Best Practices in Data Visualizations

Vihao Pham | 2014
Agenda
Best Practices in Data Visualizations

Why We Visualize
Understanding Data
Visualizations
Enhancing Visualizations
Visualization Considerations
Dashboard Layout
Questions and Answers
Agenda
Best Practices in Data Visualizations

Why We Visualize
Understanding Data Visualizations
Enhancing Visualizations
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Questions and Answers
Why We Visualize

Good Visualizations Should Make Data Actionable
Agenda
Best Practices in Visual Analytics

Why We Visualize
Understanding Data
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Questions and Answers
Understanding Data
Data Can be Classified into Three Groups

Types of Data

Qualitative (Attributes)
- Nominal
- Ordinal

Quantitative (Metrics)
- Numeric
Understanding Data
Data Can be Classified into Three Groups

Nominal Attributes
Data that be counted, but not ordered or aggregated.

Examples:
- Products – Books, Movies, Music
- Gender – Male, Female
- State – Virginia, Nevada, California
Data Can be Classified into Three Groups

**Ordinal Attributes**
Data that can be counted and ordered, but not aggregated.

Examples:
- **Date** – 1/1/2014, 1/2/2014…
- **Grades** – A, B, C…
- **Ranks** – Like, Neutral, Dislike
Understanding Data
Data Can be Classified into Three Groups

Metrics

Quantitative data that can be counted, ordered, and aggregated.

Examples:

- Revenue, Cost, Profit
- Number of Customers
- Temperature
- Time
Understanding Data
Data Can be Classified into Three Groups

Ordinal Attributes and Metrics
Some data can be used as either attributes or metrics. Their classification is dependent on usage.

Examples:
- Age
- Scores
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Best Practices in Visual Analytics

Why We Visualize
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## Appropriate Visualizations

<table>
<thead>
<tr>
<th>Attribute (Nominal)</th>
<th>Metric</th>
<th>Attribute (Nominal)</th>
<th>Attribute (Ordinal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar</td>
<td>Heatmap</td>
<td>Network</td>
<td>Line w/ Break-By</td>
</tr>
<tr>
<td>Heatmap</td>
<td></td>
<td></td>
<td>Bar w/ Break-By</td>
</tr>
<tr>
<td>Column</td>
<td>Line</td>
<td></td>
<td>Scatter Grid</td>
</tr>
<tr>
<td>Metric</td>
<td>Scatter/Bubble</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Visualizations
Attribute (Nominal) and Metric

Comparative Analysis
Bar Chart - Unsorted
Visualizations
Attribute (Nominal) and Metric

Comparative Analysis
Bar Chart - Sorted

<table>
<thead>
<tr>
<th>Origin Airport Name</th>
<th>Number Of Flights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honolulu International</td>
<td>30,000</td>
</tr>
<tr>
<td>Kahului Airport</td>
<td>15,000</td>
</tr>
<tr>
<td>Lihue Airport</td>
<td>10,000</td>
</tr>
<tr>
<td>Keahole</td>
<td>5,000</td>
</tr>
<tr>
<td>General Lyman</td>
<td>5,000</td>
</tr>
<tr>
<td>Seattle/Tacoma International</td>
<td>1,000</td>
</tr>
<tr>
<td>McCarran International</td>
<td>500</td>
</tr>
<tr>
<td>Los Angeles International</td>
<td>500</td>
</tr>
<tr>
<td>Portland International</td>
<td>500</td>
</tr>
<tr>
<td>Metropolitan Oakland International</td>
<td>500</td>
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<tr>
<td>Sacramento International</td>
<td>500</td>
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<tr>
<td>San Diego International</td>
<td>500</td>
</tr>
<tr>
<td>San Francisco International</td>
<td>500</td>
</tr>
<tr>
<td>Sky Harbor International</td>
<td>500</td>
</tr>
<tr>
<td>San Jose International</td>
<td>500</td>
</tr>
</tbody>
</table>
Comparative Analysis

Avoid: Line Chart – Implies continuity between points
Visualizations
Attribute (Nominal) and Metric

Contribution Analysis – Few Elements

Pie Chart
Visualizations
Attribute (Nominal) and Metric

Contribution Analysis – Many Elements
Heat Map
Visualizations
Attribute (Ordinal) and Metric

Time-Series Analysis – Few Elements
Column Chart
Visualizations

Attribute (Ordinal) and Metric

Time-Series Analysis – Many Elements

Line Chart
Visualizations
Attribute (Ordinal) and Metric

Time-Series Analysis

Avoid: Pie Chart – Removes ordinality
Metric and Metric Correlation Analysis Scatter Plot
Visualizations
Attribute (Nominal) and Attribute (Nominal)

Market Basket or Network Analysis

Network Visualization

![Network Visualization Diagram](image-url)
Visualizations

Attribute (Nominal) and Attribute (Nominal)

Market Basket or Network Analysis

**Avoid:** Scatter Grid – Implies ordinality
Visualizations
Attribute (Nominal) and Attribute (Ordinal)

Time-Series Comparative Analysis
Line Chart with Break-By
Visualizations
Attribute (Ordinal) and Attribute (Ordinal)

Cluster or Heatmap Analysis

Scatter Grid
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Enhancing Visualizations for Additional Insights

## Appropriate Visual Enhancements

<table>
<thead>
<tr>
<th></th>
<th>Attribute (Nominal)</th>
<th>Attribute (Ordinal)</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Hue</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Color Saturation</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
Enhancing Visualizations
Color (Hue) to Identify Groups of Attributes
Enhancing Visualizations

Color (Hue) to Identify Groups of Attributes
Enhancing Visualizations
Color (Saturation) to Highlight Metric Patterns
Enhancing Visualizations

Color (Saturation) to Highlight Metric Patterns
Enhancing Visualizations
Adding Size to Emphasize Metric Trends
Enhancing Visualizations
Adding Size to Emphasize Metric Trends
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Visualization Considerations

Color Blindness Affects 10-18% of the Male Population
Visualization Considerations
Colors Should Enhance Data Comprehension, Not Distract

Use Fewer Than 6 Colors
Use Colors to Emphasize Comparisons

Use Opposing Colors for Comparisons

[Diagram showing bar graphs comparing Company A and Company B for the years 2010, 2011, and 2012]
Visualization Considerations
Use Color Temperatures to Highlight Information

Cool Colors: Backgrounds
Warm Colors: Data
Visualization Considerations

Use Color Saturation Correctly

Less Saturation: Smaller Values
More Saturation: Greater Values
Avoid Color Gradients for Backgrounds
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Dashboard Layout
People Have a Bias in How They Read and Scan Content

Reading Gravity

Primary Optical Area

Weak Fallow Area

Strong Fallow Area

Terminal Area
Dashboard Layout
Place the Most Important Visualizations in the Top Left Corner

Reading Gravity

Primary Optical Area

Strong Fallow Area

Weak Fallow Area

Terminal Area
Dashboard Layout
Use Layout to Present Information Hierarchically

Present Information Hierarchically

Diagram showing a layout with sections labeled "Navigator", "Master", and "Detail".
Dashboard Layout
Place High-Level Visualizations to the Left, Detail Visualizations to the Right and Bottom

Present Data Hierarchically
Agenda

Best Practices in Visual Analytics

- Why We Visualize
- Understanding Data Visualizations
- Enhancing Visualizations
- Visualization Considerations
- Dashboard Layout

Questions and Answers
Questions?