Common 2D infovis

• Comparing numerical value of a data attribute across data entities
Common 2D infovis

• Comparing several numerical values of a data attributes across data entities
Common 2D infovis

- Comparing several numerical values of a data attribute
ThemeRiver: Visualizing Theme Changes over Time

Susan Havre, Beth Hetzler, and Lucy Nowell
Battelle Pacific Northwest Division
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German economic and monetary union

OPEC agrees to raise oil price

NATO to redefine military strategy

Iraq invades Kuwait

Associated Press July - August 1990
ThemeRiver: Visualizing Theme Changes over Time

Associated Press June – July 1990
ThemeRiver: Visualizing Theme Changes over Time

Histogram shows that news is light on Sundays - not a theme shift.
Parallel rivers let users compare AP data from Washington, D.C. and New York from the same time period.
Stacked graphs

• the twin goals are to show many individual time series, while also conveying their sum.
- Superbad
- Hairspray (2007)
- The Silver Surfer
- Rush Hour 3
- X-Men: The Last Stand
- X-Men: The Last Stand and the Order of the Phoenix

Residents Evil: Extinction
Click for details
The Ebb and Flow of Movies: Box Office Receipts 1986 - 2007

Common 2D infovis

• Relationship between 2 data attributes
• http://www.babynamewizard.com/voyager#

1D visualization

• 1D data?
• Point representation
• 1D representations
• 1D+
• $M \times 1D$ data or representation
1D+ Visual Representations

more than one strip of 1D representation

partial use of 2nd dimension

1 vastly dominant dimension
1D Visual Representations

- **x**: Displacement only
- **y**: Displacement with variation
- **xy**: Displacement with variation on both axes
- **z**: Displacement with variation on both axes, shown in a 3D representation
1D visualization

Point data
A single data point that changes over time

Examples?
  Speed
  Temperature
1D visualization

Time – one time divided into hours and minutes
Full circle for hours
Full circle for minutes
1D visualization

altitude when flying

![Diagram showing 1D visualization of altitude when flying. The diagram includes two circular graphs with arrows indicating changes in altitude from 100 to 10,000 feet.]
1D visualization

altitude when flying

Stop

1200

2000

1400

1600

1800

2200
Linear stream data

- Speech
- Music
- Time variate data
- Complex patterns
- In a sequence of symbols
Repeating subsequences

- One type of structure
- Arc Diagrams
- Visualizing matching substrings
Repeating subsequences

A maximal matching pair is a pair of substrings of $S$, $X$ and $Y$, which are:

- **Identical.** $X$ and $Y$ consist of the same sequence of symbols.
- **Non-overlapping.** $X$ and $Y$ do not intersect.
- **Consecutive.** $X$ occurs before $Y$, and there is no substring $Z$, identical to $X$ and $Y$, whose beginning falls between the beginning of $X$ and the beginning of $Y$.
- **Maximal.** There do not exist longer identical non-overlapping subsequences $X'$ and $Y'$ with $X'$ containing $X$ and $Y'$ containing $Y'$.

- In 123a123 what is the maximal matching?
  - 123
  - Not 12 or 23
Repeating subsequences

A maximal matching pair does not always work ideally

• 10101010?

A repetition region $R$ is a substring $R$ of $S$ such that $R$ is made up of a string $P$ repeated two or more times in immediate succession. Each repetition of $P$ is called a fundamental substring for $R$.

ABC010101
“010101” repetition region
“01” fundamental substring
Repeating subsequences

An *essential matching pair* is a pair of substrings of $S$, $X$ and $Y$, which are:

- A maximal matching pair not contained in any repetition region,
- *Or*, a maximal matching pair contained in the same fundamental substring of any repetition region that contains it,
- *Or*, two consecutive fundamental substrings for a repetition region.
Repeating subsequences

Connecting an essential matching pair
Repeating subsequences

A substring repeated three times

Immediate repetition
Repeating subsequences

Macro and micro patterns
Translucency give both readings
Repeating subsequences

Too much detail
Small and large sequences obscure each other
Same sequence
Arc Diagram
Dot plot
Identity matrix for strings
Beethoven's *Für Elise*

Matches based on pitch
And with chords on the top note
Beethoven’s Für Elise.

Top based on pitch.
Bottom based on intervals.
Thread Arcs: an email thread visualization

B. Kerr. Thread Arcs: an email thread visualization

Threads are useful in that they
• provide context for message
• show conversations in progress
• show discussion state
• a type of filter (reduce clutter)
• email editing as a group
Thread Arcs: an email thread visualization

1. **Chronology**: arrival sequence -> evolution, order, initiator and most recent.

2. **Relationships**: all “reply to” relationships visible at a glance. trace back through the chain and see which messages subsequently respond to a particular message.

3. **Stability**: messages should appear in the same location - > finding the thread (or message) in the future, to see additions.

4. **Compactness**: competing for screen space.

5. **Attribute Highlighting**: by a particular person, unread messages, date, time, etc..

6. **Scale**: small threads and large threads. Since usual length between 2 and 20 does not have to scale to hundreds or thousands of messages.

7. **Interpretation/Sense**: sense of the type of conversation (back-and-forth - two people, info request - group responses).
Thread Arcs: an email thread visualization

Chronology
– important -> position

Relationships:

to alleviate confusion
Thread Arcs: an email thread visualization

Bushy
-> many people replying to one sender

Back and forth between two people (narrow)
Thread Arcs: an email thread visualization

Combinatoric space

Distinct message structure for two to five messages
Thread Arcs: an email thread visualization

Stability

A Thread Arc

B tree diagram

C tree table
Thread Arcs: an email thread visualization

Tree Diagram (A) and Tree Table (B) oversimplify the conversational structure of a thread. The 8 Thread Arcs (C) reveal different ways the conversation may have evolved.
Thread Arcs: an email thread visualization
Thread Arcs: an email thread visualization

P  Personal highlighting
T  Time shading
C  Contributor coloring
G  Generational shading
Thread Arcs: an email thread visualization

Different types of sorting
Shows different structure
References

