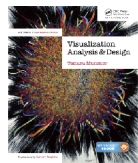


Visualization Analysis & Design



What's Vis, and Why Do It? (Ch 1)

Tamara Munzner
 Department of Computer Science
 University of British Columbia
 @tamaramunzner

Why have a human in the loop?

Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively.

Visualization is suitable when there is a need to augment human capabilities rather than replace people with computational decision-making methods.

Why depend on vision?

Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively.

- human visual system is high-bandwidth channel to brain
 - overview possible due to background processing
 - subjective experience of seeing everything simultaneously
 - significant processing occurs in parallel and pre-attentively
- sound: lower bandwidth and different semantics
 - overview not supported
 - subjective experience of sequential stream
- touch/haptics: impoverished record/replay capacity
 - only very low-bandwidth communication thus far
- taste, smell: no viable record/replay devices

Why analyze?

- imposes structure on huge design space
 - scaffold to help you think systematically about choices
 - analyzing existing as stepping stone to designing new
 - most possibilities ineffective for particular task/data combination

Defining visualization (vis)

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Visualization is suitable when there is a need to augment human capabilities rather than replace people with computational decision-making methods.

- don't need vis when fully automatic solution exists and is trusted
- many analysis problems ill-specified
 - don't know exactly what questions to ask in advance
- possibilities
 - long-term use for end users (ex: exploratory analysis of scientific data)
 - presentation of known results (ex: New York Times Upshot)
 - stepping stone to assess requirements before developing models
 - help automatic solution developers refine & determine parameters
 - help end users of automatic solutions verify, build trust

Why represent all the data?

Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively.

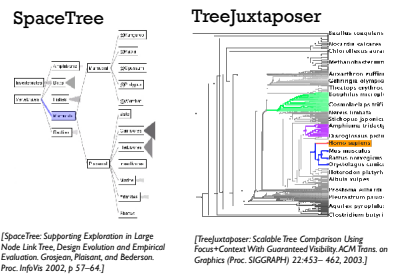
- summaries lose information, details matter
 - confirm expected and find unexpected patterns
 - assess validity of statistical model

Anscombe's Quartet

Identical statistics	
x mean	9
x variance	10
y mean	7.5
y variance	3.75
x/y correlation	0.816

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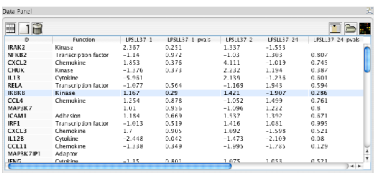
Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively.

Why?...

Why use an external representation?

Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively.

- external representation: replace cognition with perception



[Central Visualizing Multiple Experimental Conditions on a Graph with Biological Context, Bardsley, Munzner, Gandy, and Kincaid. IEEE TVCG (Proc. InfoVis) 14(6):1253-1260, 2008.]

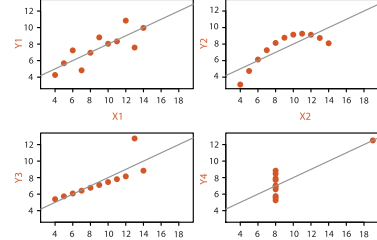
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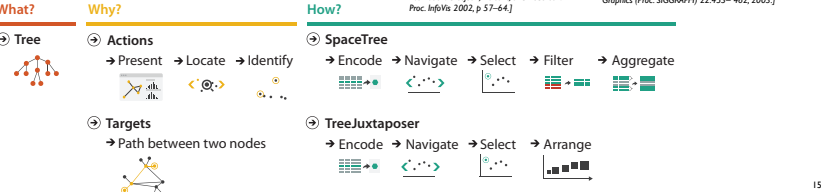
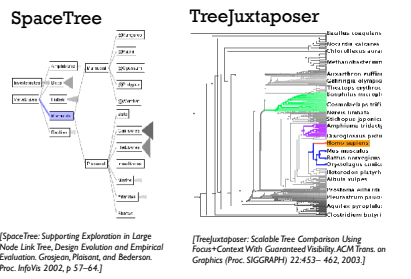
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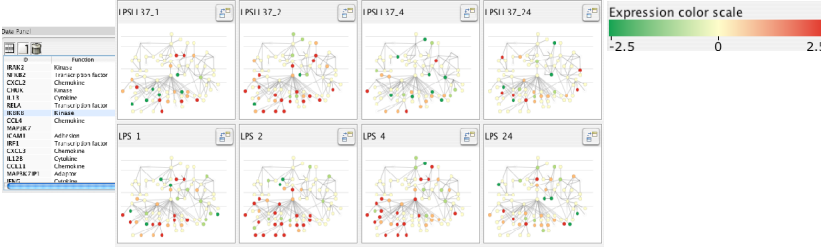
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What resource limitations are we faced with?

Vis designers must take into account three very different kinds of resource limitations: those of computers, of humans, and of displays.

- computational limits
 - computation time, system memory
- display limits
 - pixels are precious & most constrained resource
 - information density:** ratio of space used to encode info vs unused whitespace
 - tradeoff between clutter and wasting space
 - find sweet spot between dense and sparse
- human limits
 - human time, human memory, human attention