Shining the Bright Light of Analytics on Big Cities

Session ID:

108840

Prepared by:

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May 28, 2020

Remember to provide your session feedback in the app!

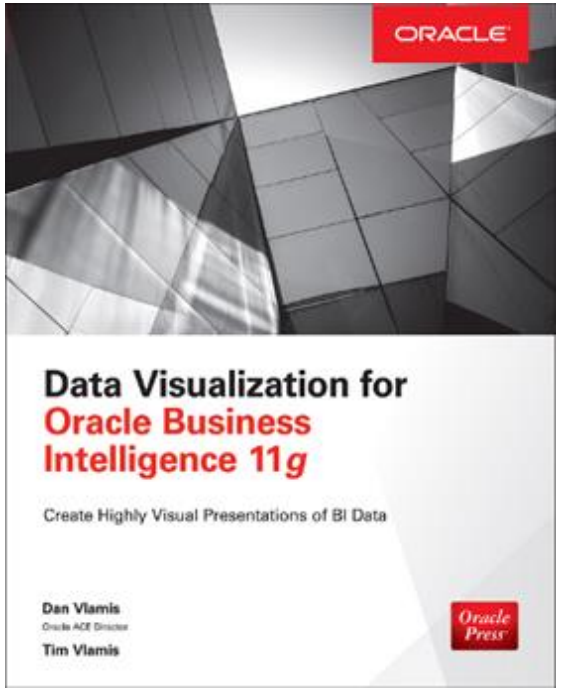
Vlamis Software Solutions

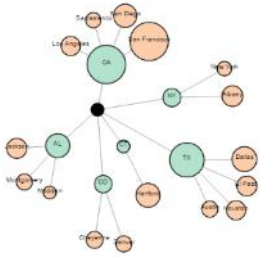
- Founded in 1992 in Kansas City, Missouri
- 400+ Enterprise Clients
- Consults in :
  - Enterprise Business Intelligence & Analytics
  - Analytic Warehousing
  - Machine Learning and Predictive Analytics
  - Data Visualization
  - ETL and data integration
- Multiple Oracle ACEs, consultants average 15+ years
- Creators of the Force Directed Graph Plugin on Oracle Analytics Library
- www.vlamis.com (blog, papers, newsletters, services)
- Co-authors of book “Data Visualization for OBI 11g”

ORACLE Gold Partner
Specialized
Oracle Business Analytics Cloud Platform

ORACLE ACE Director

ORACLE ACE





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Tim Vlamis

Vice President & Analytics Strategist

- 30+ years in business modeling and valuation, forecasting, and scenario analyses
- Oracle ACE
- Instructor for Oracle University's Predictive Analytics, Data Mining Techniques and Oracle R Enterprise Essentials Courses
- Professional Certified Marketer (PCM) from AMA
- MBA Kellogg School of Management (Northwestern University)
- BA Economics Yale University

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Agenda

- Introduction
- Differences and Challenges of Big Cities
- Oracle Analytics Cloud SWOT
- Visualization and dashboard best practices
- Data Discovery Frameworks
- Data Valuation Frameworks
- Q&A

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Big Cities are Different

- Cities are more dynamic
  - Cross many jurisdictional boundaries
  - Highly diverse structures
  - Large operational employment rolls (compared to state and county)
  - High degree of coordination with other entities (smaller and larger)
  - Boundary changes far more dynamic
- Cities are embracing technology
  - Leading participation in opendata.gov and other
  - Operational adoption of technology

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Challenges that Big Cities Face

- Large constituencies with diverse analytic needs
  - Emergency responders
  - Strategic planners (code, zoning, new projects)
  - Finance and administration
  - Service departments
  - Primary and secondary education
- Need for transparency, consistency, efficiency, performance
- Cities are moving beyond reporting to analytics

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Cloud-based solutions are attractive

- More and more cities are moving from data centers to cloud
- Faster adoption of new technology
- Standards apply to deployment rather than adoption

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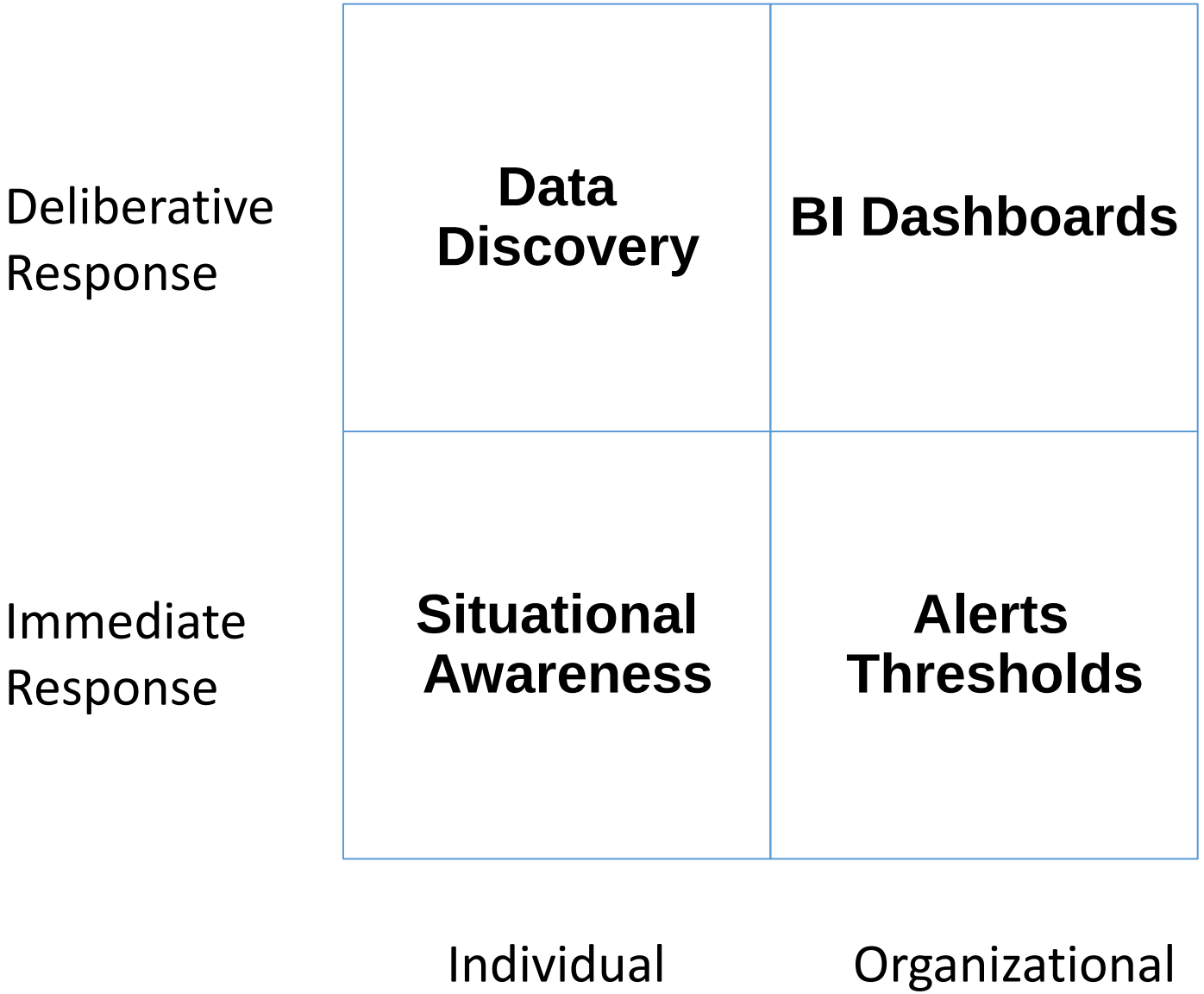
Data Visualization Scenarios



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Answers and Dashboards SWOT

Strengths

- Highly designed dashboards
- Query definition power
- Prompts and selections
- Good control of table formats
- Decent selection of graphs

Weaknesses

- Dynamic layout WYSIWYG
- High training costs
- Endlessly deep menus
- Poor dashboard layout tool

Opportunities

- Ability to set standards

Threats

- Visual analytics and data discovery tools
- Poorly designed repositories

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Data Visualization SWOT

Strengths

- Extremely interactive
- Framework for brushing
- Mashup
- No RPD required
- Data source connections
- Leverages Oracle security

Opportunities

- Machine learning is promising
- Data Flows transform data

Weaknesses

- Highly designed dashboards
- Weak documentation

Threats

- Starting from behind
- Users love Tableau

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BI Publisher SWOT

Strengths

- Very strong formatting
- “Pixel perfect” forms and reports
- Printed forms and reports
- Independent data source

Weaknesses

- Very complex
- Visualization styles are dated
- Most everything is explicitly stated, weak in dynamic web

Opportunities

- Strong established installed base

Threats

- Lack of development

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Simple Pivot Table with Easy Questions

2014 Monthly Sales by Company

	2014 / 01	2014 / 02	2014 / 03	2014 / 04	2014 / 05	2014 / 06	2014 / 07	2014 / 08	2014 / 09	2014 / 10	2014 / 11	2014 / 12	Grand Total
D4 Company	Sales	Sales	Sales	Sales	Sales	Sales	Sales	Sales	Sales	Sales	Sales	Sales	
Genmind Corp	$202,019	$296,178	$393,254	$401,352	$621,749	$921,152	$823,760	$576,288	$590,033	$477,079	$324,569	$326,255	$5,953,688
Stockplus Inc.	$317,533	$475,312	$650,825	$605,253	$868,347	$1,272,701	$1,076,425	$904,047	$947,674	$788,834	$515,927	$531,188	$8,954,066
Tescare Ltd.	$261,837	$422,774	$555,255	$550,912	$844,094	$1,222,869	$1,012,856	$810,286	$814,160	$691,479	$447,950	$457,773	$8,092,246
Grand Total	$781,389	$1,194,264	$1,599,334	$1,557,516	$2,334,190	$3,416,722	$2,913,041	$2,290,621	$2,351,868	$1,957,392	$1,288,446	$1,315,216	$23,000,000

- What was the highest monthly sales for a company?
- Which month had the largest drop in sales for a company?
- In which month(s) did Tescare have a greater gain than Stockplus?
- Is there a seasonal pattern to sales for all companies?

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Answers are Easy to Find in Graphs

Total Sales 2014

$23,000,000

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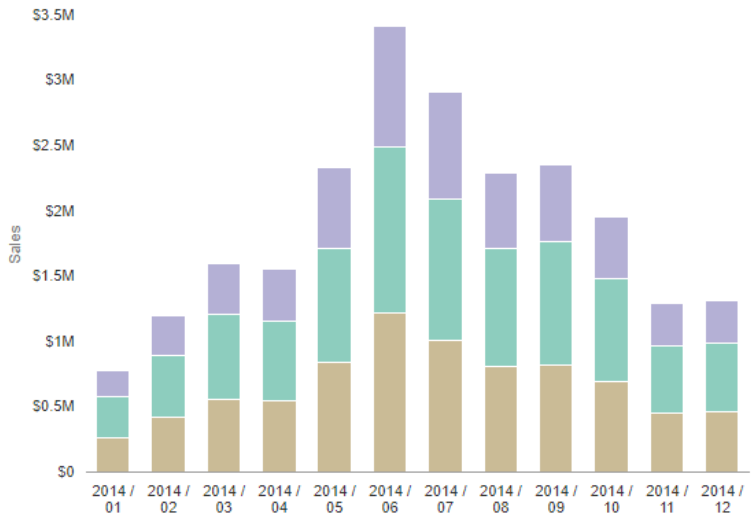
2014 Sales	2014 Sales	2014 Sales

2014 Monthly Sales by Company



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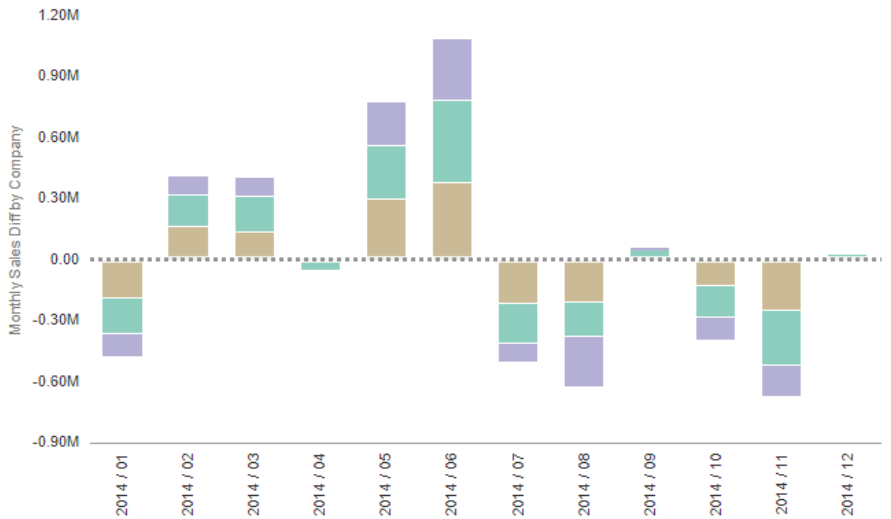

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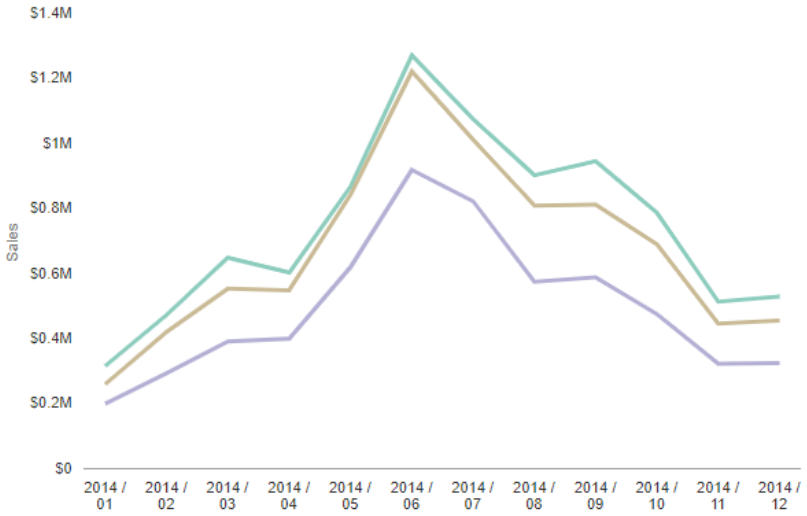

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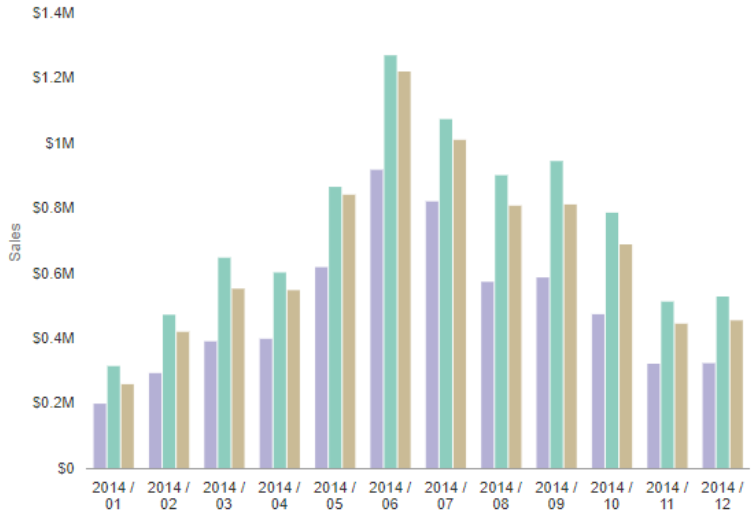

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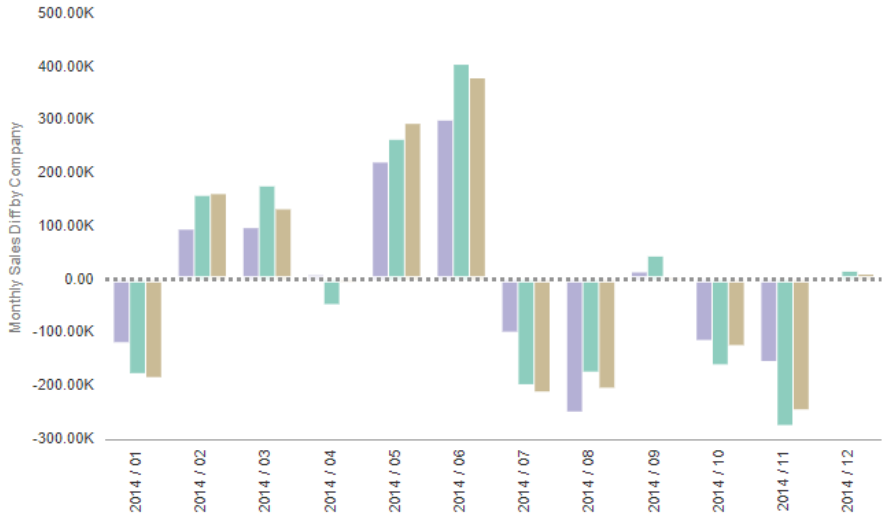

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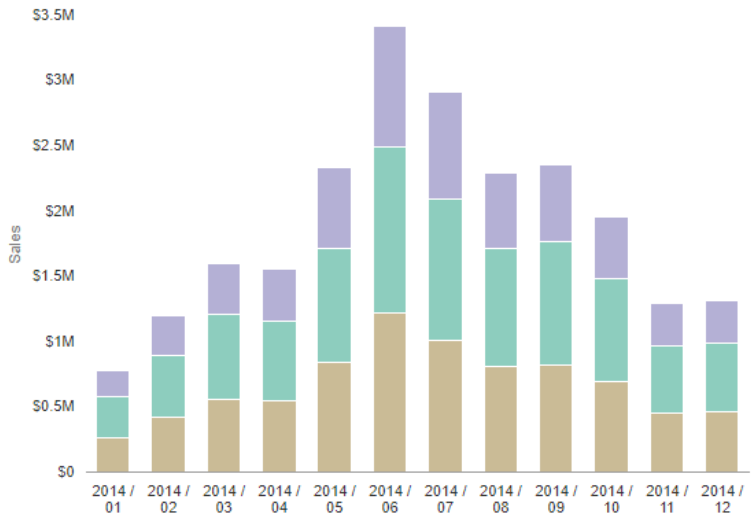

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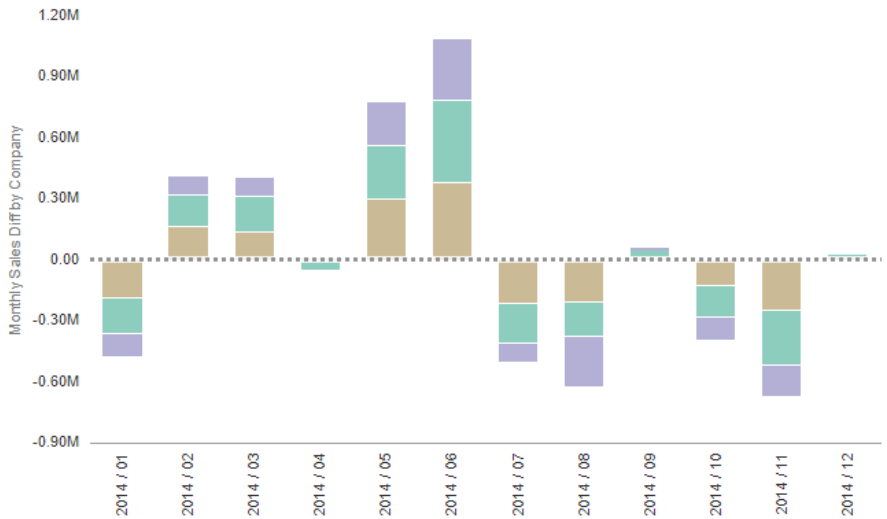

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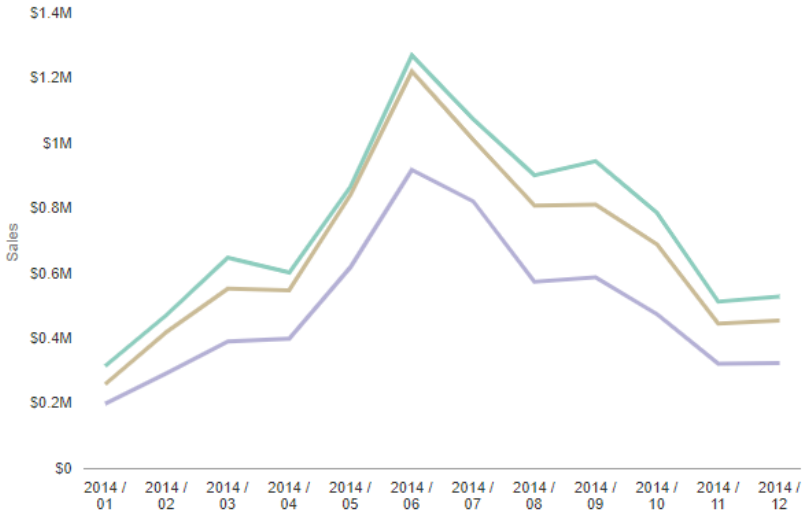

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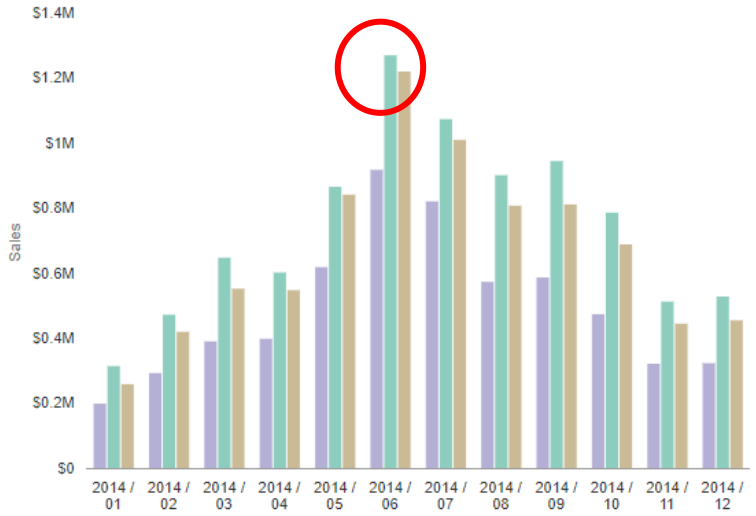

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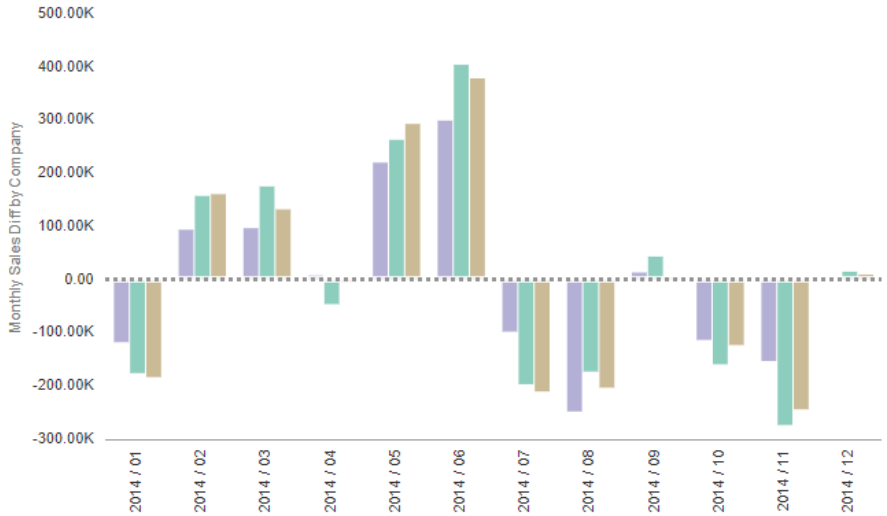

Which month had the largest drop in sales for a company?

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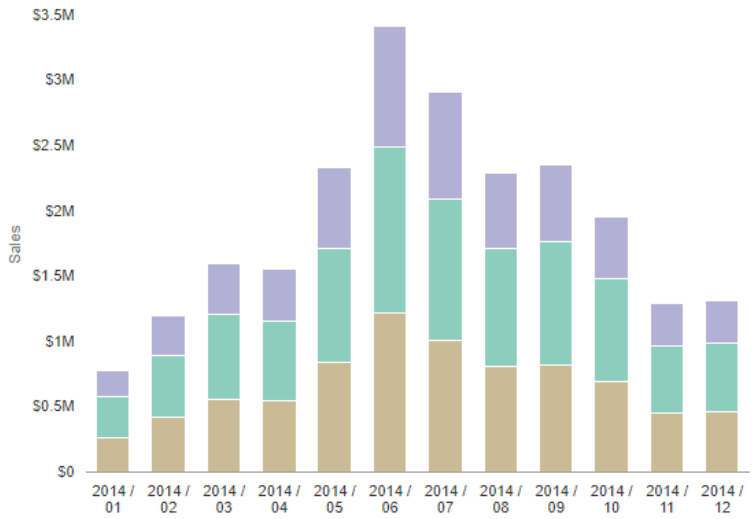

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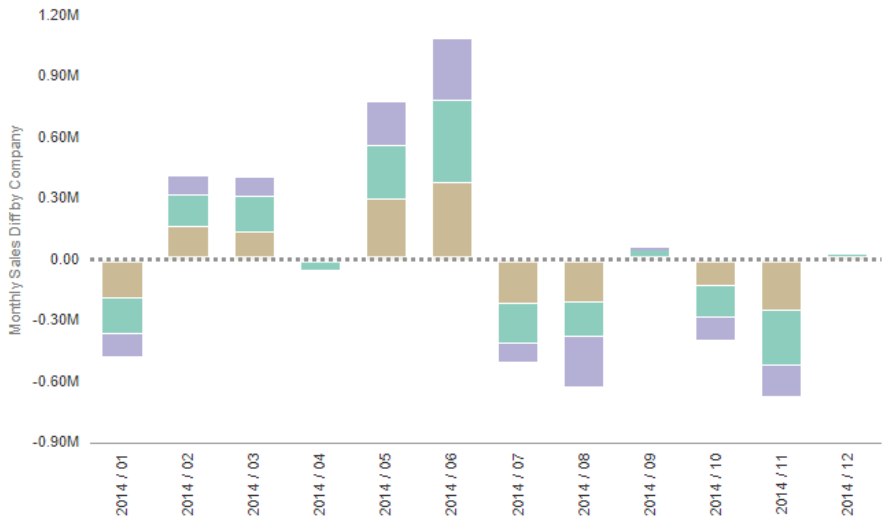

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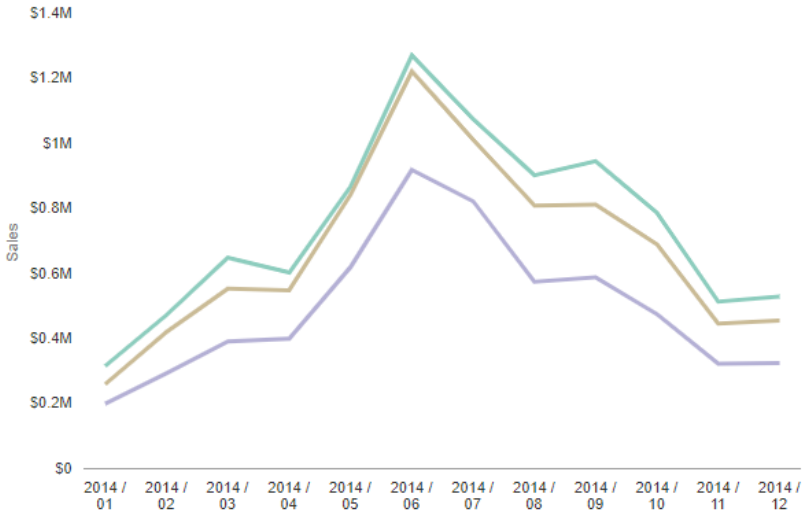

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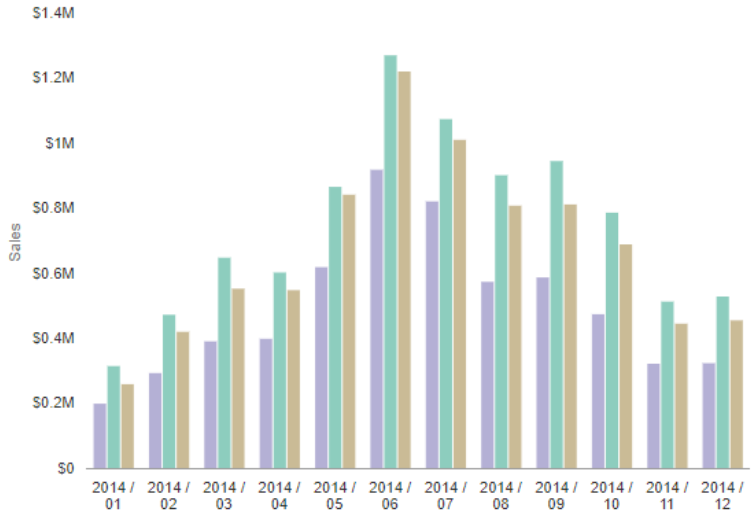

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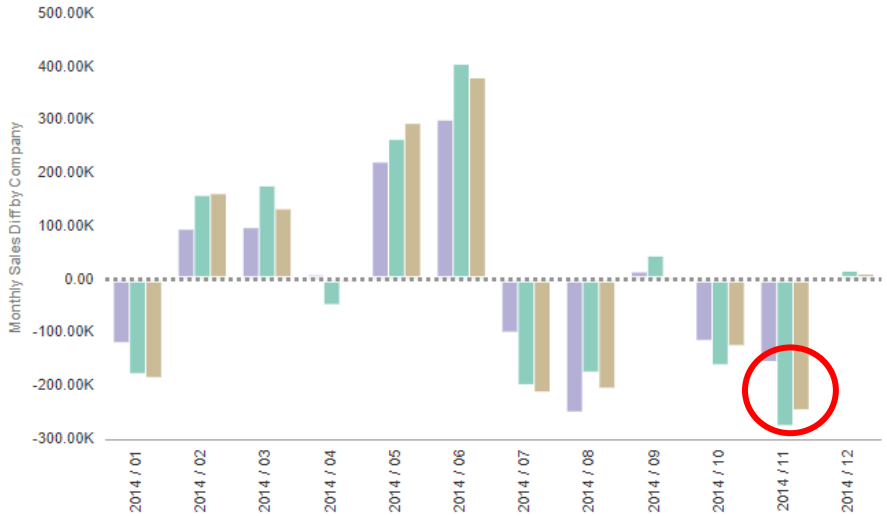

In which month(s) did Tescare have a greater gain than Stockplus?

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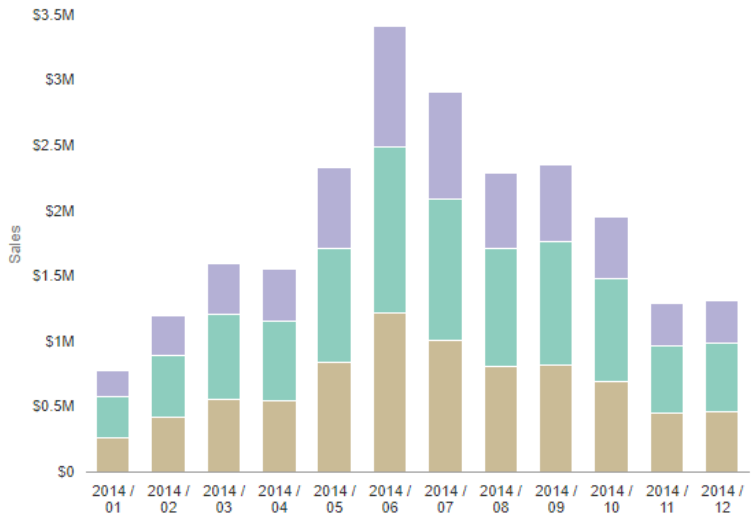

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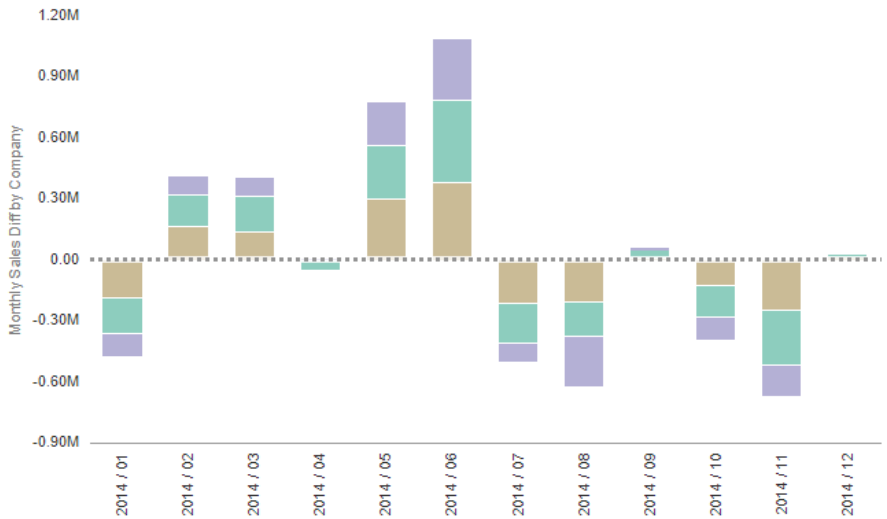

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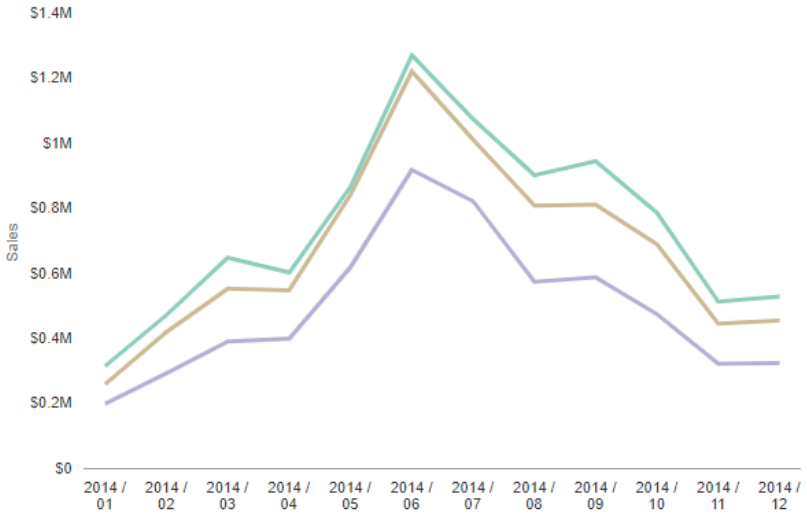

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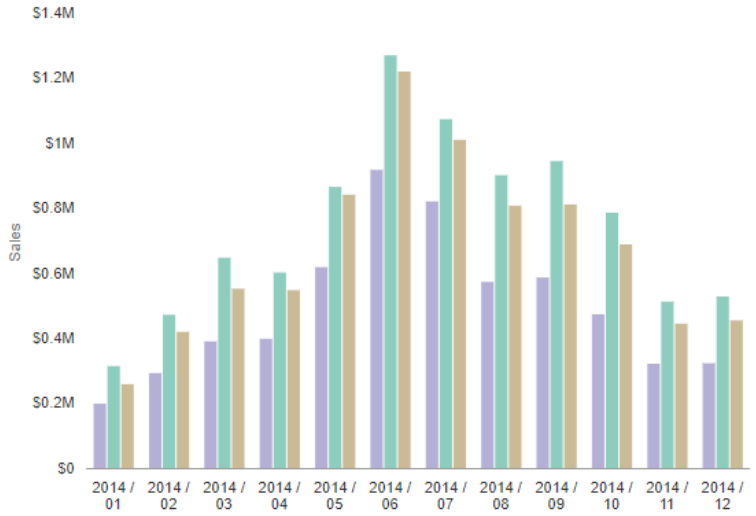

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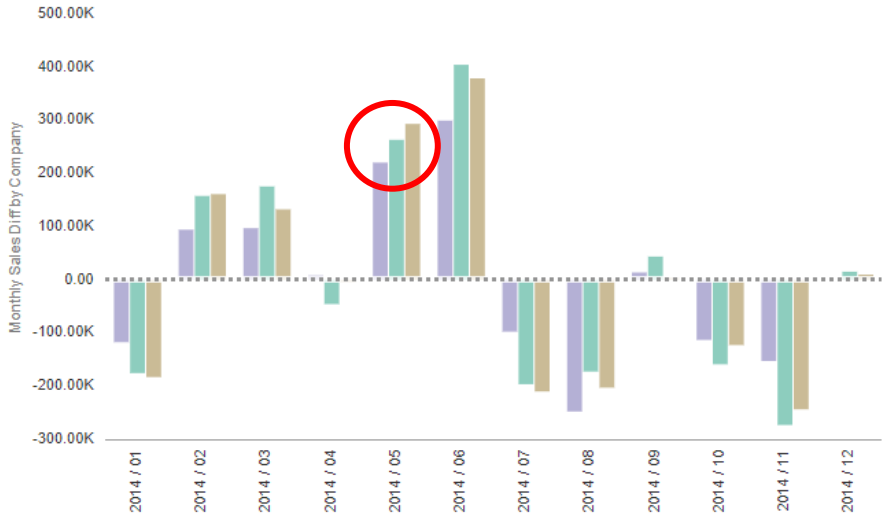

Is there a seasonal pattern to sales for all companies?

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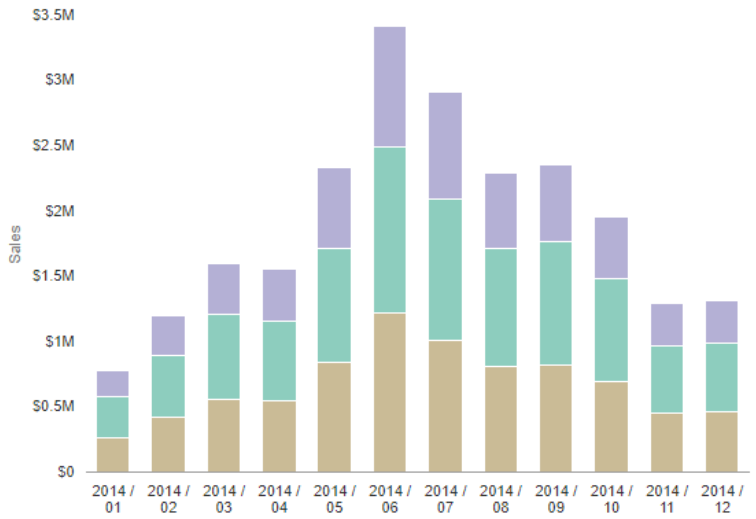

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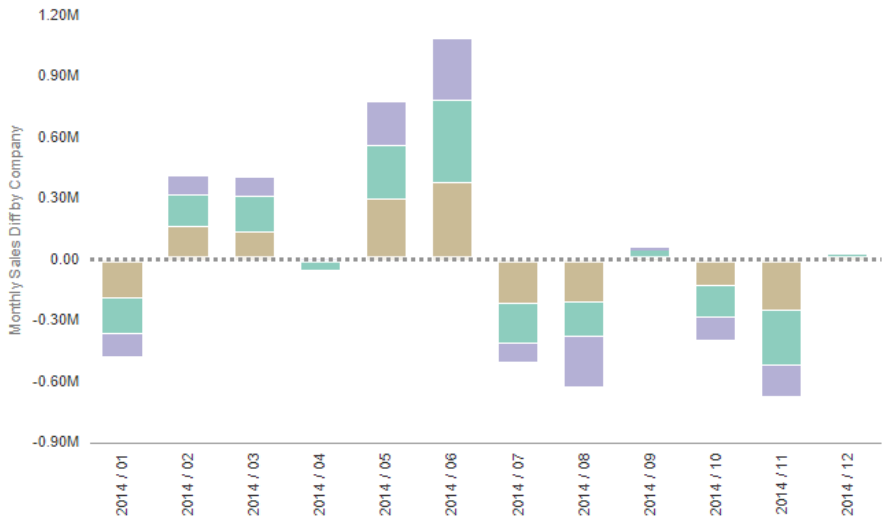

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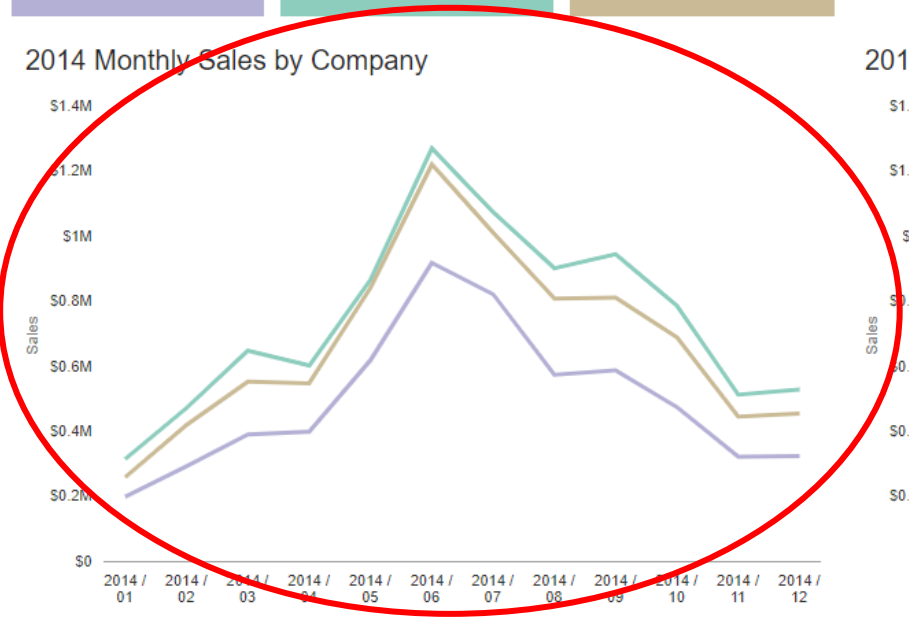

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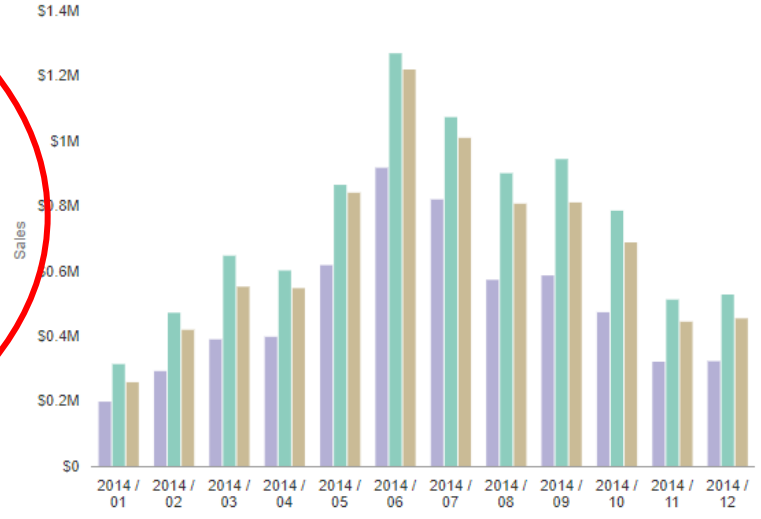

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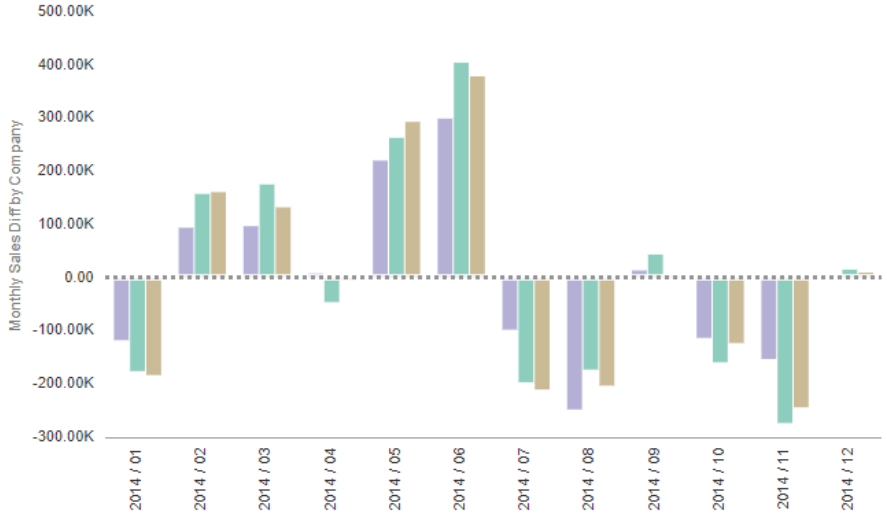

Dashboard Definition

A Dashboard is a visual presentation of current summary information needed to manage and guide an organization or activity.

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Dashboard Definition

BI Dashboards should be designed to drive organizational coherence through a shared understanding of organizational position, performance, flows, and influencers.

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Exec Dashboard Issues Never Talked About

- Too many prompts
- Too much raw data without comparisons
  - Lack of normalization
  - Lack of differencing
- Lack of exception analysis
- Data views out of scale with each other
- Data scale not matched to decision scale

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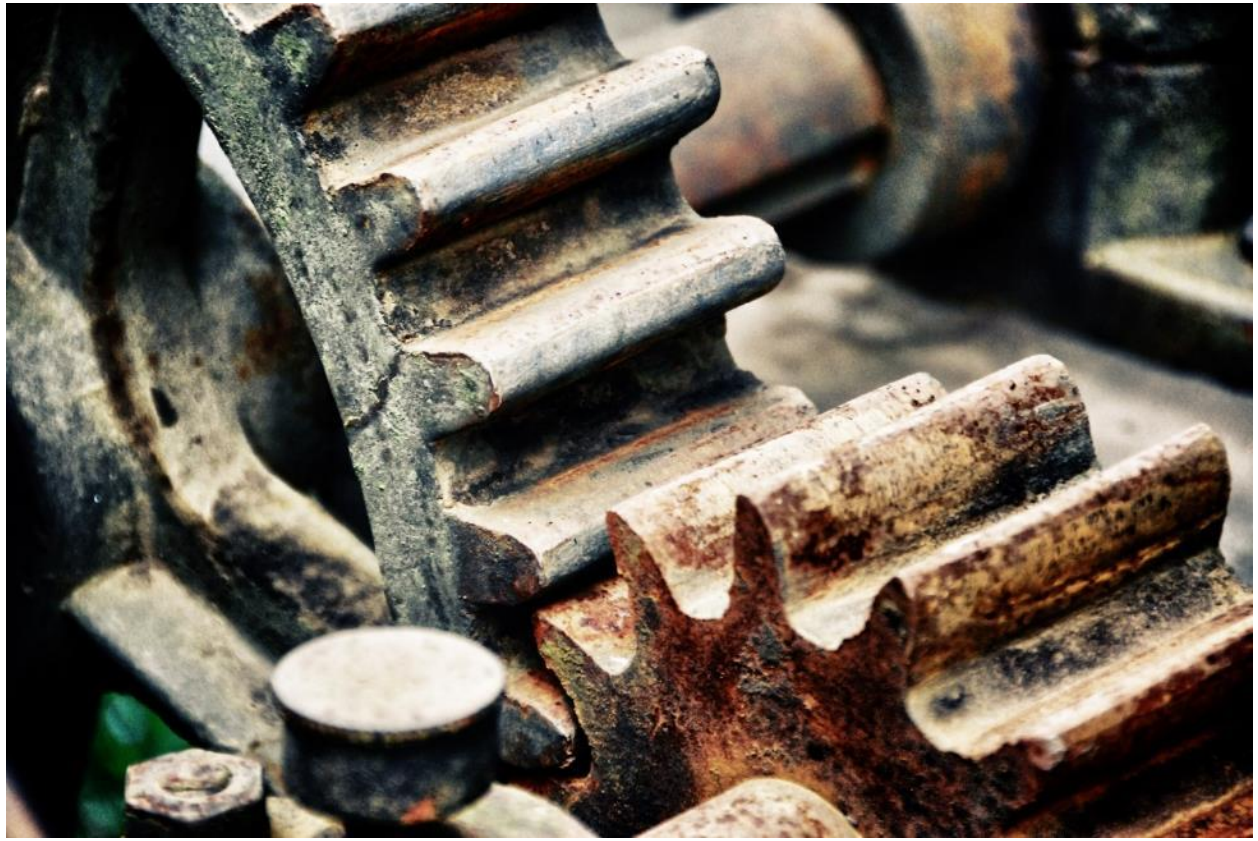
Bad Exec Dashboards Cause Grind

- People see different things
- Assumed context
- Data is distorted



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Great Exec Dashboards Reduce Friction

- Common data
- Shared context
- Established prioritization

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BI Standards Drive Value

- Best Practice Driven
- Work best when documented and reinforced with examples
- Dashboard layout and style
  - Prompt placement
  - Prompt styles
  - Navigation
- Naming and Titles
- Graph design
- Table design
- Color palettes and assignments

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Discovery - Explore vs Pioneer

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True Discovery

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How many responded to Shackelton's ad?

a. Zero
b. Two
c. Twelve, but he needed fifteen
d. Tens of thousands

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Everyone Wants to do Data Discovery!

- Honor and recognition in case of success!
- People believe their own work
- Tough to depend on others

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Data Discovery Steps

- Read through data in Data Prep view
- Determine what defines a record
- Identify facts and dimensions
- Use “Explain” with fact(s) to reveal important dimensions
- Build major dimension summary view

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Data Discovery Sequence

- "Skim" the entire data set to get a sense of its size and scope
- "Read" the data set a **second** time more carefully
  - Identify facts/measures
  - Transaction/event records included?
  - Identify major dimensions
- Make a list of potentially important or interesting business issues/implications
- Compare your original business issues with your new list
- Apply useful frameworks
- Transform data and add new data
- Apply useful frameworks

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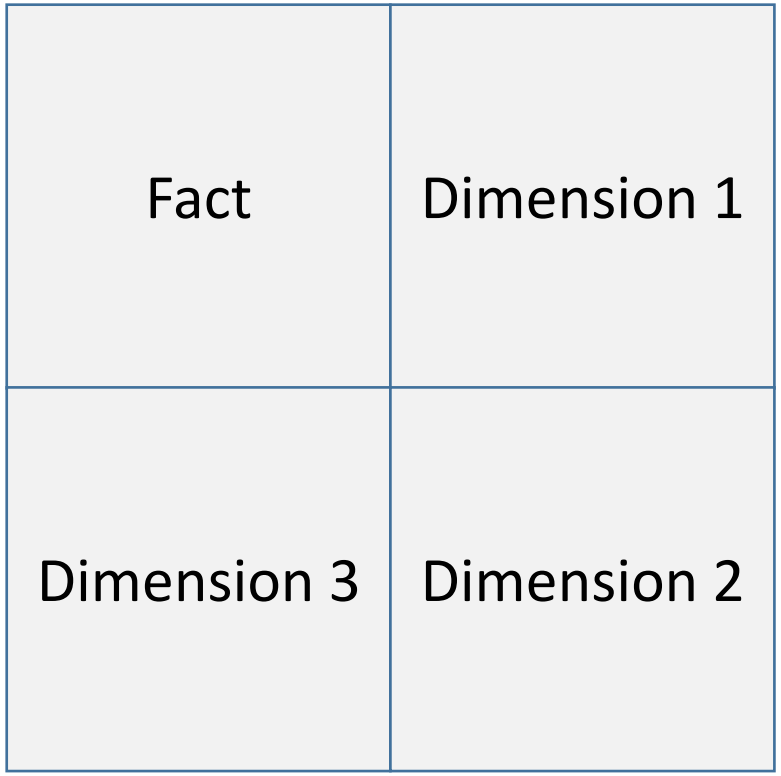
Keys to Data Discovery

- Identify your main topic of interest with a performance tile
- Summary
- Evaluating a fact or a dimension?
  - Sales analysis
  - Customer or product analysis
- Fact analysis
  - Find lowest grain
  - Flat low distribution
  - Event or transaction
- Look for clustered distribution
    - Scatter with points as event in fact table
      - Set fact on X axis and response variable on Y axis



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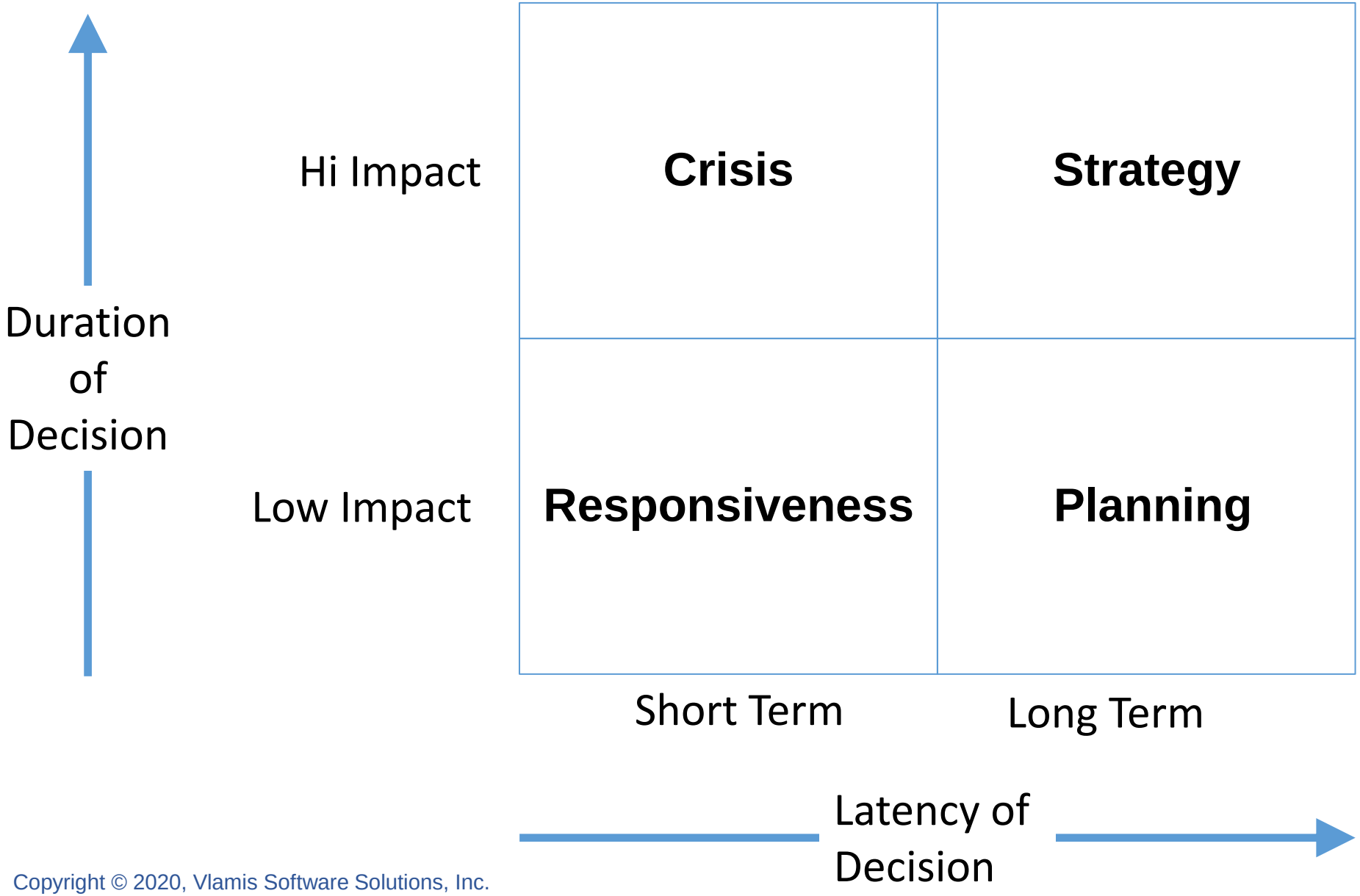
Four Realms of Decision Making



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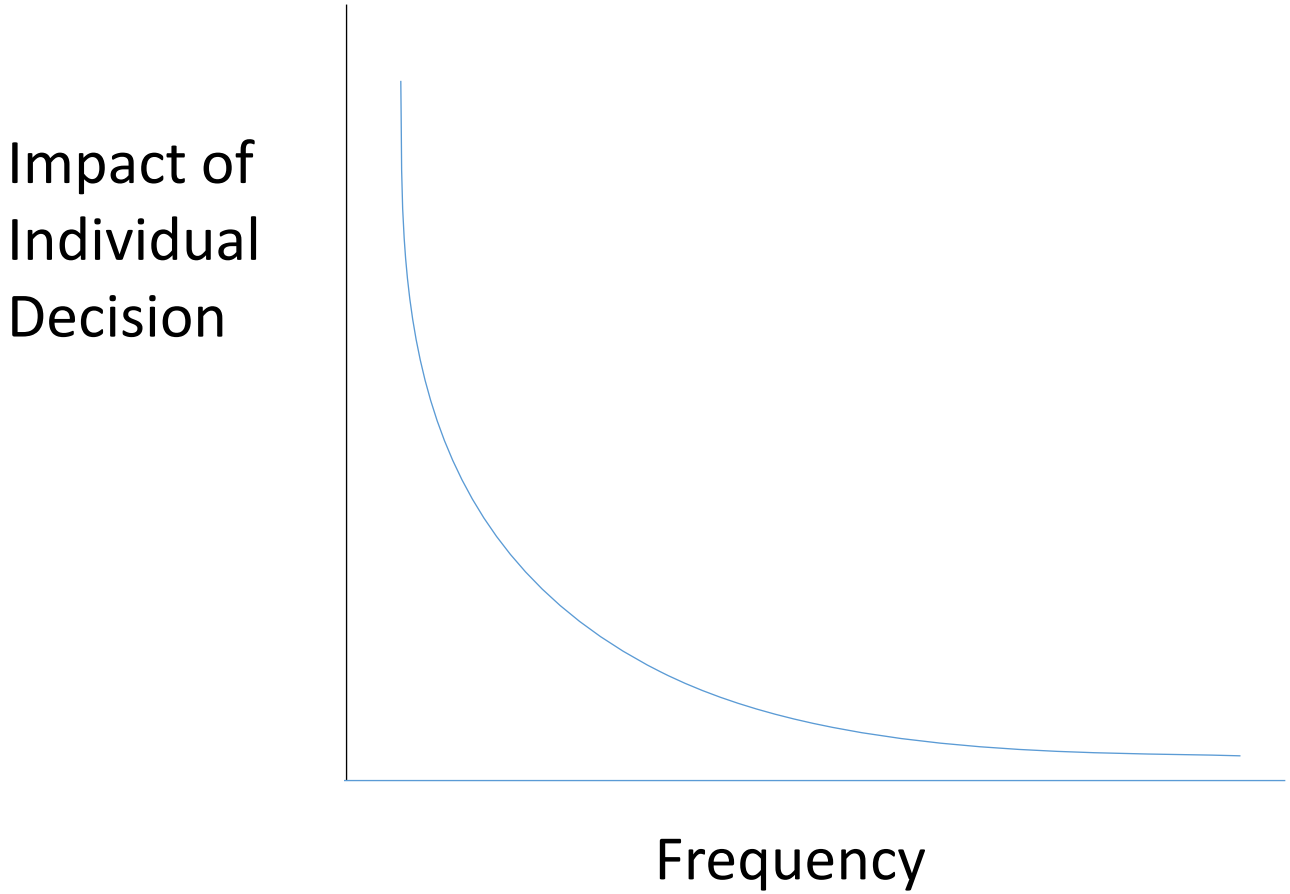
Organizational Decision Making



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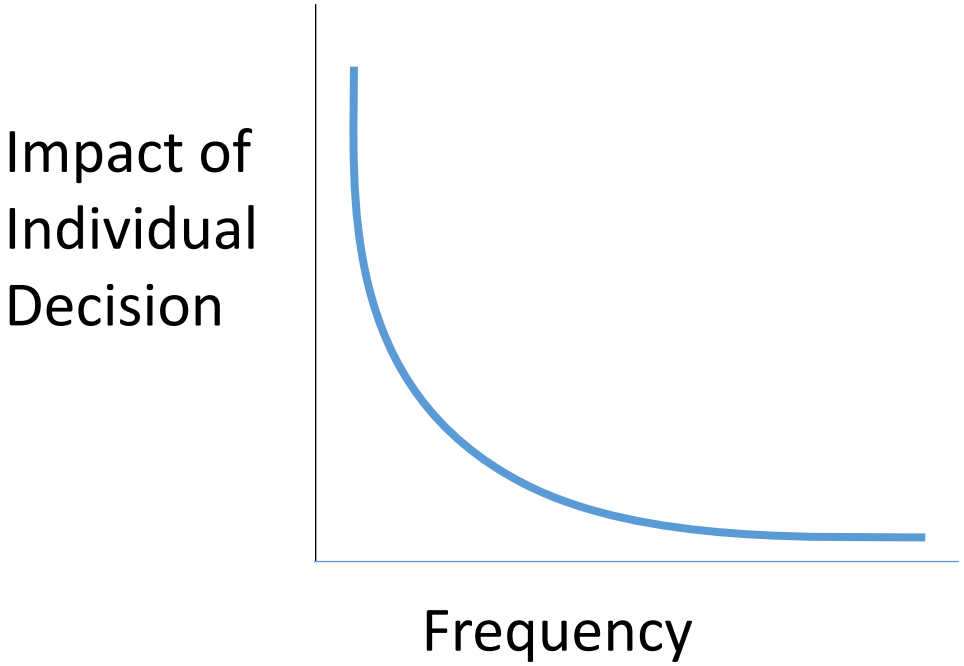
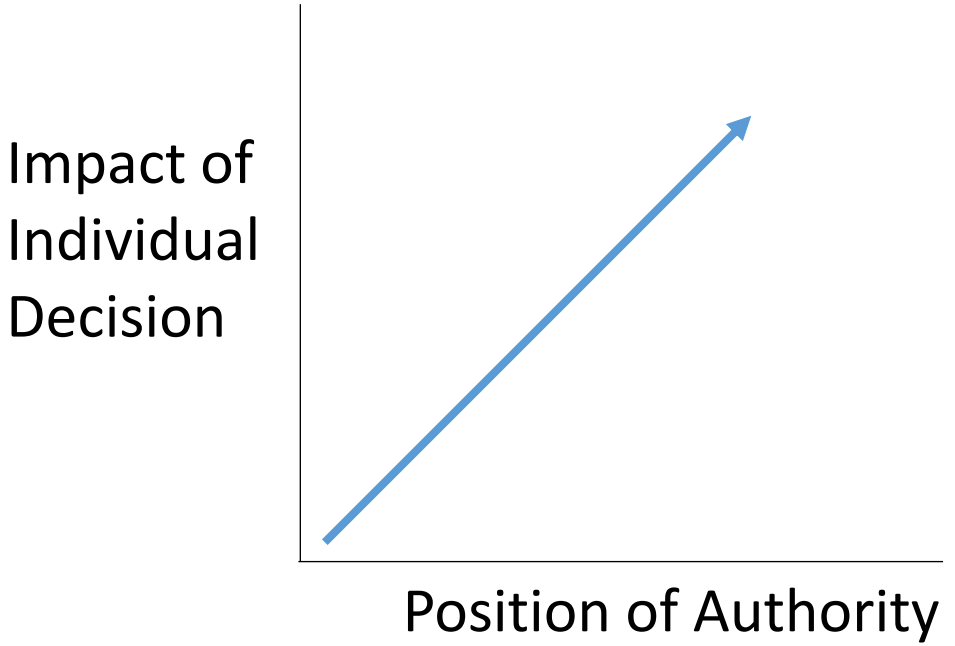
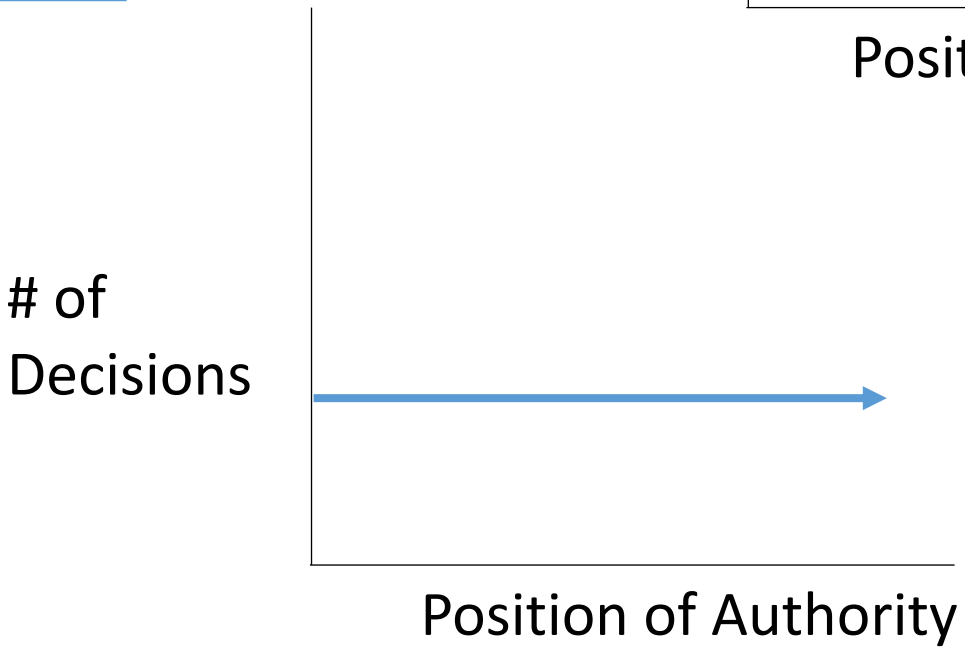
Organizational Decision Making







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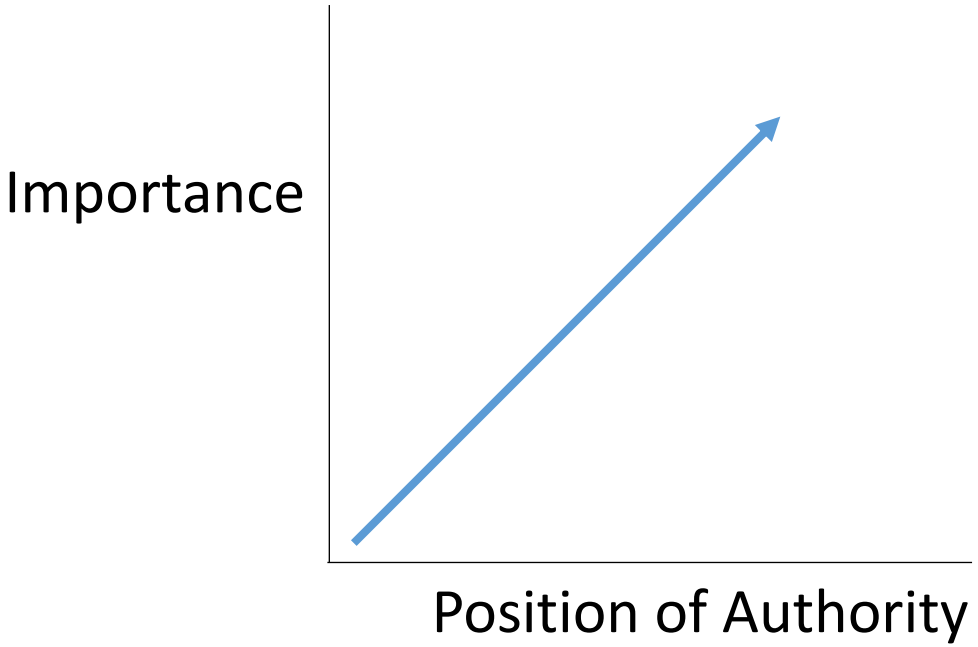
Dashboard Importance Score



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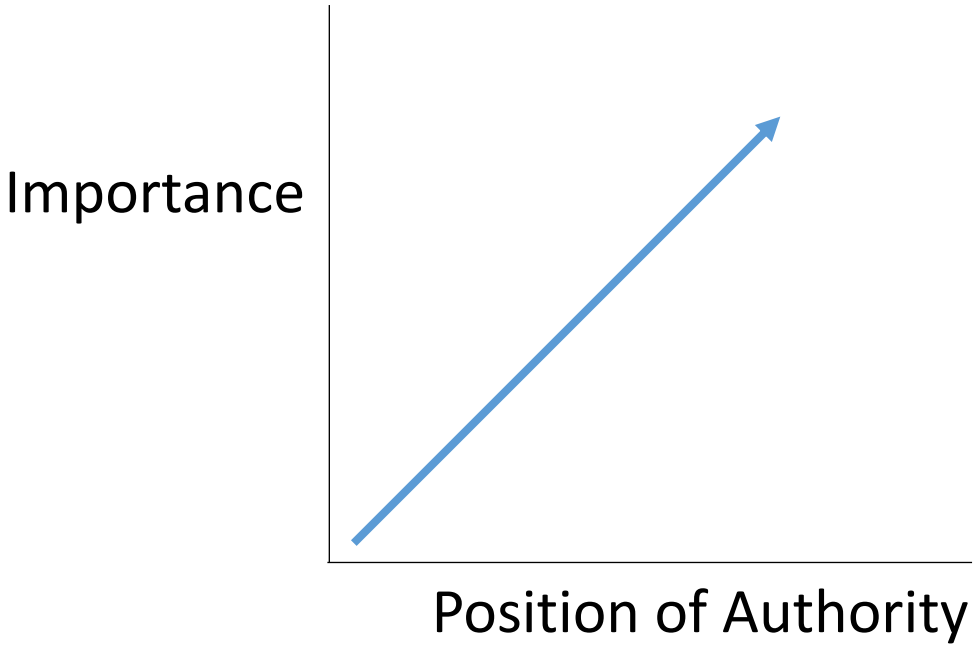
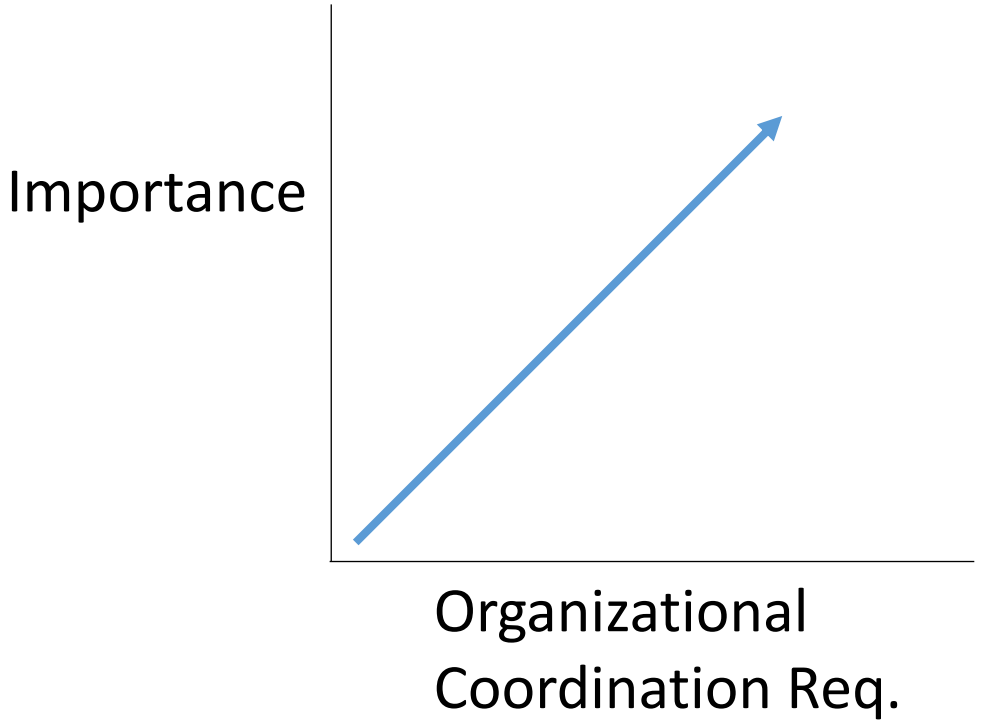
Dashboard Importance Score





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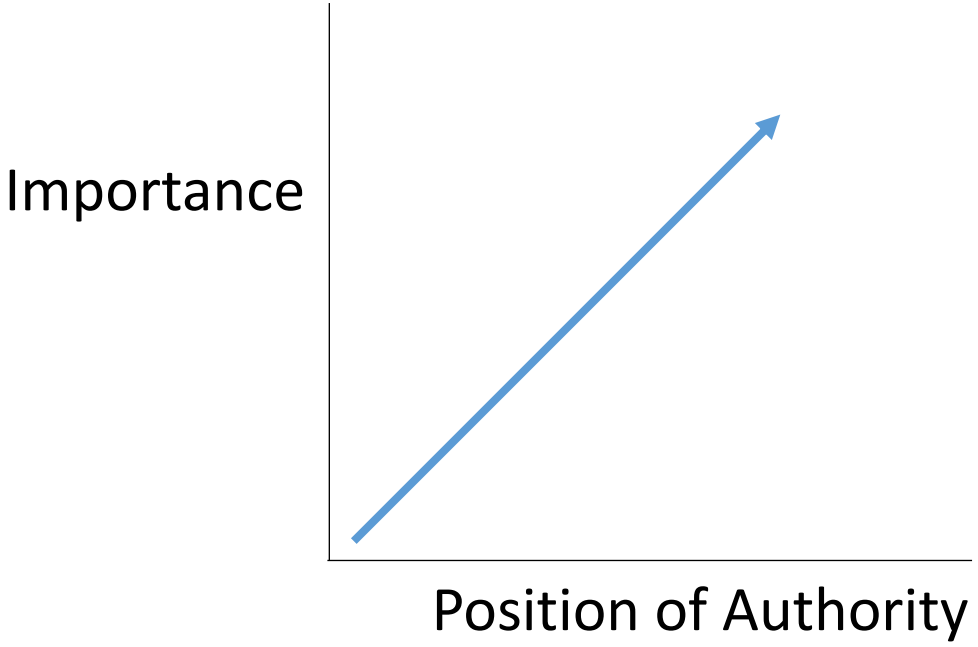
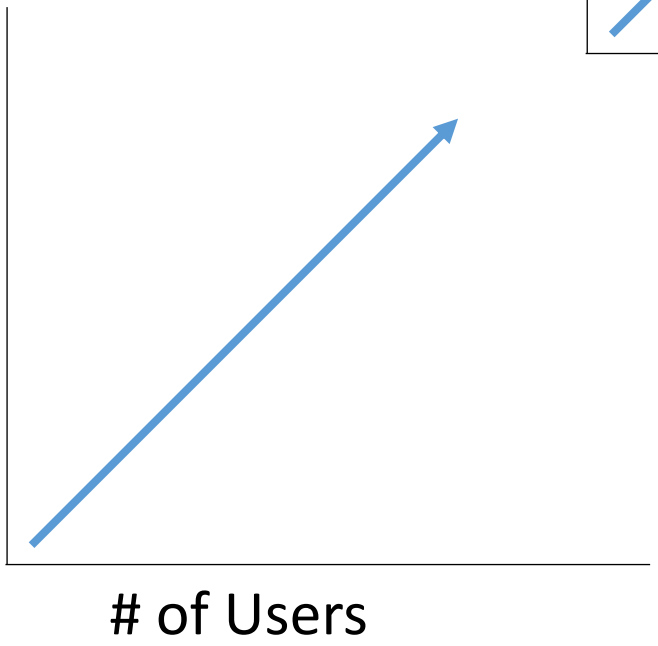
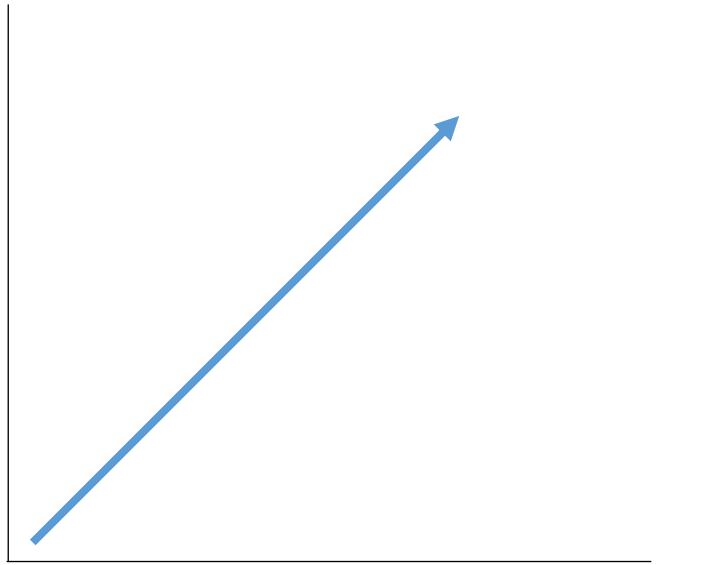
Dashboard Importance Score







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Dashboard Importance Score

$$\text{Dashboard Importance} = \sum_{1}^{n} \text{Position X Coordination X Users}$$

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Example Dashboard Importance Rubric

Division Operational Expenses YTD Dashboard					
Role	Authority	Org Coord	Users	Product	Notes
Director	8	3	3.5	84	
Fin Analyst	2	3	4	24	
Managers	4	1	9	36	
Dashboard Importance				**144**	

Department Manager Monthly Dashboard					
Role	Authority	Org Coord	Users	Product	Notes
Analyst	1	1	2	2	
Managers	4	2	2	16	
Dashboard Importance				**18**	

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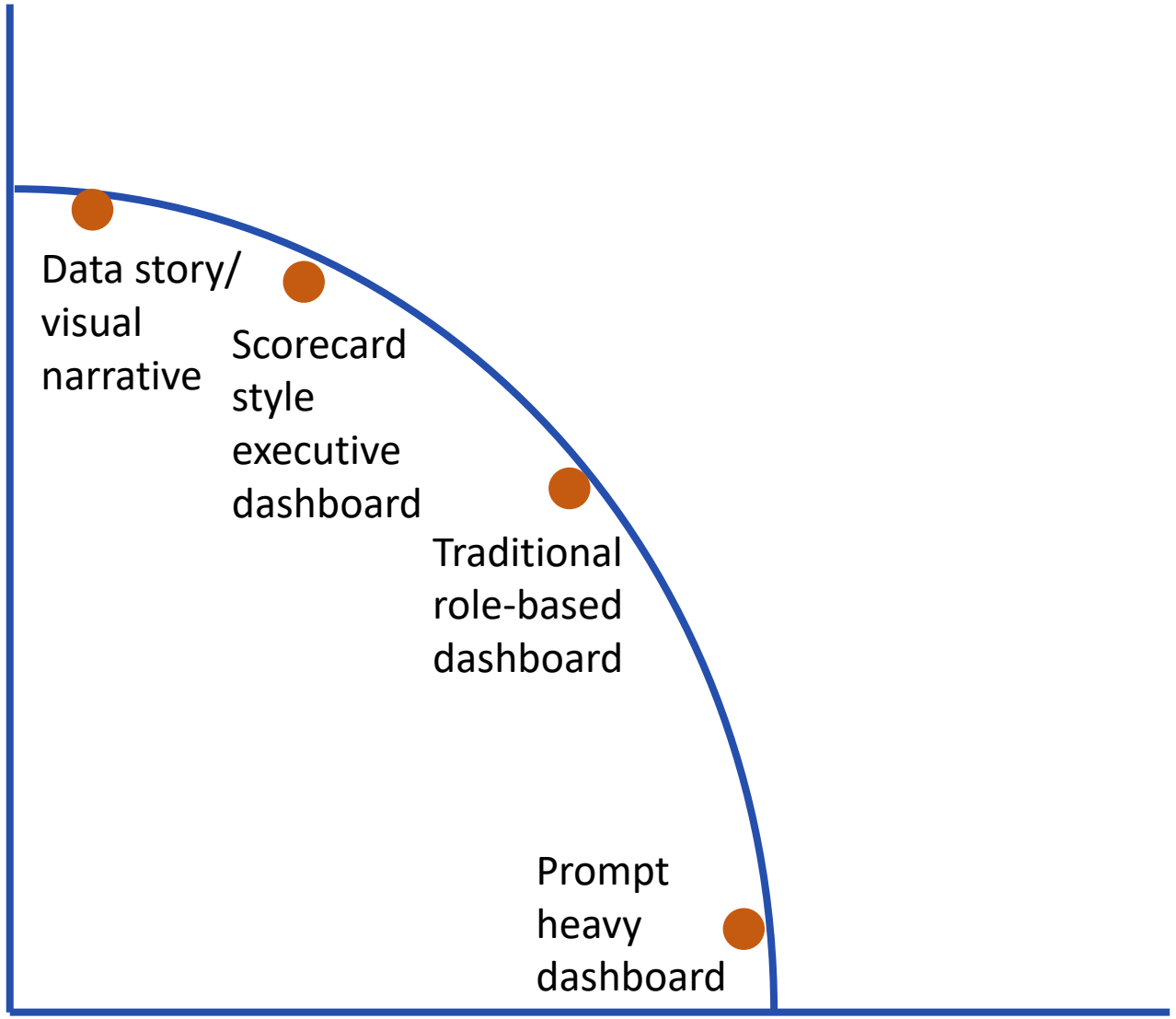
Balance Choices with Shared Views



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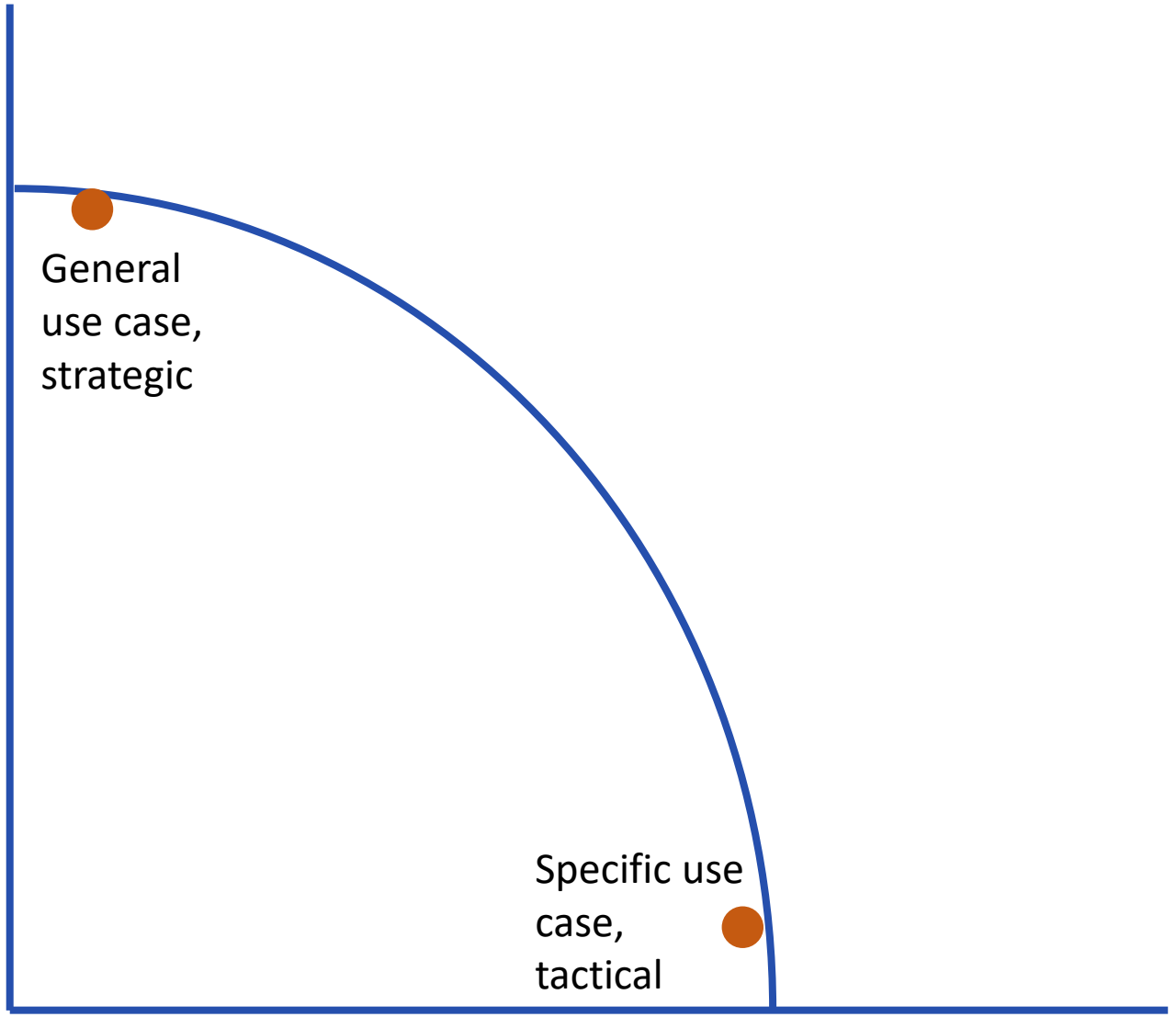
Strategic vs Tactical Dashboards



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Differencing (aka variance)

- How does the raw data differ from a comparative?
  - Difference from the average?
  - Difference by time?
  - Difference from a baseline?
- Graph differences when change or context is important.

Tables of raw data are difficult to interpret in terms of insights.

Profit by Product Category, Ship Date (Month of Year)

Ship Date (Year): 2016

	January	February	March	April	May	June	July	August	September	October	November	December
	Profit	Profit	Profit	Profit	Profit	Profit	Profit	Profit	Profit	Profit	Profit	Profit
Furniture	15,319.52	-6,521.75	-6,036.51	-3,840.61	815.26	786.44	-1,495.06	4,773.15	6,144.44	1,592.76	11,754.98	14,248.85
Office Supplies	1,304.85	4,328.80	18,881.06	15,416.42	6,415.03	10,620.04	10,439.39	13,747.45	7,426.44	8,987.29	39,365.44	20,105.56
Technology	20,072.05	9,937.51	21,529.90	10,436.88	15,091.24	15,696.36	17,631.00	33,250.75	20,419.80	11,012.20	34,628.01	40,749.94

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Profit by Profit, Product Category, Ship Date (Month of Year)

Ship Date (Year): 2016

	January	February	March	April	May	June	July	August	September	October	November	December
	Profit	Profit	Profit	Profit	Profit	Profit	Profit	Profit	Profit	Profit	Profit	Profit
Furniture	15,319.52	-6,521.75	-6,036.51	-3,840.61	815.26	786.44	-1,495.06	4,773.15	6,144.44	1,592.76	11,754.98	14,248.85
Office Supplies	1,304.85	4,328.80	18,881.06	15,416.42	6,415.03	10,620.04	10,439.39	13,747.45	7,426.44	8,987.29	39,365.44	20,105.56
Technology	20,072.05	9,937.51	21,529.90	10,436.88	15,091.24	15,696.36	17,631.00	33,250.75	20,419.80	11,012.20	34,628.01	40,749.94

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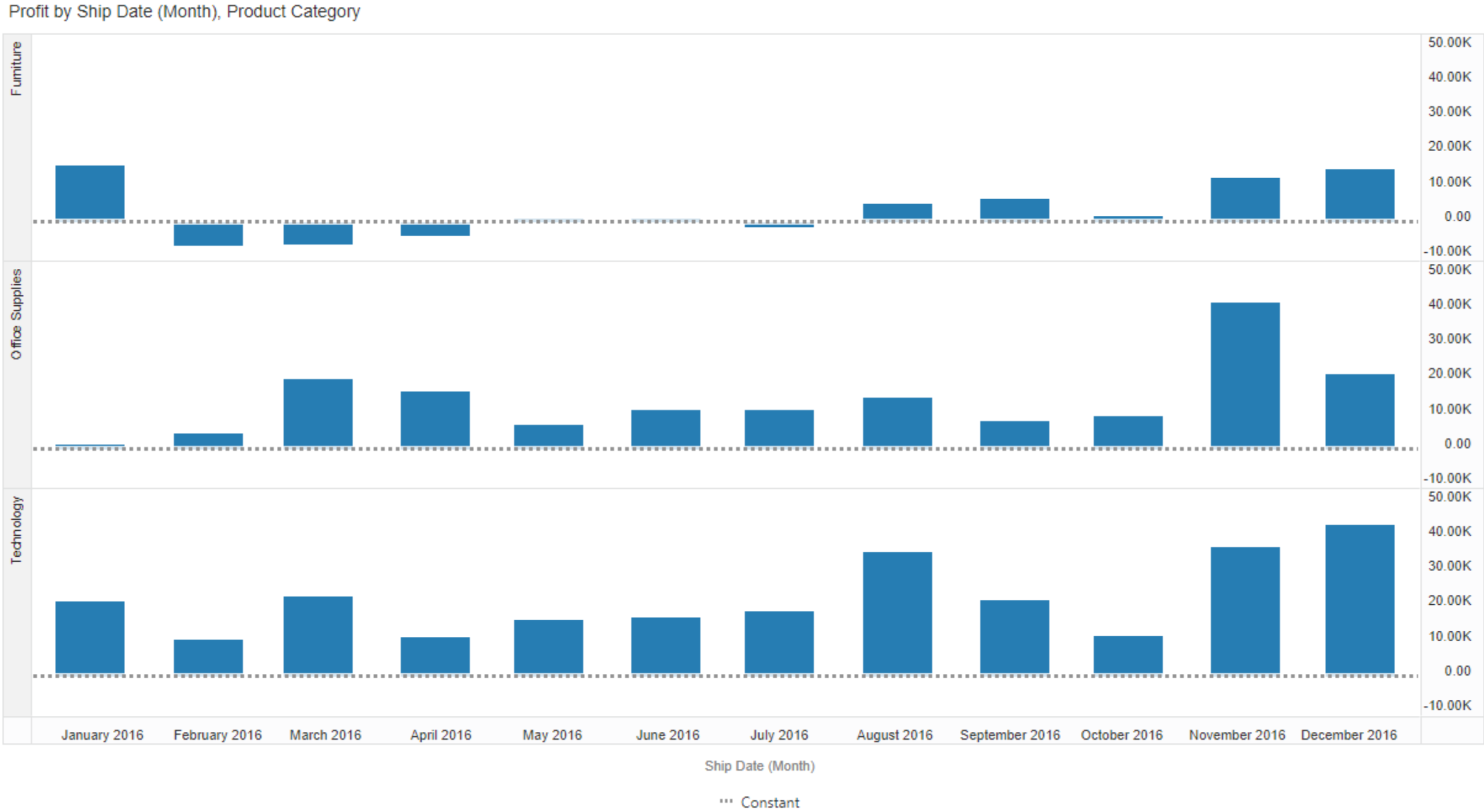

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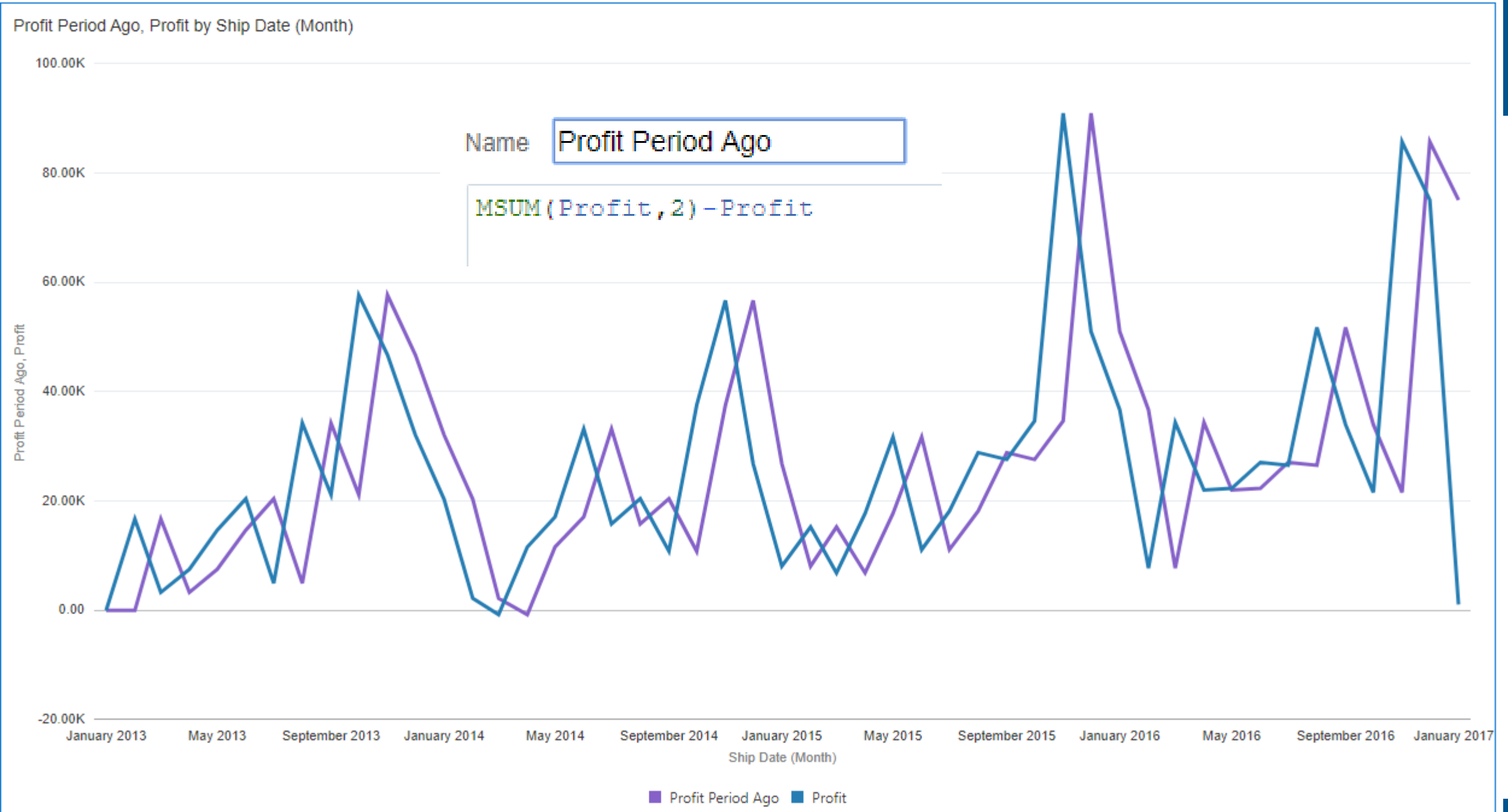

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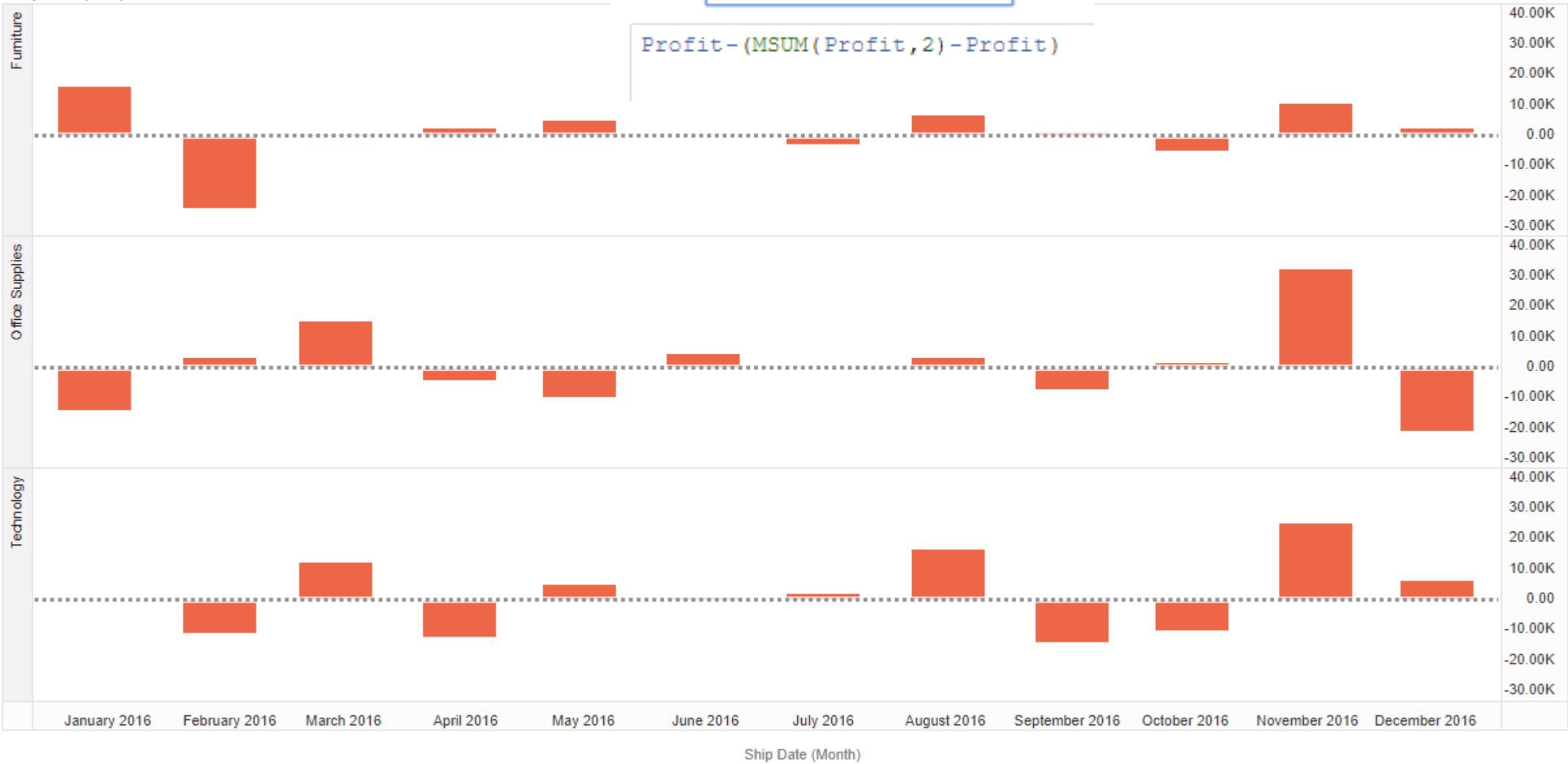
Profit Diff by Ship Date (Month), Product Category

Ship Date (Year): 2016

Name: Profit Diff

```
Profit-(MSUM(Profit,2)-Profit)
```



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Ship Date (Year): 2016 | Sales: Top 50 | Ship Date (Month): February 2016

Horizontal Bar

Trellis Columns

Trellis Rows

Values (X-Axis)
- Profit Diff

Category (Y-Axis)
- Product Name

Color

Size (Width)

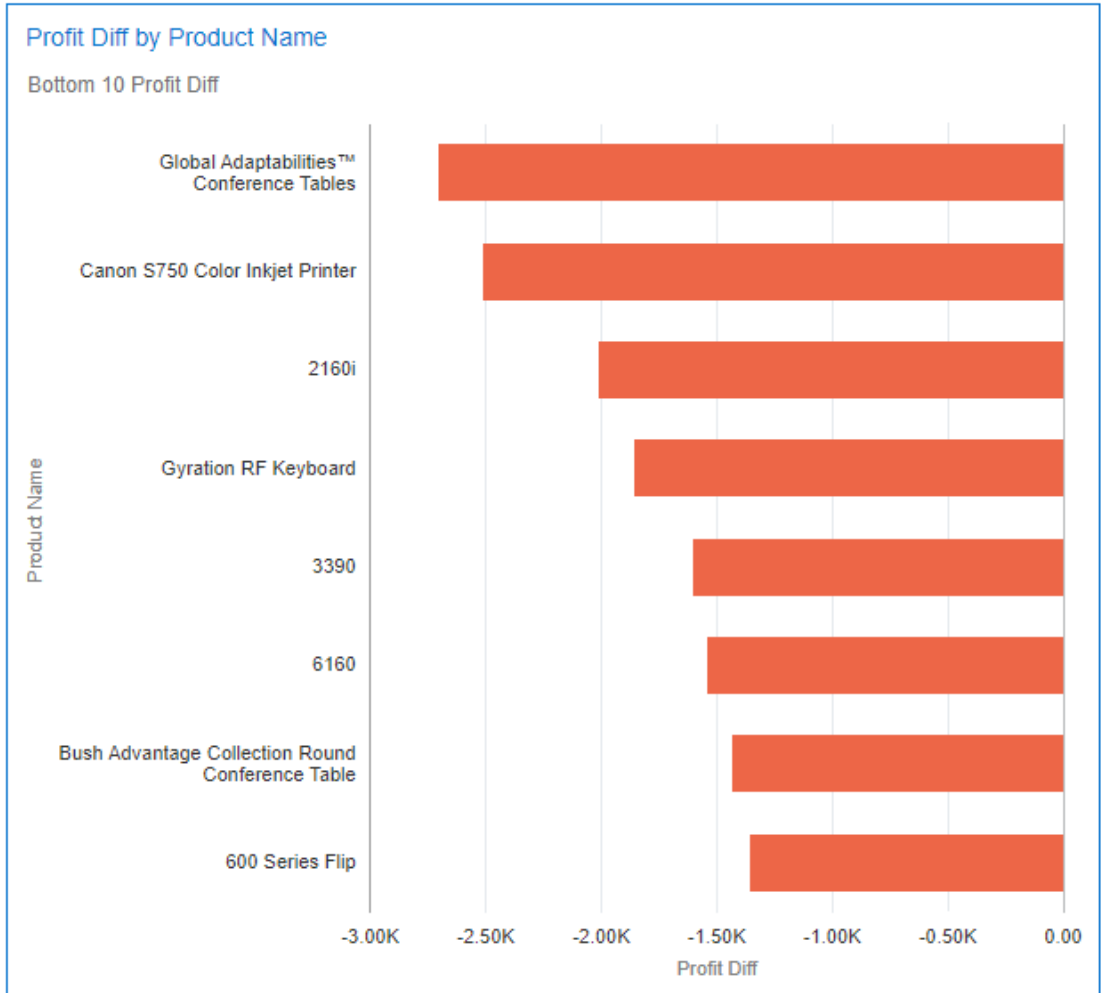
Tooltip

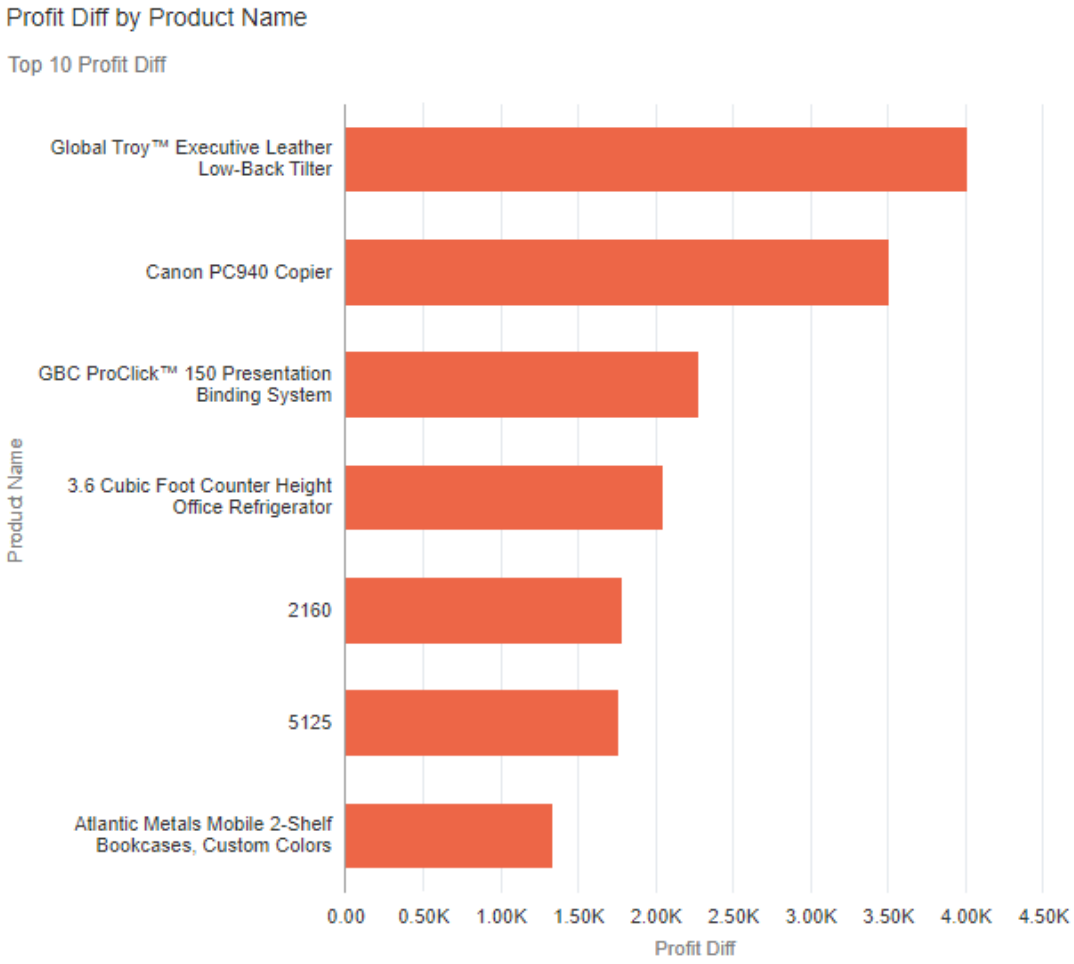
Detail

Filters
- Profit Diff

Biggest Profit Movers By Month

Top 50 Products by Sales





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Bar

Trellis Columns

Trellis Rows

Product Cate...

Values (Y-Axis)

Profit Diff

Category (X-Axis)

Ship Date (M...

Color

Size (Width)

Tooltip

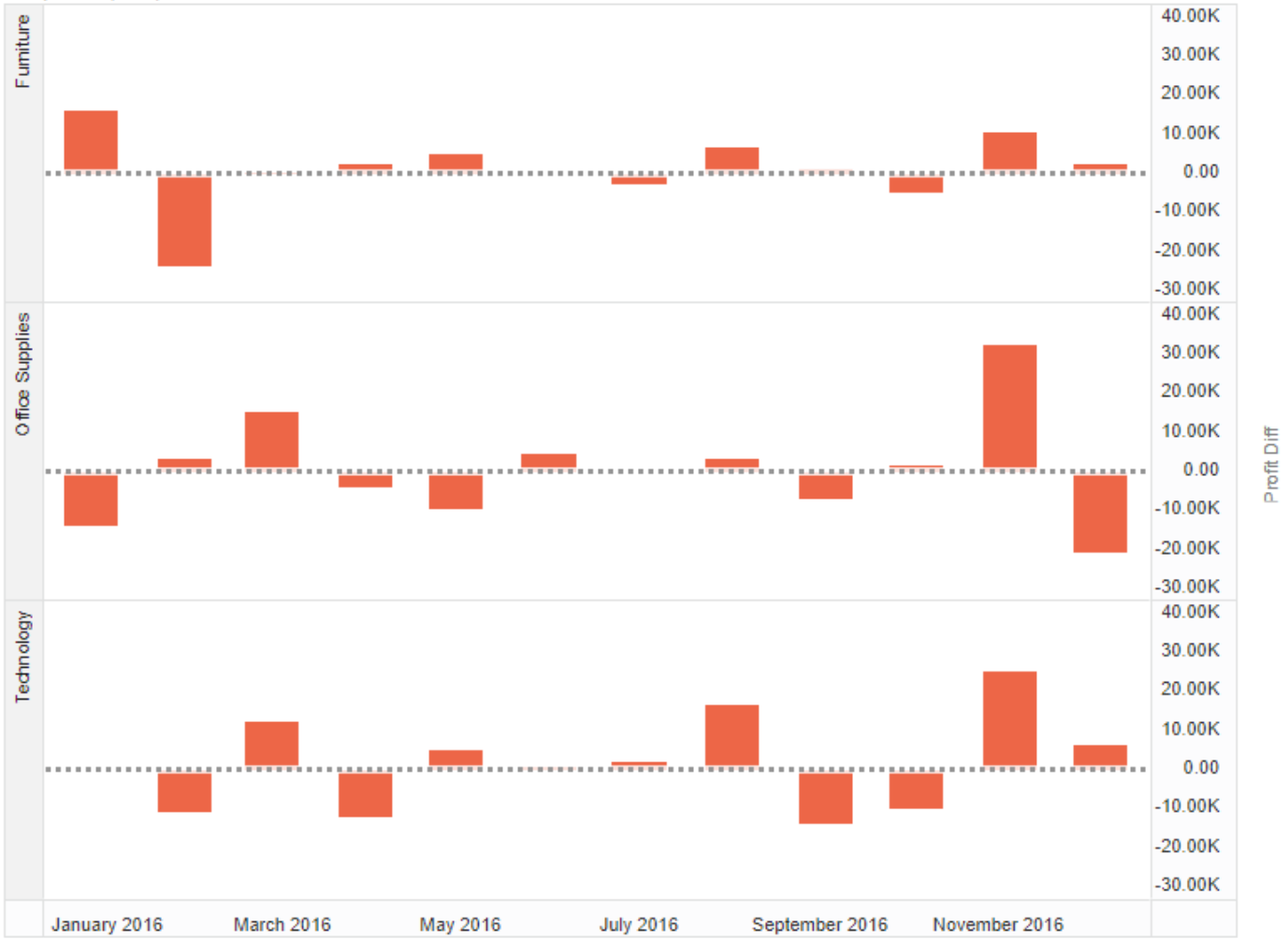
Detail

Filters

Ship Date (Ye...

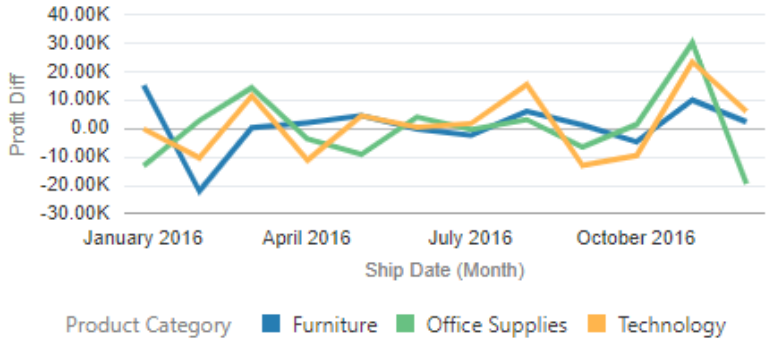
Profit Diff by Ship Date (Month), Product Category

Ship Date (Year): 2016



Profit Diff by Ship Date (Month), Product Category

Ship Date (Year): 2016



Product Category Furniture Office Supplies Technology

Profit by Profit, Ship Date (Month of Year), Product Category

Ship Date (Year): 2016

	Furniture	Office Supplies	Technology
	Profit	Profit	Profit
January	15,319.52	1,304.85	20,072.05
February	-6,521.75	4,328.80	9,937.51
March	-6,036.51	18,881.06	21,529.90
April	-3,840.61	15,416.42	10,436.88
May	815.26	6,415.03	15,091.24
June	786.44	10,620.04	15,696.36
July	-1,495.06	10,439.39	17,631.00
August	4,773.15	13,747.45	33,250.75
September	6,144.44	7,426.44	20,419.80
October	1,592.76	8,987.29	11,012.20
November	11,754.98	39,365.44	34,628.01
December	14,248.85	20,105.56	40,749.94

Profit -7K 41K

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Dimensional Analysis

- Use brushing and selection with multiple graph layouts.
  - Build four or five graphs with related attributes or measures.
  - Too many graphs or several highly dense graphs exceed limitations
- Consider alternative graph types
  - Scatter plots
  - Trellis charts
  - Sankey graphs
  - Parallel coordinates

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Dimensional Analysis

- Order of importance for Scatter Plots
  1. Y Axis typically has the “response variable”, i.e. highest interest
  2. X axis has the “independent variable”.

  3. Color (can be categorical or numeric)
  4. Size
  5. Trellis by category
  6. Shape
  7. Filters
- Use logarithmic scale for “long tail” distributions or break into two or more graphs.

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Trellis Charts

- Make sure that the major axis of interest is aligned with Trellis chart choice.
  - Vertical when X axis is important
    - Example: compare patterns over time
    - Compare length of horizontal bar graph
  - Horizontal when Y axis important
    - Compare lengths of vertical bar graphs
- Use horizontal for long, scrolling trellis charts with many members
- Use both to create a table of graphs

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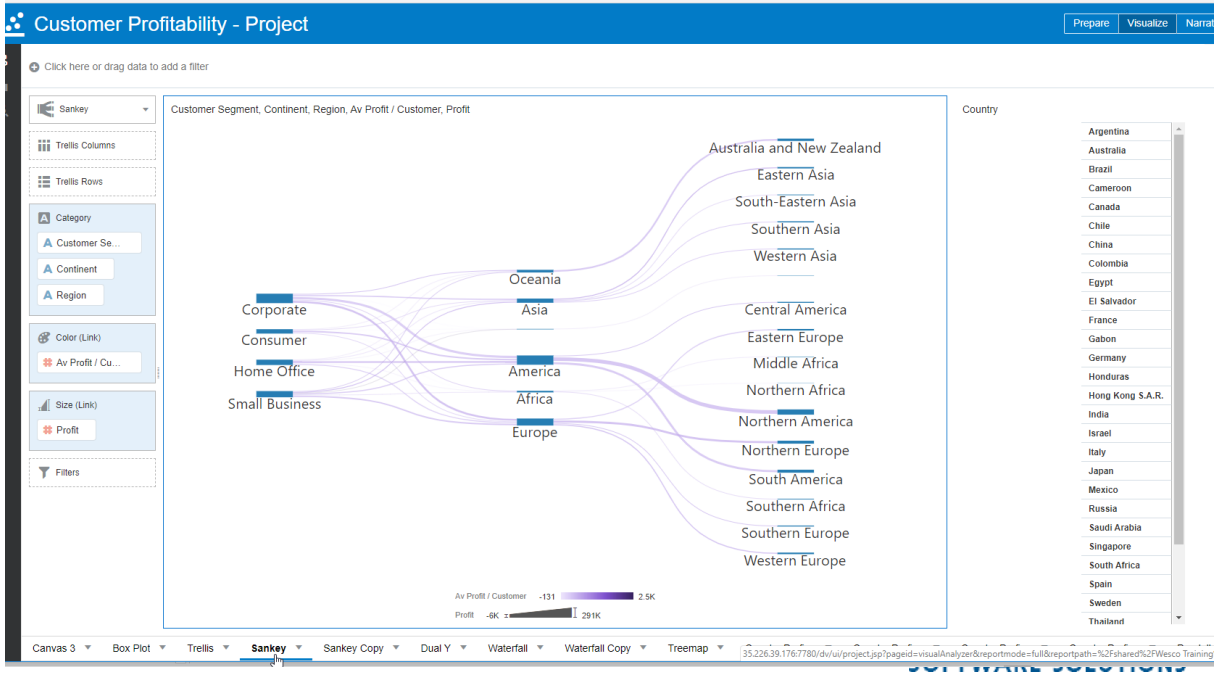
Sankey Graphs

- Used in “flow” analyses and comparative analyses
- Used to show relative strengths of relationships between attributes
- Line weight and size are proportional to flow/relational measure
- Hover and click on lines to show relationships
- Sort order is very important



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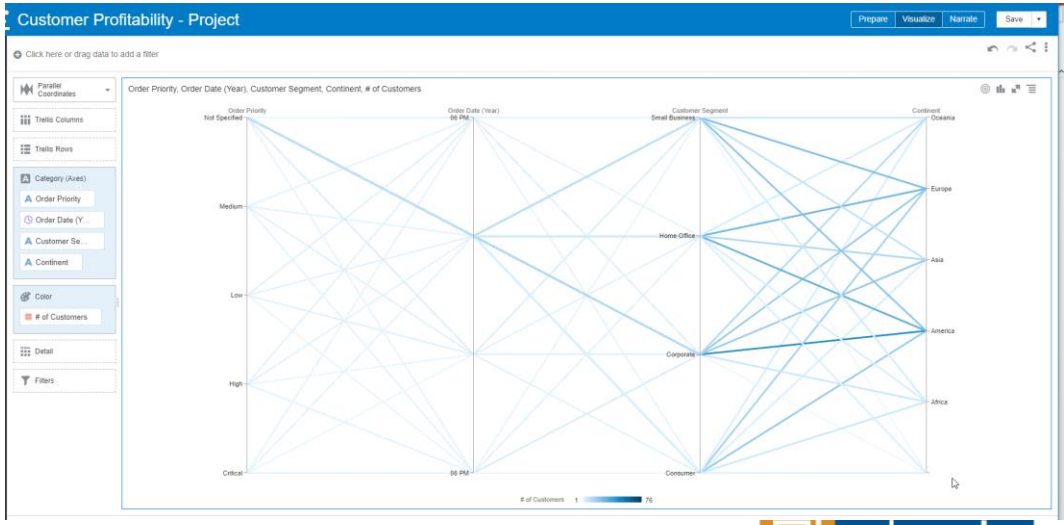
Parallel Coordinates Graphs

- Used to show otherwise disparate relationships
- “Custom join graph”
- Each line represents a record in the **active** data set
- Sort order is extremely important
- Highly interactive
- Not recommended for general users



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Customer Profit Analysis

- Highlight **Customer Segment** and **Profit** and drag to canvas.
  - Horizontal bar chart
  - Set “Use as Filter”
- Create new column “**Customer Profit Bin**” and “**Gross Profit**”
- Highlight **Sales**, **Profit**, **Customer Profit Bin** and **Gross Profit** and drag to canvas.
  - Bar graph Sales and Profit, color as “Gross Profit”
- Highlight **Profit**, **Sales**, and **Customer Name** and drag to canvas.
  - Scatter plot and add reference lines.

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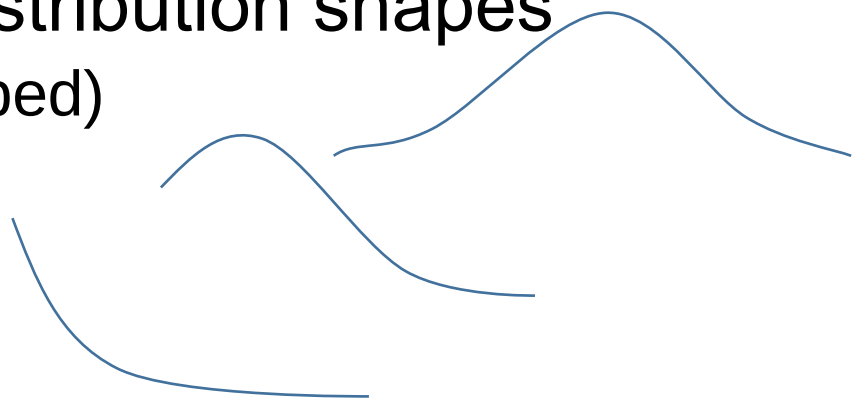
Understanding Measures for Exploration

- Aggregation method is important
- If use average, also add a bucketed measure
- Compute differences
- Understand data's natural distribution shapes
  - Normal distributions (bell shaped)
  - Log-normal distributions
  - Exponential distributions



- Average has strong meaning only for normal distributions
- Outlier identification & treatment are important for non-normal distributions

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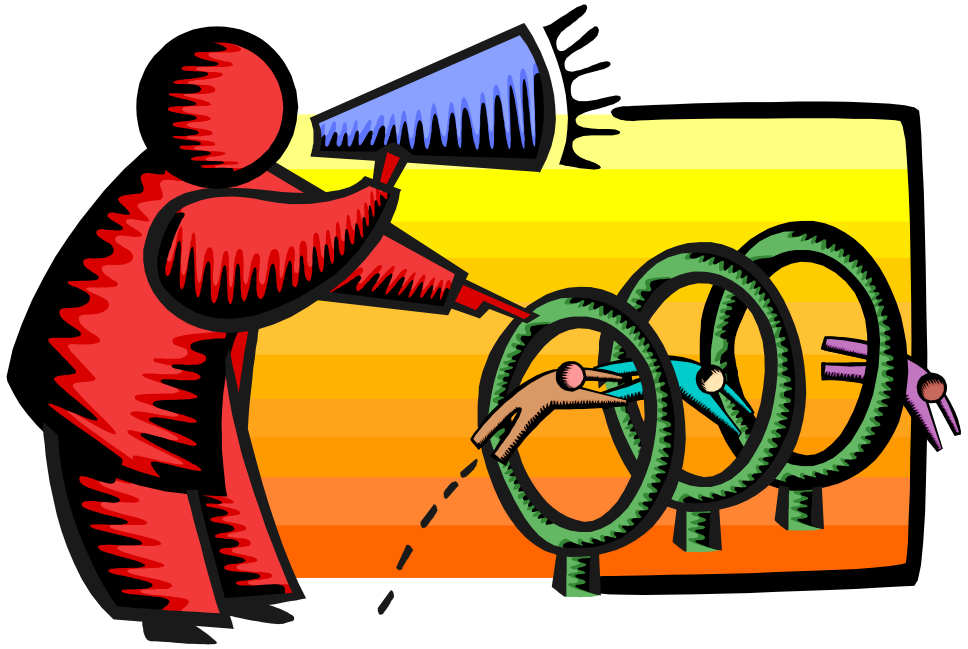
Demo



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Keys to Data Discovery

- Identify your main topic of interest with a performance tile
- Summary
- Evaluating a fact or a dimension?
  - Sales analysis
  - Customer or product analysis
- Fact analysis
  - Find lowest grain
  - Flat low distribution
  - Event or transaction
- Look for clustered distribution
    - Scatter with points as event in fact table
      - Set fact on X axis and response variable on Y axis

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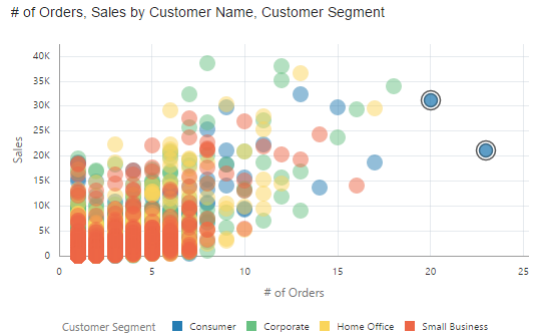
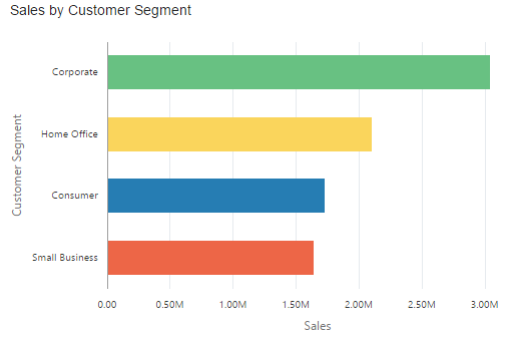
Major Types and Uses of Graphs

- Scatter plot – outlier detection



- Line graph – time based measures. Looking for trends and patterns

- Bar graph – comparison analysis



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Map Views and Location Analytics

- GeoJSON map layers
- Understanding and using built-in features of OAC
- NEW Spatial Studio

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Data Narratives/Evidence Based Stories

- Using OAC Narrative tab
- Reader/viewer experience
- Add verbiage for clarity and emphasis
- Numbers are read like words
- Graphs and visualizations are interpreted like pictures

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Starting with Data Discovery

- Begin either with a specific question or a framework
- Avoid “wandering around”
- Most of your visualizations will not produce new insights
- Move quickly through visualizations
- Be prepared to open a lot of browser tabs

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Finding is not Explaining

- Process of interaction has a huge impact on the contextual understanding of an insight
- When someone discovers something, they believe it more
- Human Cognition Biases

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Questions?

Session ID:

108840

Shining the Bright Light of Analytics on Big Cities

Remember to provide your session feedback in the app!

Prepared by:

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VP & Analytics Strategist
Vlamis Software Solutions
@timvlamis
tvlamis@vlamis.com

May 28, 2020