iPlots 2.0

Tobias Wichtrey
Alexander Gouberman
Simon Urbanek
Martin Theus

iPlots 2.0

Tobias Wichtrey, Alexander Gouberman, Martin Theus   RoSuDa, Augsburg University, Germany
Simon Urbanek   AT&T Labs, Florham Park, NJ

2
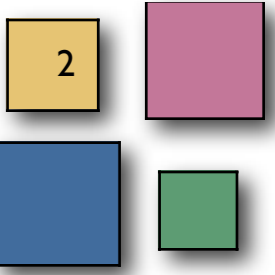
iPlots: Motivation

- ## R is good at managing
  - data
  - models
  - (static) graphics

  but is less strong in exploratory data analysis

- ## Interactive Statistical Graphics (ISG) is good at
  - supporting exploratory analyses
  - checking data quality
  - revealing structure in data

  but can not be automated or scripted

- ## Solution: Bring both tools/paradigms together

Tobias Wichtrey, Alexander Gouberman, Martin Theus
Simon Urbanek

RoSuDa, Augsburg University, Germany
AT&T Labs, Florham Park, NJ
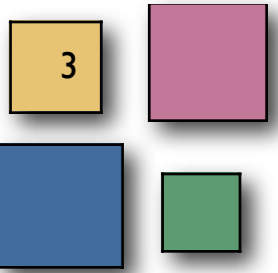
Bringing Interactive Graphics and R together

- Different ways of bringing ISG and R together

1. **Run two applications in parallel**
   pros: full feature-set of both applications available
   cons: two different user interfaces, coupling relatively loose
   example: ggobi

2. **Use R as stat-computing engine**
   *pros*: no need to learn R, only one interface
   cons: only packaged functionality, no extensibility
   example: KLIMT, Mondrian (all via Rserve)
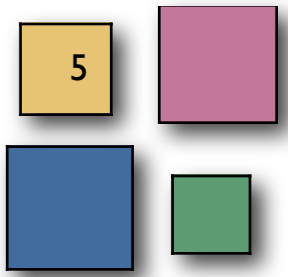
3. **Add interactive plots within R**
   pros: one interface, still "just" R, flat learning curve
   cons: can not be implemented using R graphics
   example: iPlots
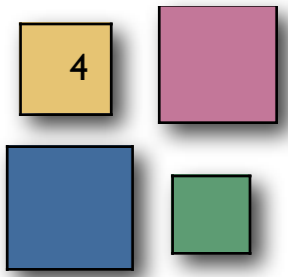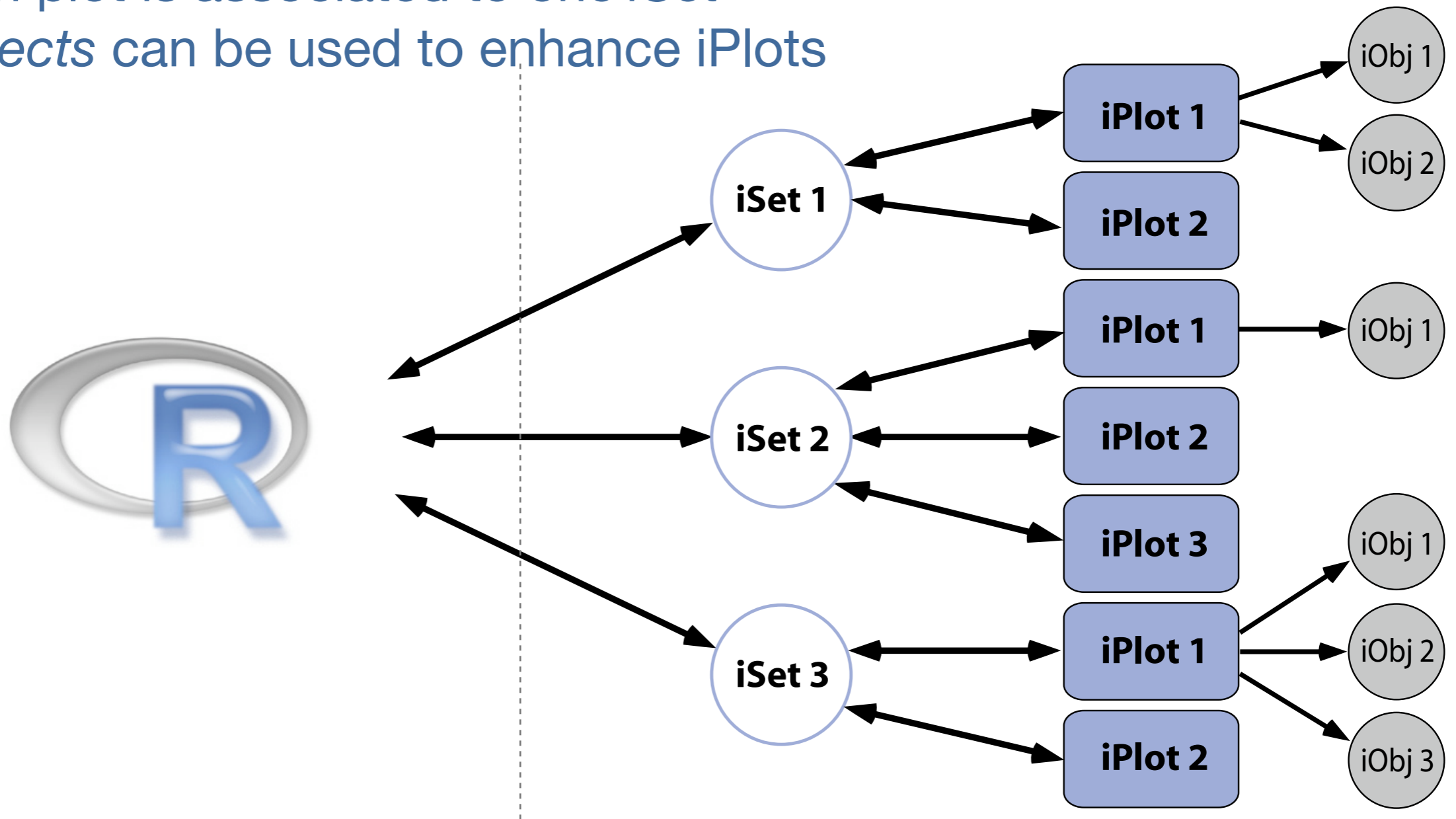
iPlots Internals

- iPlots use JAVA to achieve interactivity
- Data is stored in so called *iSets*
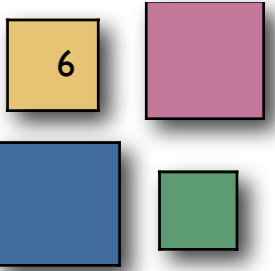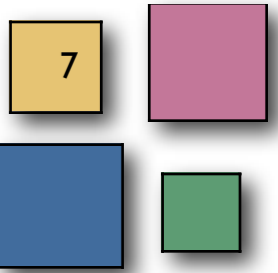- Each plot is associated to one *iSet*
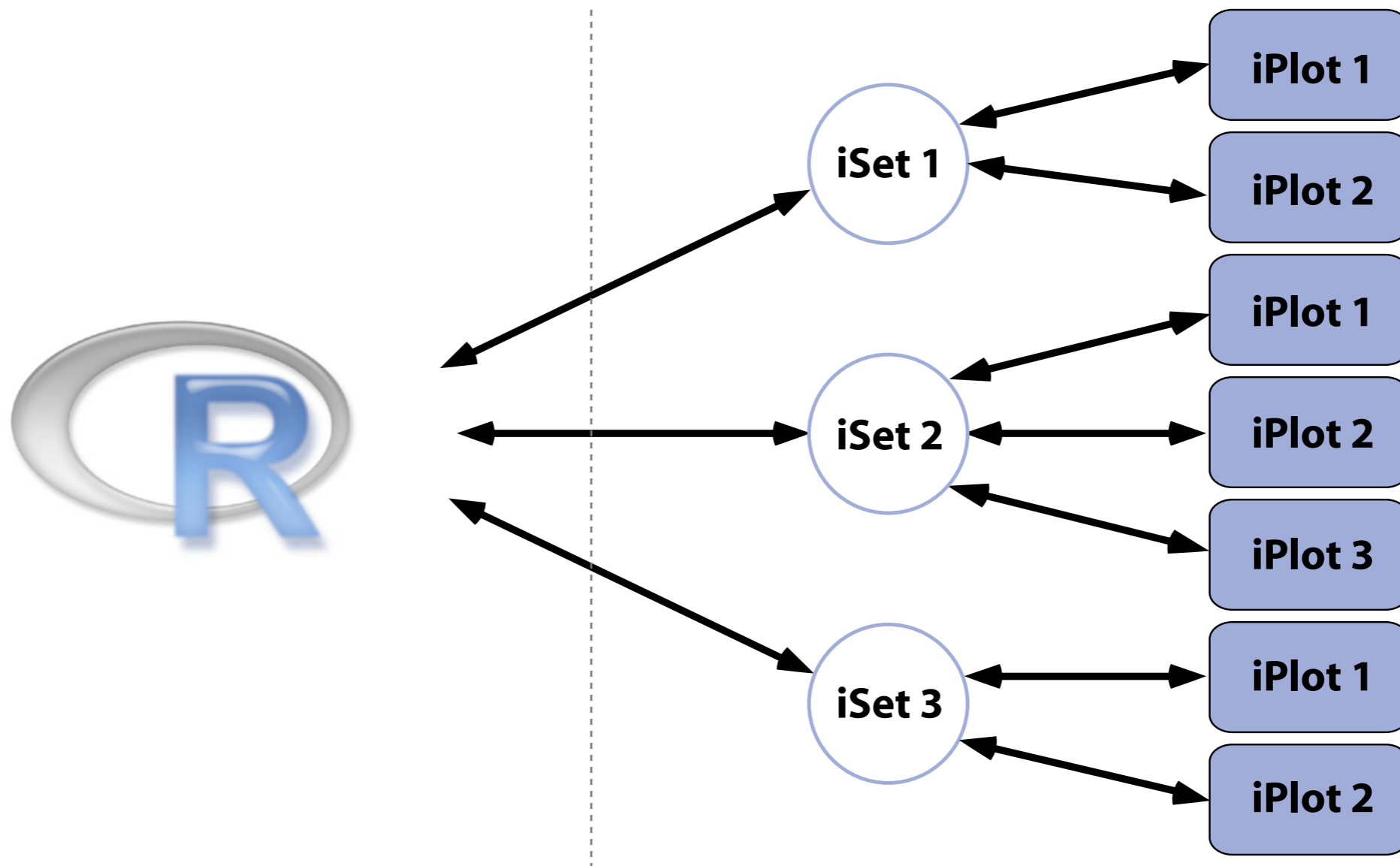
iPlots Internals

- iPlots use JAVA to achieve interactivity
- Data is stored in so called *iSets*
- Each plot is associated to one *iSet*
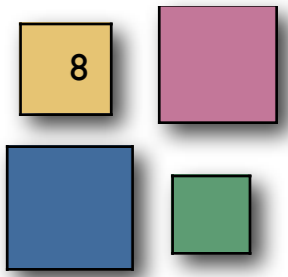- *iObjects* can be used to enhance iPlots

iPlots 2.0

Tobias Wichtrey, Alexander Gouberman, Martin Theus   RoSuDa, Augsburg University, Germany
Simon Urbanek   AT&T Labs, Florham Park, NJ

6

iPlots: Past

- The first version of iPlots was presented at the DSC meeting in 2003.

- Features of Version "1.0"
  - implemented basic plots
    - histogram
    - barplot
    - scatterplot
  - defined API
    - as similar to existing R functions as sensible to flatten the learning curve
    - handling of *iSets* and *iObjects*
  - available from RoSuDa repository
  - "proof of concept"
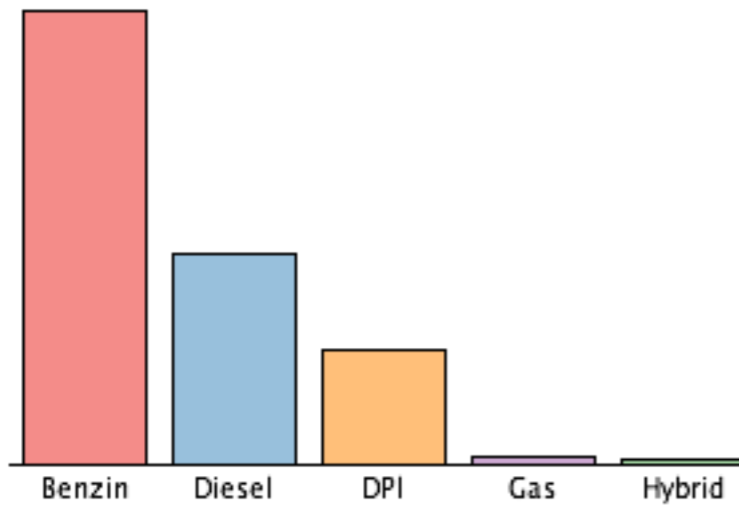
iPlots 2.0

Tobias Wichtrey, Alexander Gouberman, Martin Theus   RoSuDa, Augsburg University, Germany
Simon Urbanek   AT&T Labs, Florham Park, NJ

7

What is new in iPlots 2.0?

- ## Extensions to existing plots:
  - Histogram / Spinogram
  - Barplot / Spineplot

- ## New (multivariate) Plots
  - (parallel) Boxplots (y by x)
  - Parallel Coordinate Plots
  - Mosaic Plots (and its variants)

- ## New Features
  - Color Brushing
  - Better control through R calls

- ## OpenGL support to speed up glyph-based plots

- ## Custom plots allow creation of new interactive plots

iPlots 2.0

Tobias Wichtrey, Alexander Gouberman, Martin Theus   RoSuDa, Augsburg University, Germany
Simon Urbanek   AT&T Labs, Florham Park, NJ
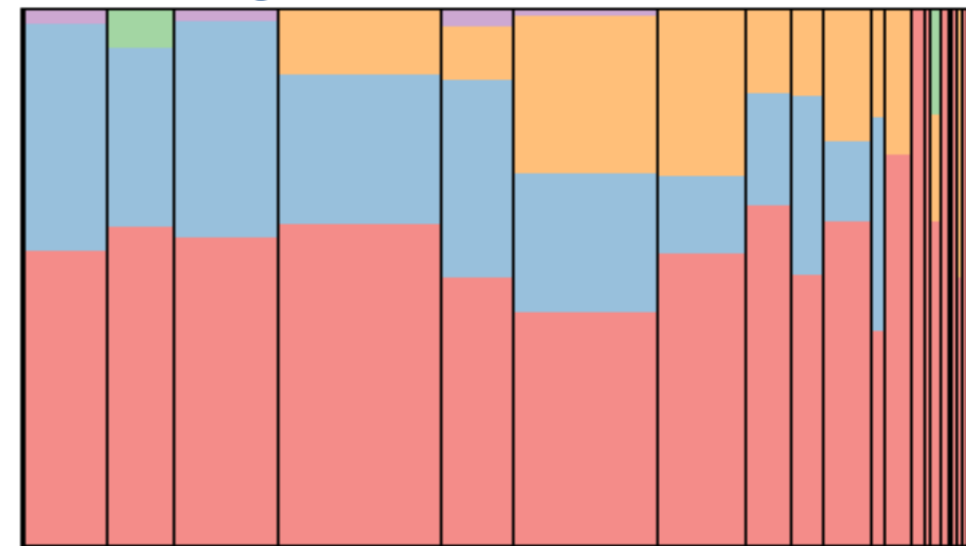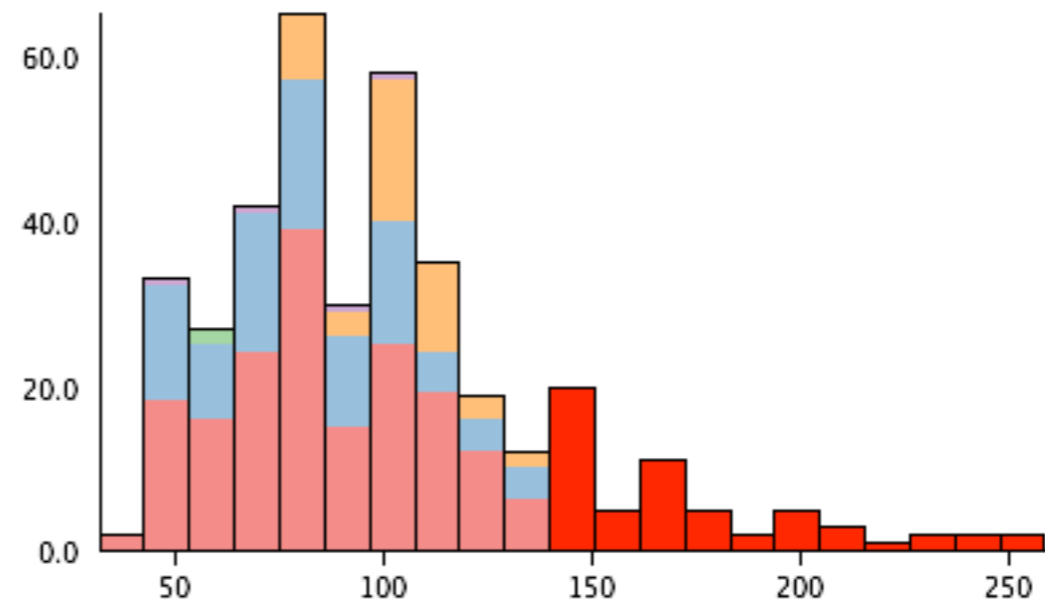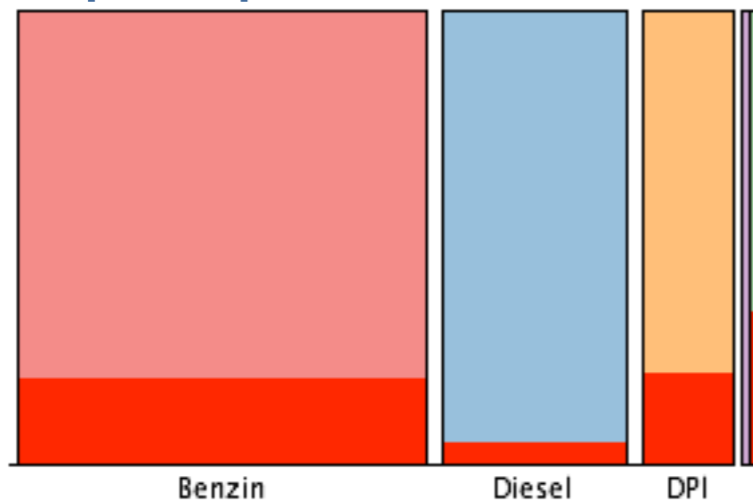
8

Extensions to existing Plots

- Conditional plots for continuous and categorical data

Spinogram

Spineplot

iPlots 2.0

Tobias Wichtrey, Alexander Gouberman, Martin Theus   RoSuDa, Augsburg University, Germany
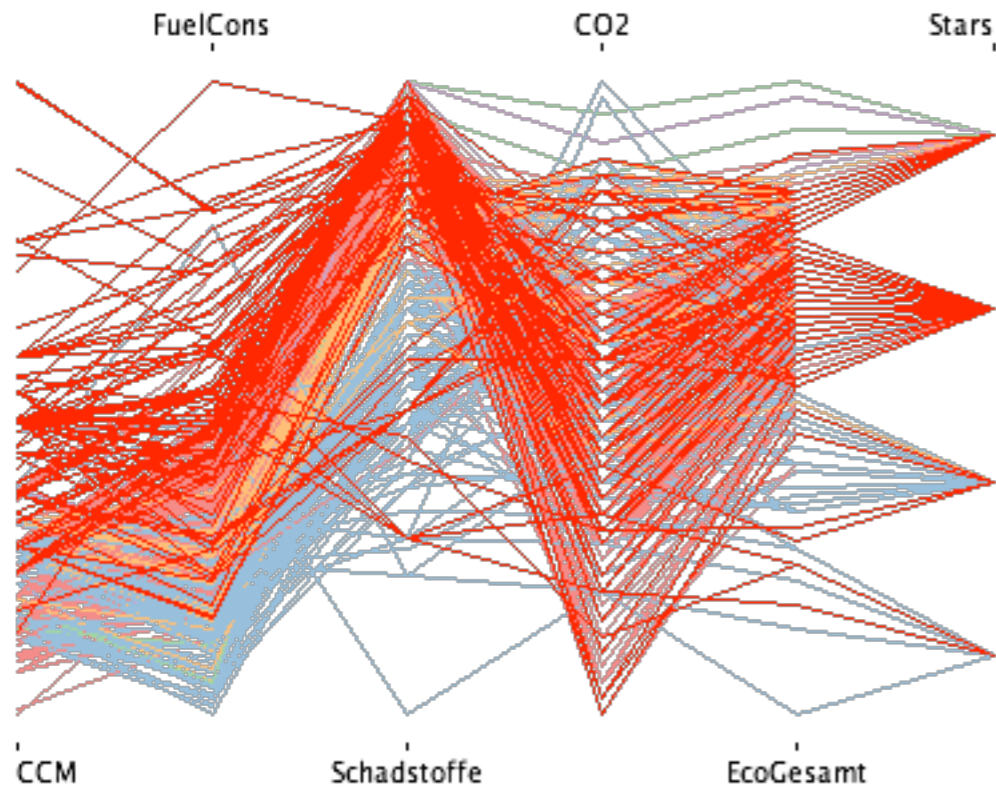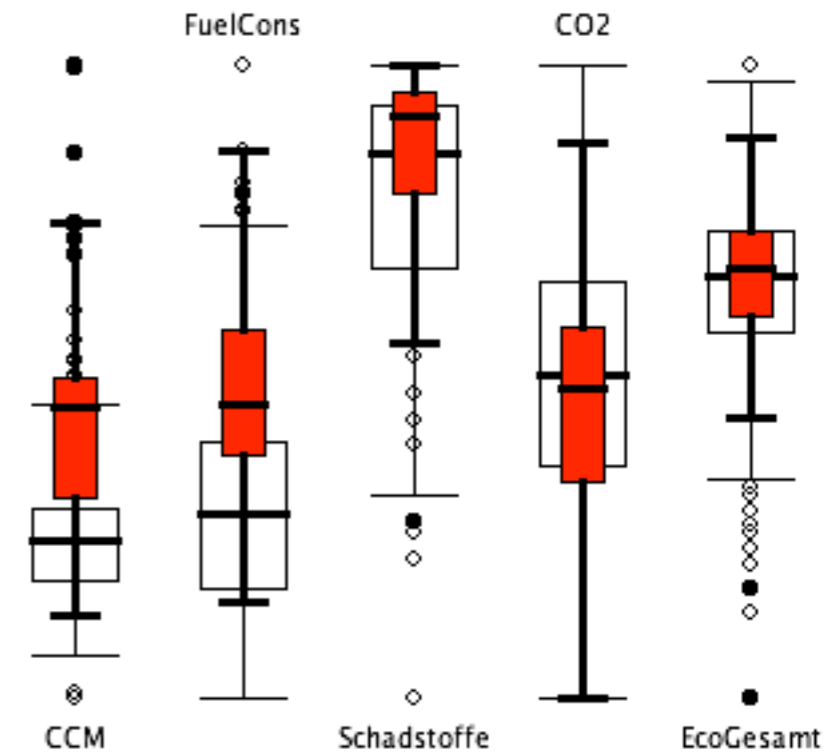Simon Urbanek   AT&T Labs, Florham Park, NJ
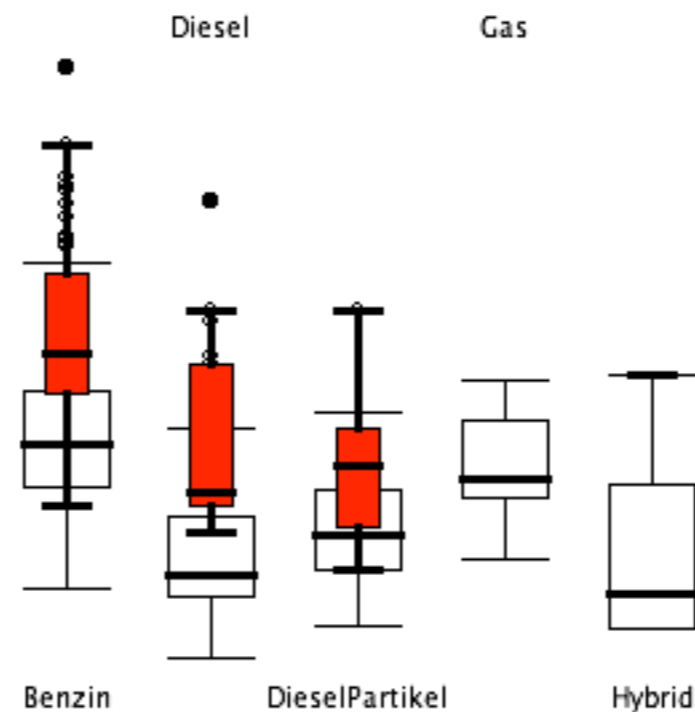
9
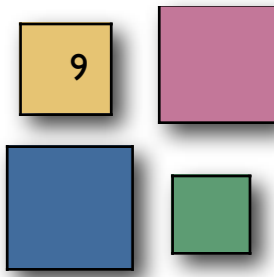
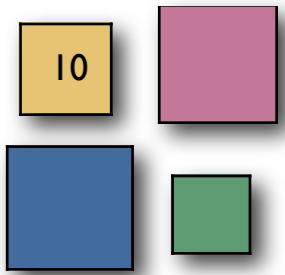# New Multivariate Plots

Parallel Coordinates
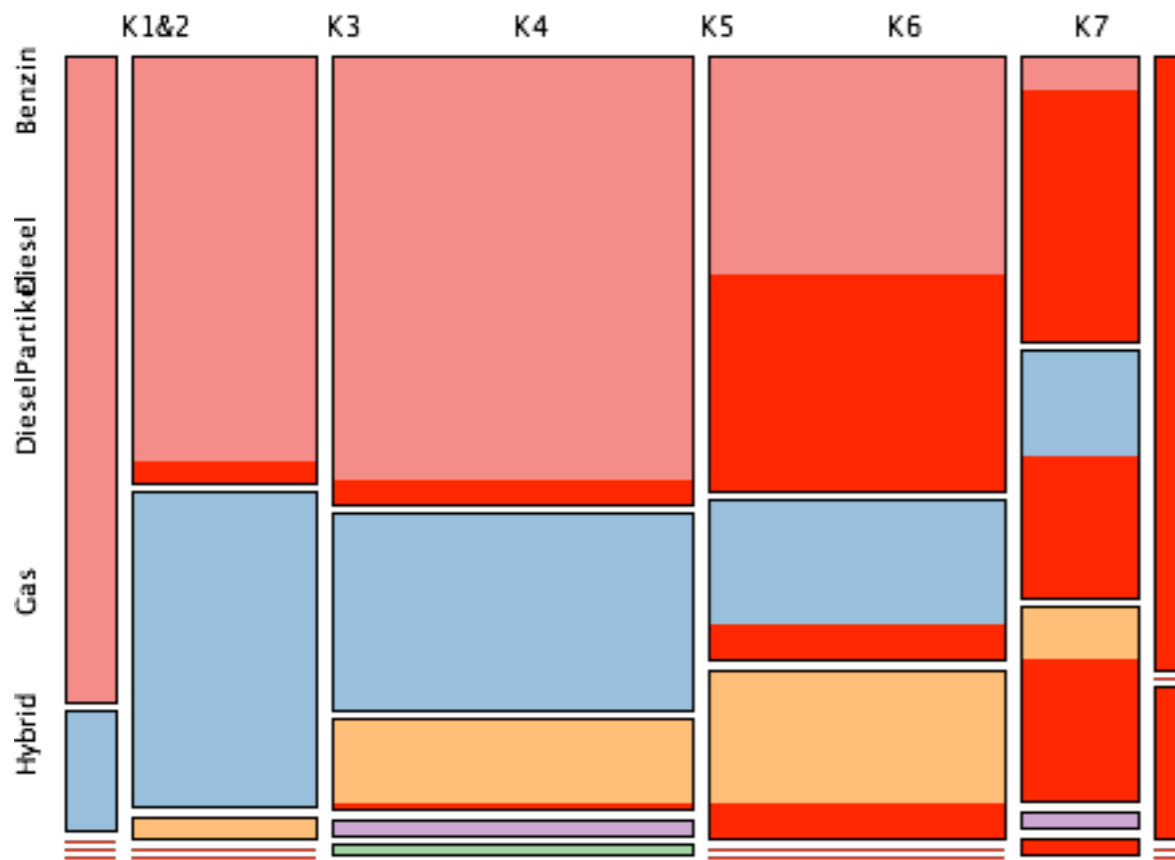

Parallel Boxplots

Boxplot y by x

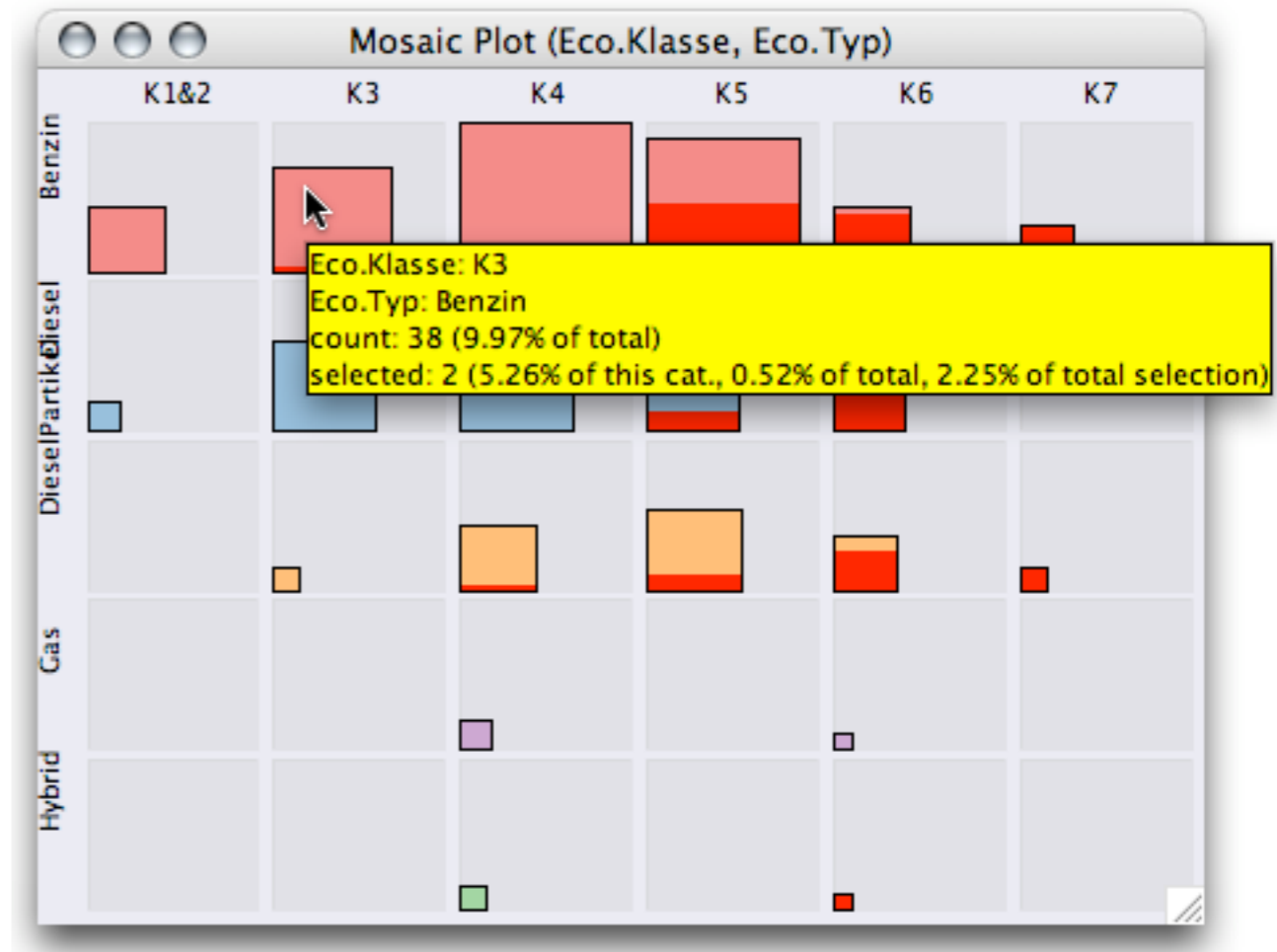# New Multivariate Plots

Mosaic Plot

Fluctuation Diagram

- Further variations include
  - Same Binsize
  - Multiple Barchart
  - Double Decker Plot

iPlots 2.0

Tobias Wichtrey, Alexander Gouberman, Martin Theus   RoSuDa, Augsburg University, Germany
Simon Urbanek   AT&T Labs, Florham Park, NJ

11
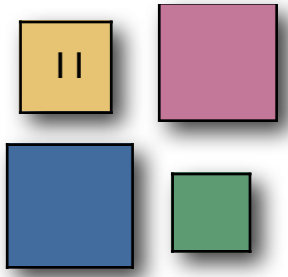
New Features

- ## Color Brushing, both
  - Quantitative and
  - Qualitative

- ## Extended Queries
  All objects – points, lines, axes, plot-canvases – can be queries. Results of extended queries can even be user defined.

- ## Full Parameter control from R

- ## α blending is implemented for all-glyph based plots to get crude density estimations and handle larger data decently.

AWT vs. 2D vs. OpenGL

- Java is platform independent, but graphics rendering is still done by the CPU (as of Version 5.0, 6.0, …)

- iPlots support three different "graphics" engines
  - AWT
  - Swing
  - OpenGL

- OpenGL speeds up glyph-based plot by factor
  - 2-3 point based plots
  - ~10 for line based plots

- Specific timings may vary, essential improvement is to push the rendering from the CPU to the GPU.

iPlots 2.0

Tobias Wichtrey, Alexander Gouberman, Martin Theus   RoSuDa, Augsburg University, Germany
Simon Urbanek   AT&T Labs, Florham Park, NJ

13

Custom Plots

- iPlots 2.0 support several standard plots which are defined on the JAVA side

- In an extensible environment like R, we want to be able to build new plot, defined by R code.

- iPlots 2.0 expose the plot primitives (elementary objects like points, lines/polygons, bars, …) defined on the JAVA side within R.

- These plot primitives know about:
  - selection
  - highlighting
  - queries

- See also the Focus Session on Friday 15:00 - 18:30.

Tobias Wichtrey, Alexander Gouberman, Martin Theus
Simon Urbanek

RoSuDa, Augsburg University, Germany
AT&T Labs, Florham Park, NJ

Conclusions

- iPlots 2.0 now feature the full set of statistical standard graphics.

- Advanced features like color brushing and extended queries

- Custom plots offer new perspective in prototyping and developing new interactive applications.

- Soon available on CRAN

- Still need a Logo? Any ideas?