

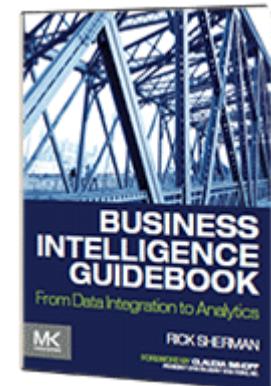
Slides for Courses Using the *Business Intelligence Guidebook*

From Data Integration to Analytics

by

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www.biguidebook.com



Business Intelligence Guidebook – From Data Integration to Analytics

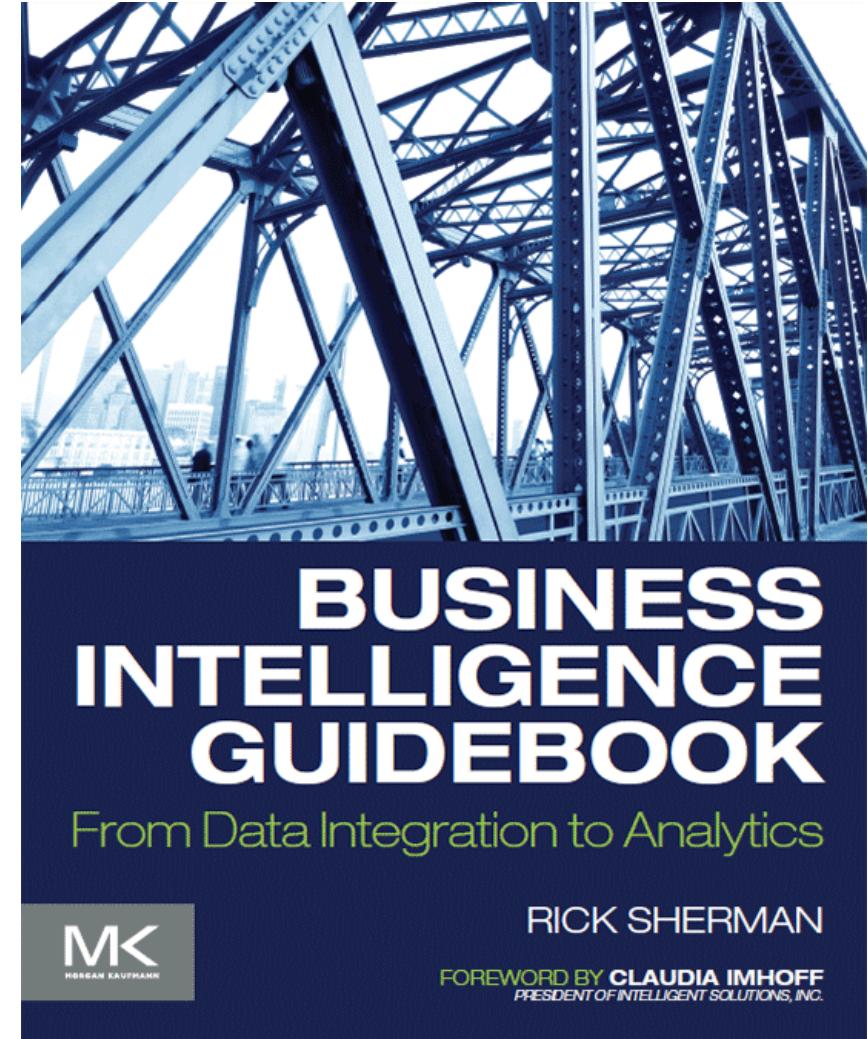
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Chapter 13

Business Intelligence

Applications

INFORMATION IN THIS CHAPTER

- Creating BI content specifications
- Choosing the BI application
- Creating personas
- Best practices for BI design layout
- Data design for self-service BI
- Matching visualization and analysis types

BI Content Specifications

- The project team needs to develop BI content specifications in [order to design and document the BI applications they are going to build](#).
- The requirements gathering processes discussed in Chapter 3 will have collected the [preliminary content for the specifications, but more details are needed](#), and the input from the requirements must be organized in the context of the BI applications.
- The specification is [a tool to help in the design, development, and maintenance of each BI application](#).
- The specification is [a living document that will be updated and modified at various points in the project](#) as designers, developers, and business people (its consumers) discover different aspects of the BI application.
- The BI application content specification includes the following: [BI content specification](#) (page 338) .

Revise BI Applications List (Choosing BI application)

- Create the initial list of BI applications by reviewing the data and business requirements gathered earlier in the project.
- The BI content specification process will help you create a revised and agreed-upon list of BI application deliverables. The revisions will evolve during the following steps:

1. Assessing scope

- Defining the BI content specifications involves categorizing the BI applications, getting the business to set priorities, and estimating the level of effort to create them.
- The BI team members developing the specifications will need to coordinate with data modelling and data integration efforts.
 - Review any data schemas that will be used by the BI applications.
 - BI application design (especially if prototyping is involved) and BI development efforts will need to have BI data stores populated with data, even if it is just sample or test data to begin with.
- Identify and document project dependencies and risks in the BI application specifications.

Revise BI Applications List (Cont.)

2. Consolidating BI applications

- Refine the initial list of BI applications to be delivered during the BI content specification process.
- Examine each of the individual BI applications in the context of the entire list.
 - First, there are often overlapping requirements across multiple BI applications that can be consolidated into a single BI application with the use of filtering or parameters.
 - Second, the use of more self-service oriented BI analytical styles, such as data discovery, OLAP, and in-memory columnar analytics, enable what appeared to be separate BI applications to be viewed on a dashboard.
 - Both of these scenarios are very common when legacy reports are included in the mix of BI deliverables.
- **Do not be intimidated if there are hundreds or even thousands of legacy reports to be migrated; Some projects had consolidation ratio of 10 to 1. This is likely to be the only time during the BI project where BI deliverables will be reduced rather than expanded.**

Revise BI Applications List (Cont.)

3. Reviewing specifications

- The consolidated list of BI applications with their content specifications needs to be reviewed by the business stakeholders and reporting subject matter experts (SMEs) to provide feedback and confirm or refine deliverables.
- In addition, the project dependencies and risks must be reviewed within the context of business priorities to determine if any adjustments need to be made to the list of deliverables, the schedule, or project resources.

4. Creating an agreed-upon BI deliverables list.

- This milestone reflects the exit criteria for the BI content specification process and, more importantly, BI scoping.
- With the agreed-upon list in place you can proceed with the tasks of data modelling, data integration, and BI development.

Creating BI Personas

- In almost every industry, marketing groups perform **customer segmentation** analysis for their companies to sell products or services targeted at specific segments.
- The key to success, just like in marketing, is to target the BI application to the correct customer segmentation.
- We refer to the characteristics of a segmentation of business people as a **persona**.
- Product vendors and IT personnel have been frustrated for years that they have not been able to get BI to be pervasive throughout an enterprise. The key to making it pervasive is to identify the BI personas, determine what tools support them, and then structure BI applications for them.
- The business personas are:
 - Casual consumers
 - Analysts
 - Power users
 - Data scientists

Creating BI Personas

Casual Consumers

- Many, if not most, of the people in an enterprise are casual consumers of analytics.
- These business people will use **pre-built reports and dashboards** to obtain information they need to perform their jobs.
- If **filters or parameters** need to be input in order to obtain their specific data, then they would prefer to save the settings so they do not have to remember them for the next time.
- Casual consumers may range from **operations staff to executives**.

Creating BI Personas

Analysts (Business analysts, financial analysts, sales analysts, etc.)

- The analyst persona includes people in an enterprise who regularly use BI applications to gather and explore data they need to perform their jobs. Data analysis is in their job descriptions. The job titles may include the word “analyst” (business analyst, financial analyst, sales analyst, operations analyst, etc.) but many other managerial or staff jobs also apply.
- Analysts will leverage their business knowledge to explore and analyze data using spreadsheets and BI applications.
- They are quite comfortable using **pivot tables**, so BI applications that present data in that context are easy for them to use. A wide range of BI styles present data in this context, including **OLAP cubes, in-memory columnar data, discovery, data visualization, dashboard, scorecard, and report tools**.
- Analysts typically use a dashboard or report template rather than building it from scratch. They will drag the dimensions and measures presented in the power pivot palette onto the templates to perform their analysis. Analysts will also typically use existing data models, but may augment those by adding calculated measures or augmenting the data with something from a spreadsheet.
- Analysts offer the most significant opportunity for the BI application to expand and increase its overall business ROI because they are underserved in most enterprises, yet their job role means they would benefit from becoming BI application consumers.

Creating BI Personas

Power Users (Combine the business needs of analyst persona as well as IT skills, usually develop data shadow systems)

- Power users have always been the sweet spot for BI sales, as they have the business needs of the analyst persona, but they also love technology.
- These people are the departmental experts in the BI tools that have been bought, and they are their core enterprise customers.
- Because their efforts to build and enhance BI applications gives them a pseudo IT role, they take the time to learn all the BI tools' features and keep asking for more.
- Although power users are the core of an enterprise's BI efforts, they present risks to those efforts:
 - First, their skills and enthusiasm for BI tools does not represent those of the other business people. BI applications should be positioned to support the power users but, **more importantly, support the rest of the business community.**
 - Second, power users are the people who have been **creating data shadow systems for years**. These systems provide them with their gravitas with their peers and managers—**something they are not likely to give up easily**. Keep in mind that power users may build their next data shadow system with the BI tools rather than a spreadsheet. **With that in mind, make sure that migration of legacy reporting and data shadow systems are part of the deliverables for BI projects.**

Creating BI Personas

Data Scientists

- These are the data and statistical geeks. Data scientists **work with predictive analytics**.
- Predictive analytics moves BI from merely analyzing the past and present to leveraging that knowledge to predict outcomes.
- Data scientists know **statistics and math**, but what is often overlooked is their expertise in their enterprise's business and industry. They may also have expertise **in psychology, economics, or other disciplines that help build predictive models**.
- The size of the data scientist population in most enterprises is small, but their business impact may be significant. This book covers [predictive analytics and how to build BI applications for the data scientist persona](#) in Chapter 15.

Best Practice for BI Design Layout

- This section discusses **how to design the applications so they are intuitive and functional:**

First, focus on the purpose

Second, follow design layout best practices

Best Practice for BI Design Layout

Focus on the Purpose

- The BI team identifies the who, what, where, and how of each BI application in the BI content specifications and establishes its specific purpose.
- Designing the application should begin with finding the area focus up front and then ensuring that it will be adhered to.
- The business person will inevitably ask for more, tempting the BI developer to expand the focus, but that should be avoided at all costs. If new purposes arise, then the BI team needs to determine if it needs to develop new BI applications to fulfil those requirements.
- BI design techniques, such as wireframes, mockups, and prototyping, are extremely useful in getting business feedback and in maintaining focus on the purpose of the application.

Best Practice for BI Design Layout

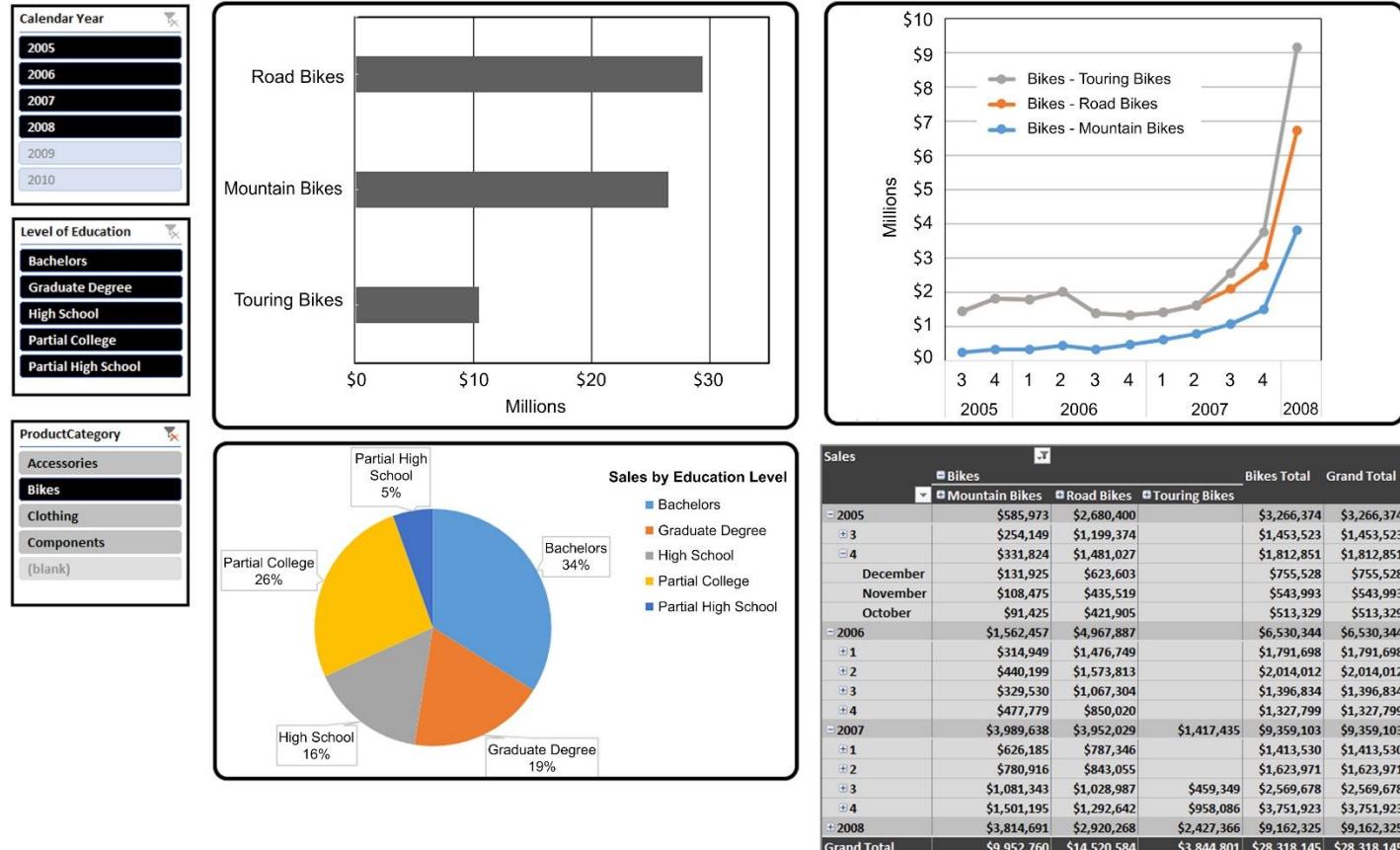
Design Layout

Follow **these basic design layout practices** when developing BI applications:

Consistency beats elegance

- The BI team should develop [a template layout](#) for each BI style deployed in BI applications.
 - The layouts [should be as consistent as the variation in BI styles allows](#).
 - The template should include [standard positioning](#) for titles, legends, navigation tools, help, and visual elements, such as icons and text styles.
 - There should also be a [standard background and branding](#) such as a company or product logo.
- Business people should feel that each BI application is [familiar in both layout and navigation](#), which improves their productivity and allows them to concentrate on the analysis rather than on the application.
 - In addition, developing [templates improves the productivity of the BI team, speeds up BI delivery, and decreases maintenance costs](#).

Dashboard example 1



f13-01

Figure 13.1 depicts a standard template designed by a BI team for a product marketing group.

Design elements that are standardized in this example include:

- Filters located on the upper left corner of the display.
- Comparison and contribution analysis presented in two left-hand quadrants. Data is aggregated and drillable when there is a dimensional hierarchy.
- Trending analysis presented as a line chart in the upper right quadrant.
- Sales data presented in tabular form in the lower right quadrant.

Best Practice for BI Design Layout

Design Layout (Cont.)

Keep it simple

- There is a temptation to try to cram too much information or too many visual elements onto a BI application's display
- Creating too much visual clutter makes it more difficult or sometimes impossible to work effectively.
- Do not be afraid of white space, as it is not a sign of weakness; rather, it shows restraint. The term data-ink ratio identifies the relationship between data and white space.
- Business people should be able to **determine at a glance** what elements on the layout they are going to work with.

Best Practice for BI Design Layout

Design Layout (Cont.)

Location, location, location

- Place the most important data at the top of the dashboard, in particular the upper left-hand corner, which is where a person's eyes travel first.
- If visualizations are linked together to support a particular business analysis, then the workflow should be from top to bottom and from left to right.
- This workflow places the last visualization at the bottom or bottom right of the layout.

Best Practice for BI Design Layout

Design Layout (Cont.)

Use colors judiciously

- Colors can be used very effectively to enhance the understanding of data, but they can also become a distraction or even a hindrance.
- It is very common to encode or associate colors with specific values of something, such as a different color for each product category displayed on a line chart.
- In addition, making a color hue darker or increasing the size of an object on a chart can portray increasing values, such as sales or income.
- Always keep in mind that the layout needs to be understandable even if only seen in grayscale in order to accommodate people who are color blind, or when the display has been printed (or saved to a PDF document) without color.

Best Practice for BI Design Layout

Design Layout (Cont.)

Use colors judiciously (Cont.)

There are several guidelines:

- ✓ **Use a limited number of colors**, as too many colors makes it impossible to discern how the data has been encoded. Also limit the number of color palettes in the layout to no more than two.
- ✓ **Color gradients are effective in displaying differences in measures' sizes or rankings.** This technique can reduce the total number of visualizations necessary to convey information and can also reduce the number of colors needed.
- ✓ **Use contrasting colors rather than colors with slightly different hues**, as it will be difficult to distinguish between the colors.
- ✓ **Color schemes should represent distinct things on the single display.** Overlapping color schemes on different views creates confusion because the same color is used to represent two different things.
- ✓ **Use colors conventionally whenever possible.** The best example is to use the **color green for positive values** such as business profits and the **color red for negative values** such as business losses. This enables the business person to mentally encode the visualization without the need for any legend or other visual cue.

Best Practice for BI Design Layout

Design Layout (Cont.)

It looked great on my monitor

- Many data visualization tools enable the dashboard to be designed once and deployed on many platforms, such as PC, tablet, and smartphone.
- These devices range in size from huge wide-screen monitors to handheld phones and will also vary in display quality.
- Dashboards designed on a huge wide-screen monitor may look very compelling, but may be too cluttered on the typical notebook's screen and impossible to use on a tablet.
- If the BI applications are planned to be deployed on multiple platforms, then the developer needs to prototype the layout on each of those platforms from screen size and display quality perspectives.

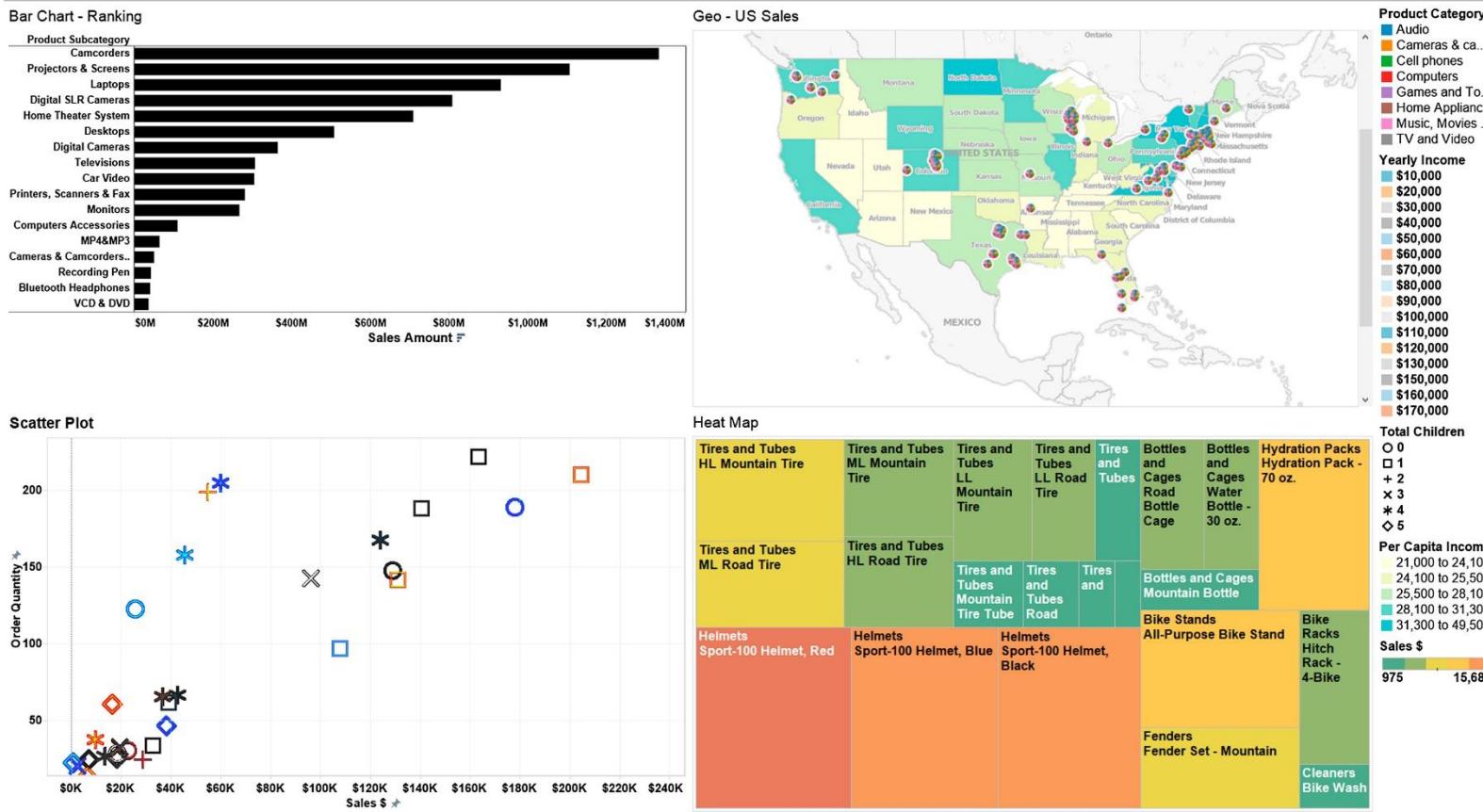
Best Practice for BI Design Layout

Design Layout (Cont.)

Limit the visualizations on a single layout

- The classic dashboard has **four visualizations or charts** that are related to each other in a business context.
- If the layout starts adding more than four visualizations, it gets cluttered, the data-ink ratio goes astray, visualizations get smaller, and the overall usefulness of the BI application decreases.
- If additional visualizations are linked to one of the four selected for the BI applications layout, you should place those visualizations on another dashboard or report.

Dashboard example 2



f13-02

Figure 13.2 depicts a different standard template designed by a BI team for a product marketing group. This template uses a:

- Bar chart for ranking analysis.
- Geomap for sales.
- Scatter graph for correlation analysis.
- Heat map for contribution analysis.

Best Practice for BI Design Layout

Design Layout (Cont.)

Leverage filters and slicers

- Filters enable business people to customize their data discovery and exploration within a BI application. They allow business people to reduce the data set into more detail. There are several guidelines:
 - ✓ It is best to apply filters to all visualizations in a layout. This avoids different visualizations using different filters, which would be misleading. For example, if there is a product category filter, then all the visualizations with the product category should only display those filtered product categories.
 - ✓ Filters are typically implemented by selecting from a list of values; however, deep and numeric values are best displayed by using a sliding bar filter.
 - ✓ Visibly display filters that are in use so that the business person knows what they are saying in the visualizations. In addition, dynamic titles that include filters that were applied are often useful if the number of values is limited.
 - ✓ If attributes being used in filters have hierarchies, then the filters should be displayed in hierarchical order from highest to lowest. Filter values applied in a hierarchy should cascade to all levels of the hierarchy.
 - ✓ If a filter value list is lengthy, it may be useful to include all or none options in the filter list.

Best Practice for BI Design Layout

Design Layout (Cont.)

Use legends judiciously

- Legends are another visualization that can lead to clutter if overused.
- Only use legends when needed to understand a visualization such as when colors aren't labeled.
- Also, many times visualizations that are related to each other may be able to share the same legend. When using a common legend for multiple visualizations, make sure it is visible everywhere it is needed.

Outliers should be flagged

- Assuming that outliers are the exception rather than the rule on the display, then there should be a visual cue indicating that it is an outlier. These cues may involve using color, size, boldness, highlighting, or icons.
- The outliers may represent the best and/or worst measure values, depending on what the business is interested in tracking.

Best Practice for BI Design Layout

Design Layout (Cont.)

Make it easy to read labels

- Horizontal labels are much easier to read than vertical labels.
- Consistent text style, fonts, and size also adds to readability.

Scrollbars

- Typically it is best to avoid scrollbars because it is difficult to ascertain the full context of the data being presented.
- If the business person does need to see a tabular data grid, then consider linking to a stand-alone grid from the initial dashboard.

Data Design for Self-Service BI

- The data presented in each BI application must be designed in **the context of the ease-of-use and functionality** that is appropriate for its intended use and audience.
- In the previous section, you read that cluttered and poorly designed visual layouts can hinder business analysis. It's the same with data layouts.
- When the data model that business people see when using the BI application is cluttered and poorly designed, it makes it much harder to use. We will refer to this as **the BI presentation model**.

Data Design for Self-Service BI

The Last Data Preparation Step

- Most BI tools present data to the business people in the context of a dimensional model, displaying the data as dimensions and measures (or facts).
- This context exists regardless of the data structure of the data sources the BI tool is accessing.
- In addition, hierarchies can be created by linking dimensions together, new measures can be derived by performing functions on other measures, entities can be renamed, and things can be hidden from view.
- All of this information is stored in the BI tool's repository. The dimensional model with all of its modifications results in the BI presentation model that business people see when using the BI applications.

Data Design for Self-Service BI

The Last Data Preparation Step (Cont.)

Two approaches for the BI presentation model are:

- **Vertical**—it is tailored to meet the needs of its BI application just like the visualizations and analytical functionality. **It is geared toward a specific business group** and the functions that they perform. This is a vertical orientation with the same people performing different functions. Examples include the accounts receivables (A/R) or the sales group.
- **Horizontal**—**it focuses on a specific business process**. This is a horizontal orientation with one process supported by people who work across different business groups. Examples include supply chain management and budgetary planning.

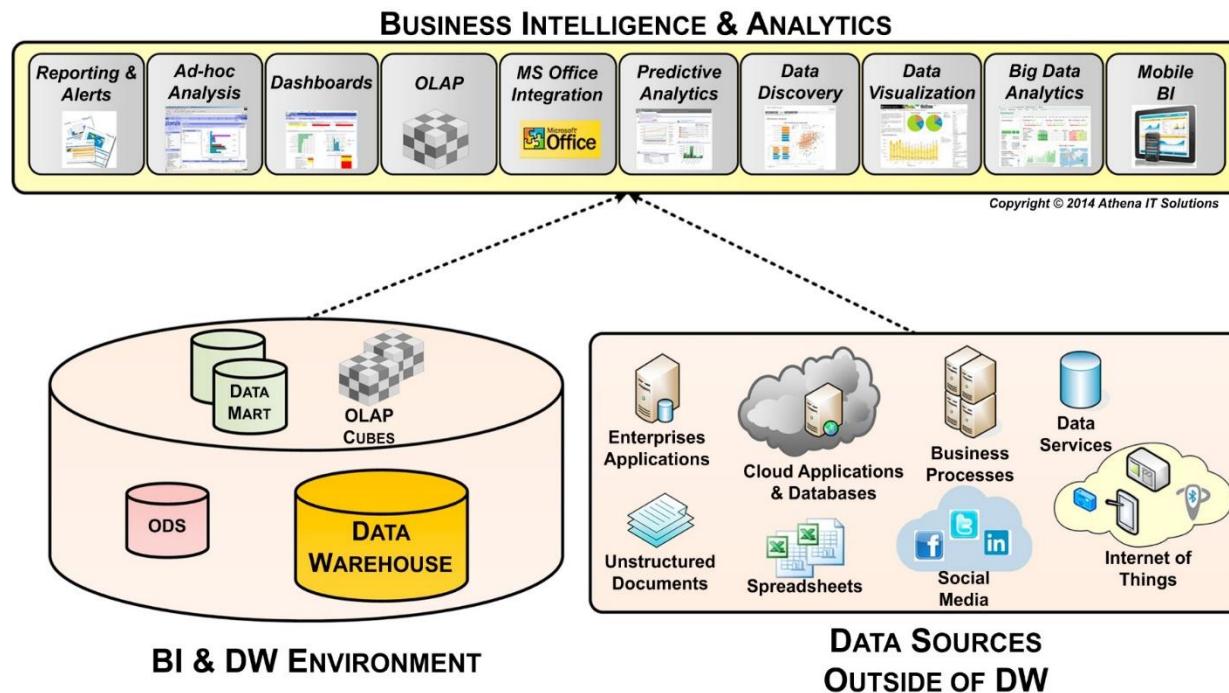
Data Design for Self-Service BI

The Last Data Preparation Step (Cont.)

- Just as a dashboard overloaded with irrelevant or inappropriate visualizations is distracting, an overloaded BI presentation model is also a hindrance. The project team can build relevancy into the BI presentation model by:
 - **Eliminating clutter.** When a business person is performing analysis, it is best to have available relevant dimensions or measures rather than have to sort through dozens of irrelevant choices. For example, if the business person is interested in sales data, then manufacturing measures will not be useful.
 - **Using business terminology.** The dimensions and measures should use the names and terminology of the people who will be using it. Although the BI team or source system applications may have well-thought-out data-naming conventions, what the business people see is not the database column name, but the name they use.
 - **Prebuilding hierarchies and business-specific measures.** During data discovery, the project team should have uncovered the hierarchies and business-specific measures that are being used in the business process or analysis being supported.

Data Design for Self-Service BI

When Inconsistency is Reintroduced



f13-03

- BI applications can be built to access a wide variety of data sources as depicted in Figure 13.3.
- **One group of data sources is the BI environment** that may include operational data stores (ODS), EDW, data marts, and OLAP cubes.
- Each of these data stores was created using data integration processes that generated the information 5 C's, so along with the steps we just discussed the business people will have consistent and relevant data.
- **The other group of data sources comes from the operational environment** with enterprise applications, cloud applications, unstructured data, spreadsheets, databases, or files. **These data sources may be terrific for operational reporting, but when used together, may result in inconsistent or incompatible data.**

Data Design for Self-Service BI

When Inconsistency is Reintroduced

- The best practice is to work with the business people who are going to be involved with self-service BI and discuss what data sources from the operational and BI environments they plan to intermix.
- The BI team should perform data profiling and data discovery on the operational data sources, if they have not done so already, when building the BI environment. From the data profiling and discovery activities [you can classify the operational data in the following categories:](#)
 - **Data augmentation.** [The operational data sources do not overlap any existing BI data source and expand the amount of data that can be used](#) for analysis while retaining consistency.
 - **Data consistent but semantically different.** The operational data source [does augment](#) the BI environment; however, due to naming or other metadata differences, it may be difficult for the business people to conduct their analysis. In this case, the BI team should [assist the business people by creating consistent semantics within the BI presentation model](#).
 - **Data consistent but not able to link together.** The operational data sources [have relevant data but it does not have the form or relationships to support the dimensions and measures presented in the BI application](#). In this case, the BI team may expand an ODS, EDW, or data mart, depending on the scope of the data involved, [to integrate the data into a dimensional model](#).
 - **Data is inconsistent.** Sometimes the operational data and BI data sources are [not consistent or compatible](#). Under these circumstances, the BI team and business people using the BI application [must discuss the issues](#). Then the business people must [decide which data is more valid for their business analysis](#).

Data Design for Self-Service BI

OLAP Cubes and In-Memory Columnar Databases

- BI tools support various BI analytical styles that use **OLAP cubes** or **in-memory columnar** databases as one or more of their BI data sources.
- Both require building a logical data model to present the data to business consumers, even though **they have different underlying physical structures**.
- OLAP cubes and in-memory columnar databases require mapping and then loading data from relational databases, flat files, spreadsheets, or other data sources. **Some BI tools enable the mapping and loading of these data structures with data integration tools**, but most require the use of their own tools specific utilities. In the case of data discovery tools and spreadsheets, often the responsibility rests **with the business person using the BI tool**.
- Although BI tools are optimized to work with a dimensional model, **the reality is that they will work without one or with a poorly constructed schema**. Without a dimensional schema, business people are basically using the equivalent of a series of flat or denormalized tables, which limits the tool's effectiveness for their business analysis and lessens their productivity. **Unfortunately, many proofs of concept and pilots use a limited**

Data Design for Self-Service BI

OLAP Cubes and In-Memory Columnar Databases (Cont.)

- The best practice is to designate a BI team member to be responsible to define and create the dimensional models that will then be loaded into the OLAP cubes or in-memory columnar databases.
- The BI team should work with the business people using the BI application to then fine-tune the BI presentation model for effective business analysis.

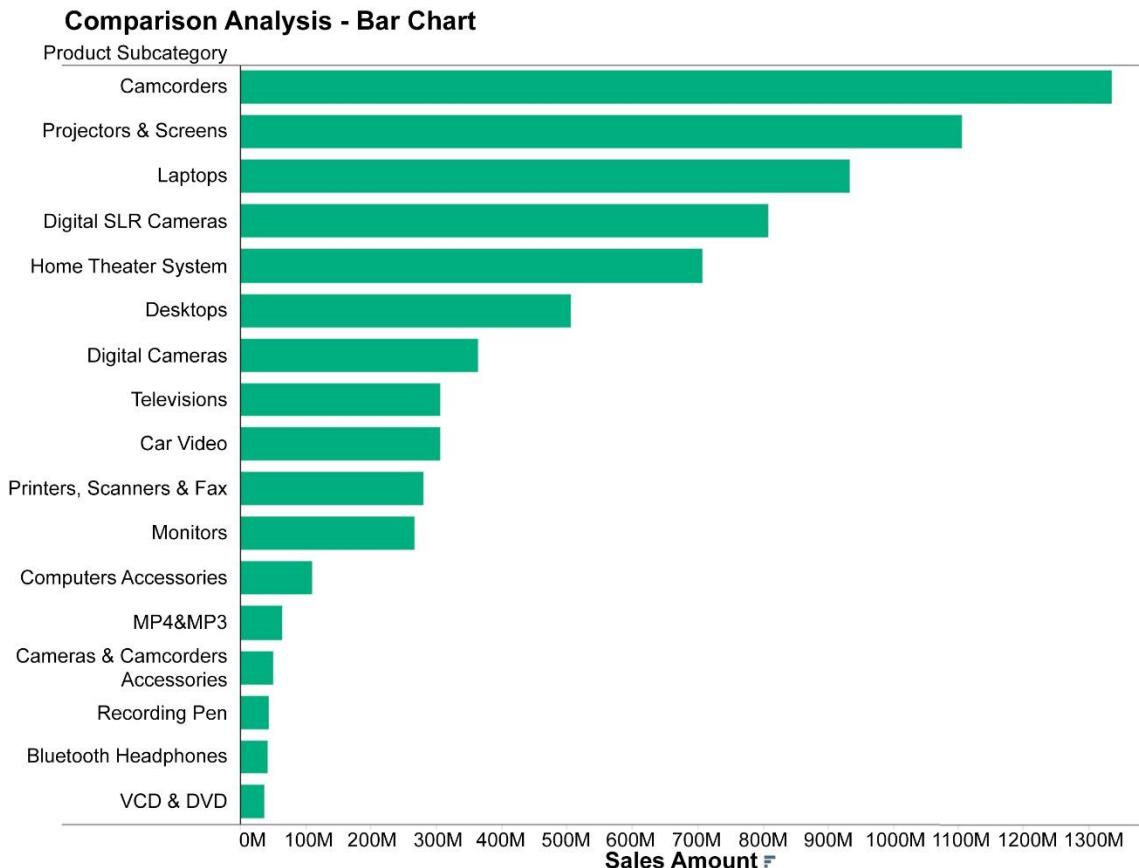
Matching Types of Analysis to Visualizations

- When designing the BI application, keep in mind the type of analysis that the business person needs it to perform. This will help you choose the best type of chart to optimize visualization. The most common types of analysis performed include:
 - Comparative
 - Time-series or trending
 - Contribution
 - Correlation
 - Geographic data
 - Distribution

Matching Types of Analysis to Visualizations

Comparative Analysis

- People frequently compare and rank data. An enterprise, for example, will compare sales by categories of product and then rank those sales by the top products, as depicted in [Figure 13.4](#).
- [Bar charts, as illustrated in the example, are very effective for comparative analysis](#) because the lengths of the bars represent quantitative measures that can be compared quite easily. When ranking is important, sorting bars by the measure's value enables a person to quickly discern the ranking order.
- It is best to use one color for the bars rather than multiple colors, because it is easier to estimate the different bar sizes.
- Horizontal bars work well for any number of items. Vertical bars work well with fewer than a dozen items.



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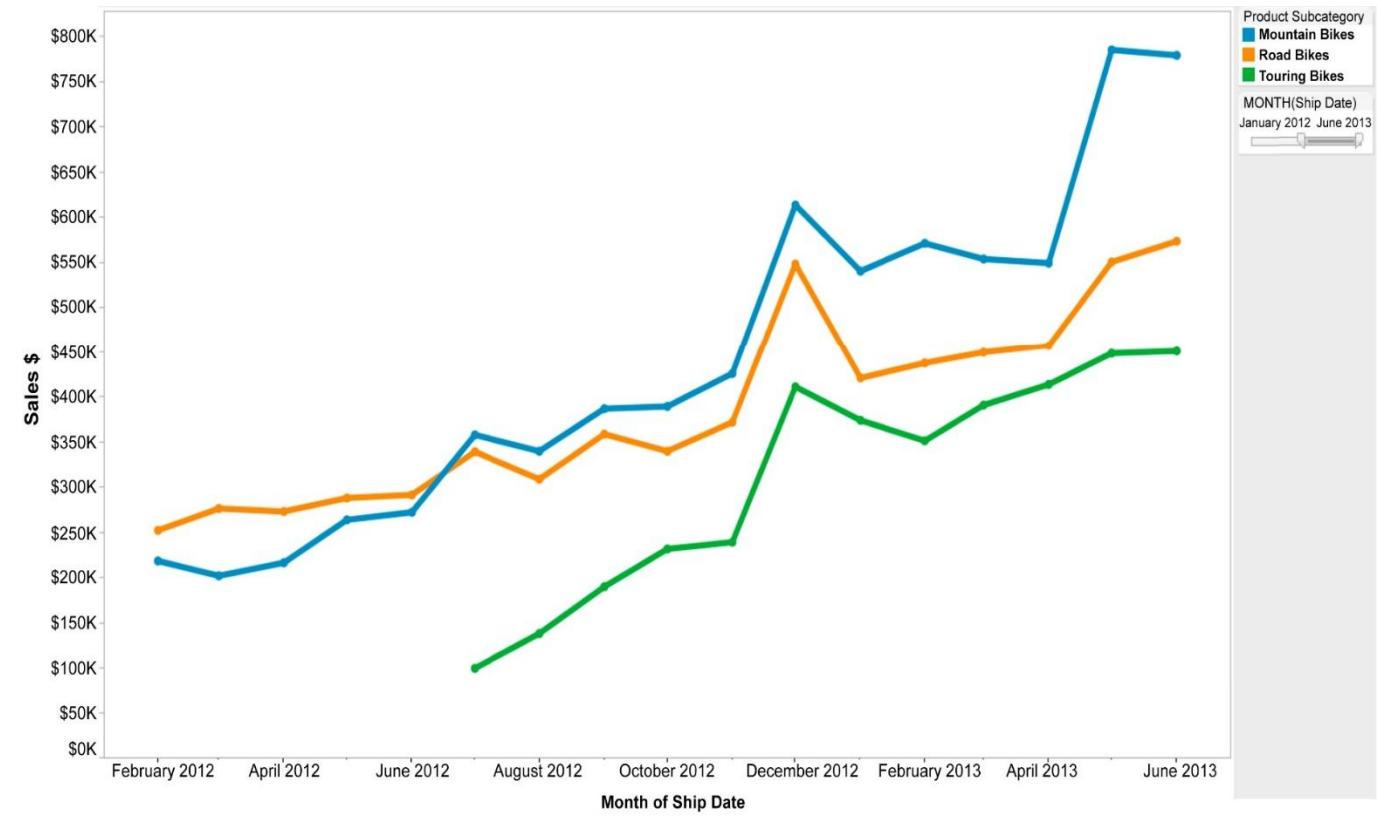
Matching Types of Analysis to Visualizations

Time-Series or Trending Analysis

- Examining trends over time, such as tracking sales is a very frequent analytical activity. Often the data tracked is broken down by some form of segmentation, such as product categories or by a person's income level. **The best visualizations for time-series analysis are:**
 - **line,**
 - **area, and**
 - **bar charts.**

Trend analysis – line chart

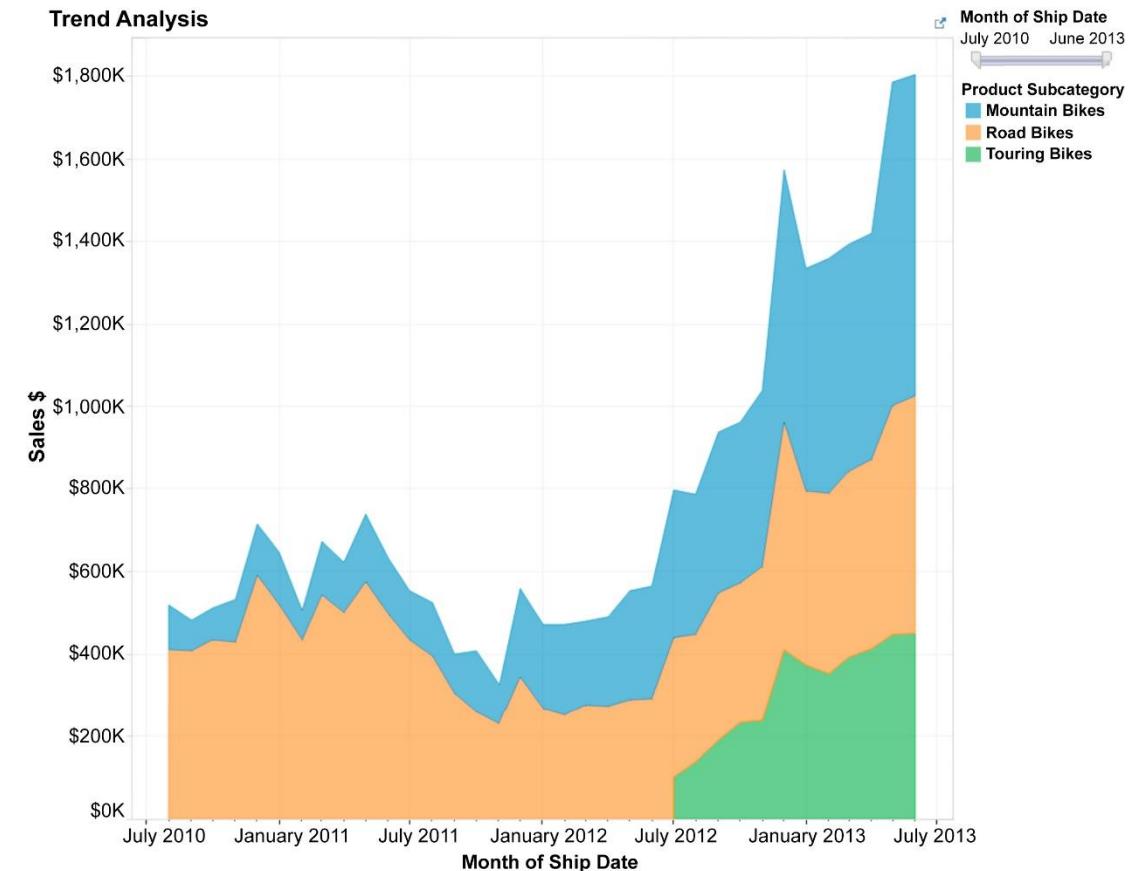
- Line charts are very effective at displaying segmented data as it changes over time, as depicted in [Figure 13.5](#). Both the trends and relative differences in each of the segments are easy to discern. Different colors or line types often enhance usability.



f13-05

Trend analysis – area chart

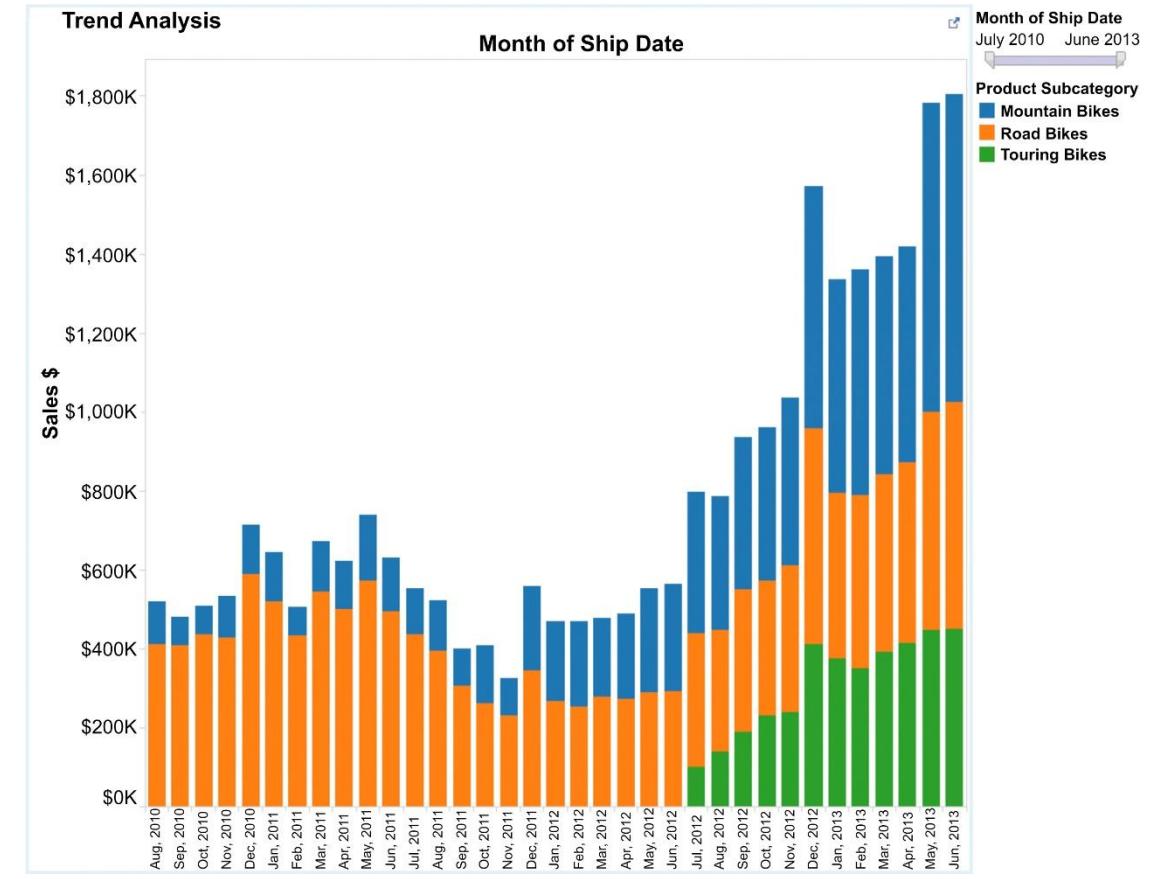
- Area charts are better than line charts if the person using the chart is interested in examining the trends, not only of the individual segments, but also their totals. [Figure 13.6](#) illustrates how the segments and their total are highlighted using an area chart.



f13-06

Trend analysis – bar chart

- Bar charts, as depicted in [Figure 13.7](#), are effective when there are only a few segments to be tracked or when each time period is discrete and people are not interested in seeing the trend, such as in a line chart
- The convention for the trending charts is for time to be displayed horizontally on the X-axis while the measure is displayed on the Y-axis.



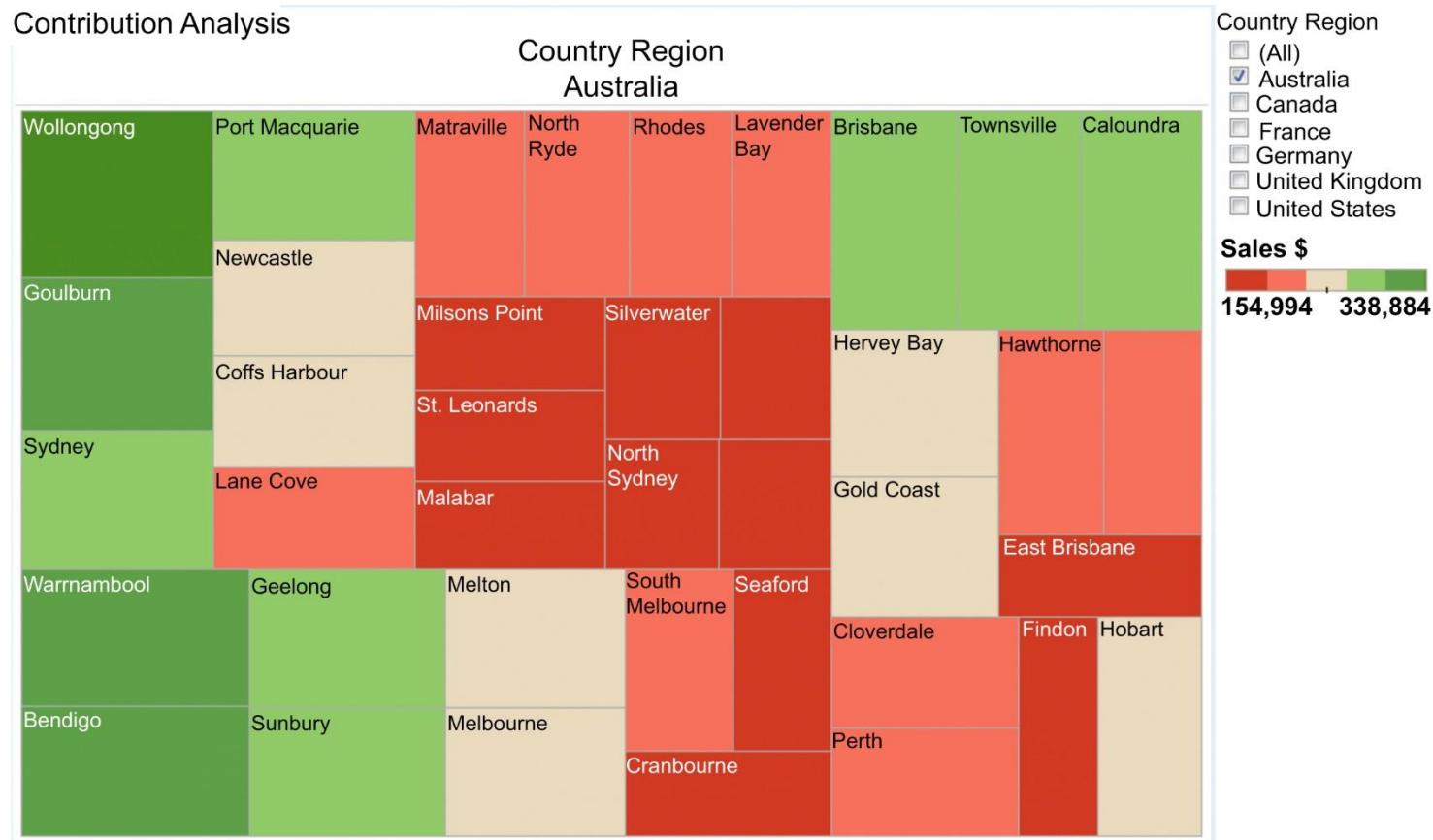
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Matching Types of Analysis to Visualizations

Contribution Analysis

- In this analysis, the contribution that each segment of something makes in relationship to the whole is typically represented by a percentage. The most common visualization used for this purpose is a pie chart, but it really is only effective when there are only a few elements to display, such as three or four.
- When there are too many slices it is very difficult to compare the slices relative to each other, especially when they are nonadjacent. As the number of slices gets larger, use other visualizations. Bar charts where each bar is the same length and segments are sized by percentages support a larger number of segments than pie charts, but they still encounter an upper bound fairly quickly.
- As shown in Figure 13.8, the preferred contribution analysis visualization is the heat map, as it can accommodate a large number of slices, especially when a color gradient is used to enhance its usefulness.

Contribution analysis – heat map



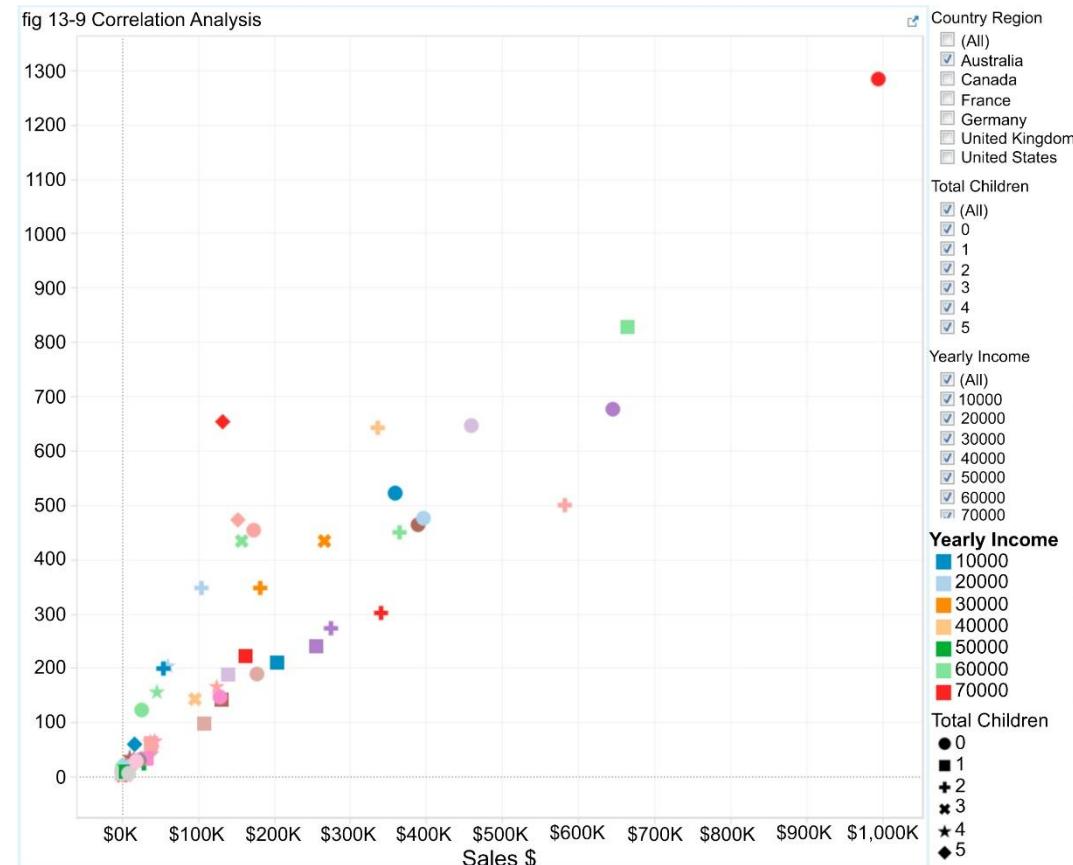
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Matching Types of Analysis to Visualizations

Correlation Analysis

- Visualizations are more effective than tables of numbers for enabling people to identify potential relationships among measures. This is especially true when there is a lot of data to show. Visually, people have become adept at discerning potential patterns.
- **Scatter plots** (see [Figure 13.9](#) for an example) are very effective for correlation analysis, especially when size and color are used to depict variation in the measure's quantitative values. Also, combinations of line and bar charts are sometimes effective to support correlation analysis, especially when trend analysis is being used to identify correlations.
- But be cautious, however, because a potential relationship does not guarantee a correlation. Validate causation prior to declaring there is a correlation.

Correlation analysis – scatter plot



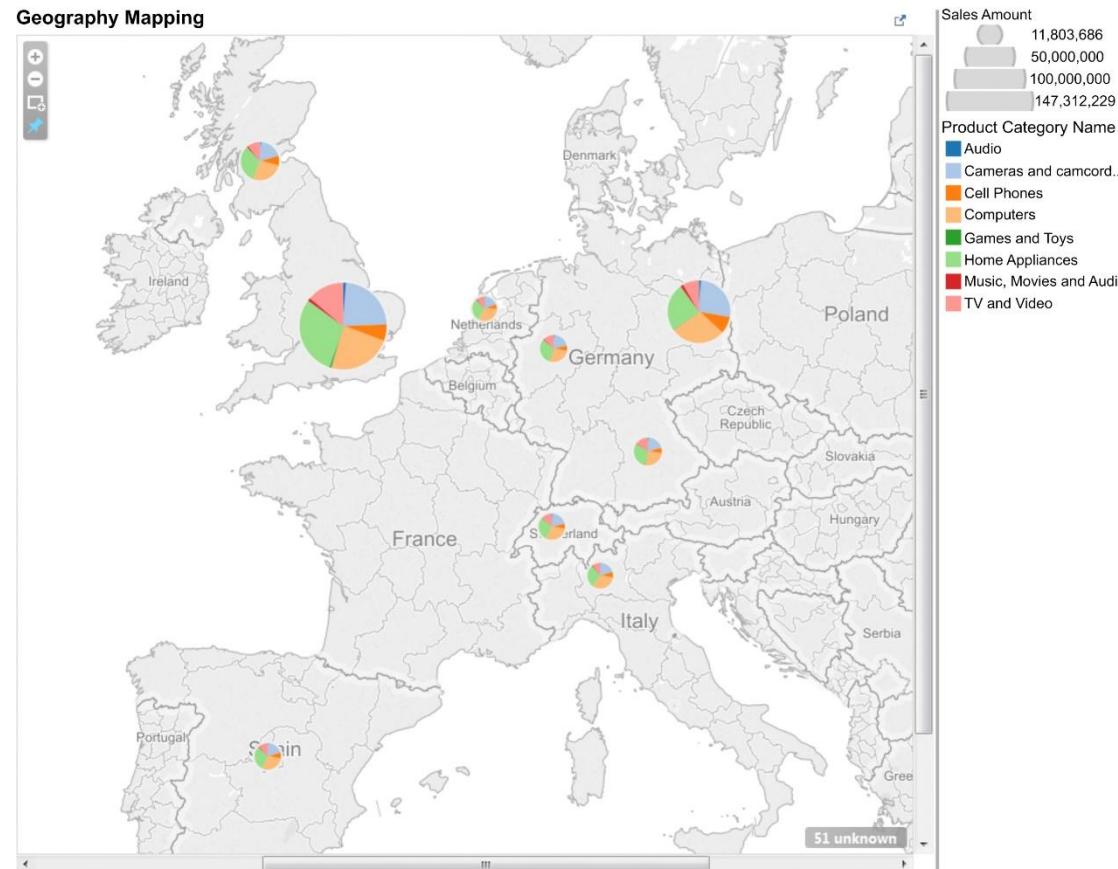
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Matching Types of Analysis to Visualizations

Geographic Data

- The most effective method to **visualize data by location is to use a map.**
- Sales by the location of the retail store where the product was bought or by where the customer lives are excellent examples of how a map can show the distribution of sales.
- See [Figure 13.10](#) for an example.
- Pairing an additional chart, such as a line chart showing trends or a data table providing the underlying detail with the map, is often very useful in enhancing the information conveyed.

Geography mapping

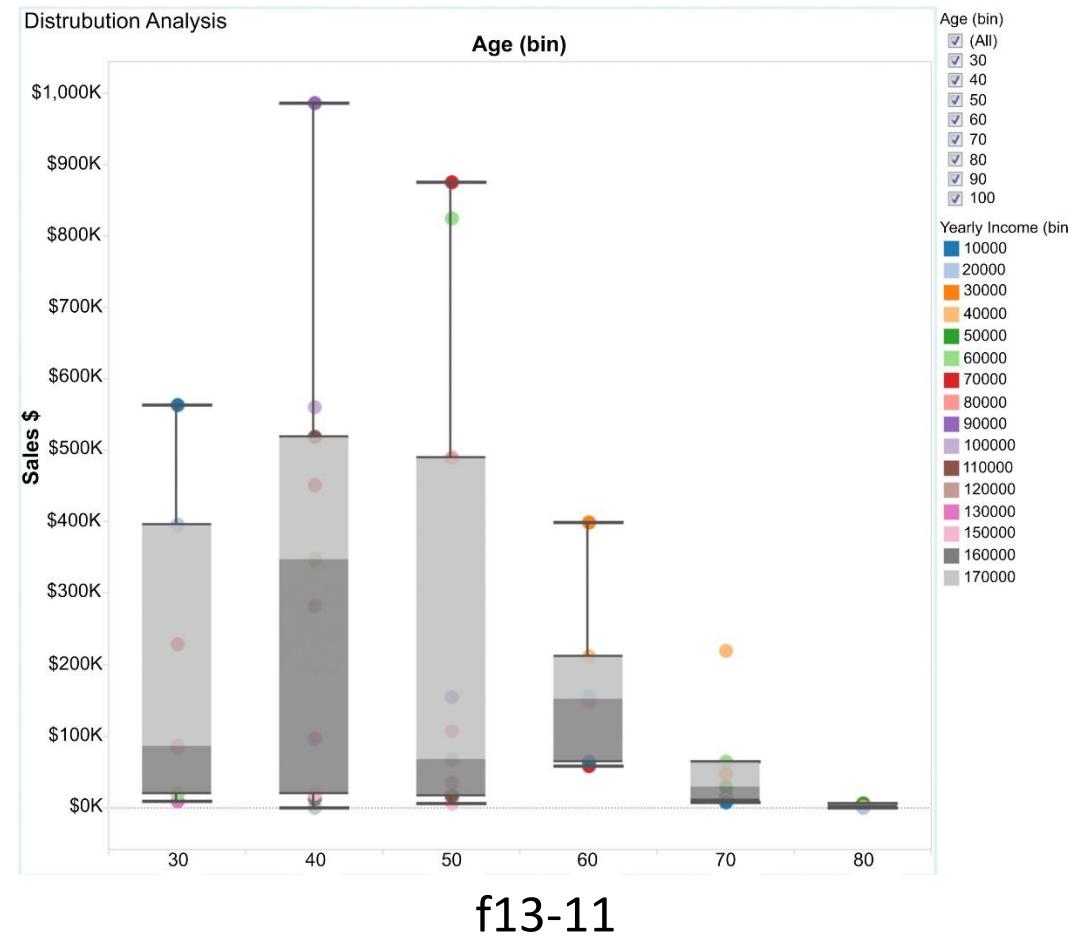


Matching Types of Analysis to Visualizations

Distribution Analysis

- This type of analysis displays the distribution of values across your full quantitative range. For example, call center talk time is examined by the length of call with its average, minimum, and maximum for different types of support calls.
- The two visualization techniques used to support distribution analysis are:
 - box plots, and
 - histogram.
- [Figure 13.11](#) provides an example.

Distribution analysis – box plot



f13-11