Data Visualization for Evaluation Findings

Linda Caswell (Presenter)
Barbara Goodson (Principal Investigator)

Abt Associates
Linda Caswell

Role: i3 TA Liaison, EIR Evaluator

Background: Linda is a Senior Associate in Abt Associates’ Social and Economic Policy division, with more than 15 years of experience conducting, managing, and providing technical assistance on evaluations of interventions and curricula aimed at improving student outcomes, particularly in the areas of language and literacy. She is currently a TA provider for two i3 grants and an evaluator for two EIR grants.
Agenda

- Introduction and overview
- Choosing your visualization: 10 options
- Formatting: 6 tips and tricks
- 5 ways data visualizations can be misleading
- Data visualization resources
Introduction and Overview
Data Visualizations: Storytelling with a Purpose

Visualizations are more than just pie charts and bar graphs

- Can be internalized quickly
- Highlight useful information, without the noise
- More engaging and impactful
- Make it easier to understand and retain important statistics

https://www.tableau.com/learn/articles/data-visualization
## What’s Your Dream Company?

<table>
<thead>
<tr>
<th>Company</th>
<th>Rank</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google</td>
<td>1</td>
<td>19.67%</td>
</tr>
<tr>
<td>Apple</td>
<td>2</td>
<td>12.74%</td>
</tr>
<tr>
<td>Facebook</td>
<td>3</td>
<td>8.90%</td>
</tr>
<tr>
<td>U.S. Department of State</td>
<td>4</td>
<td>7.89%</td>
</tr>
<tr>
<td>The Walt Disney Company</td>
<td>5</td>
<td>7.67%</td>
</tr>
<tr>
<td>Amazon</td>
<td>6</td>
<td>6.63%</td>
</tr>
<tr>
<td>FBI</td>
<td>7</td>
<td>6.59%</td>
</tr>
<tr>
<td>Microsoft</td>
<td>8</td>
<td>5.76%</td>
</tr>
<tr>
<td>Sony</td>
<td>9</td>
<td>5.14%</td>
</tr>
<tr>
<td>Central Intelligence Agency</td>
<td>10</td>
<td>5.04%</td>
</tr>
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Ideal Employers for Young Workers: Google leads the pack

Survey results of 6,700 young professionals

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<td>5.04%</td>
</tr>
<tr>
<td>Nike</td>
<td>5.01%</td>
</tr>
<tr>
<td>Teach for America</td>
<td>4.34%</td>
</tr>
<tr>
<td>NASA</td>
<td>4.32%</td>
</tr>
<tr>
<td>Peace Corps</td>
<td>4.20%</td>
</tr>
<tr>
<td>Electronic Arts</td>
<td>4.06%</td>
</tr>
</tbody>
</table>

The above represents the top 15 companies out of the 150 included in the survey. Companies not shown were chosen by <4% of survey respondents each. Data source: 2011 Universum survey.
Before You Visualize

**Who’s the audience?** Technical or non-technical? What type of information would they find most useful?

**In what format will these visuals be presented?** Is it a report, memo, presentation, webinar?

**Clarify your story.**
Choosing Your Visualization: 10 Options
Perceptions of Visualizations Differ

- Visualizations encode data using cues
- Quantitative data best perceived by aligned length
- Categorical data best represented by color and shape

Visualization source: [http://paldhous.github.io/ucb/2016/dataviz/week2.html](http://paldhous.github.io/ucb/2016/dataviz/week2.html)
1. Big Number + Icon

- **Do:**
  - Use when a single statistic is important

- **Don’t:**
  - Overuse them
  - Use a complicated or unrepresentative icon
2. Icon Array: Pictogram

**Do:**
- Use when a single categorical statistic is important
- Use when you are trying to visualize part of a whole

**Don’t:**
- Use a complicated or unrepresentative icon
2. Icon Array: Waffle Chart

- Do:
  - Use if the data are difficult to represent in an appropriate icon

3. Donut and Pie Charts

- **Do:**
  - Use to show yes/no or parts of a whole
  - Use small multiples with caution
  - Use a side legend, instead of adding labels directly to each slice

- **Don’t:**
  - Use if sum of categories ≠ 100%
  - Use with more than three categories
4. Lollipop Chart

- **Do:**
  - Use when you have A LOT of categories/responses
  - Use if you want to highlight values on opposite sides of a scale

- **Don’t:**
  - Exclude labels if endpoints are important

Visualization source: [https://creativewithdata.com/2019/05/31/title/](https://creativewithdata.com/2019/05/31/title/)
5. Dumbbell Dot Plot

- **Do:**
  - Use when you are comparing two or more numbers (i.e., pre- vs. post-test; treatment vs. control)
  - Use when comparing different points in time

- **Don’t:**
  - Clutter with too many comparisons

Visualization source: [https://www.pluralsight.com/guides/tableau-playbook-dumbbell-chart](https://www.pluralsight.com/guides/tableau-playbook-dumbbell-chart)
5. Dumbbell Dot Plot, Continued
6. Stacked Bar Chart: Simple, 100%

- **Do:**
  - Use to simultaneously compare totals and notice sharp changes at the response level
  - Use instead of a pie chart

- **Don’t:**
  - Have too many values stacked together
7. Overlapping Bar Chart

- **Do:**
  - Use when you have two inter-related statistics that you want to compare
  - Use to depict progress towards a goal or against a benchmark
  - Consider adding a target line if applicable
8. Diverging Stacked Bar Chart

**Do:**
- Use when you have Likert scales/survey data
- Mark the central baseline to tell your story

**Don’t:**
- Have too many bars unless your goal is show an overall trend

9. Geographic Map: Choropleth Map

- Do:
  - Use when you want to highlight geographic differences or similarities

- Don’t:
  - Use when you are interested in intra-regional variation
  - Use if your unit of analysis is not the regional unit shown

Title I funding per low-income child in 2017 by state
Vermont, Wyoming and North Dakota received substantially more Title I grant money per eligible child in FY2017 than other states.

Visualization source: https://journalistsresource.org/studies/society/education/2020-census-title-i-maps/
9. Geographic Map: Tile Square Map

- **Do:**
  - Use when you want to equalize units that are geographically dissimilar
  - Use any consistent shape (squares, hexagons)

- **Don’t:**
  - Use if the actual location and relation of regions to one another is important

10. Network: Flow or Diagram

Do:
- Use to show how things are interconnected
  - Can be directed (flow) or not (diagram)
- Use with qualitative or quantitative data

Don’t:
- Make it too complicated

Visualization Source: [http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan](http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan)
Formatting: 6 Tips and Tricks
Example Bar Chart Before Formatting

Money spent abroad in millions, 2016

- Singapore
- France
- Russian Federation
- Korea, Republic of
- United States
- Italy
- Hong Kong, China
- Canada
- United Kingdom
- Australia

1. Make an Active Title

- Write an “active” title that describes the main point you are trying to make
- Keep it short (6 to 12 words, or one line in a report)
  - Note any nuances in text, an exhibit note, or during your presentation
2. Intentionally Order Your Data

- Intentionally order your data

- You can group by:
  - Frequency
  - Time period
  - Alphabetically

![Bar chart showing U.S. tourists spent the most money abroad in 2016.](chart)
3. Unclutter Your Visuals

- Delete or minimize grid lines
- Consider deleting your axis line and instead use numeric labels
  - The exception is line graphs

<table>
<thead>
<tr>
<th>Country</th>
<th>U.S. tourists spent the most money abroad in 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>121,526</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>63,586</td>
</tr>
<tr>
<td>France</td>
<td>40,427</td>
</tr>
<tr>
<td>Canada</td>
<td>29,104</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>26,642</td>
</tr>
<tr>
<td>Australia</td>
<td>25,255</td>
</tr>
<tr>
<td>Italy</td>
<td>24,991</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>24,194</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>23,951</td>
</tr>
<tr>
<td>Singapore</td>
<td>22,102</td>
</tr>
</tbody>
</table>
4. Strategically Place Minimal Labels

- Think about placement for easiest understanding
  - Should always be horizontal

- Minimize to the extent possible
  - If possible, annotate each slice/bar/point directly
  - Use as few decimal points as possible, but be consistent
  - Avoid redundancy – only use a label once

<table>
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<tr>
<th>Country</th>
<th>Spending (mil)</th>
</tr>
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<td>United States</td>
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5. Color

- Choosing color:
  - Use similar colors to represent the same data
  - Use gradients of the same color
  - Use color to highlight important numbers

- Greyscale and color blindness

- Color sets tone

### U.S. tourists spent the most money abroad in 2016

- United States: $121,526 mil
- United Kingdom: $63,586 mil
- France: $40,427 mil
- Canada: $29,104 mil
- Republic of Korea: $26,642 mil
- Australia: $25,255 mil
- Italy: $24,991 mil
- Hong Kong: $24,194 mil
- Russian Federation: $23,951 mil
- Singapore: $22,102 mil
Comparison – Original vs. Revised

Money spent abroad in millions, 2016

- Singapore
- Russian Federation
- Hong Kong, China
- Italy
- Australia
- Korea, Republic Of
- Canada
- France
- United Kingdom
- United States
Comparison – Original vs. Revised

Money spent abroad in millions, 2016

- United States: 121,526 mil
- United Kingdom: 63,586 mil
- France: 40,427 mil
- Canada: 29,104 mil
- Republic of Korea: 26,642 mil
- Australia: 25,255 mil
- Italy: 24,991 mil
- Hong Kong: 24,194 mil
- Russian Federation: 23,951 mil
- Singapore: 22,102 mil

U.S. tourists spent the most money abroad in 2016.
6. All Fonts Are Not Created Equal

- Different fonts can evoke emotion and have personality

- Choice of fonts can impact readability and legibility

https://venngage.com/blog/how-to-choose-fonts/
5 Ways Data Visualizations Can Be Misleading
1. Showing a Limited Range of Potential Scores

Percent Who Agreed with Court

Democrats: 64%
Republicans: 52%
Independents: 54%

Image: Western Reserve Public Media
1. Showing a Limited Range of Potential Scores

Image: Western Reserve Public Media
2. Manipulating the y-axis

Average Annual Global Temperature in Fahrenheit
1880-2015
2. Manipulating the y-axis

Average Annual Global Temperature in Fahrenheit
1880-2015

Average global temperature, 1880 to 2014
60°F fahrenheit

Date: NASA
3. Cherry-picking the Data

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**Arctic Ice Area 1989 and 2009 by Month**

(million square kilometers)

This is the data point cherry-picked by the Heartland Institute to argue that there was more ice in 2009 (red line) than 1989 (blue line).

Source: P. Gleick 2011 from NSIDC data
4. Using the Wrong Type of Chart

![Image of a pie chart showing the number of 1st-round picks for various universities. The chart includes the following numbers and universities: 49 for Alabama, 47 for Florida, 69 for USC, 60 for Miami, 64 for Ohio State. The chart is titled "Most 1st-Rounders in Common Era by School."
4. Using the Wrong Type of Chart

Most Players Drafted In The First Round

[Chart showing the number of players drafted in the first round by different universities]
5. Going Against Conventions

States by Total Population

- 15+
- 10-15
- 5-10
- 1-5
- 0-1

millions of people
5. Going Against Conventions

States by Total Population

- 15+ millions of people
- 10-15 millions of people
- 5-10 millions of people
- 1-5 millions of people
- 0-1 millions of people
5. Going Against Conventions, Continued

![Chart showing gun deaths in Florida](chart.png)

**Gun deaths in Florida**

Number of murders committed using firearms

- **2005**: Florida enacted its ‘Stand Your Ground’ law

Source: Florida Department of Law Enforcement

C. Chan 16/02/2014
5. Going Against Conventions, Continued
Data Visualization Resources
Data Visualization Resources

- **Graph Types:**
  - [https://datavizproject.com/](https://datavizproject.com/)
  - [https://www.data-to-viz.com/](https://www.data-to-viz.com/)
  - [https://depictdatastudio.com/charts/](https://depictdatastudio.com/charts/)
  - Effective Data Visualizations: The Right Chart for the Right Data by Stephanie Evergreen

- **Formatting:**
  - Stephanie Evergreen’s Data Visualization Checklist
Data Visualization Resources, Continued

- **Other Webinars:**
  - Data Visualization Storytelling (1h45m) covered somewhat in his overall course [https://www.linkedin.com/learning/data-visualization-storytelling/welcome?u=77842946](https://www.linkedin.com/learning/data-visualization-storytelling/welcome?u=77842946)
  - Picking the Right Chart for your Data (1h 30m) [https://www.linkedin.com/learning/picking-the-right-chart-for-your-data/welcome?u=77842946](https://www.linkedin.com/learning/picking-the-right-chart-for-your-data/welcome?u=77842946)
Questions
EIR Evaluation TA Team

EIREvalTA@AbtAssoc.com

www.abtassociates.com