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# A Visualization is Worth a Thousand Tables: How IBM Business Analytics Lets Users See Big Data

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## Executive Summary

Too often, organizations must resort to presenting data in summary tables and generating graphs and charts with spreadsheet applications. As business data gives way to big data, these approaches are increasingly inadequate and fail to produce useful, accessible views of data. At the same time, an increasing number of users have the desire, wherewithal, and need to engage in their own exploratory data analysis projects beyond reviewing standard dashboards and scorecards.

In both cases, visualization tools are often better suited than spreadsheets and tables to helping stakeholders truly understand their data. IBM has several solutions that let technical and non-technical users alike dispense with ineffective, legacy approaches and intuitively explore and visualize data, regardless of its complexity. This paper explores the advantages of visualization for data exploration and analysis as well as specific tools from IBM that support analytics across an organization.

## Introduction

Organizations are expected to be “data-driven.” They collect metrics, store user preferences, track customer behavior, and collect machine data by the terabyte. But as the amount of data a business collects increases, often its ability to act on the data decreases. The volume and complexity of the data are simply too overwhelming and many organizations struggle to see the forest for the trees. The predictive value of the data and the competitive advantages it can create are lost in the noise.

This problem is compounded as lines of business require interactive access to data and incorporate business analytics in daily decision-making. What was once the sole responsibility of statisticians and data scientists has trickled down to a much broader group of business users. Although these users may lack statistical expertise, their deep understanding of the business itself can make access to the right analytical tools invaluable in improving operational efficiencies and identifying new opportunities. In mid-sized businesses, where there often aren't resources for dedicated data scientists, these tools are even more critical.

### **Too much data, not enough information**

Virtually all mid- and large-sized organizations are now contending with big data. Whether the data is big because of sheer volume, the velocity of its collection, or the complexity of the data itself, many businesses have reached a point where traditional means of analysis and reporting simply aren't adequate to derive real predictive insights from the data.

While we have well-defined practices, software, and hardware for collecting and storing data ranging from high-speed transactional processing to unstructured

### **The evolving role of the data scientist**

Many large organizations have employed statisticians for years to analyze data, identify trends, support strategic planning, and improve processes. More recently, the term “data scientist” has started appearing in corporate job listings, as business analytics have become more critical to success and competitiveness. Though often statisticians by trade, what sets them apart is that data scientists:

- Bring greater business acumen to the table and spend more time thinking strategically about an organization's data resources.
- Sift through all incoming data with the goal of discovering a previously hidden insight, which in turn can provide a competitive advantage or address a pressing business problem.
- Communicate findings to both business and IT leaders in a way that can influence how an organization approaches a business challenge.

data stores in Hadoop, organizations are often still relying on legacy approaches to reporting. Distilling usable insights from such a wide variety of data is increasingly difficult, even as users at all levels of an organization are demanding decision support, predictive capabilities, real-time data access, and targeted information.

### **Only statisticians like tables**

Most humans are wired for visual learning and understanding. Very few people can pour over data tables and pick out trends or grasp big picture issues. Even statisticians and data scientists who are better equipped than most to deal with data in all its forms benefit from interactive graphical interpretations of data. More importantly, data scientists need to be able to communicate in straightforward, visual ways with broad, heterogeneous audiences.

Yet while basic graphs and charts are excellent communicators in most cases, creating easily understood interactive graphics from complex data is remarkably difficult with applications like Excel. And, as data scales and users require predictive insights, traditional approaches and tools for data reporting often fail.

### **Spreadsheets do not equal data visualization tools**

Spreadsheet applications are incredibly useful for certain types of calculations, recordkeeping, tabulation, and many other business tasks. However, they are very poor exploratory and discovery tools. Despite this limitation, they remain in widespread use in analytical settings.

Similarly, the existing graphical capabilities in spreadsheets and even some major analytics tools are far too limiting and require too much user input to enable users to efficiently visualize and explore large or complex datasets. Instead of understanding what the data is telling them about business trends, users spend their time attempting to create useful pictures.

*"How much time do you spend manipulating complicated datasets to generate a graphic that actually communicates something in a slide deck?"*

#### **What if you don't have a data scientist?**

Data scientists are fairly common in large enterprises, but many mid-sized businesses are wrestling with big data issues without the benefit of dedicated staff. This is where user-friendly analytics and visualization tools come in, allowing a variety of users to sift through and explore data and succinctly communicate their insights.

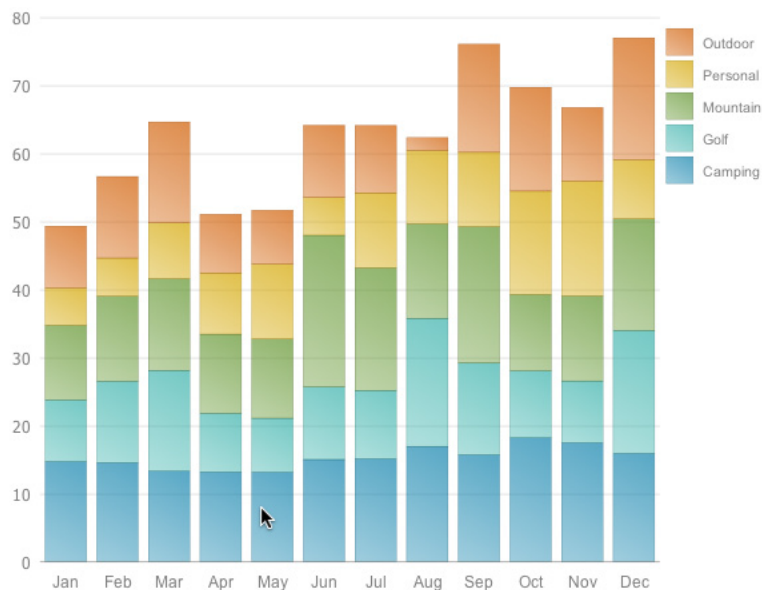
## The Solution: Rich Visualization

Visualization is a natural progression for business analytics, delivering compelling, interactive and highly descriptive graphics that are well-suited to a variety of data types. Visualization complements standard written, tabular, and graphical reporting practices, simplifying many aspects of presenting data and delivering business insights to users. Perhaps a more important advantage of visualization, though, is that it enables exploratory analysis that is powerful enough for data scientists and accessible enough for end users without specific background in statistics.

### What is visualization?

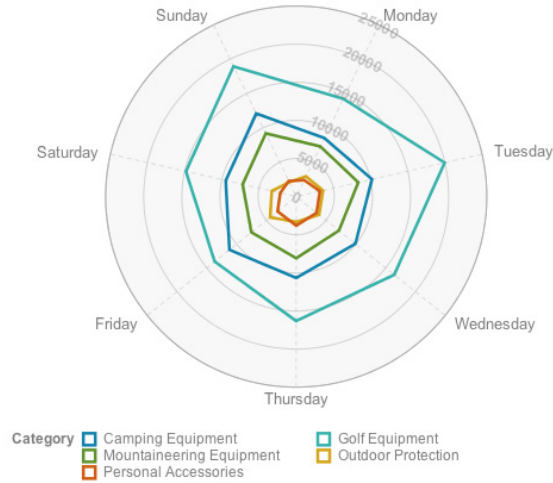
To better understand visualization and ways that it can add value for organizations, it's useful to view examples from modern tools generated with different types of data. While some of the visualizations shown below are fairly typical charts and graphs, others are state-of-the-art images that take entirely different approaches to presenting data.

### Bar Chart



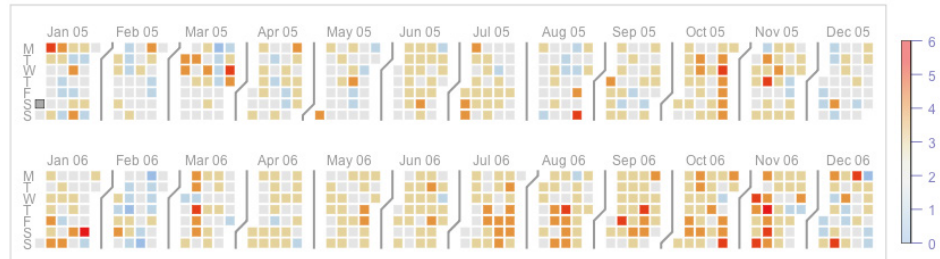
*This stacked bar chart shows a single measure for multiple sales categories over time.*

### Radar Chart



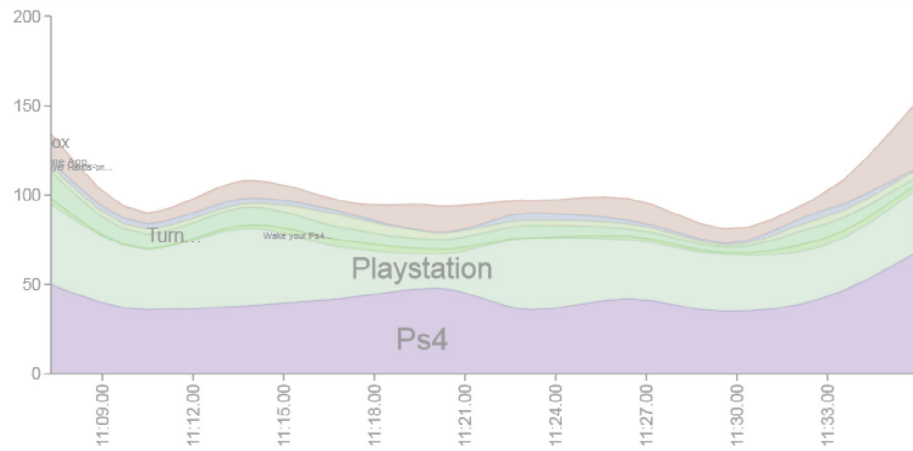
A radar chart that shows weekly cycles of sales data that are arranged in a circular fashion to better illustrate relative fluctuations of data points over time.

### Calendar Heat Map



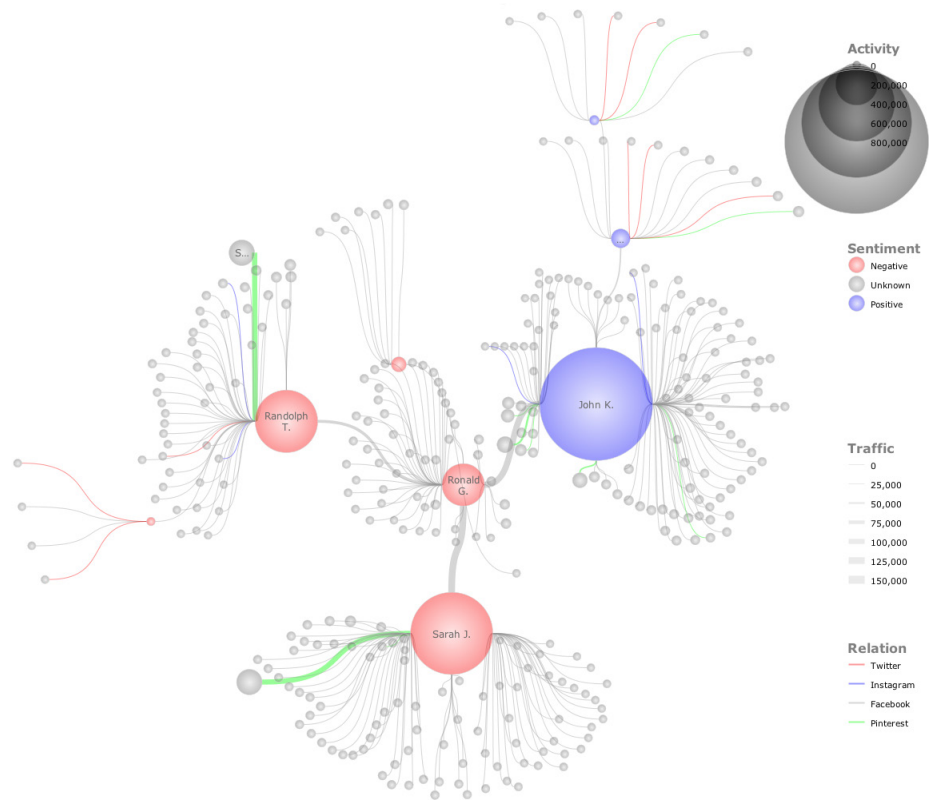
A calendar heat map example shows two years of changes (in percentages) in customer web orders by (row), month (column), day of week (sub row), week (sub column) and day. Heat maps can replace line charts with a more intuitive and compact representation of layered data.

### Theme River



*A theme river is useful for visualizing unstructured and text-based data. This theme river shows phrase popularity related to gaming platforms over time.*

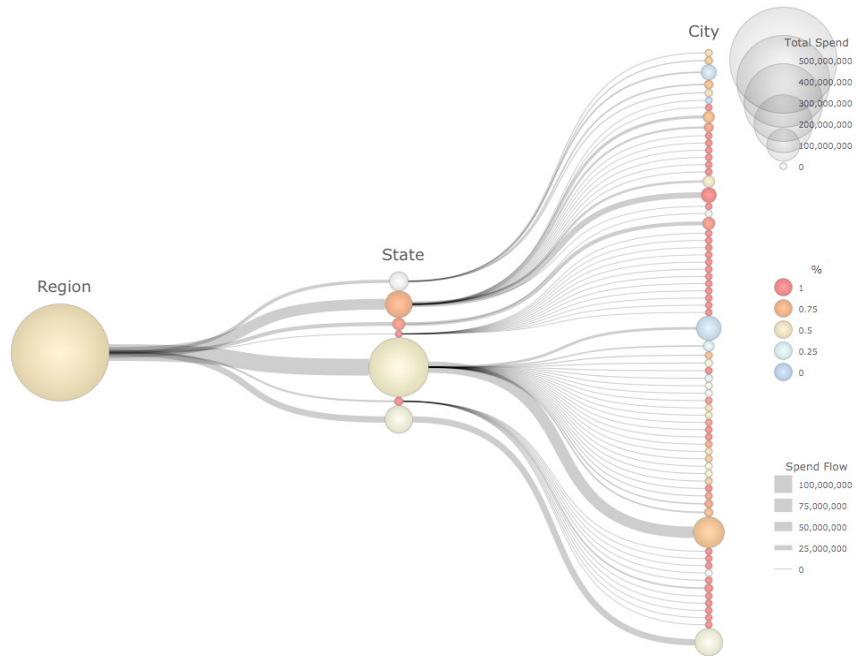
## Social Network Visualization



*A social network visualization can show patterns of customer sentiment, key influencers, and their reach. As with theme river above, this type of graphic would be impossible to generate with traditional tools like spreadsheets and even many analytical applications.*

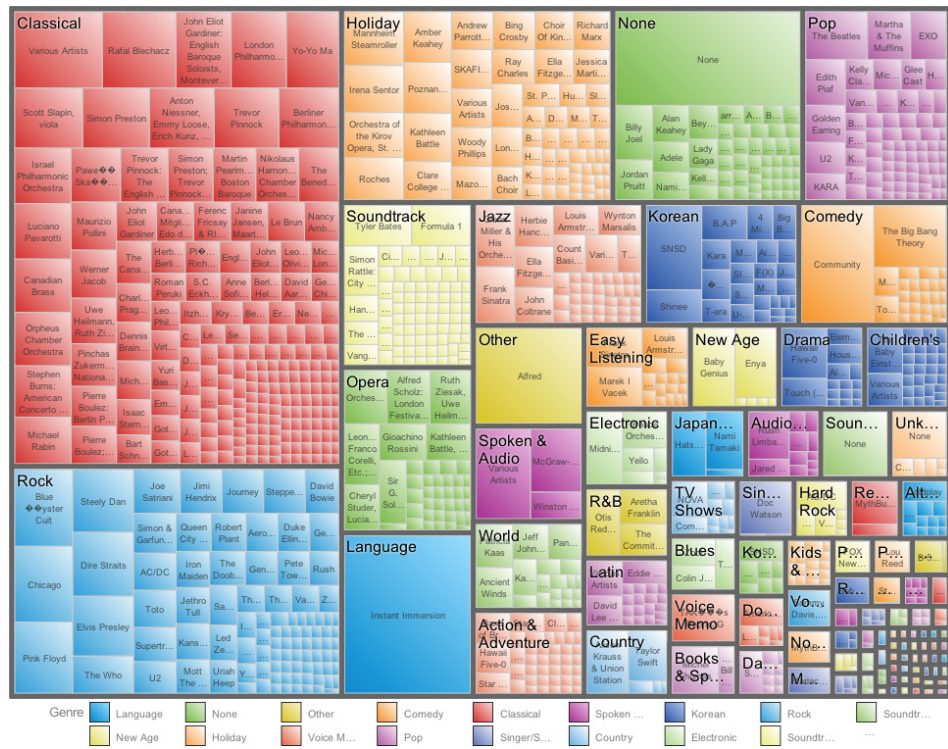


### Hierarchy Visualization



*A hierarchy visualization represents the relative magnitude of data points, as well as subsets of data, using bubbles of various sizes and colors. In this example, the visualization shows the number of targeted campaign responses on regional, state and city levels. Notice that a single scale is applied across all bubbles, replacing nested or sequential pie charts with a single graphic.*

### Tree Map



Tree maps display data as nested rectangles, the size of which represent their hierarchical importance in a dataset. This is a tree map view of a social network's track selections from a streaming media service.

There are many other types of visualizations that either enhance or replace more familiar types of charts. Others, like chord diagrams (used to show relationships among related entities) or the tree map above represent entirely new ways of looking at data. Regardless of the type of visualization used, the key differentiators between visualization and standard reporting techniques are interactivity and intuition. Visualization appeals to our inherent understanding of spatial relationships and graphical illustrations while enabling us to drill down into data to more fully explore and examine areas of interest.

### Why visualization is different than reporting

Visualization is not a replacement for reporting, whether those reports are delivered in dashboards, scorecards, or more detailed write-ups describing business issues. Rather, visualizations are powerful supplements that can be incorporated in reports and presentations that better communicate complex ideas, relationships, and trends than data tables or more traditional graphics.

Even if data visualization incorporates simple bar charts like the first example shown above or uses less sophisticated graphical elements, the presentation should suit the underlying data, rather than attempting to shoehorn data into limiting legacy graphics. Visualization is about creating business insight, rather than simply reporting on collected business data.

### Exploratory data analysis and predictive analytics – Visually

Perhaps the most powerful use of visualization is in exploratory data analysis. Pivot tables and other spreadsheet-based tools don't handle big data well and are quite limiting when users want to explore relationships in large, complicated datasets. It is far easier to tease out these relationships with visualizations designed to display temporal, hierarchical, and thematic associations.

At the same time, users at all levels of a business are trying to derive predictive insights from these complex datasets. Forrester Research explained how predictive analytics should be implemented in the enterprise with the following diagram in their 2013 report, [“The Forrester Wave: Big Data Predictive Analytics Solutions, Q1, 2013”](#):

Figure 1 The Predictive Analytics Process Must Be Continuous To Ensure Effectiveness



85601

Source: Forrester Research, Inc.

The tasks of monitoring, understanding, preparing, and evaluating data are all especially well-served by visualization, particularly when users are working with web-scale and/or unstructured data.

### **How analytics visualization creates competitive advantages**

If business insights from data analytics are confined to data scientists and executive leadership, an organization may benefit strategically, but building real competitive advantages from data requires insight from all lines of business. Operations must be data-driven as well and for that to occur, users need a means of quickly and easily exploring, understanding and leveraging an organization's intricate data resources. Visualizations are the key to realizing the promise of big data analytics at both operational and strategic levels. They are also democratizing, letting both mid-sized businesses and large enterprises tap into their data in ways that were previously out of reach for many users.

### **IBM Visualization: Natural, Intuitive, and Powerful**

IBM Business Analytics solutions include industry-leading tools for creating the types of visualizations described in this document. These tools are designed to support a variety of users, from line of business decision-makers to statisticians and data scientists with fewer limitations, less complexity, and more useful automation than other solutions. IBM's visualization solutions meet the needs of mid-sized businesses and large enterprises, both of which can derive substantial benefits from the powerful, intuitive, graphical presentation of increasingly complex data.

### **Visualizations that automatically suit the data**

Where spreadsheet-based approaches to creating charts and graphs require significant user input, manipulation, and manual selection of appropriate graph types, IBM Business Analytics tools incorporate substantial data intelligence and advances in cognitive computing. This means that IBM SPSS Visualization

### **The IBM Analytics Ecosystem**

IBM has several platforms and tools that let executives, data scientists, and line of business users analyze and, more importantly, visualize data in support of business goals and objectives:

- IBM Cognos Business Intelligence includes a library of visualization types that can be downloaded from IBM Analytics Zone and customized for reports. Cognos Business Intelligence also offers independent, desktop business intelligence that features visualization as a way to better explore data.
- IBM SPSS Modeler includes built-in visualization capabilities to help users better understand their data mining and models.
- IBM SPSS Analytic Catalyst creates visualization from big data and other complex data sources.
- IBM Cognos Express offers extensible visualization capabilities to help midsize companies and workgroups better interpret and analyze data.
- IBM SPSS Visualization Designer enables the creation and sharing of customized data visualizations.

Designer, for example, can suggest the types of visualizations best suited to the underlying data. If a dataset includes specific time series information, the application may suggest a heat map; they may suggest a chord diagram when data elements have clear directed relationships, even if these relationships aren't obvious to the user.

### **Interactivity**

Many of the built-in visualizations available for IBM Cognos Business Intelligence and IBM SPSS Analytic Catalyst also have interactive elements. Thus, even highly detailed visualizations can allow users to drill down through specific relationships or isolate subsets that further enhance their understanding of the data.

### **Extensibility and ready-made solutions**

Finally, IBM offers a library of ready-made visualizations for Cognos Business Intelligence. In addition, many of the graphics generated in Cognos and SPSS can be customized and extended, giving organizations the flexibility to present, explore, and act on their data in whatever ways are the most useful and informative to their users.

## **Conclusion: Visualization Makes Big Data Accessible**

Visualization is not just a logical progression of business analytics, business intelligence, or even predictive analytics. It is critical to the broader adoption of analytical, data-driven approaches outside of IT and the offices of data scientists. As BI platforms become more commonplace, organizations are looking for ways to make these tools truly useful across their organizations. For analytics to generate meaningful insights at both executive and operational levels, organizations need to go beyond standard dashboards and scorecards. Embedding better pie charts in a slide deck or quarterly report won't provide widespread benefits or increase competitiveness either.

Instead, delivering on the promise of big data and making analytics broadly accessible to users and data scientists alike requires fast, interactive and intuitive visualization of data in a variety of formats. These visualizations should be suited to heterogeneous data and diverse audiences, providing dynamic views of data and supporting the predictive needs of users with widely varying interests and areas of expertise. Requirements like these won't be met with spreadsheets or even many of the dedicated analytics applications on the market. They will be met with powerful, intelligent visualization tools built on robust analytics platforms.

To learn more about IBM Business Analytics and visualization, visit:  
<http://www-01.ibm.com/software/analytics/many-eyes/>