

Information Visualization

Visualization Motivation, What: Data Abstraction

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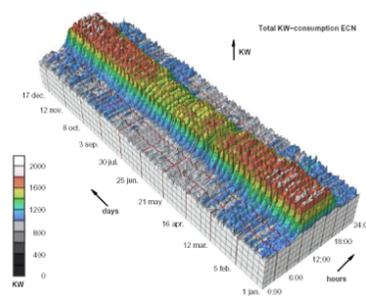
5 January 2017
<http://www.cs.ubc.ca/~tmm/courses/547-17>

Before: In-class design exercise, in small groups

- Five time-series scenarios
 - A: every 5 min, duration 1 year, 1 thing: building occupancy rates
 - B: every 5 min, 1 year, 2 things: currency values (exchange rate)
 - C: several years and several things: 5 years, 10 currencies
 - D: 1 year, many things: CPU load across 1000 machines
 - E: 1 year, several parameters, many things: 10 params on each of 1000 machines
- Small-group exercise: 15-20 min
 - one group per table (3-4 people/group, 10 groups)
 - discuss/sketch possible visual encodings appropriate for your assigned scenario
- Reportback: 20-30 min
 - 3 min from each group
- Design space examples/discussion: 15-20 min

Case A: 3D Approach (Not Recommended)

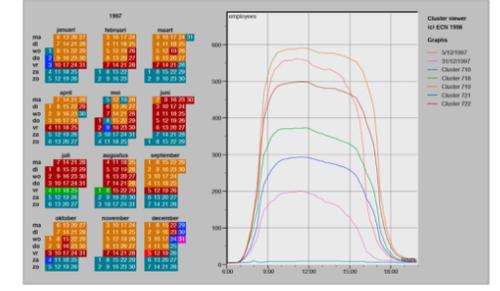
- extruded curves: detailed comparisons impossible



[Cluster and Calendar based Visualization of Time Series Data. van Wijk and van Selow, Proc. InfoVis 99.]

Case A: Cluster-Calendar Solution

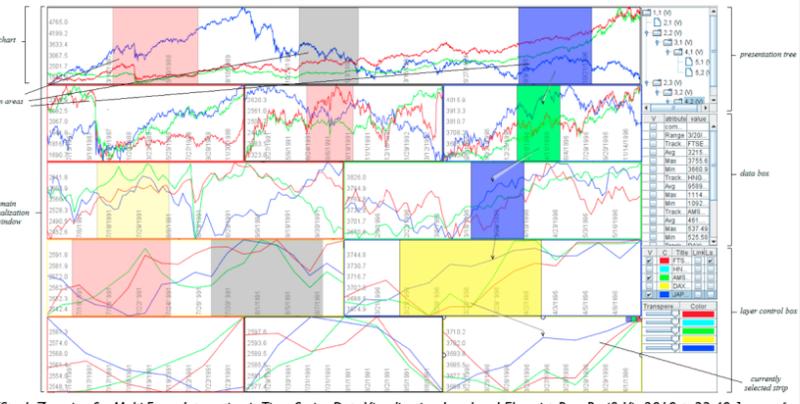
- derived data: cluster hierarchy
- juxtapose multiple views: calendar, superimposed 2D curves



[Cluster and Calendar based Visualization of Time Series Data. van Wijk and van Selow, Proc. InfoVis 99.]

Case B: Stack Zooming

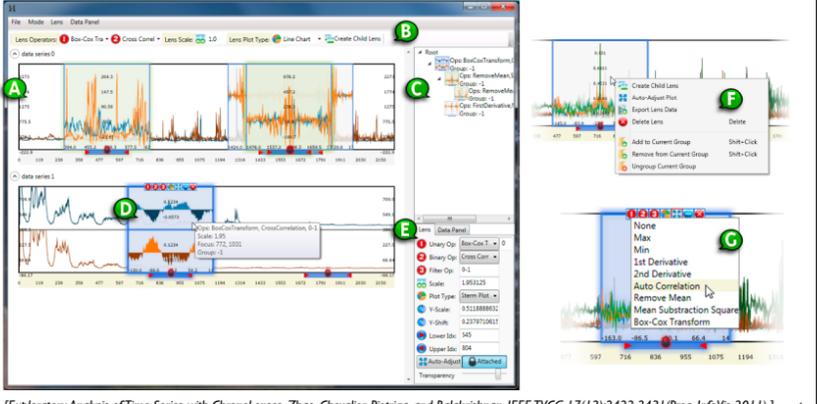
<https://youtu.be/dK0De4XPm5Y>



[Stack Zooming for Multi-Focus Interaction in Time-Series Data Visualization. Javed and Elmqvist. Proc. PacificVis 2010, p. 33-40.]

Case C: ChronoLenses

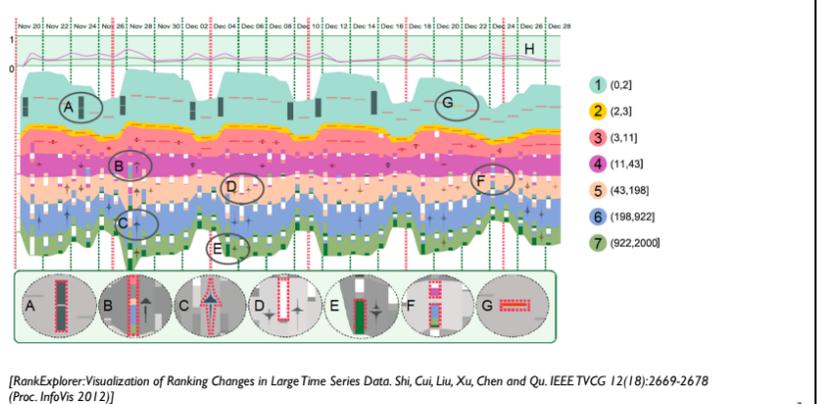
<https://youtu.be/k7pl8kczqk>



[Exploratory Analysis of Time-Series with ChronoLenses. Zhao, Chevalier, Pietriga, and Balakrishnan. IEEE TVCG 17(12):2422-2431 (Proc. InfoVis 2011).]

Case D: RankExplorer

<https://youtu.be/rdgnlqcZ2A4>



[RankExplorer: Visualization of Ranking Changes in Large Time Series Data. Shi, Cui, Liu, Xu, Chen and Qu. IEEE TVCG 12(18):2669-2678 (Proc. InfoVis 2012).]

Case E: LiveRAC video

<http://youtu.be/ld0c3H0VSkw>



[LiveRAC - Interactive Visual Exploration of System Management Time-Series Data. McLachlan, Munzner, Koutsofios, and North. Proc. Conf. on Human Factors in Computing Systems (CHI) 2008, pp 1483-1492.]

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

VAD Ch 1: What's vis, and why do it?

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.

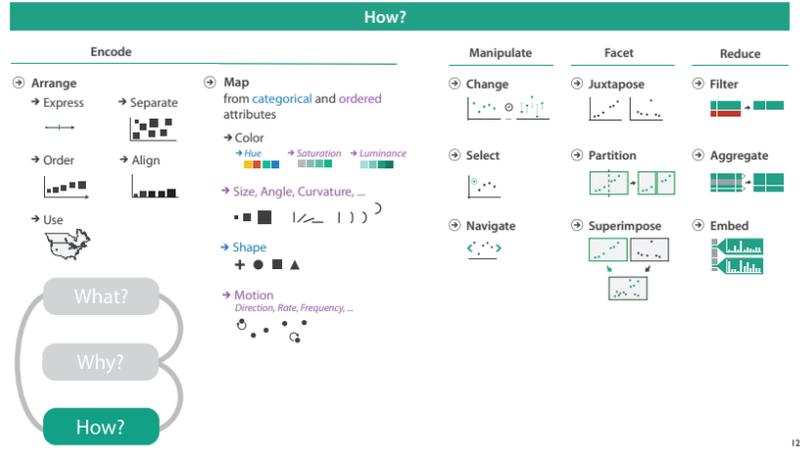
- human in the loop needs the details
 - doesn't know exactly what questions to ask in advance
 - longterm exploratory analysis
 - presentation of known results
 - stepping stone towards automation: refining, trustbuilding
- external representation: perception vs cognition
- intended task, measurable definitions of effectiveness

Analysis: What, why, and how

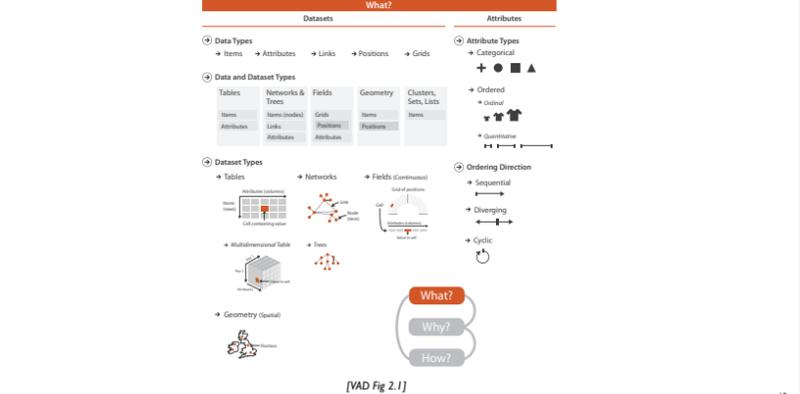
- what is shown?
 - data abstraction
- why is the user looking at it?
 - task abstraction
- how is it shown?
 - idiom: visual encoding and interaction



- abstract vocabulary avoids domain-specific terms
 - translation process iterative, tricky
- what-why-how analysis framework as scaffold to think systematically about design space



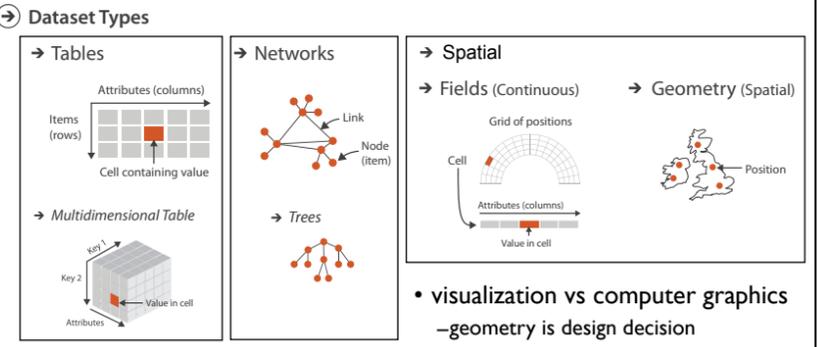
VAD Ch 2: Data Abstraction



[VAD Fig 2.1]

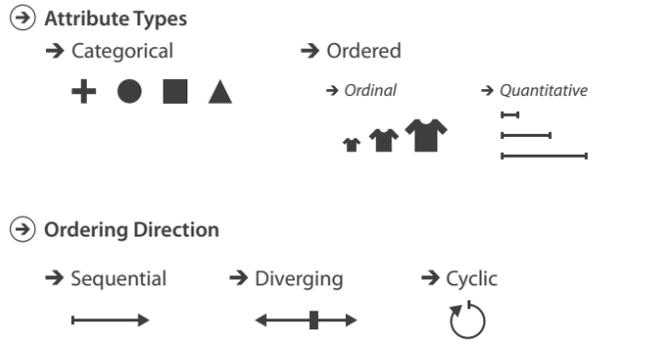
Ch 2. What: Data Abstraction

Three major datatypes



- visualization vs computer graphics
 - geometry is design decision

Attribute types



Dataset and data types

➔ Data and Dataset Types



➔ Data Types

→ Items → Attributes → Links → Positions → Grids

➔ Dataset Availability

→ Static → Dynamic

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Further reading: Articles

- [Mathematics and the Internet: A Source of Enormous Confusion and Great Potential](#). Walter Willinger, David Alderson, and John C. Doyle. Notices of the AMS 56(5):586-599, 2009.
- [Rethinking Visualization: A High-Level Taxonomy](#). InfoVis 2004, p 151-158, 2004.
- [The Eyes Have It: A Task by Data Type Taxonomy for Information Visualizations](#) Ben Shneiderman, Proc. 1996 IEEE Visual Languages
- [The Structure of the Information Visualization Design Space](#). Stuart Card and Jock Mackinlay, Proc. InfoVis 97.
- [Polaris: A System for Query, Analysis and Visualization of Multi-dimensional Relational Databases](#). Chris Stolte, Diane Tang and Pat Hanrahan, IEEE TVCG 8(1): 52-65 2002.

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Further reading: Books

- Visualization Analysis and Design. Munzner. CRC Press, 2014.
 - Chap 2: Data Abstraction
- Information Visualization: Using Vision to Think. Stuart Card, Jock Mackinlay, and Ben Shneiderman.
 - Chap 1
- Data Visualization: Principles and Practice, 2nd ed. Alexandru Telea, CRC Press, 2014.
- Interactive Data Visualization: Foundations, Techniques, and Applications, 2nd ed. Matthew O. Ward, Georges Grinstein, Daniel Keim. CRC Press, 2015.
- The Visualization Handbook. Charles Hansen and Chris Johnson, eds. Academic Press, 2004.
- Visualization Toolkit: An Object-Oriented Approach to 3D Graphics, 4th ed. Will Schroeder, Ken Martin, and Bill Lorensen. Kitware 2006.
- Visualization of Time-Oriented Data. Wolfgang Aigner, Silvia Miksch, Heidrun Schumann, Chris Tominski. Springer 2011.

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Next Time

- to read
 - VAD book, Ch 3: Why: Task Abstraction
 - paper: Design Study Methodology

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