IG Interactions

- What plot objects can you interact with?
 - points, bars/cells/rectangles, axes, ...
- How can you interact with the objects?
 - click, drag, arrow keys, ...
- What can you do with the objects through these interactions?
- What would you like to be able to do?
- What information can be found with these actions?
- What common principles are there?

Some basic plots

- Barchart
- Histogram
- Boxplot
- Scatterplot
- Missing value plot(s)
- Variable window
- Time series, Parallel coordinates plot, Splom, Mosaicplots

Data and statistical objects

- Windows (complete plots or sets of plots)
- Points (glyphs)
- Bars/rectangles/cells
- Axes
- Boxes
- Models (lines, smoothers, estimates, intervals,...)
- Background/other areas
- Graph title, variable names, ...

Actions for all plots (1)

- Actions on whole plots
 - Resize, reshape, rotate
 - Organise sets of plots
 - Align (by shape, by scale, by vertical/horizontal)
 - Tile or Group (by type, by variable,...)
 - Zoom
- Actions on objects
 - -Query
 - Select
 - Recolour, reshade, reshape

Actions for all plots (2)

- Actions on variables
 - Flip axes (vertical -> horizontal, horizontal -> vertical)
 - Rescale axes
 - Transform existing variables (inc. discretisation/grouping)
 - Derive new variables (e.g., selection as a binary variable)
 - Weight variables
- Actions on models
 - vary parameters
 - Add error bars, intervals to selections/models

Principles (1)

- Interactive tools should be intuitive (it should be obvious what can be done): avoid modes
- Implicit availability of actions and information
- Make data information available (immediacy of data)
- Every click must get feedback use all the plot real estate
- Consistency: same command means same thing everywhere
- Actions should be context sensitive (respect for place)
- "Do it where it's at" (immediacy of place)
- Give immediate feedback (immediacy of time)
- Actions should be possible on groups of objects (e.g., points)

Methods of interaction

- Click
- Drag
- Modifier keys (ctrl, alt, ...)
- Tab
- Arrow keys
- cf Interactivity hierarchy
- Popup menus
- Drag and drop
- Touchscreen (smartphones, iPad...) e.g., for zooming

Principles (2)

- Computing should not interfere with thinking
- Redraw as little as possible
- Don't overtax the user's memory (use defaults to help users)
- Return: allow recovery: undo/redo and repeat/replicate
- Be able to record results plot and screen saving
- Be able to record processes video?
- Provide helpful help (be user-helpful, not user-friendly)

Types of action: querying

- Querying levels
 - default
 - extended
 - deep
- Querying objects
 - data (raw and statistics of groups)
 - variables (statistics)
 - scales
 - models (options, estimates and fit)
 - plots

Types of action: scaling

- Change minimum and maximum
 - change tickmark levels
- Transform scale
- Common scaling
 - within a small multiples plot or pcp
 - by type of plot (e.g., all histograms)
 - by variable across plots
- How might this be done interactively?

Types of action: selection

- Selecting
 - points
 - bars, cells or rectangles
 - variables
 - axes
 - plots
- Selecting multiple objects
- Toggling selections
- Selections across windows (selection sequences)

Types of action: sorting

- Ordering of categories (including ID lists)
 count, absolute selected, relative selected, alphabetic
- Ordering of variables
 - in missing value plots, pcps, mosaicplots, trellis plots
 - by statistics of selected or all
 - min, max, median, mean, IQR, sd
 - visually compliant sorting
 - alphabetic
- Reversing orderings is useful
- Linking orderings, nesting orderings

Types of action: zooming

- Zoom as magnification (+ bird's eye view and panning)
- Logical (Semantic) zooming
 - show more detail when zooming in (cf. maps)
- Selective zooming
 - growing points
 - -Quantum zooming
 - for small bars/low levels of selected/non-selected
 - Censored zooming
 - ceiling-censored
 - floor-censored

Interaction for histograms

- Querying
- Selection
- Zoom: magnification/semantic
- Anchorpoint and binwidth
- Range, vertical scaling
- Density
- Spinogram, CD plot
- Weighting

Types of action: colour/shading

- Colouring different subsets
 - by individual selection
 - by a barchart or histogram classification
- Colouring by value
 - choice of palette (heat, rainbow, sequential, ...)
 - choice of mapping (cf. MANET, SEURAT)
- Invert colour coding
- Alphablending

Interaction for scatterplots

- Querying
- Selection
- Zoom: magnification/semantic
- Pointsize, colour, shape/glyph
- Scales
- Flip axes
- Regression line, smoothers
- Density estimates (marginals and bivariate)
- Weighting





