Visualizing Data for Business Reporting and Analysis

Getting Started
Information design is a discipline that draws from several other disciplines. Improving your data visualization skills will be hard at first. Time constraints, tool limitations, and cultural inertia will work against you. Start by learning about effective practices and techniques.

Learn from the Masters
Learn about effective techniques from the masters. Here is a list of resources to get you started.

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<td>Edward Tufte</td>
<td>The Visual Display of Quantitative Information, 2nd</td>
<td>2001</td>
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<td>Envisioning Information</td>
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<td>Beautiful Evidence</td>
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<td>Stephen Few</td>
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<td>William Cleveland</td>
<td>The Elements of Graphing Data, 2nd Edition</td>
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<td>Visualizing Data</td>
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Master the Basics
Master the basic techniques first. Apply those techniques to small problems when time is not a factor. Learn how to use your given tools more effectively. Then, start applying the techniques in non-critical situations. As you become more comfortable, find harder problems to work. Try some new techniques with larger data sets and harder problems.

Find Good Examples
Information design is a research project not a creative exercise. Look for effective examples of solved problems in elite journalism, science, cartography, medical settings, and industrial operations. Evaluate designs on their effectiveness at illuminating complex situations. Avoid examples from marketing and politics. These fields use similar visual techniques but for a very different and sometimes opposing purpose.

Remember: The Oracle Only Has Answers, So Ask Very Good Questions
In ancient mythology, oracles gave people seeking their advice seemingly perfect answers, just not how the person receiving the advice expected. People naturally want to make sense of the information they receive, but this doesn’t mean they do. The information designer must be aware of people’s decision making biases. People tend to bias towards drawing conclusions quickly, giving more weight to recent trends, and misattribute causes with effects. Asking the right questions is the most fundamental component of analysis.

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The Problem: Presenting Meaningful Comparisons in Limited Space and Time
Analyzing and communicating business data in support of effective decision-making is challenging. Information Design can help you turn data into information, but it takes more than simply selecting a chart type in a program.

The human visual systems can process large amounts of information and detect patterns quickly; however, the human visual system does not decode all visual attributes equally and benefits from making comparison that are presented on the same visual display instead of sequentially in time.

The challenge of information design is to present the audience with meaningful comparisons, often multivariate in nature, in limited two-dimensional space and time. Therefore, the information designer must make choices that efficiently and effectively use the limited space and time available.

The Design Approach: Focus on Content and Comparisons
Design is about making choices. Information Designers must make thoughtful choices because they have a lot of content to fit in a limited space.

Understand the Audience and Their Needs
Understand who your audience is and what their goals are. What is the content they need to understand a problem, take an action, or make a decision? If they need to make decisions, what is the time frame of their decision making? Is there some action your audience needs to take from the information presented?

Identify Important Comparisons
What are the key comparisons that support the audience’s thinking tasks? Analytical thinking and policy thinking are causal thinking. The primary thinking task is answering the question “…compared to what?” Information is data put “in formation”. Form turns data into information.

Organize the Content as a Narrative
People learn and remember stories. This is how we turn short term memory into long term memory. Organize the content to flow as a narrative. Start with the conclusion and then present the evidence in decreasing order of importance. Context turns information into intelligence.

Create the Displays Using Data Visualization Best Practices
The human visual system is very good at processing large amounts of information and finding patterns. However, it neither processes all visual attributes equally, nor does it process visually represented information equally. Use data visualization best practices to help the audience process, compare, and comprehend the display efficiently and effectively. The audience doesn’t have to “get” the visualization immediately, especially if the problem is complicated. However, the audience should be using their mental energies to understand the data not the design.

Get Feedback
The best way to know if you are successful is to launch your design into the wild and get feedback. Beware of “like” and “don’t like” discussions. These discussions have no resolution. Focus on aiding the thinking task of the audience. People should be focusing on the data not the design.

Refine
The design can always be improved. Is there better content to help the audience? Did the thinking tasks change? Are there more comparisons the audience needs to put information in context? Intelligence is a perishable product and a constant service.
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Selected Design Best Practices

Arrange Content in Space Instead of Stacking in Time

The human visual system finds patterns and process information better when comparisons are presented on the same display because the brain is not tasked to use short term memory. Stacking in time is turning a page in a report, transitioning slides in a presentation, or clicking to another screen on an electronic display. Scrolling, panning, and zooming are methods of stacking in time as well but usually provide a sense of local context and provide fast movement on the display.

Arranged in Space

Maximize Data Density by Minimizing Non-Data Elements

Not all objects on the display have equal importance and space is scarce. Devote most of the space to content and use visual attributes to create a visual hierarchy. Everything on the display will compete and interact with everything else, regardless of your intentions. Give elements on the display visual importance in the following order:

1. Content, data, and comparisons should have the most visual weight. Even within this group, not all elements are equal.
2. Axes, scales, legends, borders, controls, footer information, and navigation. These elements play important roles but should not upstage the content. They are support.
3. Branding, like logos, and non-data graphics can serve a purpose but they are not why someone is consuming your display.

Based on how people read, these are the areas of the display that are emphasized or not.

Emphasized Neutral

Emphasized

Neutral

De-emphasized

Use Grid layouts, Spacing, Alignment and White Space to Aid Scanning

Make scanning and reading easy. Use grid layouts to structure pages and promote scanning and comparisons. Use white space and proximity to define the grid instead of strong borders. Use light borders to group like elements into distinct groups.

- Left align text, IDs, and dates.
- Right align numbers along the decimal point.
- Center icons or codes of the same length.
- Align column headers with the alignment of the cell contents.
- Use upper and lower case. Use all UPPERCASE only for emphasis.
- Follow reading conventions of your audience. For western languages this means reading top to bottom, left to right. Text should be as horizontal as possible. Scales increase bottom to top, left to right.

Honestly and Effectively Represent Data Visually for Clear, Quick Decoding by the Human Visual System

Not all methods of representing data visually are equally effective. Choose the best encoding method for the data. Understand how different chart types represent data. Understand the limitations of different encoding methods. Make sure those graphical elements that represent data change proportionally with the data.

Important Consideration

- People perceive angles near 45 degrees better than steep or flat angles. Choose an aspect ratio for line graphs that makes the trends lumpy instead of spiky or flat.
- People calculate the difference between two lines at the tangents of the lines. This makes comparing two lines that both change at high rates difficult. Graph the difference between the lines.
- People perceive visual elements in relation to neighboring visual elements. This point is especially important when using color or area.
- Colors have different meanings in different cultures and are perceived differently, or not at all, by the color blind.

Create Macro/Micro Views

Provide an overview of the whole picture first, preferably by showing individual data points in relation to the whole. Aggregation can help provide an overview of large data sets but use aggregation wisely because it can obscure stratifying variables and dimensions. In interactive displays, let the user zoom and filter, and then get details on demand. Keep the hierarchy more flat than deep or the user might become disconnected from the big picture.