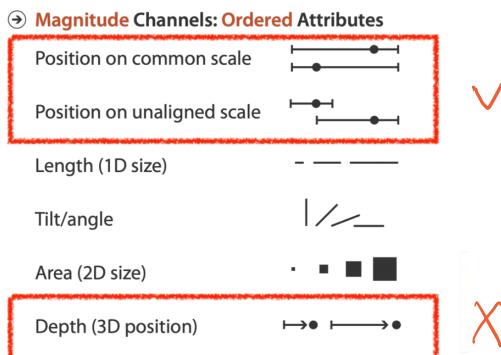


Depth vs power of the plane

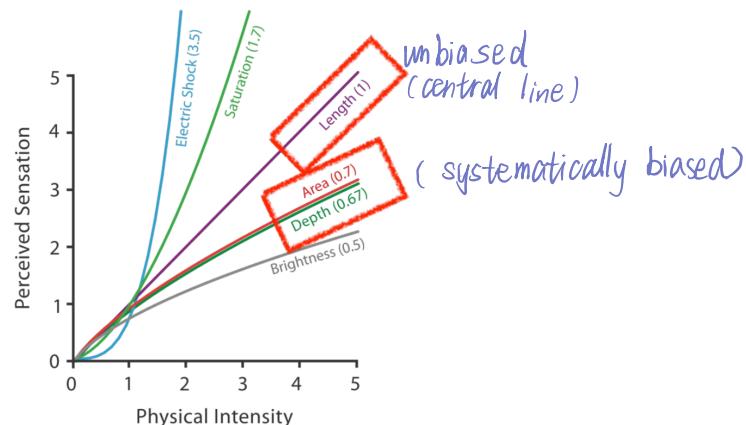
High-ranked spatial position channel: **planar** spatial position
– not depth!



✓

don't rely on people's depth perception in 3D

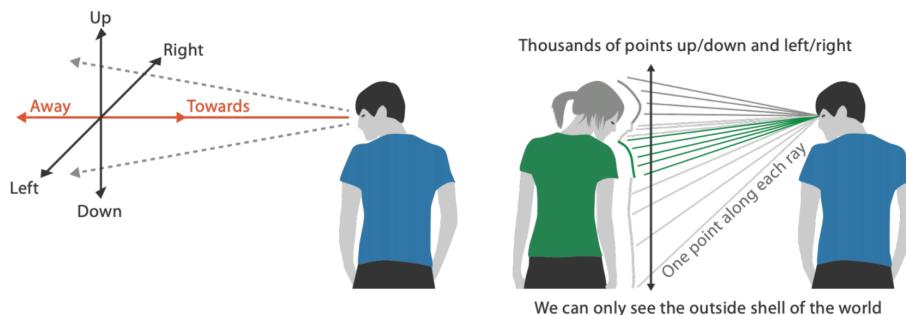
Steven's Psychophysical Power Law: $S = I^N$



No unjustified 3D: Danger of depth

We don't really 'live' in 3D: we **'see'** in 2.05D

- We acquire more info on image plane quickly, from eye movements presented in 2D
- We acquire more info for depth slowly, from head/body motion 3D



No unjustified 2D?!

Consider whether network data requires 2D spatial layout

– especially if reading text is central to task!

– arranging as network means lower information density and harder label lookup, compared to text lists

Benefits outweigh costs when topological structure/context is important for task

– However, be especially careful for search results, document collections, ontologies

simple presentation (list)

simple text list Targets

Network Data

→ Topology



→ Paths



Eyes beat memory

Principle: external cognition vs. internal memory

– It is easy to compare side-by-side views, by moving eyes between them quickly

– harder to compare a new item, to memory of what you saw before in the same view

Implications for animation

– great for choreographed storytelling (see also the 'economic growth curve' example)

– great for transitions between two states

– poor for many states with changes everywhere

- consider small multiples instead



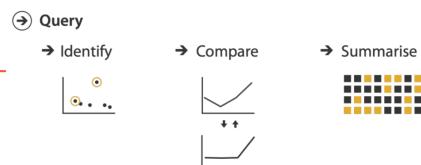
Overview first, zoom and filter, details on demand

Influential slogan, about a pattern of tasks to design for

[*The Eyes Have It: A Task by Data Type Taxonomy for Information Visualizations.*
Shneiderman. Proc. IEEE Visual Languages, pp. 336–343, 1996.]

Overview ≡ identify pattern/structure

- give a view of most/all of the data
- find interesting large-scale aggregates



Zoom and filter ≡ compare

- Use closer views, selection, filtering to understand these aggregate features better

Details ≡ summarise

- Look at individual data items within these features, to get most valuable result(s)

Responsiveness is required

Visual feedback: three rough categories

which to give users

- ~0.1 seconds: perceptual processing
 - Interaction makes it feel like the action and the response are basically the same thing
 - Subsecond response for mouseover highlighting, cursor movement responding to mouse/trackpad
- ~1 second: immediate response
 - fast but discrete response, so it feels like the action triggers a simple/lightweight operation
 - e.g. window pop-up after mouse click or button press, selection highlighting when you drag out a rectangle over a scatterplot
- ~10 seconds: brief task
 - Delayed or gradual response after dialog box → mental model of heavyweight operation
 - e.g. file loading and visualisation redraw, after a 'New File' command

Responsiveness is required

Considerations when scaling to large data sets

- highlight selection without complete redraw of view (graphics frontbuffer)
- show hourglass for multi-second operations (check for cancel/undo)
- show progress bar for long operations (process in background thread) 线程
- rendering speed when item count is large (guaranteed frame rate)

Function first, form next

Dangerous to start with aesthetics

- Usually impossible to add function retroactively
有追溯效力的

Start with focus on functionality

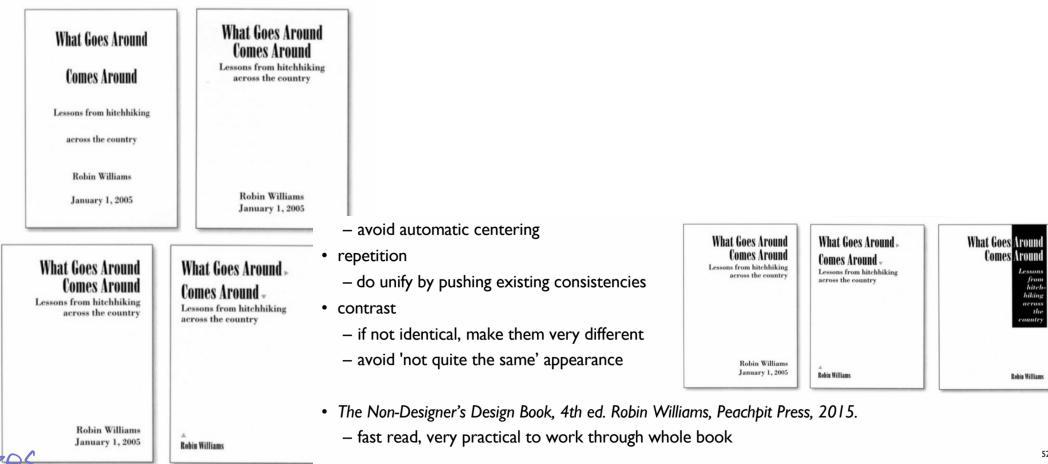
- Possible to improve aesthetics later on, as refinement
- If no expertise in-house, find a graphic designer to work with not easy features
- Aesthetics do matter! another level of function
 - Culture, norms and expectations, in visual hierarchy, alignment, flow
 - Also psychology, e.g. Gestalt principles in action

Form: basic graphic design ideas

- proximity
 - do group related items together
 - avoid equal whitespace between unrelated
- alignment
 - do find/make strong line, stick to it
 - avoid automatic centering
- repetition
 - do unify by pushing existing consistencies
- contrast
 - if not identical, then very different
 - Be careful of 'not quite the same' features

many different fonts and font sizes

variation on fonts and typefaces



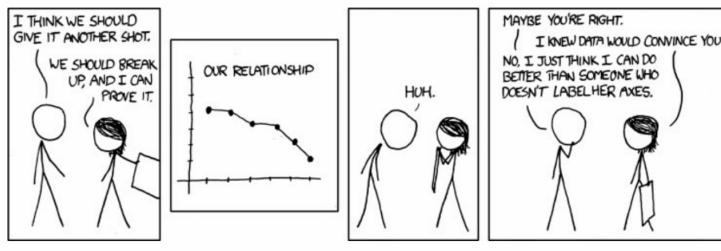
525

- avoid automatic centering
- repetition
 - do unify by pushing existing consistencies
- contrast
 - if not identical, make them very different
 - avoid 'not quite the same' appearance
- The Non-Designer's Design Book, 4th ed. Robin Williams, Peachpit Press, 2015.
 - fast read, very practical to work through whole book

Best practices: Labelling

Make visualizations as self-documenting as possible

- meaningful & useful title, labels, legends
 - axes and panes/subwindows should have labels
 - and axes should have good mix/max boundary tick marks
 - everything that's plotted should have a legend
 - and own header/labels if not redundant with main title
 - use reasonable numerical format
 - avoid scientific notation in most cases



*title : what is going to be shown
labels on objects
legends : categories . what colour means*

Rules of Thumb Summary

- No unjustified 3D
 - Power of the plane
 - Disparity of depth
 - Occlusion hides information
 - Perspective distortion dangers
 - Tilted text isn't legible
- No unjustified 2D
 - Eyes beat memory
 - Resolution over immersion
 - Overview first, zoom and filter, details on demand
 - Responsiveness is required
 - Function first, form next