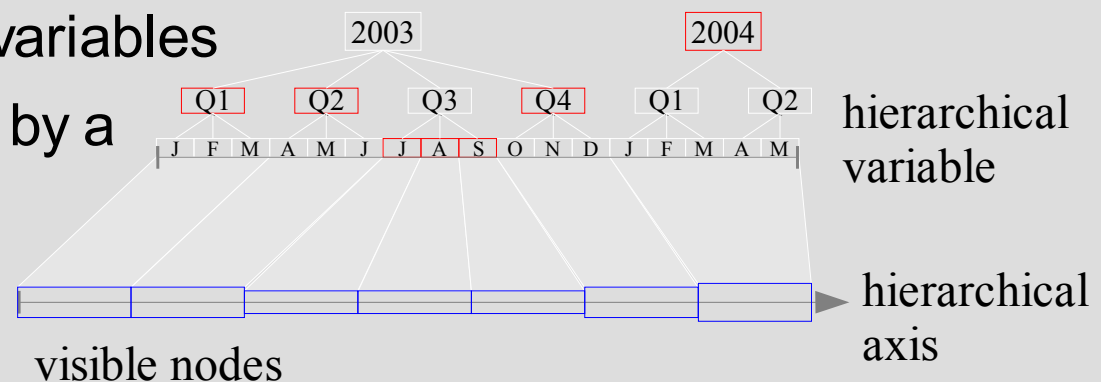# Axes-Based Visualization
Axes Design

- Focus+Context Axis
  - Constitutes a non-linear min-max-mapping
  - Focus slider for interactive focus and magnification adjustment

- Hierarchical Axis
  - Hierarchically organized variables like time are represented by a hierarchical axes
 - Nodes can be expanded or collapsed

Axes-Based Visualization
Axes Arrangement

TimeWheel

- Motivation: Point out the dimension of reference
- Approach:
  - Centrally exposed axis representing the dimension of reference
  - Radially arranged axes representing depending variables
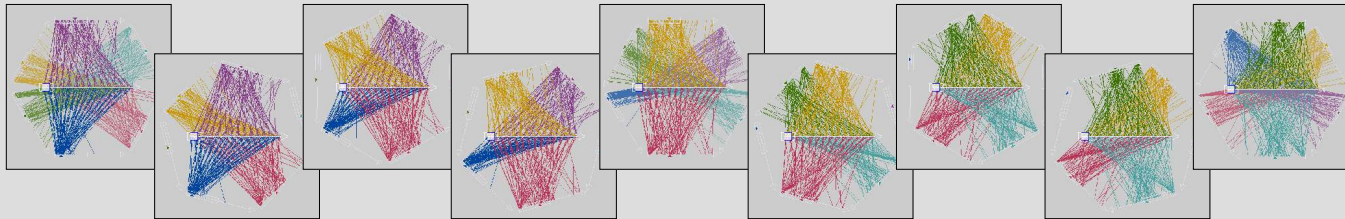 - Data records are depicted by line segments

Variable axes

Axis of reference

lines connecting time and variable values
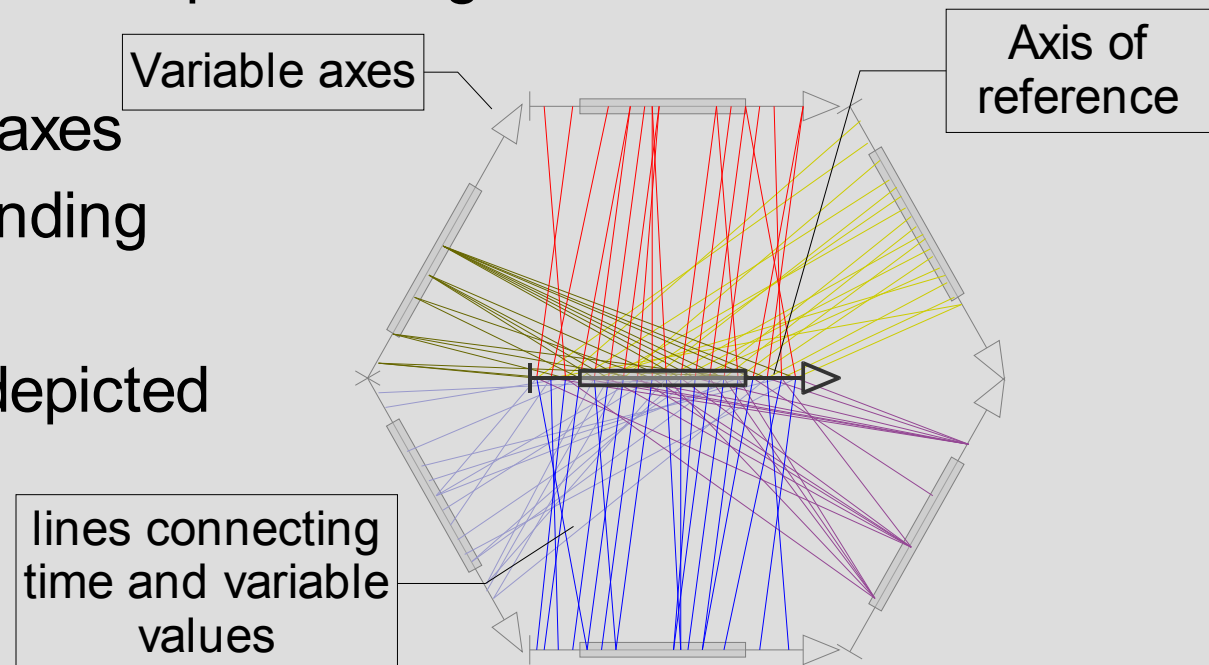
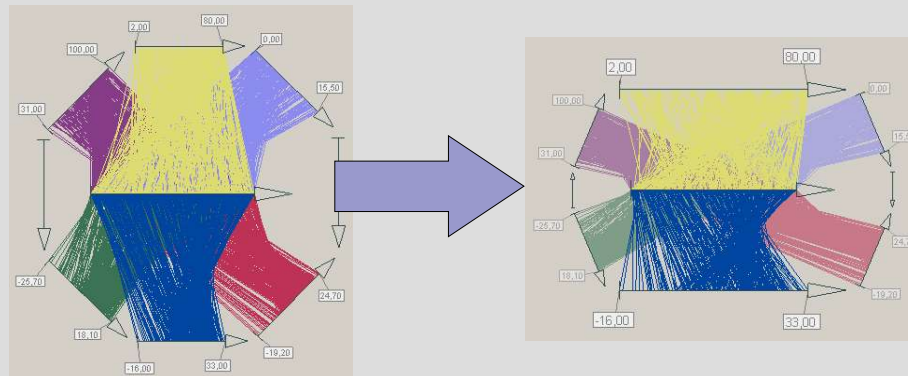# Axes-Based Visualization
Axes Arrangement

Advancing the *TimeWheel*

- – Interactive rotation allows "focusing" different variables

- – Emphasizing axes in focus

  - Aid users during data exploration and de-clutter the display
 - Axes length adjustment and color-fading

Axes-Based Visualization
Axes Arrangement

MultiComb

- Motivation: Make use of the expressiveness of line charts

- Approach:

  - Arrange plots radially

  - Each plot represent a depending
    variable and the dimension
    of reference directly

  - Two variants:

    - Plots extending outwards
      from the central point

    - Plots extending around
      the central point

Axes-Based Visualization
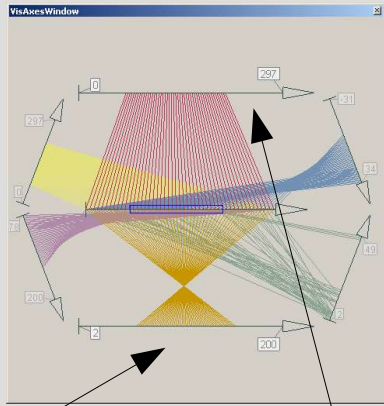## *Axes Arrangement*

Advancing the *MultiComb*

- Use the center of the *MultiComb* to provide additional information

  - Aggregate view in combination with a scroll axis

    - Aggregated "history" values are

      mapped to small arcs

  - Spike glyph for easy value comparison

    - Each value of a data record

      is mapped to the length of a spike
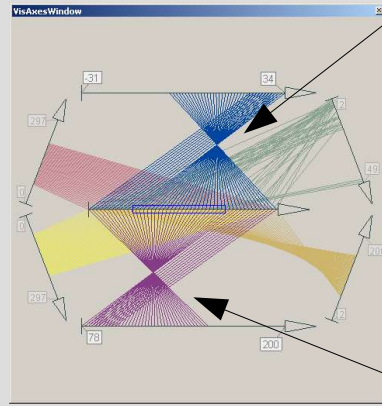
      in the spike glyph
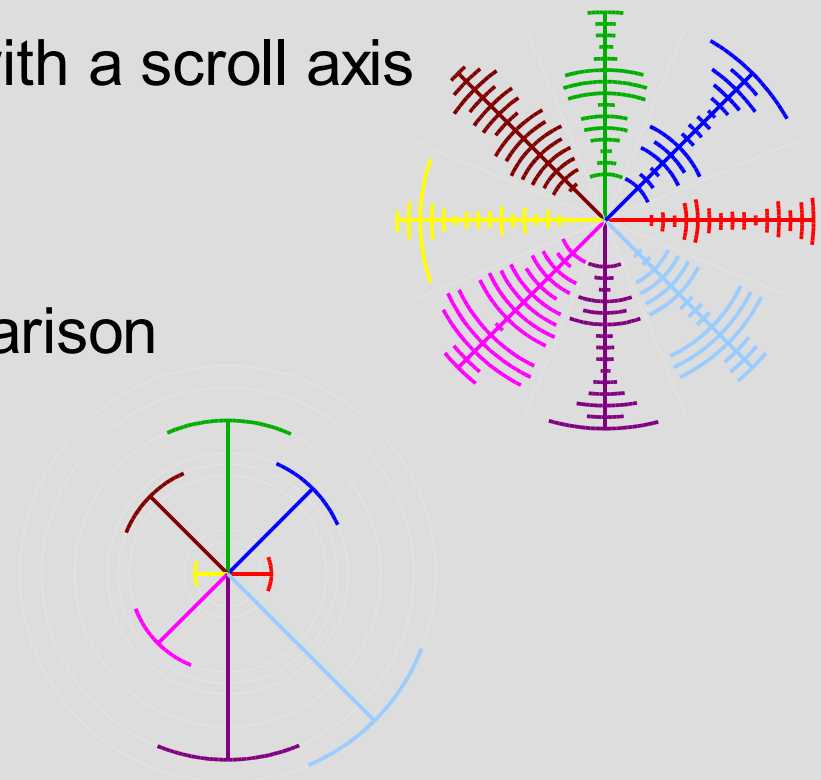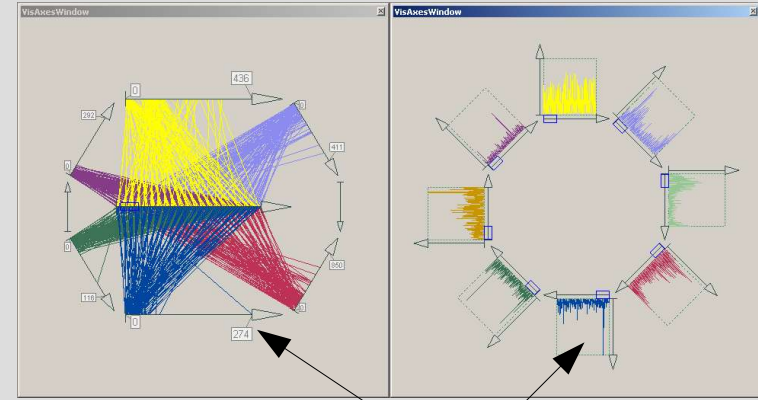
Axes-Based Visualizations
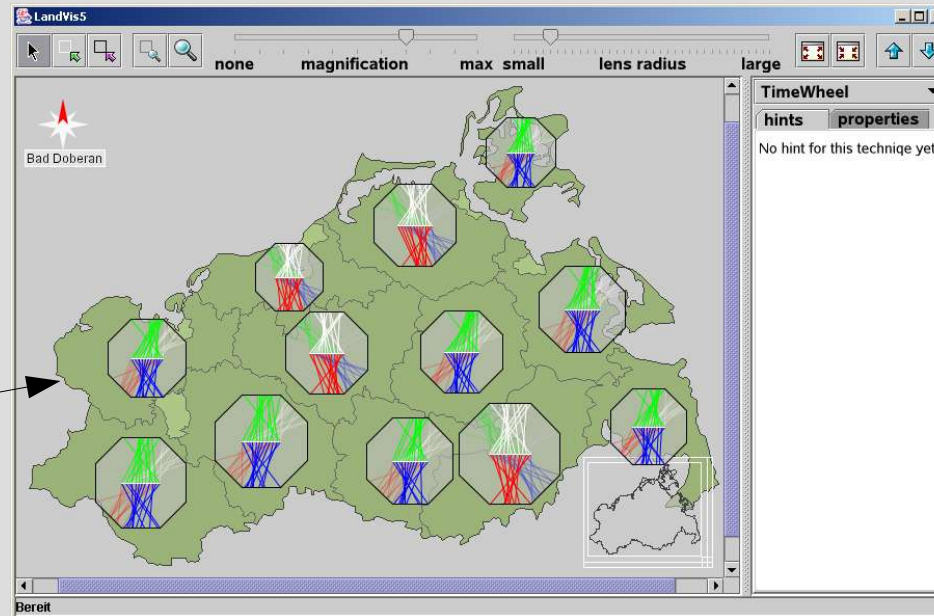## *Visualization Examples*

Change form increase to decrease

Change form decrease to increase

Decreasing variable
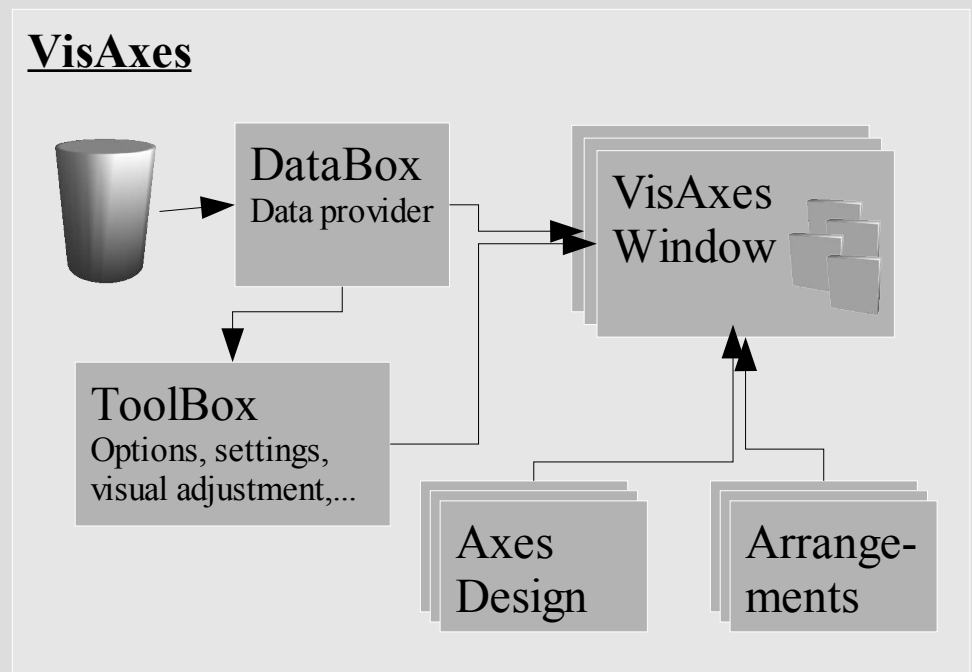
Increasing variable

Outliers

TimeWheels on a map
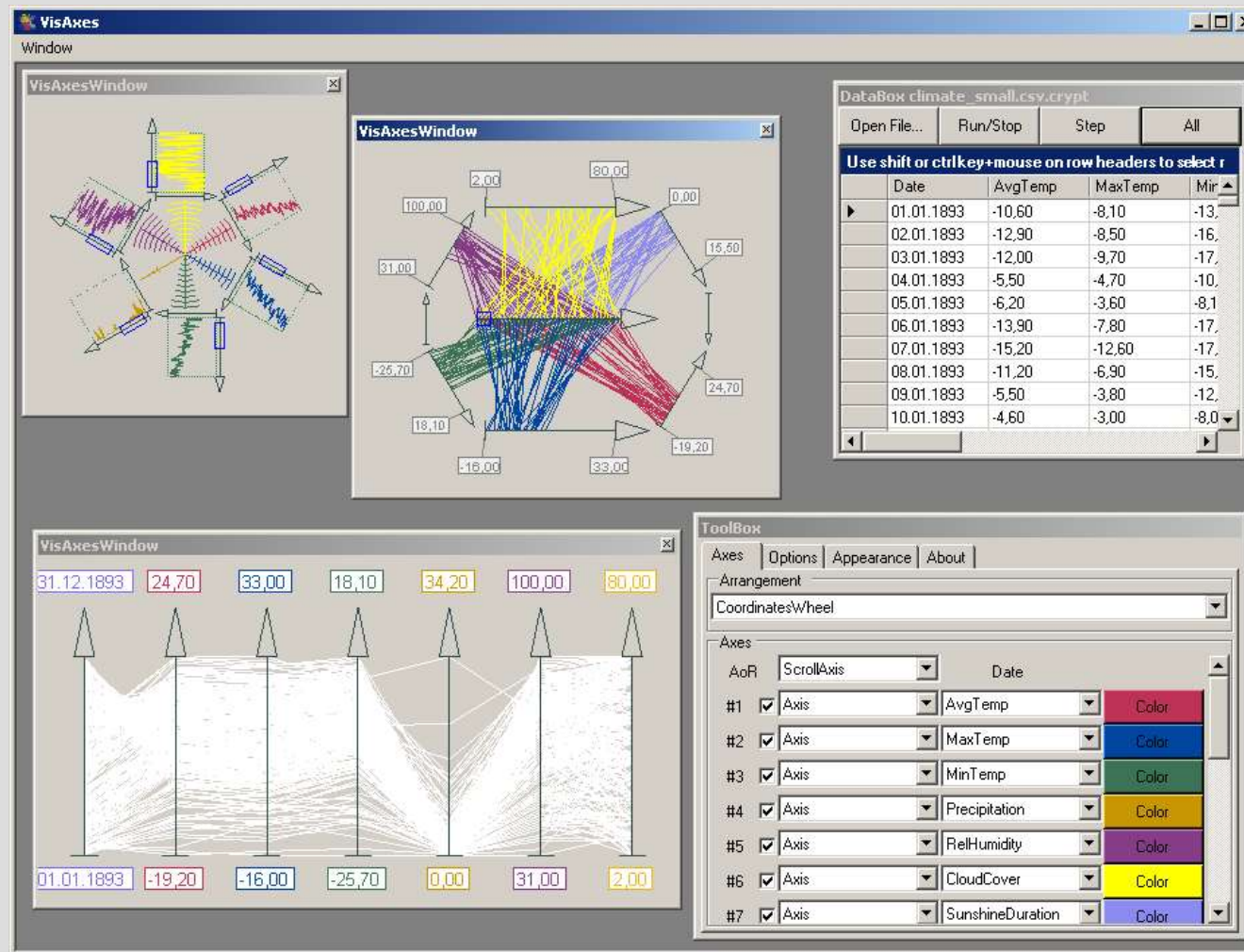
The Framework VisAxes
Architecture

- The presented techniques have been realized in the interactive framework *VisAxes*

- DataBox, ToolBox and VisAxesWindow are main components of the architecture

- .Net and C# have been used as development environment

The Framework VisAxes
Demonstration

Conclusion & Future Work

- Innovative interactive axes for easy data exploration
- New axes arrangements for emphasizing one dimension of reference in a multidimensional data set
- Implementation of the concept in the modular axes-based framework VisAxes

- Future work
  - Automatic variable-axis-mapping (similarity, correlation,...)
  - Extension of the techniques to 3D
  - User tests to prove eligibility of the approach