Communicating Evidence Visually: Overview

Visual or Verbal
Tables vs Figures
Constructing Tables
Constructing Figures
Visual Communication and Ethics
Using Graphics as an Aid to Thinking
Visual or Verbal

Some data are equally clear verbally or graphically

In 1996, on average, men earned $33,144 a year, women $23,710, a difference of $9,434.

Some are too complex verbally:
In 1970 almost nine out of ten families had two parents—85%. But in 1980 that number declined to 77%, then to 73% in 1990, and to 68% in 2000. The number of 2-parent families rose, particularly families headed by just a mother. In 1970 just 11% of families were headed by a single mother. In 1980 that number rose to 17%, in 1990 to 20%, and to 23% in 2000. Single fathers headed just 1% of the families in 1970; 2% in 1980, 3 percent in 1990, and 4% in 2000. Families with no adult in the home have remained stable at 3–4% from 1970–2000.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 parents</td>
<td>77%</td>
<td>73%</td>
<td>68%</td>
<td></td>
</tr>
<tr>
<td>Single mother</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single father</td>
<td>1%</td>
<td>2%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>No adult in home</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Exact Numbers

Visual or Verbal

Depends on data
Depends on what you want to communicate
Depends on convention of the field/venue
Never should be used for obfuscation
Tables vs Figures

Data, communicative goal, convention

Tables preferred if the point is to show data precisely and you don’t want to impose interpretation

Figures preferred for communication purposes if precise data presentation is not the point

Constructing Tables

Introduce your data with a sentence that explicitly tells the reader what to see in them. Then give the table, graph, or chart a title that explicitly names its purpose.

Organize your data, bar chart, or line graph in a way that anticipates how your readers will use it, and highlight those data most relevant to the claim you want the data to support.

Down the left-hand side of the table, list the items whose numbers you are presenting to the right.

Across the top, list the categories of data. If your table represents a sequence of months, years, and so on, put them across the top.

Group and order the items running down the left side and across the top so that what goes together conceptually is grouped together visually; present everything in an order that helps readers find what they want them to look for quickly and reliably. Choose an alphabetical order only if there are a lot of items and you have no particular point to draw from the data.

Don’t clutter a table with horizontal and vertical lines separating all rows and columns. If there are five to seven rows, use faint separating lines horizontally; for eight to twelve rows, put a small space or heavier line between every four rows; for very large tables, use faint gray scale for rows at regular intervals (every other row, every fifth row, etc.).

Make your numbers relevant to your readers’ needs by rounding to eliminate irrelevant differences. The numbers 2,123,000 and 2,124,000 may be irrelevantly precise if no decision or judgment will turn on a difference of 1,000. In most cases, you would help readers by representing both as 2.1 million.
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Though the United States has had unprecedented economic growth in the last twenty-five years that has benefited some, most Americans have lost ground. Between 1977 and 1999, the top 20% of wage earners increased their income by more than 38%, and the top 1% more than doubled theirs, but the bottom 60% of the population earned less in 1999 than they did in 1977.

### Table 1: Changes in After-Tax Annual Income, 1977–1999

<table>
<thead>
<tr>
<th>Income Level</th>
<th>1977</th>
<th>1999</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top 20%</td>
<td>$12,000</td>
<td>$18,000</td>
<td>50%</td>
</tr>
<tr>
<td>Second 20%</td>
<td>$8,000</td>
<td>$12,000</td>
<td>50%</td>
</tr>
<tr>
<td>Third 20%</td>
<td>$4,000</td>
<td>$6,000</td>
<td>50%</td>
</tr>
<tr>
<td>Fourth 20%</td>
<td>$2,000</td>
<td>$3,000</td>
<td>50%</td>
</tr>
<tr>
<td>Bottom 60%</td>
<td>$1,000</td>
<td>$1,500</td>
<td>50%</td>
</tr>
</tbody>
</table>

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**TABLE 15.5: Unemployment Rates of Major Industrial Nations**

<table>
<thead>
<tr>
<th>Country</th>
<th>1990</th>
<th>1995</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>6.2</td>
<td>5.3</td>
<td>(0.8)</td>
</tr>
<tr>
<td>Canada</td>
<td>7.1</td>
<td>5.9</td>
<td>(1.2)</td>
</tr>
<tr>
<td>France</td>
<td>8.8</td>
<td>6.4</td>
<td>(2.4)</td>
</tr>
<tr>
<td>Germany</td>
<td>6.0</td>
<td>5.1</td>
<td>(0.9)</td>
</tr>
<tr>
<td>Italy</td>
<td>9.8</td>
<td>8.5</td>
<td>(1.3)</td>
</tr>
<tr>
<td>Japan</td>
<td>2.1</td>
<td>3.1</td>
<td>(1.0)</td>
</tr>
<tr>
<td>Sweden</td>
<td>5.3</td>
<td>4.6</td>
<td>(0.7)</td>
</tr>
<tr>
<td>USA</td>
<td>6.0</td>
<td>5.1</td>
<td>(0.9)</td>
</tr>
<tr>
<td>UK</td>
<td>6.9</td>
<td>5.1</td>
<td>(1.8)</td>
</tr>
<tr>
<td>Brazil</td>
<td>8.1</td>
<td>5.5</td>
<td>(2.6)</td>
</tr>
</tbody>
</table>

**TABLE 15.6: Changes in Unemployment Rates**

<table>
<thead>
<tr>
<th>Country</th>
<th>1990-1995</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>6.2-5.3</td>
<td>0.8</td>
</tr>
<tr>
<td>USA</td>
<td>5.4-6.0</td>
<td>0.6</td>
</tr>
<tr>
<td>Canada</td>
<td>7.1-5.9</td>
<td>1.2</td>
</tr>
<tr>
<td>Italy</td>
<td>9.8-8.5</td>
<td>1.3</td>
</tr>
<tr>
<td>Japan</td>
<td>2.1-3.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Sweden</td>
<td>5.3-4.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Brazil</td>
<td>8.1-5.5</td>
<td>2.6</td>
</tr>
</tbody>
</table>

**Constructing Figures**

Use a format that best tells your story:

**TABLE 15.7: Rise in Public and Private Spending on Health (in Billions), 1960–1999**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>20.1</td>
<td>45.5</td>
<td>141.0</td>
<td>413.2</td>
<td>662.1</td>
</tr>
<tr>
<td>Public</td>
<td>6.6</td>
<td>27.6</td>
<td>104.8</td>
<td>282.4</td>
<td>548.1</td>
</tr>
</tbody>
</table>

**Figure 15.3: Rise in Public and Private Spending on Health (in Billions), 1960–1999**
Constructing Graphics

Concept of Dependent vs Independent Variables

Convention is to put IV on the horizontal axis and the DV on the vertical axis

Use appropriate grid intervals

Choose graph types appropriately (e.g., bar graphs for static comparisons, line graphs for trend information)

Don’t go crazy with Excel just because you can

Constructing Graphics

Line Graphs
Bar Charts
Stacked Bar Charts
Horizontal Bar Charts
Centrally-Divided Bar Charts
Pie Charts
Avoid 3D Graphics
Constructing Graphics: Line Graphs

- Avoid clutter (e.g. too many dependent variables)
- Use line labels instead of just using legends
- Mark key data points and critical points on the graph

Constructing Graphics: Bar Charts

- Group the bars into related sets whenever possible.
- Arrange the bars so that they give an image of order.
- Highlight a bar if it is a relevant point of comparison for the others.
- Keep visual contrasts simple: black, white, and one or two shades of gray. If possible, avoid cross-hatching, stripes, and so on (impossible if you try to chart too many cases).
- If necessary, include numbers above the bars to give readers more precision.
- For study results with statistics, plot both means and error bars or confidence intervals (typically one standard division).
Constructing Graphics: Bar Charts

Organize your bar graph to support the point you want to make.

Most of the world's desert areas are concentrated in Africa.

Constructing Graphics: Stacked Bar Charts

Avoid stacked bars if possible.

Arrange the segments in some principled order, from bottom to top. If feasible, put the largest elements at the bottom, smaller ones on top, and use the darkest color at the bottom, lightest at the top.

Use numbers and connecting lines to clarify proportions.

Don't bother to include cases whose numbers are so small that they are dwarfed by larger ones.
Constructing Graphics: Horizontal Bar Charts

Sometimes used because of typographical advantage

May be useful in some ‘space crunch’ situations

Constructing Graphics: Centrally-Divided Bar Charts

Useful in certain circumstances for direct comparisons

Vertical configurations are OK, but may be challenging typographically
Constructing Graphics: Pie Charts

Pie charts are seldom used academically, and can be considered amateurish.

- If you have to use them:
  - Arrange the segments in an order meaningful to your readers, beginning at 12 o'clock and moving clockwise. If you have no better order, arrange the segments from largest to smallest.
  - If one segment is significant, emphasize it by coloring it or breaking it out from the rest.
  - Don’t use a legend; label the segments directly.

Constructing Graphics: Avoid 3D Graphics

Avoid 3D graphics

- 3D is seldom necessary

- Never use overly cute graphics unless you are writing a popular magazine article
Visual Communication and Ethics


Graphics can be manipulated to mislead.

Using Graphics as an Aid to Thinking

Graphics and tables are effective tools to support exploration and thinking about data, not just for data presentation.