

Visual Thinking and Visualization

Course overview

Visualizations

complex thinking happens usually through an interaction with **cognitive tools**, such as:

- pencils and paper
- calculator
- computer-based information and support

Visualizations

- graphical representation of data or concepts
- an increasingly important cognitive tool

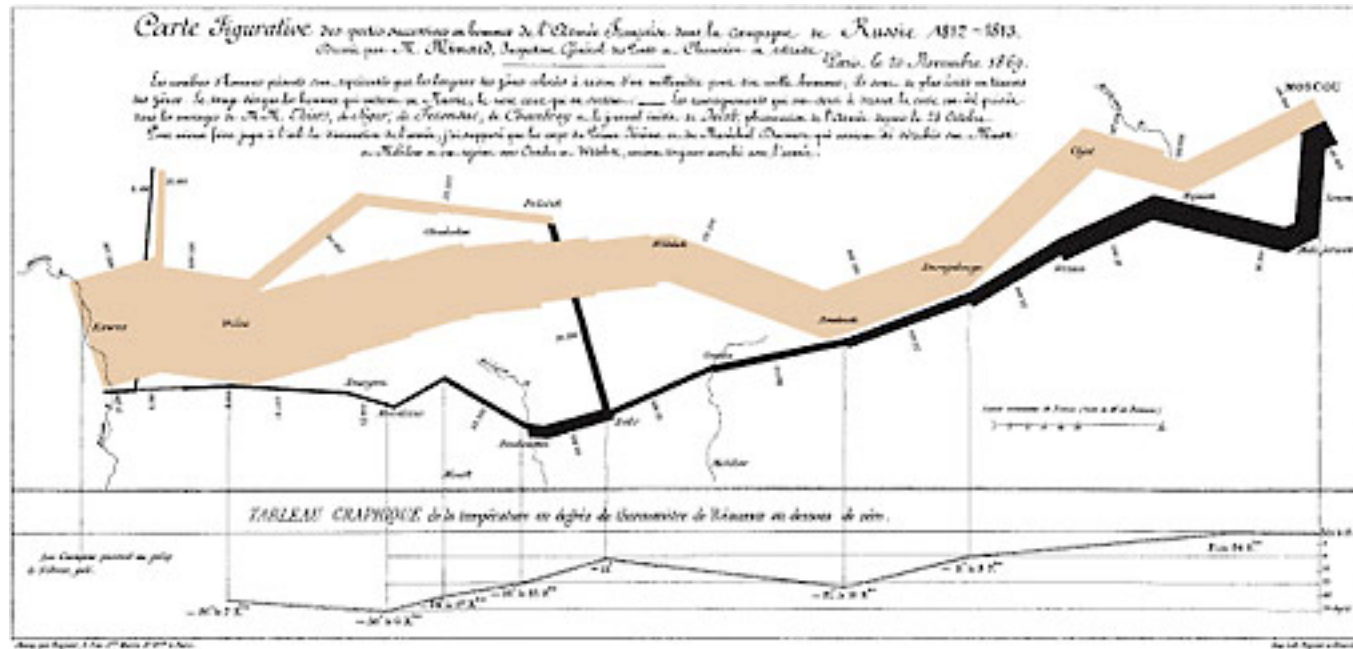
Visualizations

good data visualizations allow huge quantities of information to be rapidly processed

a good visualization allows us to represent, and therefore grasp, an entire process or system – we can focus on a component while still having access to the global view.

can make use of visual metaphors

Famous visualization: Minard's Map of Napoleon's march to Moscow



created in 1861 and often described by information designers as “the best information graphic ever made”

Napoleon's March to Moscow The War of 1812

The chart of Charles Joseph Minard (1800-1872), the French engineer, shows the terrible fate of Napoleon's army in Russia. Described by E. J. Meeus as among the best of the history by its brief elegance, this combination of diagram and line-art, shows in detail, perhaps the devastating losses suffered in Napoleon's Russian campaign of 1812. Beginning at the left on the Polish-Russian border near the Niemen River, the thick band shows the size of the army (112,000 men) as it moved toward Moscow in June 1812. The width of the band indicates the size of the army at each place on the map. In September, the army reached Moscow, which was then in full and glorious, with 10,000 men. The path of Napoleon's retreat from Moscow is depicted by the dotted, lower band, which is linked to a temperature

scale and data at the bottom of the chart. It was a bitterly cold winter, and worse than on the march out of Russia. At the graphic shows, the crossing of the Russian River was a disaster, and the army finally struggled back into Poland with only 10,000 men remaining. Also shown are the movements of auxiliary troops, as they sought to protect the rear and the flank of the advancing army. Minard's graphic sets a rich, colorful story with its evocative lines, far more enlightening than just a single number bounding along over time. The variables are plotted: the size of the army, its location on a two-dimensional surface, direction of the army's movement, and temperature on various dates during the retreat from Moscow. It may well be the best statistical graphic ever drawn.

Edward R. Tufte, *The Visual Display of Quantitative Information* (Graphics Press, Box 500, Cheshire, Connecticut 06034)

Image courtesy of Graphics Press

visual thinking

- **Aim to:**
 - outline current understanding of how we think visually
 - demonstrate how we can use this knowledge to:
 - design more powerful graphical interfaces
 - design better visualizations
 - display important quantitative information effectively
 - Principals will be applicable to many of the Honours projects

this is a design course ...

- focused on designing visualizations based on the current understanding of how our visual system works
- rationally-based first design
- followed by phases of criticism and improvement
- strong focus on high-dimensional data (much of it scientific) and how to display/interact with this effectively

topics

1. Visual queries and how the mind works
2. Structuring two dimensional space
3. Colour
4. Visual space and time: depth perception and motion
5. Visual objects: Graphical elements that we see easily and how to how to design visual objects that are easy to identify
6. Theory and best practice in the design of data graphics.

Recommended Reading



- ***Visual Thinking for Design*** by Colin Ware
- ***Information visualization: perception for design*** by Colin Ware
- ***The Visual Display of Quantitative Information.*** by Edward R. Tufte (second edition)
- ***Visual Complexity. Mapping Patterns of Information.*** by Manuel Lima (Princeton Architectural Press, New York)
- ***Visual Language for Designers. Principles for creating graphics that people understand.*** by Connie Malamed

all very beautiful books, most are in the UCT library.

Assignment

- The single major practical
 - 50% course mark (balance is the exam)
- involves the design and prototyping of an interface or visualization
 - focussed on multi-dimensional data
- Demonstration and defense to class twice:
 - preliminary design on 22nd/25th April
 - final design on 13/14/16th May
- Groups of 2 or 3

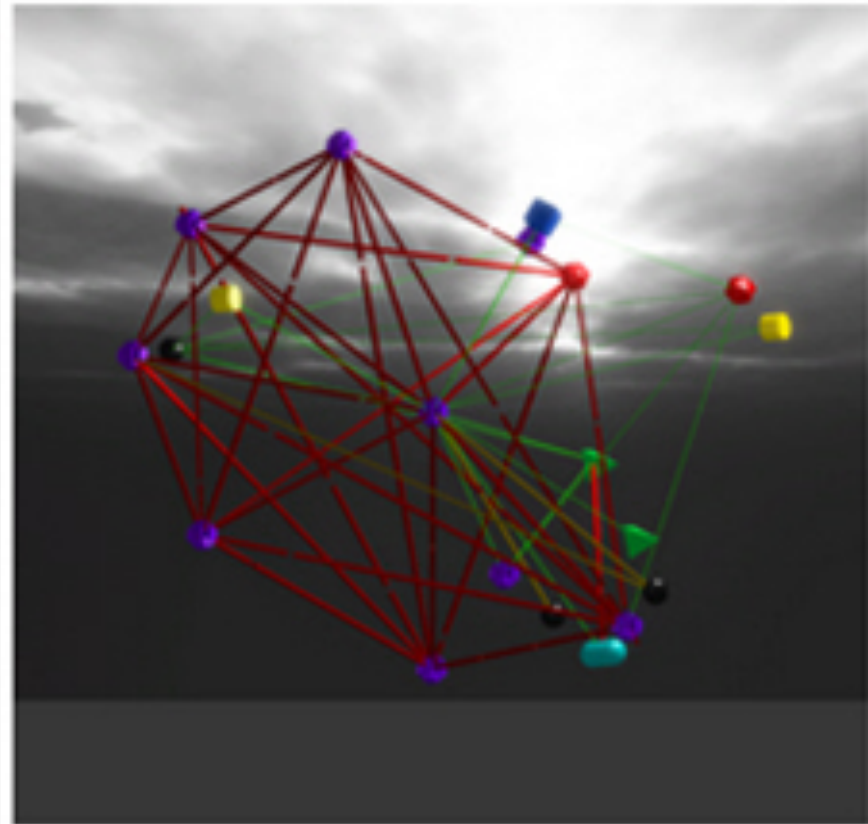
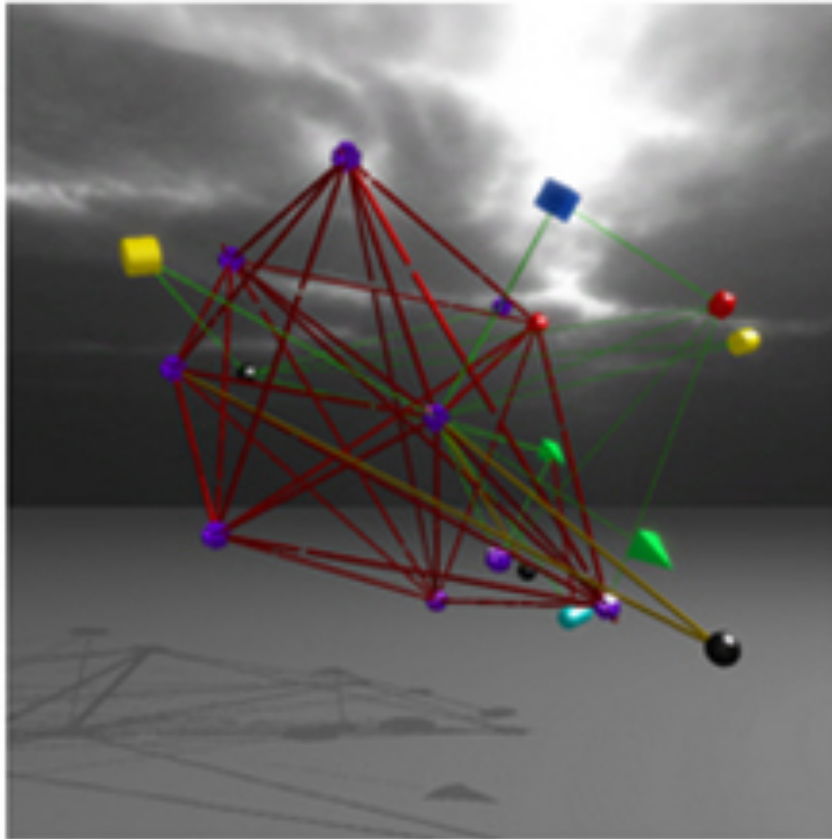
Assignment

- Topics released this week
- Presentation and participation marks – DP requirement
- Attendance at ALL of **these lectures** compulsory for module DP
- Final report also due in final week

Assignment – own topic

- **with pre-approval of the module convenor**
may suggest your own topic for visualization.

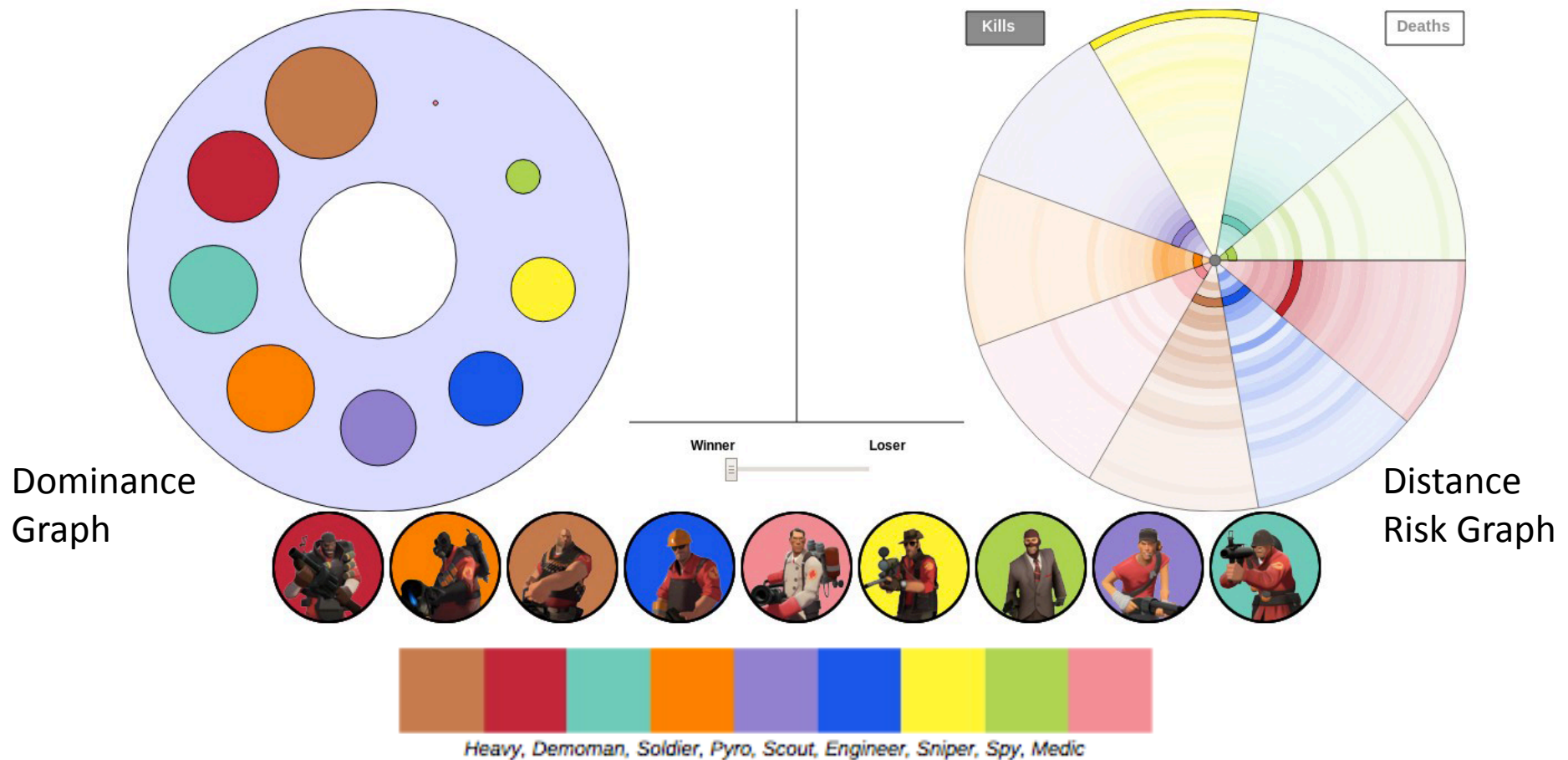
Example from last year: Protein network visualization



Assignment – own topic eg

- **Visualising Team Fortress 2 Game Statistics**

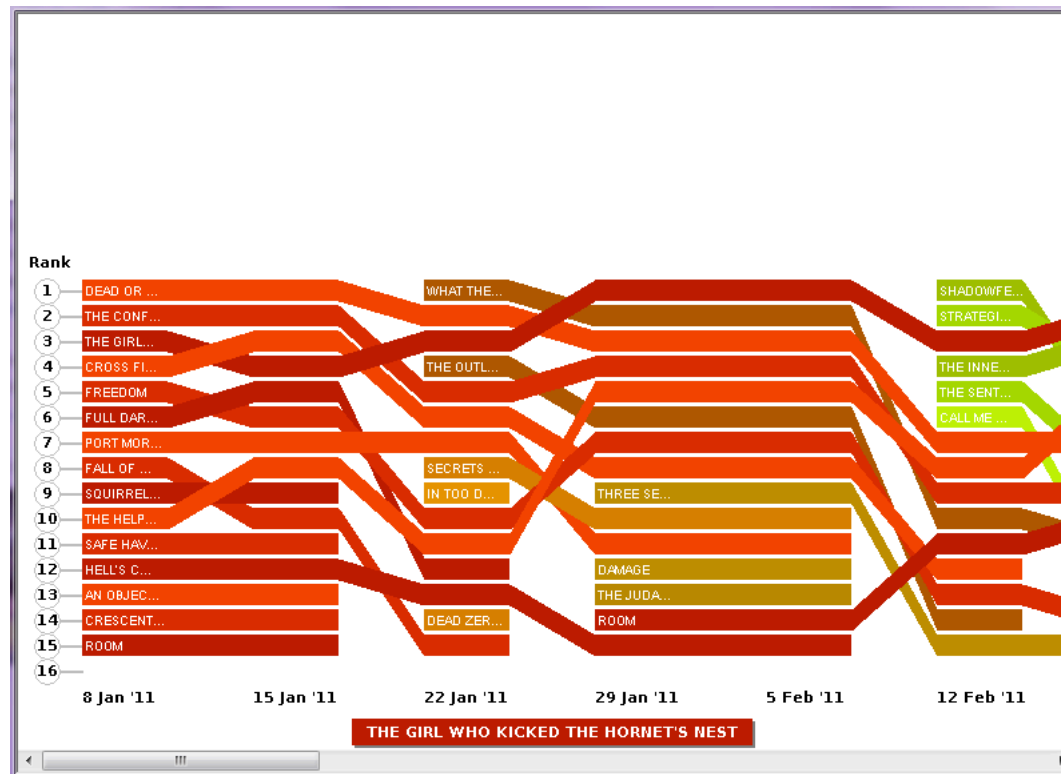
Robin Tyler Jacques Questiaux Stephen Finniss



Assignment – own topic eg

- **New York Times (NYT) Best Sellers List**

Rainer Dreyer, Rizmari Versfeld, Lawrence Webley



Assignment – own topic eg

- **New York Times (NYT) Best Sellers List**

Rainer Dreyer, Rizmari Versfeld, Lawrence Webley

