For more than two decades, business intelligence (BI) professionals have tried to shoehorn all reporting and analysis tasks into the same BI toolset and architecture, often with disappointing results. Some users find BI too difficult and confusing; others find it too limiting and underpowered. The solution to this problem is recognizing that reporting (top-down BI) and analysis (bottom-up BI) are two different tasks that require different toolsets and architectures. But unless organizations find a way to gracefully bridge these two environments, users will be hopelessly stranded in one or the other.

One way to plug the gap is to create a network of superusers—tech-savvy business users—who can create ad hoc information views on behalf of colleagues in their departments. Another way is to deploy self-service BI tools, which enable users to create their own reports and dashboards and conduct their own ad hoc analyses. Whatever the output, a reporting or analysis environment needs a clear and powerful visual display to communicate the story contained within each dataset.
Strategies and Techniques for Effective Reporting and Analysis

Table of Contents

Top-Down Versus Bottom-Up BI
Approaches to Self-Service BI
Six Ways to Improve Your Visual Displays
About the author
Resources from Tableau Software
Top-Down Versus Bottom-Up BI

For more than two decades, business intelligence (BI) professionals have tried to shoehorn all reporting and analysis activity into the same BI architecture, often with disappointing results. Some users find BI too difficult and confusing, and others find it too limiting and underpowered. As a result, BI in most organizations is paradoxically both underutilized and overly used (and abused).

To succeed in the future, BI professionals need to break away from the “one size fits all” architecture of the past. They need to implement multiple approaches to BI, each geared to different types of users, workloads and data types. The two most important BI architectures are represented by top-down and bottom-up approaches to BI.

Top-down BI consists of reports and dashboards driven from a data warehouse or data marts that are designed to answer predefined questions or monitor predefined metrics aligned with business goals and objectives. The majority of people who “consume” top-down BI output are casual users: executives, managers and front-line workers who need information to do their jobs. In contrast, bottom-up BI consists of analyses and ad hoc queries run against any data source that are designed to answer unanticipated questions in an effort to optimize business processes and projects. The people who conduct these analyses are business analysts, analytical modelers and power users. For them, information is their job (see Figure 1).

In short, the top-down approach delivers reports, and the bottom-up approach delivers analyses.
Most organizations already support both these approaches but don’t recognize them as distinct and legitimate architectures. Most BI teams try to jam all reporting and analysis activities into one or the other architecture, reaping all the downsides and few of the benefits of either approach. Then, in an effort to find an ideal solution, many BI teams whipsaw between the two approaches rather than maintain a healthy balance between the two.

**Top down.** The benefit of a top-down approach is that it ensures information consistency—the proverbial “single version of truth”—and avoids disputes over the meaning of common data elements, such as *customer* or *product* or *sale*. A top-down environment is crucial for creating a fact-based decision-making culture that measures performance and holds individuals accountable for outcomes.

However, it is not easy gaining consensus on rules and definitions for shared metrics and data elements or creating key performance indicators that embody an organization’s
strategy and goals. A top-down environment takes several months or more to deploy and isn’t easy to change. Top-down solutions are best deployed in nonvolatile business environments where requirements don’t change frequently.

**Bottom up.** In contrast, a bottom-up approach is more agile and less expensive than a top-down approach because it doesn’t inscribe a business model into the structure of the data. In a bottom-up world, business users empowered with ad hoc query tools get their own data instead of waiting for IT to create a standardized repository of information and reports. These users download data into spreadsheets, desktop databases, OLAP (online analytical processing) databases, visual analysis or analytical modeling workbenches, and they can usually begin answering business questions immediately.

However, by sourcing and integrating data on their own, business analysts create unique silos of information, applying different rules to common metrics and data elements. When a top executive calls an operational meeting to discuss results, these analysts often spend hours arguing about whose data is correct. This lack of information consistency at the enterprise level has caused many CEOs to launch data warehousing initiatives as a prerequisite for doing business.

**Dynamics.** To harmonize top-down and bottom-up approaches, it’s important to first understand the dynamic between the two. In the world of BI, analysis begets reports and reports beget analysis (see Figure 2).

**Figure 2. The dynamic between reporting and analysis**
For example, a business analyst will collect data, massage it and analyze it to answer an urgent question from an executive. If the executive likes this view of data and wants to see updated numbers every week, then this analysis turns into a weekly report. Here, an analysis turns into a report. Conversely, when an executive or manager views a report, it will trigger a plethora of questions, such as “Why is this number so low?” or “What can we expect next period?” Here, reports generate analyses.

Reports compile information about the way things are done; analyses gather information about things that are new or changing. In essence, reports focus on order; analyses focus on change. This dynamic is as old as human history. Humans and organizations that support a fluid interplay between order and change can adapt and grow gracefully, and those that don’t collapse under their own weight, usually victims of too much rigidity (i.e., order, tradition, law) or too much chaos (i.e., change, freedom, individuality).

**Summary.** In the world of BI, organizations need to balance reporting and analysis and not tip too far in either direction. They shouldn’t uniformly rely on a reporting environment to perform heavy duty analyses, and they shouldn’t completely rely on an analysis environment to generate reports.

The key is to align types of users with their preferred approach as well as build a bridge between the two worlds that harmonizes top-down reporting and bottom-up analysis and gives users an accessible on-ramp from one environment to another. Techniques to achieve this balance are the focus of the next article in this e-book.
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Approaches to Self-Service BI

Self-service business intelligence (BI) has been the holy grail of BI professionals for a long time. The goal is commendable: empower casual users to create their own reports and analyses instead of relying on the corporate BI team. In other words, self-service BI enables a casual user who spends most of her time in the top-down world of reporting and dashboards to act like a power user and create ad hoc views of data. With self-service BI, casual users get the information they need when they want it, and the BI team reduces its perennial backlog. Everybody wins.

Unfortunately, the reality of self-service BI has not lived up to its promise. Traditionally, most casual users find self-service BI tools too hard to use or don’t want to spend the time learning them. And many power users view the tools as glorified extraction tools to dump data into spreadsheets or desktop databases. Consequently, self-service BI has often led to both large volumes of BI shelfware and report chaos. In other words, self-service BI tools have created an even wider gulf between reporting and analysis environments instead of reconciling the two.

However, things are changing. Organizations are applying new social structures to make good on the promise of self-service BI, at least in concept, while vendors are beginning to offer new types of self-service BI tools that truly bridge the gap between top-down and bottom-up activities.

Superusers

Ad Hoc Proxies. In the absence of strong self-service BI tools, the classic way to bridge the two worlds is to recruit superusers to create ad hoc reports and dashboards on behalf of casual users. Superusers are technically savvy business people in each department who become proficient in the use of BI tools. They quickly become the go-to people in each department to create custom ad hoc reports.
Since superusers are embedded in the business and know the processes and people intimately, they become efficient and effective extensions of the BI team. They become the eyes and ears of a corporate BI team in each department and facilitate the efficient and effective delivery of comprehensive BI solutions. BI leaders who want to manage a successful BI program need to identify these superusers and work closely with them.

**Report Governance.** Superusers are key to effective BI governance and managing a healthy balance between top-down and bottom-up approaches.

Ideally, the corporate BI team—in conjunction with departmental superusers —creates a set of “standard” top-down, BI reports and dashboards. If designed correctly, these standard reports should meet about 60% of the information needs of casual users (but not power users.) The remaining 40% of requirements are impossible to anticipate—they are bottom-up, ad hoc inquiries. But since casual users by definition aren’t capable of generating their own reports and dashboards, they turn to superusers to meet their needs.

Besides fulfilling requests for ad hoc reports, superusers should also review requests for new standard or official reports. Corporate BI teams need to appoint superusers from each department to serve on a Report Review Board that maintains an inventory of existing reports, identifies overlaps between new and existing reports, and makes recommendations whether a new report should be built or an existing one expanded (see Figure 1).

Putting superusers in charge of both ad hoc and conventional reporting is an effective way to prevent report chaos and maintain information consistency. Many people equate this strategy as akin to putting the “fox in charge of the henhouse,” since superusers (or power users in general) are the major culprits behind the creation of renegade BI systems. Yet BI teams that have adopted this strategy find that distributing or “giving up” control is a powerful way to create key allies and expand BI’s footprint in the organization.
Self-Service Tools

To supplement the work of superusers, we are finally seeing the advent of self-service BI tools that truly empower all types of users to create their own reports and analyses.

There are two classes of self-service BI tools: top-down and bottom-up. Top-down tools consist of BI tool semantic layers and mashups that enable power users to create reports and dashboards on behalf of their casual user colleagues. Bottom-up tools consist of in-memory, visual analysis tools and BI search tools that enable casual users to perform ad hoc analyses without power user intervention (see Figure 2).
Figure 2. Top-down and bottom-up self-service tools

Top Down Self-Service Tools

Semantic layers. Most BI tools require architects to build a semantic layer that models data artifacts in the data warehouse (or any other source for that matter) in business-friendly terms. In principle, a business user armed with a semantic layer and a wizard-based, query generation tool should be able to construct well-formed queries against the data warehouse and generate their own reports without IT assistance. Unfortunately, most casual users find this process too difficult or time-consuming. This frustrates BI managers who believe self-service BI can alleviate their backlog of custom reports.
The good news is that while casual users won’t use a semantic layer, superusers will. Thus, a BI tool’s semantic layer has become the vehicle of choice among superusers to create ad hoc reports for friends and colleagues in their department.

**Mashups.** To cash in on the popularity of dashboards, many top-down BI vendors have recently deployed mashup or “mashboard” capabilities that enable superusers to create custom dashboards for themselves and their colleagues by dragging and dropping prebuilt widgets from a library onto a dashboard canvas. The widgets are predefined report parts—such as tables, charts or filters—built using the vendor’s report design tool. The widgets share a common interface, akin to Google Gadgets, that enables the widgets to interoperate in a dashboard environment. For instance, if two widgets or charts contain data that share a common key, they will stay synchronized. So, if a user filters the view on one widget, the other automatically updates to reflect the change. Many mashup tools also allow super-users to connect to external Web pages using URLs.

The problem with semantic layers and mashups stems from their top-down orientation. Semantic layers require you to know upfront what data users want to query and how they want to query it. In essence, a semantic layer creates “guardrails” for accessing data; this simplifies access but creates problems if users want to go “off-road.” With mashups, professional report designers first need to create a report and then widgetize its components and place them in a library. Both semantic layers and mashups assume that BI managers know what users want to see before they see it. This approach is ideal in non-volatile business environments where strategy and objectives are fixed and certain, but less suitable for dealing with unexpected events and addressing unanticipated business questions.

**Bottom-Up Self-Service Tools**

Bottom-up approaches to self-service BI avoid some of the traps of top-down approaches. Visual analysis and BI search tools impose fewer constraints on what data users can see or how they navigate through the data.
In-memory visual analysis. In-memory visual analysis tools enable power users to visually sift through data at the speed of thought. They enable users to apply filters dynamically so they update all objects on the screen instantaneously, making it easy to see correlations and navigate to new and unanticipated views of the data.

However, the real value of visual analysis tools is that they can be turned into analytical tools for casual users in a two-step process. Once power users navigate to a view that is particularly illuminating, they save the view and publish it to a server where casual users can access and interact with the view through a browser. Power users may even schedule the view to refresh on a regular basis, in effect, creating an interactive, visual report or dashboard that makes it easy for casual users to explore data in an intuitive fashion. To simplify consumption, power users often modify the view before publishing it to casual users. For example, they may hide fields, turn off functionality, or redesign the display to mimic the look and feel of other reports or dashboards in the company.

Constraints. Despite their advantages, most bottom-up approaches falter at the enterprise level, where there is an imperative to maintain common definitions for shared data elements. Most don’t have the built-in metadata and data integration architecture to enforce information consistency when running directly against sources systems. To enforce such consistency in an enterprise environment, most visual analysis tools today rely on a data warehouse to do the heavy lifting for them. As such, most visual analysis and search tools are deployed to support departmental initiatives or one-off applications where there is no pressing need to establish consensus among shared data elements across the enterprise.

BI search—ad hoc for casual users. The ultimate self-service BI enables casual users to ask any question of any data without IT or power user intervention. To date, this type of environment has not existed. However, new search technology promises to make such self-service BI a reality. BI search tools enable users to navigate across multiple data sets, both structured and unstructured. They simply type queries in plain English into a keyword search box and then refine the result sets by clicking on dynamically generated categories, called facets. This intuitive interface made popular and familiar by Google, Yahoo, and other search engines may finally empower casual users to fully service their own information requests.
Unfortunately, BI search technology is still in its infancy and not yet widely deployed. Although many BI tools incorporate search, the technology is normally used to find published reports or data elements within a semantic layer that match keywords. There are only a few tools today that use search indexing as a way to bridge structured and unstructured data in an ad hoc BI environment.

**Summary.** Most companies make the mistake of trying to shoehorn all BI activities into a top-down or bottom-up BI environment. In reality, BI teams must balance both top-down and bottom-up approaches to BI. They must recognize the value that each approach offers to business users and deploy the right tools and architectures for the right users. And they must create a robust superuser network and deploy self-service BI tools that bridge top-down and bottom-up approaches.
Six Ways to Improve Your Visual Displays

More than one executive has approved the purchase of a BI tool by virtue of the visual interface alone. Just as sex sells magazines, pretty visual displays sell BI tools. Certainly, a sleek, Flash-based interface is a breath of fresh air in the business intelligence (BI) arena, where text-heavy, static reports or spreadsheets still rule the day. New Web 2.0 interfaces invite users to interact with charts and tables and offer superior performance compared to HTML-only applications.

But just as beauty is sometimes skin deep, so, too, are visual interfaces. Users can quickly tire of a visual interface that makes them work harder to view relevant data or doesn’t offer additional value compared with viewing textual data alone. Although sexy graphical interfaces may sell BI tools, it’s the data that delivers true fulfillment.

Whether you are delivering top-down reports and dashboards or bottom-up visual analysis environments, it pays to deliver a user interface that clearly communicates the story that the data is trying to tell.

Here are a few pointers to harness visualization to sustain user adoption and interest over the long haul.

1. **Data first.** Make the visualization subservient to the data, not the reverse. Ultimately, users want data, not visual flash and sizzle. Avoid gratuitous decoration.

2. **Highlight the message.** Every set of data set has a story to communicate. Discover the message and use visual cues and techniques to highlight that message and de-emphasize the rest.

3. **Use visuals to compare.** It is hard to see trends, compare items, or spot outliers and clusters in a table of numbers. This is where visualization shines. Use line graphs to show trends over time, bar charts or heat maps to compare items, and scatterplots to identify outliers and clusters.
4. **Use visual techniques to show more data.** A skillful designer steeped in the art of visualizing quantitative information can compress a lot of data into a compact space without cluttering the page or obscuring the data’s message. (And the best BI tools do this automatically!) Also, proper use of fonts, labels, and borders can clearly delineate dense displays of items; compact chart types, such as sparklines and bullet graphs show more data in a smaller space; and proper use of visual cues (i.e., preattentive processing techniques) can focus the viewers’ eyes on the key messages in the data.

5. **Establish visual standards.** Standardize the placement of filters, toolbars, help buttons, breadcrumbs, alerts and links to additional information so users can navigate your displays almost from memory. Also, associate specific chart types with certain types of data. For example, if you always use a spider chart to display patient satisfaction data, then users already know what data to expect when they see that chart type.

6. **Balance sparsity and density.** Put fewer items on a visual display when users only have time to glance at the data, not analyze it. For example, salespeople, call center representatives, operational workers, and busy executives want and need sparse displays. Also, when first deploying a dashboard, err on the side of sparsity, not density. Once users become familiar with the display, then add more items to it.

   Conversely, analysts and managers want and need denser displays. Denser displays pack more information onto the screen, minimizing the number of times users need to click to get the information they need. However, dense displays may take longer to load, frustrating users with poor performance.

7. **Iterate.** Remember, no visual display is ever perfect. There are a million ways to tweak a visual design to improve its clarity and better communicate the underlying message in the data. Also, user preferences and needs change, so you will need to adapt your visual designs accordingly. Just as a writer knows that the key to writing is rewriting, a visual designer knows that designing quantitative displays is a highly iterative process.

   Creating an effective visual design is challenging, but fulfilling. Follow the above recommendations and you should have a delightful time icing your BI cake!
About the author

WAYNE ECKERSON has been a thought leader and consultant in the business intelligence (BI) field since 1995. He has conducted numerous in-depth research studies and is a noted speaker and blogger. He is the author of the best-selling book Performance Dashboards: Measuring, Monitoring, and Managing Your Business. For many years, he served as director of education and research at The Data Warehousing Institute (TDWI), where he chaired its BI Executive Summit and created a popular BI Maturity Model and Assessment. Wayne is currently director of research at TechTarget and founder of the BI Leadership Forum, a network of BI Directors that exchange ideas and educate the larger BI community. He can be reached at weckerson@techtarget.com. This content originally appeared on Wayne’s World, a BeyeNetwork blog that illuminates the latest thinking about how to deliver insights from business data and celebrates out-of-the-box thinkers and doers in the business intelligence, performance management and data warehousing fields.
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