Dashboard Design and Visual Data Exploration

Selected Excerpts from Freakalytics Tableau Training Course

Stephen McDaniel

Co-founder and Principal Analyst
Freakalytics, LLC
http://www.Freakalytics.com

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Stephen’s Background

• Author
  – “Rapid Graphs with Tableau”
  – “SAS for Dummies”

• Co-Founder of Freakalytics, LLC
  – Freakalytics is a Tableau Education Partner providing
    • Public training – learn the in’s and outs of Tableau while learning solid presentation and dashboard design principles
    • On-site training
    • Expert dashboard design and analytic strategy consulting

• Director of Marketing Analytics
  – Netflix, Razorfish and REI
Stephen’s Background

• **Director of Software Development**- analytics
  - SAS

• **Technical Architect**- BI, analytics & data warehousing
  - Oracle, Brio, Takeda Abbott Pharmaceuticals, Pfizer, Bristol Myers

• **Senior Product Manager**- BI & analytics
  - Brio Technology and SAS

• **Statistician**
  - Six Sigma- pharmaceutical manufacturing
  - Biostatistician- AIDS, asthma, birth control, heart failure and allergies
Dashboard Principles

Adapted from “Information Dashboard Design”
with permission of Stephen Few
Combined with original work by Freakalytics

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Why a dashboard?
Why a dashboard?

Your dashboard should **enlighten** and **empower** your audience on a periodic basis.

**Great dashboards** enable **better decisions** and inspire new questions in the business.

-*Stephen McDaniel*
What is a dashboard?
What is a dashboard?

Visual display

of

the most important information

needed to understand and manage

one or more areas of an organization

which

fits on a single computer screen

so it can be

monitored at a glance

-Stephen Few
Visual display...

### Sales and Profit YTD

<table>
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<tr>
<th>Sales (K)</th>
<th>2009</th>
<th>2008</th>
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<tbody>
<tr>
<td>$30K</td>
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<tr>
<td>$20K</td>
<td></td>
<td></td>
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<tr>
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<td></td>
</tr>
<tr>
<td>$0K</td>
<td></td>
<td></td>
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</tbody>
</table>

### YTD Sales Target and Actual Sales

<table>
<thead>
<tr>
<th>Product</th>
<th>Actual Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earl Grey</td>
<td>$22,661</td>
</tr>
<tr>
<td>Green Tea</td>
<td>$10,996</td>
</tr>
<tr>
<td>Darjeeling</td>
<td>$24,983</td>
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<tr>
<td>Mint</td>
<td>$12,492</td>
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<tr>
<td>Lemon</td>
<td>$32,520</td>
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<tr>
<td>Chamomile</td>
<td>$26,410</td>
</tr>
<tr>
<td>Caffe Latte</td>
<td>$12,397</td>
</tr>
<tr>
<td>Regular Espresso</td>
<td>$7,810</td>
</tr>
<tr>
<td>Decaf Espresso</td>
<td>$26,612</td>
</tr>
<tr>
<td>Caffe Mocha</td>
<td>$26,466</td>
</tr>
<tr>
<td>Amaretto</td>
<td>$8,742</td>
</tr>
<tr>
<td>Columbian</td>
<td>$43,944</td>
</tr>
<tr>
<td>Decaf Irish Cream</td>
<td>$21,584</td>
</tr>
</tbody>
</table>

### YTD Market Growth Over Prior Year

- Year of Data:
  - 2009
  - 2008

### Market % of Sales Target

- 2009 Percent of Sales Target:
  - 2009 Percent of Sales Target
- 2008 Percent of Sales Target

- YTD Market Growth:
  - YTD Market Growth
  - 957%

- Market % of Sales Target:
  - 2009 Market % of Sales Target
  - 2008 Market % of Sales Target

### Sales Target Achievement by Market

[Map showing sales target achievement by market]
…the most important information…

- Strategic, analytical or operational?
- Frequency of update- monthly, weekly, daily, hourly or near real-time?
…fits on a single computer screen… monitored at a glance.

- Static or interactive?
- Graphical, text, text and graphics?
- Conduit to additional analysis or stand-alone?
- **Monitored at a glance**
Common metric themes in dashboards by subject area

• Sales
  – Bookings, billings, sales pipeline, number of orders, order distribution and selling prices

• Marketing
  – Market share, campaign success, customer attributes

• Tech support
  – Number of calls, resolved cases, customer satisfaction and call duration

• Finance
  – Revenue, expenses and profits
Poor Dashboard- Oracle Contact Center

www.PerceptualEdge.com (Stephen Few)
Poor Dashboard- Oracle Contact Center

www.PerceptualEdge.com (Stephen Few)
Poor Dashboard - Finance

Income Distribution

COGS Distribution

Current Ratio

AR / AP Ratio

Debt to Equity Ratio

Expense Distribution

Profit and Loss

http://www.infocaptor.com/ (vendor site)
Poor Dashboard - Human Resources

http://www.infocaptor.com/ (vendor site)
Real-world dashboard challenges

• Data management often requires 50-70% of project time

• Dashboards unused if the audience is not considered
  – Lacking useful information
  – Confusing / overloaded presentation

• Traditional dashboard tools required weeks of expert programming

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Real-world dashboard challenges

• A working knowledge of good data presentation and dashboard design principles is rare

• Marketing-specific challenges include
  – Inadequate metrics
  – Program- and vendor-centric data “silos”
  – Multiple cloud data sources that are overly simplistic and hard to combine
Strategic sales dashboard

Customer Sales Dashboard for a Boutique Winery - from Freakalytics.com

Cascading Filters

Sales by Year Acquired
- 2009
- 2008
- 2007
- 2006

Sales by Discount Level
- 0%
- 1-5%
- 6-10%
- 11-15%
- 16-20%
- >20%

Sales by LTV Rank
- 90% +
- 80-90%
- 70-80%
- 60-70%
- 50-60%
- 0-50%

Tasting Room Customers
- Yes
- No

Newsletter Customers
- Yes
- No

E-mail Customers
- Yes
- No

Sales Mix by Marketing Program
- Tasting Room: $1,637K
- Newsletter: $432K
- Email: $266K

Percent of Total Sales (100% Without Filters)

Profit Mix by Customer Segment (2009)
- Casual Visitor
- Luxury Estate
- High Roller
- Wine Enthusiast

Customers Acquired by Year

Average LTV by Year Acquired

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Newer customers

Customer Sales Dashboard for a Boutique Winery - from Freakalytics.com

**Cascading Filters**

- **Sales by Year Acquired**
  - 2009
  - 2008
  - 2007
  - 2006

- **Sales by Discount Level**
  - 0%
  - 1-5%
  - 6-10%
  - 11-15%
  - 16-20%
  - >20%

- **Sales by LTV Rank**
  - 90%+
  - 80-90%
  - 70-80%
  - 60-70%
  - 50-60%
  - 0-50%

**Sales Mix by Marketing Program**

- Tasting Room: $472K
- Newsletter: $232K
- Email: $102K

**Percent of Total Sales (100% Without Filters)**

- 0%: $879K

**Profit Mix by Customer Segment (2009)**

- Casual Visitor
- Luxury Estate
- High Roller
- Wine Enthusiast

**Customers Acquired by Year**

- Tasting Room Customers: Yes, No
- Newsletter Customers: Yes, No
- E-mail Customers: Yes, No

**Average LTV by Year Acquired**

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Traditional customers

Customer Sales Dashboard for a Boutique Winery - from Freakalytics.com

Cascading Filters
- Sales by Year Acquired
  - 2009
  - 2008
  - 2007
  - 2006

- Sales by Discount Level
  - 0%
  - 1-5%
  - 6-10%
  - 11-15%
  - 16-20%
  - >20%

- Sales by LTV Rank
  - 90%+
  - 80-90%
  - 70-80%
  - 60-70%
  - 50-60%
  - 0-50%

Tasting Room Customers
- Yes
- No

Newsletter Customers
- Yes
- No

E-mail Customers
- Yes
- No

Sales Mix by Marketing Program
- Tasting Room: $228K
- Newsletter: $88K
- Email: $78K

Percent of Total Sales (100% Without Filters)
- $454K

Profit Mix by Customer Segment (2009)
- Casual Visitor
- Luxury Estate
- High Roller
- Wine Enthusiast

Customers Acquired by Year
- 2006: 500
- 2007: 1,000
- 2008: 2,000
- 2009: 2,500

Average LTV by Year Acquired
- 2006: $2,500
- 2007: $2,000
- 2008: $1,500
- 2009: $1,000

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High-discount customers

Customer Sales Dashboard for a Boutique Winery - from Freakalytics.com

Cascading Filters

Sales by Year Acquired
- 2009
- 2008
- 2007
- 2006

Sales by Discount Level
- 0%
- 1-5%
- 6-10%
- 11-15%
- 16-20%
- >20%

Sales by LTV Rank
- 90% +
- 80-90%
- 70-80%
- 60-70%
- 50-60%
- 0-50%

Tasting Room Customers
- Yes

Newsletter Customers
- Yes
- No

E-mail Customers
- Yes
- No

Sales Mix by Marketing Program
- Tasting Room: $366K
- Newsletter: $46K
- Email: $67K

Percent of Total Sales (100% Without Filters)
- 486K

Profit Mix by Customer Segment (2009)
- Casual Visitor
- Luxury Estate
- High Roller
- Wine Enthusiast

Customers Acquired by Year

Average LTV by Year Acquired

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High-discount and no tasting room visit

Customer Sales Dashboard for a Boutique Winery - from Freakalytics.com

Cascading Filters

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Tasting Room Customers
- Yes

Newsletter Customers
- Yes
- No

E-mail Customers
- Yes
- No

Sales Mix by Marketing Program
- Tasting Room
- Newsletter
- Email

Percent of Total Sales (100% Without Filters)

Profit Mix by Customer Segment (2009)
- Luxury Estate
- High Roller
- Wine Enthusiast

Customers Acquired by Year

Average LTV by Year Acquired

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Of great concern... declining LTV???
Wealthy customers


Selectors

<table>
<thead>
<tr>
<th>Wealth Groups</th>
<th>No Segments</th>
<th>High Roller</th>
<th>Luxury Estate</th>
<th>Casual Visitor</th>
<th>Wine Enthusiast</th>
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</thead>
<tbody>
<tr>
<td>LT $300k</td>
<td>$9,000</td>
<td>$8,000</td>
<td>$6,000</td>
<td>$5,000</td>
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<td>$7,000</td>
<td>$5,000</td>
<td>$4,000</td>
<td>$3,000</td>
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<tr>
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<td>$4,000</td>
<td>$3,000</td>
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<td>$6,000</td>
<td>$5,000</td>
<td>$3,000</td>
<td>$2,000</td>
<td>$1,000</td>
</tr>
</tbody>
</table>

Discount Selector

| 0%                  | $8,000      |
| 1-5%                | $7,000      |
| 6-10%               | $6,000      |
| 11-15%              | $5,000      |
| 16-20%              | $4,000      |
| 21-25%              | $3,000      |
| GT 25%              | $2,000      |

Before Segments

- No Segments

Customer Segments

- High Roller
- Luxury Estate
- Wine Enthusiast

Interact with the dashboard!

Compare Avg Sales by Channel for All Customers to...

- Tasting Room: $430
- Newsletter: $416
- Email: $198
- Winemaker Call: $100

The tasting room is where the action is - or is it?

Average Sales by Channel for Customer Segments

- Tasting Room
  - High Roller: $477
  - Newsletter: $423
  - Email: $295
  - Winemaker Call: $149

13X the average customer - make that call!

7X average - postage is well worth it...

3X average - hit the send button!

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Wealthy customers, high discounts


Selectors

Wealth Groups
- LT $300k
- $300-$600k
- $600k-$1m
- > $1m

Discount Selector
- 0%
- 1-5%
- 6-10%
- 11-15%
- 16-20%
- 21-25%
- GT 25%

Sales for All Customers...

No Segments
- $0
- $1,000
- $2,000
- $3,000
- $4,000
- $5,000
- $6,000
- $7,000
- $8,000
- $9,000

High Roller
- Avg $247
- 95%

Luxury Estate
- Avg $365
- 95%

Casual Visitor
- Avg $23
- 95%

Wine Enthusiast
- Avg $143
- 95%

Look Quite Different After Adding Customer Segments

Compare Avg Sales by Channel for All Customers to...

Tasting Room
- $248
- The tasting room is where the action is - or is it?

Newsletter
- $358

Email
- $322

Winemaker Call
- $66

Average Sales by Channel for Customer Segments

Tasting Room
- $30

Newsletter
- $515
- 7X average - postage is well worth it...

Email
- $33

Winemaker Call
- $23

Wine Enthusiast

Tasting Room
- $466

Newsletter
- $202
- 3X average - hit the send button!

Email
- $611

Winemaker Call
- $108

Interact with the dashboard!
End of section
Data Exploration and Dashboard Design with Tableau Software

Data Exploration Concepts
Adapted from “Now You See It”
Stephen Few and from Freakalytics.com

Stephen McDaniel
Co-founder and Principal Analyst
Freakalytics, LLC
http://www.Freakalytics.com

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Seven habits of effective analysts – adapted from Freakalytics.com

1. Collect, discuss and understand the questions that matter for your customers and business owners
2. Collect and clean the best available data for the identified questions
3. Explore the data sources to understand high level trends and exceptions
4. Understand key interactions, trends, sources of effect & possible causes
5. Communicate the right amount of information and conclusions in the language of the audience
6. Collaborate with the business to act on the findings
7. Continue to learn from and listen to the business!
Seven habits of effective analysts – adapted from Freakalytics.com

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Two primary analysis approaches

1. Directed – start with a specific question that we hope to answer – this is the traditional approach to analysis

Many analysis tools, disparate data sources and “dirty data” have long constricted the analyst to undertaking this approach

Many technical and statistical classes have long stressed this mode of thinking

Many managers/executives have been schooled in working with analysts in this mode
Two primary analysis approaches

1. Directed – start with a specific question that we hope to answer – this is the traditional approach to analysis

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Many managers/executives have been schooled in working with analysts in this mode.
Two primary analysis approaches

2. **Exploratory** – take a fresh look at some data to see what might be interesting

This is a new area for many people.

Being successful with exploratory analysis requires additional context (beyond the data) about the subject at hand.

A clear and open mind also helps.

You are exploring for unexpected outcomes (against “conventional wisdom” or outliers/unusual shapes and patterns).
Two primary analysis approaches

2. **Exploratory** – take a fresh look at some data to see what might be interesting

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You are exploring for unexpected outcomes (against “conventional wisdom” or outliers/unalusual shapes and patterns)
Sub-conscious image processing- why graphs are so powerful

• Conscious processing- how many 4’s are there?

209387056796387682736401735867389672897563095679822659065068
548609732937659865789638907566958038873326689058895709462098
907098651252134698089623213238789789708953785647878763256678
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Sub-conscious image processing- why graphs are so powerful

• Conscious processing- how many 4’s are there?

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• Subconscious or preattentive processing- how many 4’s are there?

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## Leverage pre-attentive processing with graph attributes

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<th>Example</th>
<th>Description</th>
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Leverage pre-attentive processing with graph attributes

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### Perceived Precision with Graph Attributes

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</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Length</td>
<td></td>
<td>Longer = greater</td>
</tr>
<tr>
<td>High</td>
<td>2-D Position</td>
<td></td>
<td>Higher or farther to right = greater</td>
</tr>
<tr>
<td>Low</td>
<td>Width</td>
<td></td>
<td>Wider = greater</td>
</tr>
<tr>
<td>Low</td>
<td>2-D Position</td>
<td></td>
<td>Bigger = greater</td>
</tr>
<tr>
<td>Low</td>
<td>Intensity</td>
<td></td>
<td>Darker = greater</td>
</tr>
<tr>
<td>Low</td>
<td>Shape</td>
<td></td>
<td>More jagged = more important</td>
</tr>
</tbody>
</table>

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Leverage pre-attentive processing with graph attributes

<table>
<thead>
<tr>
<th>Perceived Precision</th>
<th>Attribute</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Length</td>
<td><img src="image" alt="Length Example" /></td>
<td>Longer = greater</td>
</tr>
<tr>
<td>High</td>
<td>2-D Position</td>
<td><img src="image" alt="2-D Position Example" /></td>
<td>Higher or farther to right = greater</td>
</tr>
<tr>
<td>Low</td>
<td>Width</td>
<td><img src="image" alt="Width Example" /></td>
<td>Wider = greater</td>
</tr>
<tr>
<td>Low</td>
<td>2-D Position</td>
<td><img src="image" alt="2-D Position Example" /></td>
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</tr>
<tr>
<td>Low</td>
<td>Intensity</td>
<td><img src="image" alt="Intensity Example" /></td>
<td>Darker = greater</td>
</tr>
<tr>
<td>Low</td>
<td>Shape</td>
<td><img src="image" alt="Shape Example" /></td>
<td>More jagged = more important</td>
</tr>
</tbody>
</table>
Tableau shapes - pros and cons of each?
Color coding and perception
which square is lightest?
Color coding and perception
which square is lightest?
Poor defaults lead to poor comprehension and insights
Color coding - Tableau 10 is the default, when would you use other palettes?
If you remember just one part of this presentation!

• Show the data- let the **message** dominate
• Show the data- the **shape** should be clear
• Show the data- **eliminate clutter**

• Highlight the data that matters
• Reduce intensity of supporting data
• Avoid unintentional deception through poor choice of graph, symbols, color or perspective
Emphasis on *Profit* versus *Marketing* quarterly results
Emphasis on shape of data through the year

2008 Profit and Marketing Lines

- Measure Names:
  - Profit (Green)
  - Marketing (Pink)

- Y-axis: Sales (in $ thousands)
  - 0, 1,000, 2,000, 3,000, 4,000, 5,000, 6,000, 7,000, 8,000, 9,000, 10,000

- X-axis: Dates (Jan 1 to Dec 1, 2008)

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Emphasis on a product that lags on *Profit* relative to *Marketing*
Understanding **Sales** relative to **Profit** and **Marketing**

**2008 Profit and Marketing by Product and Month with Size for Sales**

- **Sum of Sales**
  - $896
  - $2,000
  - $3,000
  - $4,000
  - $5,000
  - $6,014

- **Product**
  - Amaretto
  - Caffe Latte
  - Caffe Mocha
  - Chamomile
  - Columbian
  - Darjeeling
  - Decaf Espresso
  - Decaf Irish Cream
  - Earl Grey
  - Green Tea
  - Lemon
  - Mint
  - Regular Espresso
Emphasis on *Path of Profit* vs. *Marketing* through the *Quarters* of the year
The power of graph types, symbols, color and size- convey very different insights
End of section