A Guide to Creating Dashboards People Love to Use

Part 2: Structure

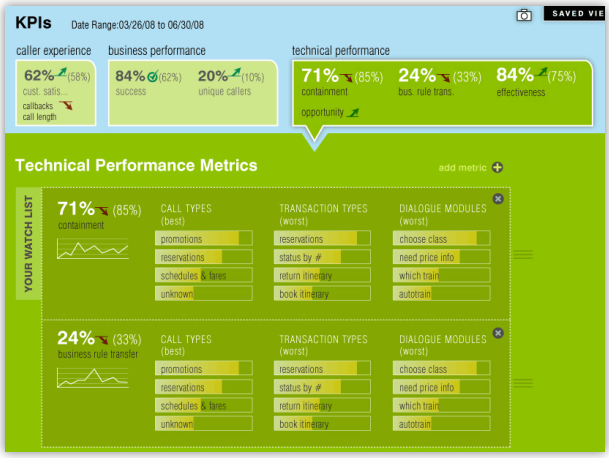
August 2009

Dashboard Design Matters

Dashboards have become a standard business tool over the last decade. Dozens of dashboard building solutions have sprung up to meet the demand. Yet in the flurry of technology and enthusiasm, little attention has been paid to how to design focused, thoughtful, and user-friendly dashboards. Our three-part guide will show you the concepts and give you the best practices to create a high-impact dashboard that people love to use.

Traditional dashboard design focuses almost exclusively on defining the right success metrics, then piecing together a bunch of charts and gauges on a single page. These techniques yield dashboards with a hodgepodge appearance and confusing information.

Traditional dashboard design techniques result in confused solutions



This guide will help you design more intuitive and effective dashboards

In the early days of the world wide web, it was good enough to simply have the right information on the web page. The current industry-standard dashboards are no more ambitious. However, modern web design has moved on to seek a union of utility, usability and beauty. We must find a similar union when displaying data in business.

This document approaches dashboard design in a holistic way, beginning with general goals and evolving to specific data presentation. *Part 1: Foundation* helped you identify your target audience, understand what type of dashboard you want to create and why it is valuable to your organization. It concluded with guidance regarding how to focus your

message on the information and metrics that matter. *Part 2: Structure* will get you started on designing your dashboard, including what form it should take, how to design for audience understanding, and what navigation, interactions, and capabilities will make your dashboard useful and engaging. Finally, *Part 3: Information Design* dives into the details of interface and information design. You will learn how to lay out your dashboard and best practices for charting and data presentation.

Framing the Dashboard

Now that we've defined in Part 1 what the dashboard should accomplish for your audience, it is time to start the thinking about how your dashboard actually looks and how it works. This section offers ideas about the big-picture elements of your dashboard–the building blocks that you will use to construct the dashboard. The building blocks can be broken into four categories:

1. **Form**: In what format is the dashboard delivered?
2. **Structure**: How is the dashboard laid out to help users understand the big picture?
3. **Design principles**: What are the fundamental objectives that will guide your design decisions?
4. **Functionality**: What capabilities will the dashboard include to help users understand and interact with the information?

Form

The conventional view has been that dashboards need to be constrained to a single page; we believe dashboards can come in many forms. A short e-mail can serve as a dashboard if it works for the recipients. Likewise, a wall-mounted 55" plasma TV showing an animated presentation has the potential to be an effective dashboard.

What's important is selecting a form that fits the need of the situation–form follows function. The function of a dashboard is to communicate critical information to your

audience in a way they can understand, delivered when and where they need the information.

Before you decide how you want to deliver your dashboard, think about a few factors that may influence the dashboard form:

1. **Timeliness**: How frequently is the data in the dashboard updated?
2. **Aesthetic value**: How important is it that the dashboard look attractive, or can it be purely utilitarian?
3. **Mobility**: Does the audience need to access the information on-the-go?
4. **Connectivity**: Does the dashboard need to connect to live data sources?

The function of a dashboard is to communicate critical information to your audience in a way they can understand, delivered when and where they need the information.

5. **Data detail**: Will the dashboard offer an ability to drill down to see more context?
6. **Data density**: How information-rich will views of the data be?
7. **Interactivity**: Will the user benefit from interacting with the dashboard?
8. **Collaboration**: Is it important that your audience be able to easily share and collaborate on the dashboard?

In the following table, we assess six forms of dashboards by their effectiveness in addressing the factors above ("+" means the form can work well for the specific factor; "-" means the form is not effective). Which forms perform well for the factors your audience cares about?

	Paper One-pager	Paper Presentation	Excel	Online app	E-mail / text message	Large screen
Timeliness	-	-	+	+	+	+
Aesthetic	+	+		+	-	+
Mobility	+				+	-
Connectivity	-	-		+	+	+
Data detail	-	+	+	+	-	
Data density	+	+			-	
Interactivity	-	-		+	-	-
Collaboration					+	-

Structure

The standard practice for laying out a dashboard, unfortunately, has been to slot charts into a grid. Take this dashboard for example (with our grid overlay):

This rigid structure tells us nothing about how different charts relate to each other; offers no clue as to where to begin understanding the data; and nothing about what information is most important.

Creating a layout that helps frame the content of your dashboard may be the most under-valued area of dashboard design.

Why structure matters?

Stephen Few, author of *Information Dashboard Design*, calls structure one of the greatest challenges of dashboard design:

> *"Dashboard content must be organized in a way that reflects the nature of the information and that supports efficient and meaningful monitoring. Information cannot be placed just anywhere on the dashboard, nor can sections of the display be sized simply to fit the available space. Items that relate to one another should usually be positioned close to one another. Important items should often appear larger, thus more visually prominent, than less important items. Items that ought to be scanned in a particular order ought to be arranged in a manner that supports that sequence of visual attention." (Pervasive Hurdles to Effective Dashboard Design, Visual Business Intelligence Newsletter, January 2007)*

The structure of your dashboard is also an opportunity to define the "right" way to look at a problem or the business. How you choose to lay out the information shapes how your audience understands the big picture and how the smaller pieces fit together. At a more practical level, structure can serve as a navigational mechanism for the user. It shows where to start, and where to go next.

Structure options

A good dashboard structure requires a deep understanding of how the system you are measuring works. There are many ways to break something down into manageable parts. For example, the performance of a (American) football game can be deconstructed in many ways: 1) by offense,defense, and special teams; 2) by down and distance; 3) by time period; 4) by drive; 5) by running vs. passing plays. A dashboard built around each of these organizing principles would tell a different story.

Choosing the right model is a dashboard-specific problem. In our experience, dashboards fall into three categories: flow, relationships, and grouping.

Flow

A flow-based structure emphasizes a sequence of events or actions across time. Systems that fit this model include leads moving through a sales pipeline, stages of customers support, and operational processes. Notice how the sales dashboard below is built around the flow of customers from leads through the pipeline, and ultimately to won or lost orders. The commitment to the vertical flow structure makes it clear to users how to think about the sales process.

SUCCESSFUL CONVERSIONS

Milestone	Pipeline		New	Inactive*	Average	Weighted	Funnel	Conv
Lead	1,820,000	6	6	1 / 4	303,333	140,000	91	-
Opportunity	3,660,040	10	10	7 / 9	366,004	259,884	84	92 %
Demonstration	402,000	6	6	5 / 6	67,000	24,806	73	80 %
Prospect	6,875,000	25	25	23 / 24	275,000	395,181	68	74 %
Negotiation	8,896,250	34	34	32 / 32	261,654	330,883	44	48 %
Order Won	1,162,000	7	7	0 / 0	166,000	1,162,000	7	7 %
Total:	**22,815,290**	**88**	**88**	**68 / 75**	-	**2,312,756**		

* Inactive projects shown as **X** / **Y** where: **X** = number of projects with no activity and **Y** = number of projects with no milestone progress

UNSUCCESSFUL CONVERSIONS

Order Lost	750,000	3	3	0 / 0	250,000	750,000	3	3 %
Total:	**750,000**	**3**	**3**	**0 / 0**	-	**750,000**		

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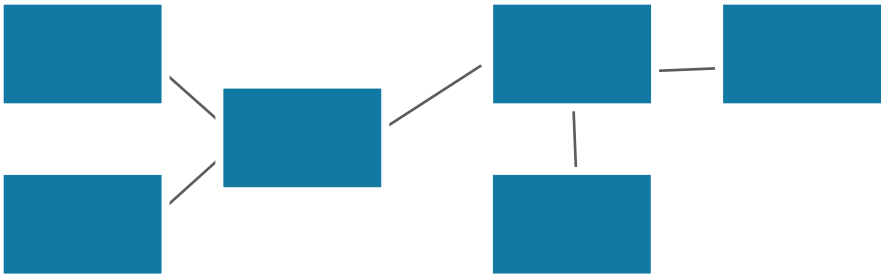
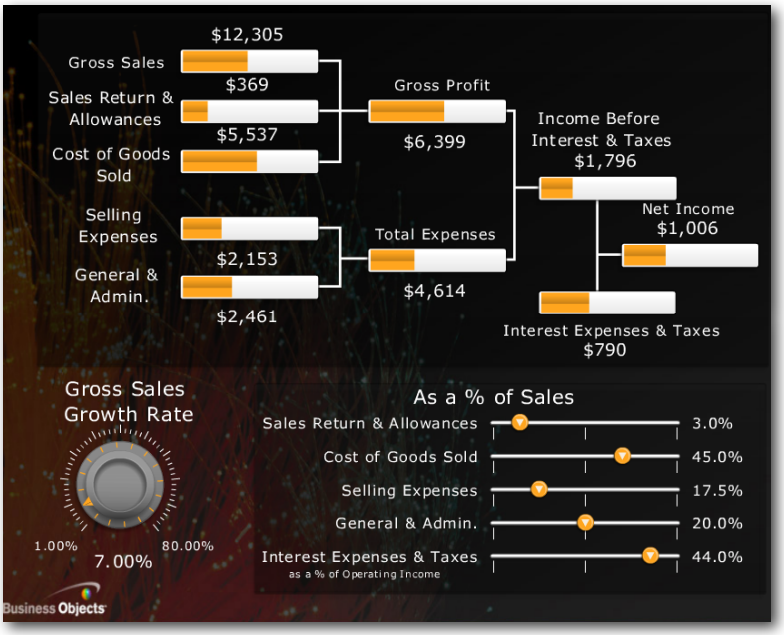
Relationships

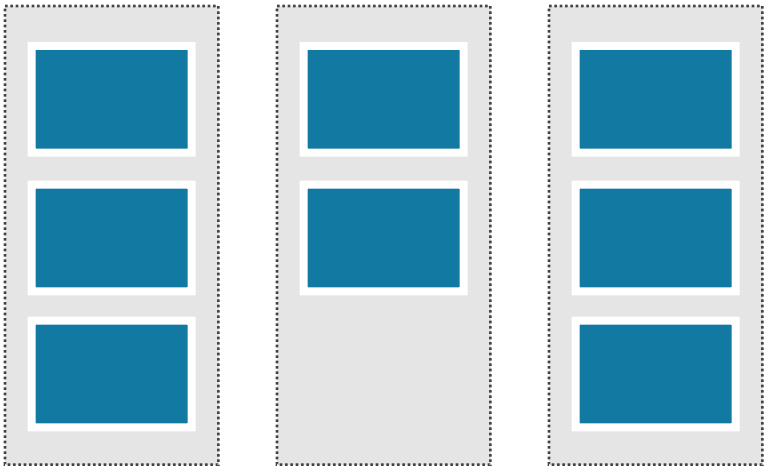


The structure of a dashboard can also emphasize the relationships between entities or measures. These relationships or connections may be mathematical, geographical, organizational, or functional. Below is a dashboard that explicitly shows the relationships between financial metrics to give users a model for understanding the factors driving net income.

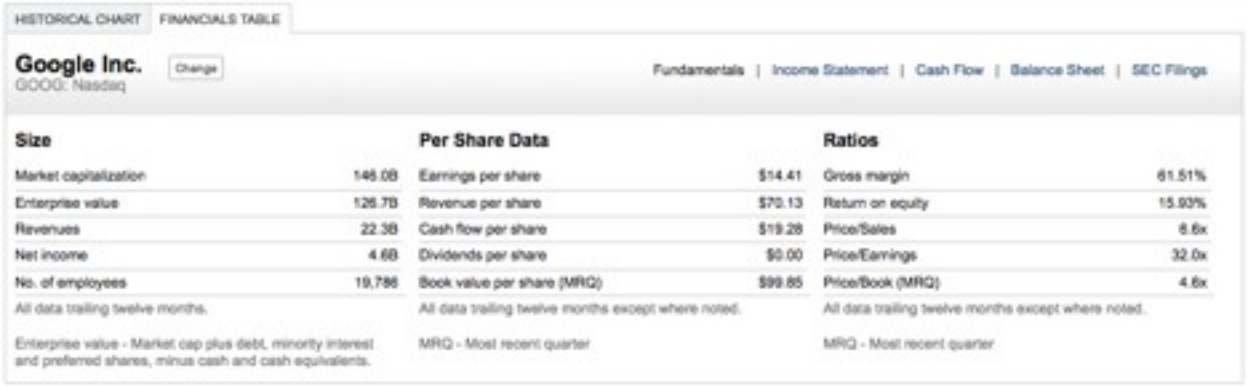


Business Objects

Grouping



The structure of last resort is to group related information into categories or a hierarchy. The simple act of putting similar things together can bring some logic and accessibility to an otherwise haphazard dashboard. The following dashboard from the New York Times financial section brings related metrics together into three categories. Based on their needs, different users will know where to start in reviewing the performance data.



Design principles

As you get closer to putting pencil on paper to design your dashboard, we'd like to lay out a few core design goals to use as reminders of what is important. We call these goals *design principles*. Below are a few key design principles that we use when we design

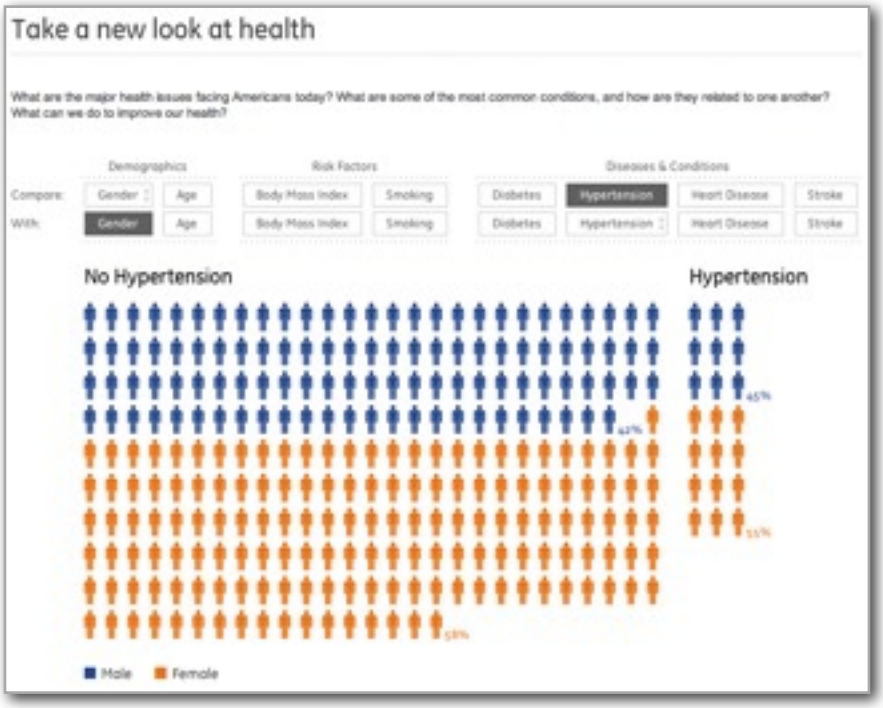
dashboards. By no means should you feel compelled to follow all of these principles; in fact, it is better to pick a one or two high priority principles to help stay focused.

Compactness / Modularity

Some dashboards become large and unwieldy in an effort to create a single comprehensive view of an entire business or process. Eric Steven Raymond, writing about good software design (http://catb.org/~esr/writings/taoup/html/ch04s02.html), offers this guidance:

> *"Compactness is the property that a design can fit inside a human being's head...Compact software tools have all the virtues of physical tools that fit well in the hand. They feel pleasant to use, they don't obtrude themselves between your mind and your work, they make you more productive."*

A dashboard can be broken into bite-sized pieces, each built around a key question. The GE Health Visualizer (http://www.ge.com/visualization/health_visualizer/) by information visualization guru Ben Fry offers a great example of a compact design.



Gradual reveal

Reveal information as the user expresses interest. In other words, don't bombard the user with all the information at once. We frequently use levels of increasing detail from (a) key metric to (b) context around the metric to (c) full breakout detail for the metric. Here's the interface of Datran Media's Aperture online advertising dashboard that shows this model:

Guide attention

It isn't good enough to make the information available; you need to use visual cues and functionality to draw the user to the things that matter most. A few mechanisms that can help are alerts, positioning on the page, and careful use of color and fonts. Trendly.com, a site that pulls information from Google Analytics, is specifically designed to highlight the most interesting changes in web analytics data.

Support casual use

Minimize the barrier to entry for new users by avoiding feature overload, minimizing clicks for each task, and providing clear, concise descriptions of what things mean. The Indianapolis Museum of Art dashboard below has kept the interface simple, inviting and attractive for the visitors to their site who want to know what's going on. There is still plentiful detail behind each panel for people who want to know more.

Lead to action

Empower the user to finish their task quickly and/or understand the action that should be taken based on the results. You can build in explicit guidance about what a change in a metric means, or who to contact to address an issues that is highlighted in the dashboard.

Customizable

Build in flexibility to allow the dashboard to become relevant for different users. The most common way to allow users to customize the dashboard is by defining the scope of the data using filters. There is more that can be done: Does the dashboard let the user save a view of the data that they've configured? Does it offer easy ways to tag or highlight things that are important to them?

Explanation before information

We need context and explanation to understand new and unfamiliar events. Providing data without this higher-level analysis is the difference between a chef presenting a fine dinner and fish monger throwing a fish at your head.

For many dashboards, there is time to interpret the results and provide a summary before presenting to your audience. Letting the data speak for itself can be a recipe for mis-interpretation and confusion. The following quote about journalism offers broader perspective on how to present complex information:

> *The most "basic" [journalistic] acts are reporting today's news and providing current information, as with prices, weather reports and ball scores. We think of "analysis," "interpretation," and also "explanation" as higher order acts. They come after the news has been reported, building upon a base of factual information laid down by prior reports...*
>
> *[However, there are some stories]* ***where until I grasp the whole, I am unable to make sense of any part.*** *Not only am I not a customer for news reports prior to that moment, but the very frequency of the updates alienates me from the providers of those updates because the news stream is adding daily to my feeling of being ill-informed, overwhelmed, out of the loop.*
>
> - Jay Rosen, NYU Journalism Institute (journalism.nyu.edu/pubzone/weblogs/pressthink/2008/08/13/national_explain.html)

Functionality

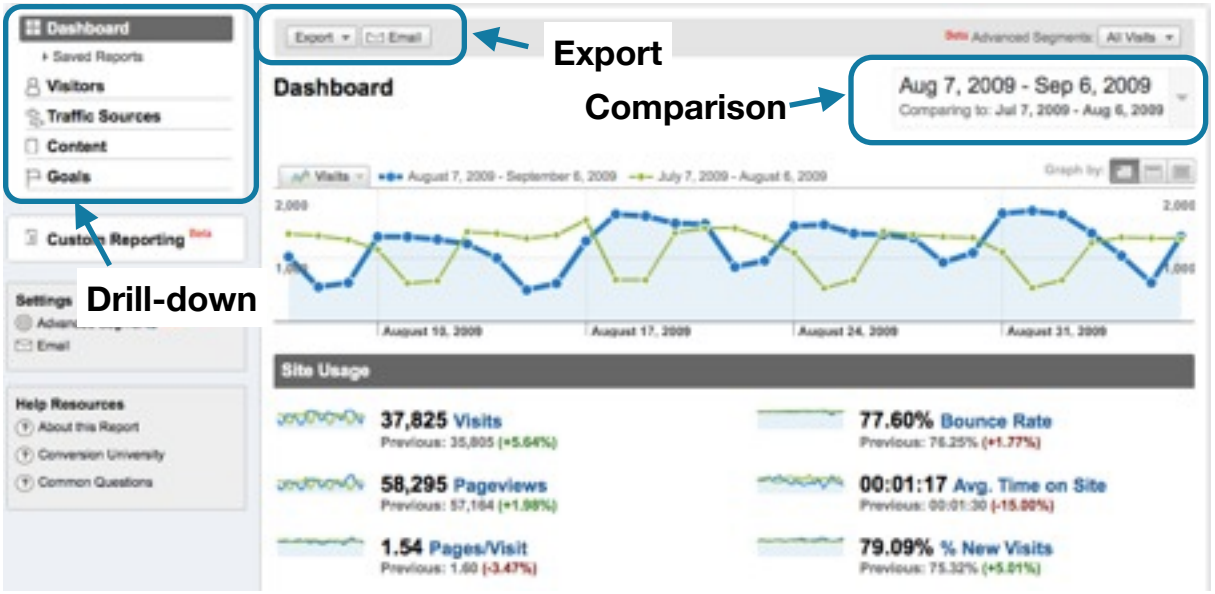
As we work our way from the big picture to the nuts and bolts of your dashboard design, we want to outline common features that can make your dashboard more useful (Part 3 will offer more detail on the best ways to implement some of these features). Depending on the form that you've chosen, the dashboard can be much more than simply charts on a page. Interactive elements highlight key information; user configuration let users customize their view of the data; advanced visualizations make complex data easy to understand and navigate.

The first group of features are the basics that should be considered for any dashboard. A second category of advanced features can differentiate your dashboard and provide exceptional user control and value.

Basics

- **Drill down**: Ability to go from a summary metric or view to additional detail that provides more context and/or breakout of the information.
- **Filters**: Allow users to define the scope of the data in the dashboard to reflect their needs. Filters can either be global (refining scope for the entire dashboard) or local (refining scope for a specific chart or metric or view).
- **Comparison**: Ability to see two or more subsets of the data side-by-side. A line chart, for example, may let the user view two geographic regions as separate lines.
- **Alerts**: Highlight information based on pre-defined criteria. The alert may be activated when a metric goes outside of a particular threshold. For more detail on best practices in dashboard alerts, read this article www.juiceanalytics.com/writing/dashboard-alerts-checklist/
- **Export / print**: Give users the ability to pull information out of a dashboard. Export to formats that let users do more with the data like Excel and CSV rather than PDF.

The Google Analytics dashboard offers elegant implementations of many of these features:

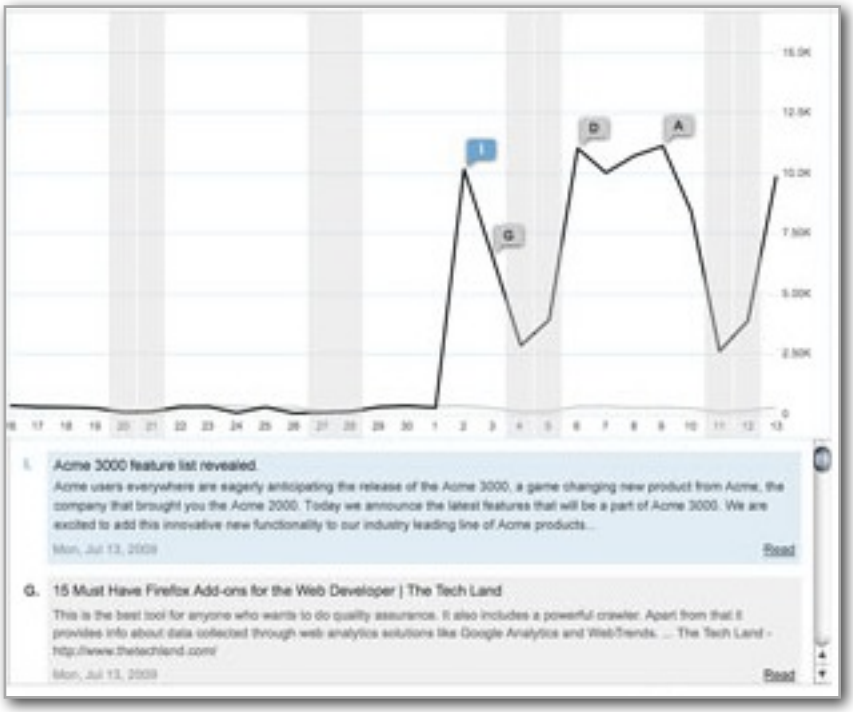


Advanced

- **Text-based summary**: Automatically generated textual description of the key information in the dashboard. This can be as simple as a sentence that includes a couple important data points. A more sophisticated example is shown below in a web analytics solution by WebTrends:

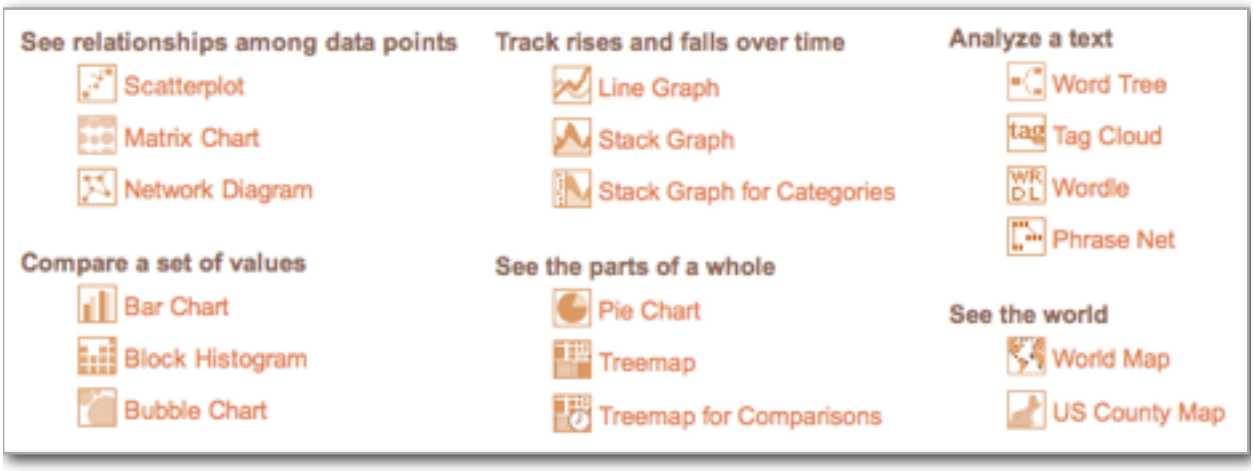
- **Starring/tagging**: Ability for users to identify things in the dashboard that are important to them. The virtual equivalent of circling a number with a red pen.

- **Annotation**: Allow users to add commentary to specific numbers or charts. The virtual equivalent of writing notes in the margin. WebTrends also offers an annotation feature:



- **Save / track changes**: The more a user configures a dashboard to their unique needs, the more important it becomes to allow them to save what they have created. For an exquisite example of saving changes as you go along, see the tee-shirt customization site Click Shirt (http://www.click-shirt.com/).

- **Advanced visualizations**: If it is useful to show more complex data in the dashboard, a variety of advanced visualizations can help make it digestible. A few visualization types to consider include geographic map, treemap, network diagram, tag cloud, scatterplots and bubble charts. But be careful, using complex visualizations incorrectly can leave your audience feeling lost and confused. A good place to explore some of these more innovative visualizations is IBM's Many Eyes site (http://manyeyes.alphaworks.ibm.com/manyeyes/):



Building Blocks

Part 2 of our guide gives you the building blocks for constructing your dashboard. Like constructing a house, we wanted to focus on framing the structure before worrying about painting the walls and installing the kitchen appliances. In this paper we've addressed these topics:

1. **Form**: In what format is the dashboard delivered?
2. **Structure**: How is the dashboard laid out to help users understand the big picture?
3. **Design principles**: What are the fundamental objectives that will guide your design decisions?
4. **Functionality**: What capabilities will the dashboard include to help users understand and interact with the information?

In Part 3, we will focus on information design -- presenting information in clear and concise ways. In addition, we will offer our perspective on designing an interface that is user-friendly and attractive.