Information Visualization

Multiple Views

Dr. David Koop
Visualization on Devices other than Personal Computers

VisTiles
[Langner, Horak, and Dachselt, VIS 2017]

David Meets Goliath
[Horak, Badam, Elmqvist, and Dachselt, CHI 2018]

Now: Large Wall-sized Displays

- More data
- More views
- More users

[R. Langner et al.]
Visualizations are more than just views

Visualizations have a rich body of characteristics and certain relationships to other visualizations

<table>
<thead>
<tr>
<th>Visualization Type</th>
<th>Encoding</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data Points</td>
<td>Internal State</td>
</tr>
<tr>
<td></td>
<td>Axis</td>
<td>Data Source</td>
</tr>
</tbody>
</table>

Idea: Considering these aspects alongside device properties and user preferences

[Horak et al., 2019]
Adding Augmented Reality

[Langner et al., 2021]
Classifying MV Layouts

- Display space
- Views of different types
- Small multiples

For example, data-driven models for automated visualization design have been integrated into the development of visualization authoring tools, such as APT (Automated Programming Tool), which builds on studies in graphical perception, to provide the foundation for data-driven MV design.

Empirical research on how MVs are designed in practice, which we categorize as an empirical study on how MVs are designed in practice, has found that MV designs are created by humans, which suggests that MV design is not always optimal. Professional designers, not to mention visualization novices, may struggle with the design of multiple views visualization, which is usually curated manually based on the operational efficiency, and reduction of understanding cost.

Moreover, multiple views visualization is usually curated manually based on the operational efficiency, and reduction of understanding cost. For example, dashboards evolve from single- to multiple-view visualizations, depicting corresponding hierarchies of the views. This approach may not provide guidelines for designing visualizations for more complex datasets.

In the simplest form of a MV design, individual visualizations can be arranged in a grid layout, as shown in VizDeck. However, as we aim to optimize certain properties, which may ignore the resulting effect of space, which can be evaluated by quantitative metrics proposed for layout arrangement in the design of MVs. For example, treemaps are nested data tables, which are often described as space-filling arrangements of the input contents of a single-page infographic layout.

MV design should also take into account the efficiency of the usage patterns of layout arrangement in the design of MVs. For example, VisLink learns to rank visualization configurations patterns of layout arrangement in the design of MVs.

We conduct a formal user study showing the effectiveness of the recommendation system. The system is freely available for the exploration of existing MV designs (Section 6.1), and (2) recommends appropriate MV designs, for both visualization novices and experts. The results of the study suggest that our recommendation system can propose useful and more nuanced MV designs that are more suited for real-world applications.
Frequency of View Count & Type

Fig. 4. Preliminary analyses on distribution of view count (left), and frequency of each view type (right).

- Area
- Bar
- Circle
- Grid
- Table
- Line
- Text
- Map
- Distri.
- SciVis
- Panel

[Chen et al.]
View Aspect Ratio Distribution

![Graph showing view aspect ratio distribution for different visualizations.](image)
Modeling layout design for multiple-view visualization via Bayesian inference
MV Design Factors

• View: Adopt Chen et al.'s Classification (Area Chart, Bar Chart, …)
• Coordination: Exploration, Focus+Context, Comparison
• Viewport: Only Desktop in this paper
• Designer: Creativity, Experience in MVs?

[L. Shao et al., 2021]
MV Layout Metrics

- **Geometry:**
  - Maximum Area Ratio (MAR): how much of one view dominates the visualization? allows identification of focus views
  - Weighted Average Aspect Ratio (WAAR): balanced in matrix arrangements or more diverse?
  - Topology: only horizontal, vertical, and hybrid

[L. Shao et al., 2021]
Effect on Maximum Area Ratio (MAR)

The effect of view on MAR

The effect of coordination on MAR

[L. Shao et al., 2021]
Effect on Weighted Average Aspect Ratio (WAAR)

[L. Shao et al., 2021]
Effect on Topology

[Image: Bar charts showing the effect of SciVis on topology]

[L. Shao et al., 2021]
Findings

- SciVis views have strong influence on topology (horizontal)
- Exploration and focus+context → hybrid
- Comparison → horizontal
- Designer has no significant impact (grouped by continent, however…)

[L. Shao et al., 2021]
MV Developer Options

• Developers can predetermine layout
• Views are positioned based on the data
• Group views that are coordinated together
• Screen size can be used to determine the layout
• Users can determine the layout
Questions

• Do these surveys show how visualizations are being used?
• How much is an artifact of screen size or publication constraints?
Schedule

- Progress Reports Today
- Presentations after Thanksgiving
- Papers due at the end of the semester
Presentations

• Format: Conference Talk
  - Motivation and Introduction
  - Background & Related Work (short)
  - Technique/Methodology
  - Results
  - Conclusion

• Demos or videos are great, pre-record a video of a demo in case
  - Can be done early or later in presentation

• Motivation and results are aided by comparison with other work, that's a good way to point to related work
Presentation Schedule

• 2 on Tuesday
• 3 on Thursday (or vice versa)
• Volunteers?
Paper

- Research paper format (IEEE TVCG preferred)
- Due at the end of the semester
Progress Reports