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Five Key Properties of Interactive Data Visualization

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According to renowned AT&T Bell Telephone Laboratories statistician John Tukey, "data may not contain the answer. The coordination of some data and an aching desire for an answer will not ensure that a reasonable one can be extracted from a given body of data." While Tukey (1915-2000) is correct in an important respect—one should not overvalue data *per se*—he was never exposed to today's Interactive Visualization, a term coined by Gartner.

The reality is that designers often fail to achieve both form and functionality, creating instead subpar visualizations—*e.g.*, bar charts, steamgraphs, treemaps, Gannt charts, and scatter plots—that fail to serve their main purpose of communicating information. These are far from the ideal way to consume data. As a result, users responsible for driving actionable intelligence from their data are often overwhelmed and frustrated by the effort required to make sense of it all.

The answer is Interactive Visualization, which enables the display and intuitive understanding of multidimensional data, provides a variety of visualization chart types, and enables users to accomplish traditional data exploration tasks by making charts interactive. Interactive Visualization implies the use of heat maps, geographic maps, link charts, and a broad spectrum of special purpose visualizations that surround processes that are inextricably linked to an underlying analytics. Increasingly, this last feature will become a differentiator among vendors.

Real-time, contextual, situational data visualization provides operational, tactical, and strategic data. A simple example is instructive. Assume that a call center closes 450 tickets on Wednesday evening. The tickets reflect static data – a snapshot in time, usually without references that aid making decisions. It isn't until you begin to trend data based on analytics that you can derive actionable intelligence. For example, if the company normally clears 150 tickets on Wednesday, that might prompt the user to ask specific questions about how dependent metrics may have resulted in this increase. He might also

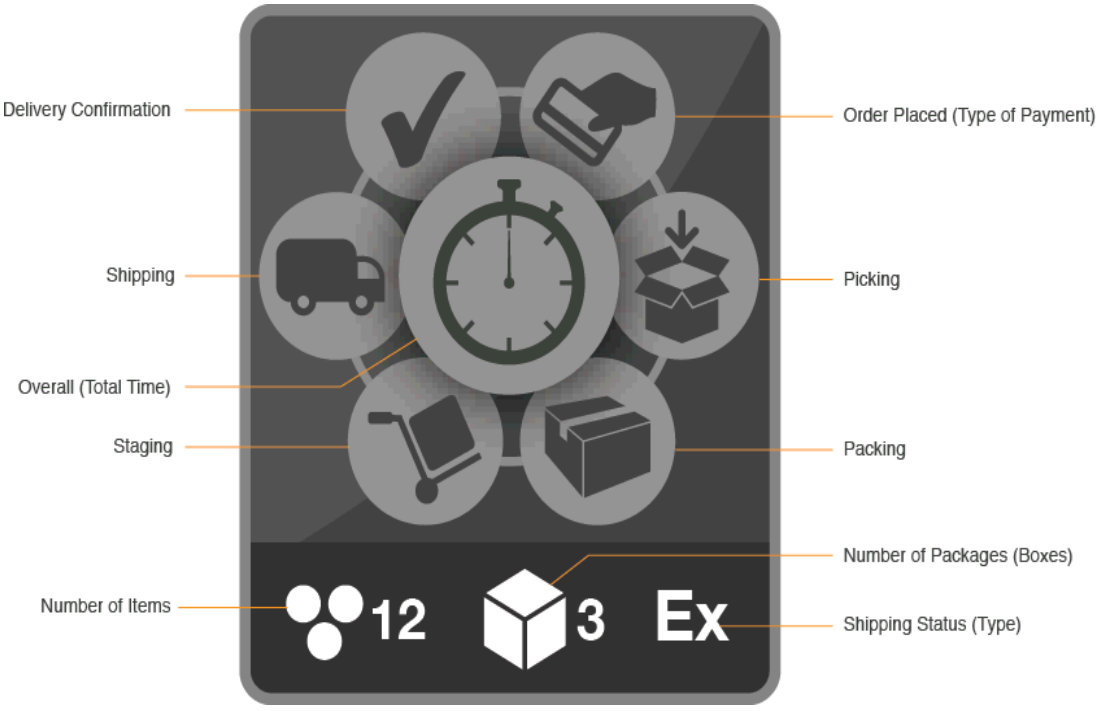
ask whether he needs to make specific changes. Do assets need to be re-allocated or obtained (*e.g.*, hire workers)? Until one is able to place a specific data point into context to identify a trend, a data point is informational but has little value to the enterprise. With typical analytics that show only one or two variables at a time, even business line managers may not know which Key Performance Indicators ("KPIs") they should track.

When an enterprise begins to trend contextual data, it can use metrics to make decisions that affect the way the organization operates in the immediate future, even on a daily basis. As trending becomes the norm, building metrics depends on the business questions one is trying to answer. Yet presentation remains a critical issue. The old adage is true: A picture is worth 1,000 words. A picture—in this case, a visual representation of data—alone, however, is insufficient unless it is presented in context to promote understanding and drive better decisions. Interactive Visualization begins with a data presentation architecture that seeks to identify, locate, manipulate, format, and present data in such a way as to communicate its meaning optimally. In this respect it is critical to note that dashboards do not constitute visualization. Gartner writes: "There is no such thing as an analytics dashboard. Dashboards have become a commodity with very little differentiation." Andreas Bitterer, Bill Gassman & James Richardson, *2013 BI Summit Hot Topics: Data Quality, Big Data, Strategy And Visualization* (Gartner Sept. 26, 2013); Daniel Yuay, W. Roy Schulte, Andreas Bitterer, Jona Tapadinles, *Predicts 2013: Adoption of Real-Time Dashboards Will Improve BI Persuasiveness* (Gartner Dec. 14, 2012).

The following are five key properties of Interactive Visualization:

1. The Novice User. Even novices must be able to examine data and find patterns, distributions, correlations, and/or anomalies. They must be able to build and use tools that enable faster decisions based on real-time information. As the National Research Council of the National Academies of Sciences states, even "naïve users" should be able to "carry out massive data analysis without a full understanding of systems and statistical uses." *Frontiers in Massive Data Analysis* (National Academy of Sciences 2013). And while data scientists play an indispensable role in today's corporation, business line executives should not have to rely on them to run analytics and make the inferences that are the basis for decisions. As McKinsey puts it, "sophisticated analytics solutions . . . must be embedded in frontline tools so simple and engaging that managers and frontline employees will be eager to use them daily." *Mobilizing Your C-Suite For Big Data Analytics* (McKinsey & Company 2013).
2. Driving Processes. The solution must allow the user to establish KPIs that provide the rules that drive processes. These must be displayed visually—for example, by color—in real time based on defined thresholds. Likes its architecture, Interactive

Visualization is a means to an end – to stimulate informed action. Thus, for example, when a fire engulfs the third floor of a company's office space, triggers are set off that alert proper actors such as the municipal fire department. Interactive Visualization displays the department's efforts through phases of the process—discovery, initial actions, mitigation, stabilization, and recovery. As each phase is completed, analytics-based data is represented in real time in green, thereby ending with the most intuitive color cycle we know: red (danger; take action); yellow (pause; remediation is underway); and green (problem solved; situation clear). With icons changing color based on pre-defined thresholds (rules) run against multiple data streams by an analytics engine, data can be understood equally by management and analysts with no need for technical translation. It is important that the status of a process (fire), a person (fireman), or a physical asset (fire truck) must be depicted visually either independent of one another or as they correlate. Each representation must be both simple and highly granular, allowing a user to understand huge amounts of data with little or no training.



3. Data Correlation. The user should immediately know not only of hot spots that require attention, but also effortlessly find trends based on the dynamic relationship between multiple data streams and the data derived from them by means of predictive analytics.
4. Prescriptions: "What should happen next?" According to Gartner, analytics evolves through four phases. The third and most discussed phase in today's market is predictive analytics – the application of rules and algorithms against data streams in order to yield actionable intelligence. This answers the question: "What is going to happen?" World-class Interactive Visualization and underlying analytics capabilities surpass that standard by offering prescriptive analytics ("What should

happen next?") to drive real-time asset behavior modification. This is the pinnacle of Gartner's evolution of analytics. It is closely linked to the need to drive processes discussed above. Recommendations may range from (i) re-routing a cargo ship to a different port based on the ratio of fuel loss to cargo weight, to (ii) suggesting additional training for underperforming members of a call center.

Conclusion

Interactive Visualization is an intuitive way to enable data trending and 'manipulation' to review findings in and across myriad dimensions. It is not a stretch to say that mission-critical Interactive Visualization can be easy (and fun) and empower the user to explore trends he could not have known existed, whether over space, time, processes, or assets, to name a few indices. Interactive Visualization does not stand alone as a mere presentation layer. It requires rich underlying data and predictive analytics to see how assets will behave and to make recommendations as to how they should behave.

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