Display Platforms for Quantitative Information

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When we present quantitative information to others, we must first determine the most effective manner in which that information can be conveyed. What will serve as the best platform of display? A dashboard? A static report? Something more interactive? In this article, I'm providing guidelines to help you make this decision.

The ways in which we display quantitative data and the types of data interaction that we enable in those displays are largely determined by the ways in which the data will be used. Different uses require different platforms of display. By platform, I mean either 1) a software tool that supports particular forms of display and functions for interacting with the data, 2) an information display that has been designed in a particularly way, or 3) both. For example, a dashboard, as I define the term, is a visual display people use to quickly and easily monitor what's going on. In this case, the *dashboard* (display platform) is used for *rapid monitoring* (purpose).

Based on my observations over several years, quantitative data displays are typically used for the following purposes:

- **Lookup**: to find particular facts when they're needed

- **Narrative**: to communicate a particular set of related facts contained in a data set

- **Monitoring**: to rapidly update one's awareness of a situation

- **Guided Data Analysis**: to perform a specific analytical task using an application that is designed to do that in particular

- **Exploratory Data Analysis (EDA)**: to explore and analyze a data set to find and understand useful information, rather than attempting to answer a particular question

- **Predictive Analysis**: to determine probable outcomes related to particular conditions

I classify the display platforms that support these uses as follows:

- **Lookup Report**, for *lookup*

- **Explanatory Report**, for *narrative*

- **Infographic**, for *narrative*

- **Live Presentation**, for *narrative*

- **Dashboard**, for *monitoring*

- **Analytical Application**, for *guided data analysis*

- **EDA Tool**, for *exploratory data analysis*

- **Predictive Model**, for *predictive analysis*

Each of these display platforms vary across the following set of characteristics:

- **Interaction**: The degree to which interactions with the data must be supported: 1) none, 2) links and tooltips only, 3) the addition of selection/filtering, 4) more, but limited, and 5) flexible and fluid

- **Frequency of use**: How often a particular individual would typically use the display: 1) rarely, 2) occasionally, and 3) regularly

- **Data update frequency**: How often the data that appears in the display is updated: 1) never, 2) seldom, 3) often, and 4) real time or near real time

- **Urgency of response**: How quickly a person using the display might typically need to respond to something that appears in it: 1) low (i.e., anytime from soon to later) and 2) high (i.e., without delay)
- **Analytical sophistication of the audience/users**: The level of analytical expertise possessed by those who use the display: 1) low, 2) mid, and 3) high
- **Medium of display**: The medium that is used to present the display: 1) paper, 2) large screen (e.g., on a projection screen for an audience to view), 3) desktop/laptop, 4) tablet, and 5) smartphone

These profiles will help us understand the nature of the display platforms and will also help us choose between platforms when more than one can serve a particular use case (i.e., in the case of narrative).

Display Platforms

This collection of display platforms that I'm proposing is not comprehensive, but it includes those that are typically useful today. Also, these platforms are not perfectly distinct from one another. There are times when hybrid or even new approaches might be necessary. And finally, these platforms are not the only possible way to classify the approaches that are available for quantitative data sensemaking and communication. Other taxonomies are certainly possible and potentially useful. Treat this content as a set of flexible guidelines and feel free to disagree with them. What matters most is that, before displaying data, we think about the ways that it will be used. Choosing an appropriate platform should be thoughtful, never arbitrary.

Let's consider the platforms individually.

Lookup Report

Organizations routinely produce great reams of lookup reports. This is what most traditional business intelligence (BI) systems have been churning out for years. They consist mostly of tabular reports—information arranged in columns and rows, with quantitative values expressed textually as numbers. Typically, information is segregated into logical groups and ordered either alphabetically or chronologically. As the name suggests, people use these reports to look up particular facts as they're needed. When designed properly, the arrangement of information makes is easy to efficiently find the particular fact that's needed. Lookup reports may be printed on paper or displayed online. When displayed online, additional means to lookup particular facts may be provided in the form of search, selection, and filter controls.

Lookup reports are typically characterized as follows (highlighted in red):

Use: Lookup
Platform: Lookup Report

Characteristics					
Interaction	None	Links & Tooltips Only	Plus Selection/Filtering	More, but Limited	Flexible & Fluid
Frequency of Use	Rarely		Occasionally		Regularly
Data Update Frequency	Never	Seldom		Often	Real Time
Urgency of Response	Low				High
Analytical Sophistication of Audience/Users	Low		Mid		High
Display Medium	Paper	Large Screen	Desktop/Laptop	Tablet	Smartphone

It's worth noting that lookup reports typically require no interaction other than what's needed to find particular facts.

Explanatory Report

As I'm using the terms, *explanatory reports* and *infographics* are similar. They are both used to communicate a particular set of facts to an audience. This is often called *storytelling* today, but the content doesn't necessarily need to be expressed in the strict form of a story. Explanatory reports differ from infographics in that they don't necessarily need to include graphics and people are usually willing to take some time viewing them, not necessarily expecting to assimilate the information quickly. An organization's annual report is an example of an explanatory report.

Explanatory reports are typically characterized as follows:

Use: Narrative

Platform: Explanatory Report

Characteristics					
Interaction	None	Links & Tooltips Only	Plus Selection/Filtering	More, but Limited	Flexible & Fluid
Frequency of Use	Rarely		Occasionally		Regularly
Data Update Frequency	Never	Seldom		Often	Real Time
Urgency of Response	Low				High
Analytical Sophistication of Audience/Users	Low		Mid		High
Display Medium	Paper	Large Screen	Desktop/Laptop	Tablet	Smartphone

Worth noting is the fact that explanatory reports do not require any interaction. They contain all of the information that the author wishes to communicate to a particular audience.

Infographic

An infographic combines words, numbers, and graphics, as needed, to communicate a particular message. When they're designed well, the specific medium of expression, whether words, numbers, or graphics, is always chosen because it communicates the content most effectively.

Infographics are typically characterized as follows:

Use: Narrative

Platform: Infographic

Characteristics					
Interaction	None	Links & Tooltips Only	Plus Selection/Filtering	More, but Limited	Flexible & Fluid
Frequency of Use	Rarely		Occasionally		Regularly
Data Update Frequency	Never	Seldom		Often	Real Time
Urgency of Response	Low				High
Analytical Sophistication of Audience/Users	Low		Mid		High
Display Medium	Paper	Large Screen	Desktop/Laptop	Tablet	Smartphone

Usually, a person views an infographic only once to absorb its content and that content doesn't change. There are exceptions, however, such as the Wind Map of the United States, designed by Martin Wattenberg and Fernanda Viegas, which someone might access regularly to view current wind patterns.

Live Presentation

The remaining display platform for narrative content is a live presentation. When we present quantitative information to a group of people who are all simultaneously present in one location, we must display it in a large format that everyone can see. We typically do this by projecting the content onto a large screen and designing the content as a sequential series of slides (e.g., PowerPoint or Keynote). A sequential series of content can also be presented using a data visualization tool that supports separate views that we can navigate by clicking tabs or a sequence of links.

Live presentations are typically characterized as follows:

Use: Narrative

Platform: Live Presentation

Characteristics					
Interaction	None	Links & Tooltips Only	Plus Selection/Filtering	More, but Limited	Flexible & Fluid
Frequency of Use	Rarely		Occasionally		Regularly
Data Update Frequency	Never	Seldom		Often	Real Time
Urgency of Response	Low				High
Analytical Sophistication of Audience/Users	Low		Mid		High
Display Medium	Paper	Large Screen	Desktop/Laptop	Tablet	Smartphone

The primary factor that distinguishes a live presentation from other forms of narrative display is the large screen. Because people view the content from a distance, everything must be larger than usual, which limits the amount of content that can be shown on the screen at once. We usually sequence the content in a series of slides, in part, because it is difficult to show a great deal of information simultaneously, which forces us to break it down into smaller chunks.

Dashboard

A dashboard, as I define it, is a display that people use to rapidly monitor information. Think of it as a display that's used to maintain situation awareness. Anyone who must regularly update his or her awareness of the current state of things (e.g., a sales manager tracking daily sales activity or an operations manager tracking what's happening on the manufacturing floor in real time) can potentially benefit from a dashboard, much as an airline pilot benefits from her cockpit displays or a driver benefits from the information that appears on his car dashboard.

Dashboards are typically characterized as follows:

Characteristics					
Interaction	None	Links & Tooltips Only	Plus Selection/Filtering	More, but Limited	Flexible & Fluid
Frequency of Use	Rarely		Occasionally		Regularly
Data Update Frequency	Never	Seldom		Often	Real Time
Urgency of Response	Low				High
Analytical Sophistication of Audience/Users	Low		Mid		High
Display Medium	Paper	Large Screen	Desktop/Laptop	Tablet	Smartphone

The only interactions that we should typically enable in a dashboard are links to additional information that can be easily accessed when needed, and tooltips that provide brief bits of additional information in the moment while hovering over particular content with a mouse. Further interaction should be discouraged because the ability to change what appears on the dashboard, the location where it appears, or aspects of its visual design, would work against the user's ability to become familiar with the dashboard well enough to rapidly assimilate its information. This is the only display platform and use case that typically requires an immediate response.

Analytical Application

When people routinely perform a particular analytical task or series of related analytical tasks, it makes sense to automate the process in the form of an analytical application that packages and customizes the data, views, and routine interactions that are needed to perform the task efficiently.

Analytical applications are typically characterized as follows:

Use: Guided Data Analysis

Platform: Analytical Application

Characteristics					
Interaction	None	Links & Tooltips Only	Plus Selection/Filtering	More, but Limited	Flexible & Fluid
Frequency of Use	Rarely		Occasionally		Regularly
Data Update Frequency	Never	Seldom		Often	Real Time
Urgency of Response	Low				High
Analytical Sophistication of Audience/Users	Low		Mid		High
Display Medium	Paper	Large Screen	Desktop/Laptop	Tablet	Smartphone

The level of interaction that we enable in an analytical application should be limited to those functions that are needed to perform the analytical task for which it was designed. Anything more would complicate its use.

Exploratory Data Analysis Tool

The process of exploring and analyzing data requires an extreme degree of flexibility and fluidity of interaction. It must always be easy to get to the next view of the data that we need to make sense of it, which requires

the ability to rapidly change the graph type, add and remove variables, filter the data, sort the data, rearrange graphs on the screen to simplify comparisons, and every other interaction that we might need to create that next view. Only EDA tools are specifically designed for this purpose.

EDA tools are typically characterized as follows:

Use: Exploratory Data Analysis (EDA)

Platform: EDA Tool

Characteristics					
Interaction	None	Links & Tooltips Only	Plus Selection/Filtering	More, but Limited	Flexible & Fluid
Frequency of Use	Rarely		Occasionally		Regularly
Data Update Frequency	Never	Seldom		Often	Real Time
Urgency of Response	Low				High
Analytical Sophistication of Audience/Users	Low		Mid		High
Display Medium	Paper	Large Screen	Desktop/Laptop	Tablet	Smartphone

Notice that only people with a high degree of analytical sophistication can use EDA tools. I'm not saying that only those who are highly trained in statistics can use them, but that exploratory data analysis beyond a rudimentary level requires a set of skills that can only be acquired through training and experience, and more than a basic understanding of statistics. Also notice that the only display medium that's appropriate is a desktop/laptop computer. A tablet could be used for EDA to a limited degree, but to do it well we need a screen that is larger than those found on existing tablets because we must often view a great deal of information at once.

Predictive Model

Before predictive analysis can be done to determine the probability of a particular outcome (dependent variable) based on a particular set of input conditions (independent variables), a predictive model must be built. This requires an expert knowledge of statistics. Once the model is built, however, it can be used by others with less expertise.

Predictive models are typically characterized as follows:

Use: Predictive Analysis

Platform: Predictive Model

Characteristics					
Interaction	None	Links & Tooltips Only	Plus Selection/Filtering	More, but Limited	Flexible & Fluid
Frequency of Use	Rarely		Occasionally		Regularly
Data Update Frequency	Never	Seldom		Often	Real Time
Urgency of Response	Low				High
Analytical Sophistication of Audience/Users	Low		Mid		High
Display Medium	Paper	Large Screen	Desktop/Laptop	Tablet	Smartphone

Notice that users of low analytical sophistication are excluded. While it is true that someone with little analytical skill could enter input variables to see the probable outcome resulting from those inputs, greater skill is usually required to understand that outcome. It would be risky for someone who didn't understand the relationships between the variables that were built into the model—at least at a basic level—to rely on the model when making decisions. For instance, someone with little analytical acumen might not notice when the model produces an error that would be obvious to anyone with greater understanding.

Concluding Thoughts

Written guidelines like these can be useful, especially when developing skills. I always provide them with reservations, however, because they can be misused and counterproductive when we follow them as a rigid set of procedures without thinking. I'm hoping that these guidelines will encourage you to think about the choices that you make when displaying quantitative data for various purposes. Don't follow them blindly. Question them. Disobey them when you think it's useful, but do so for a good reason.

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About the Author

Stephen Few has worked for nearly 30 years as an IT innovator, consultant, and teacher. Today, as Principal of the consultancy Perceptual Edge, Stephen focuses on data visualization for analyzing and communicating quantitative business information. He provides training and consulting services, writes the quarterly *Visual Business Intelligence Newsletter*, and speaks frequently at conferences. He is the author of three books: *Show Me the Numbers: Designing Tables and Graphs to Enlighten*, Second Edition, *Information Dashboard Design: Displaying Data for at-a-Glance Monitoring*, Second Edition, and *Now You See It: Simple Visualization Techniques for Quantitative Analysis*. You can learn more about Stephen's work and access an entire library of articles at www.perceptualedge.com. Between articles, you can read Stephen's thoughts on the industry in his blog.