



LISBON
SCHOOL OF
ECONOMICS &
MANAGEMENT
UNIVERSIDADE DE LISBOA

BI & DASHBOARDS

Prof. Carlos J. Costa, PhD

Associate Professor of Information Systems and Operation
Management

What Are the Different Types of Decisions, and How Does the Decision Making Process Work?

(1 of 2)

- Business value of improved decision making
 - Improving hundreds of thousands of “small” decisions adds up to large annual value for the business
- Types of decisions
 - Unstructured: Decision maker must provide judgment, evaluation, and insight to solve problem
 - Structured: Repetitive and routine; involve definite procedure for handling so they do not have to be treated each time as new
 - Semistructured: Only part of problem has clear-cut answer provided by accepted procedure

© Laudon & Laudon, 2018



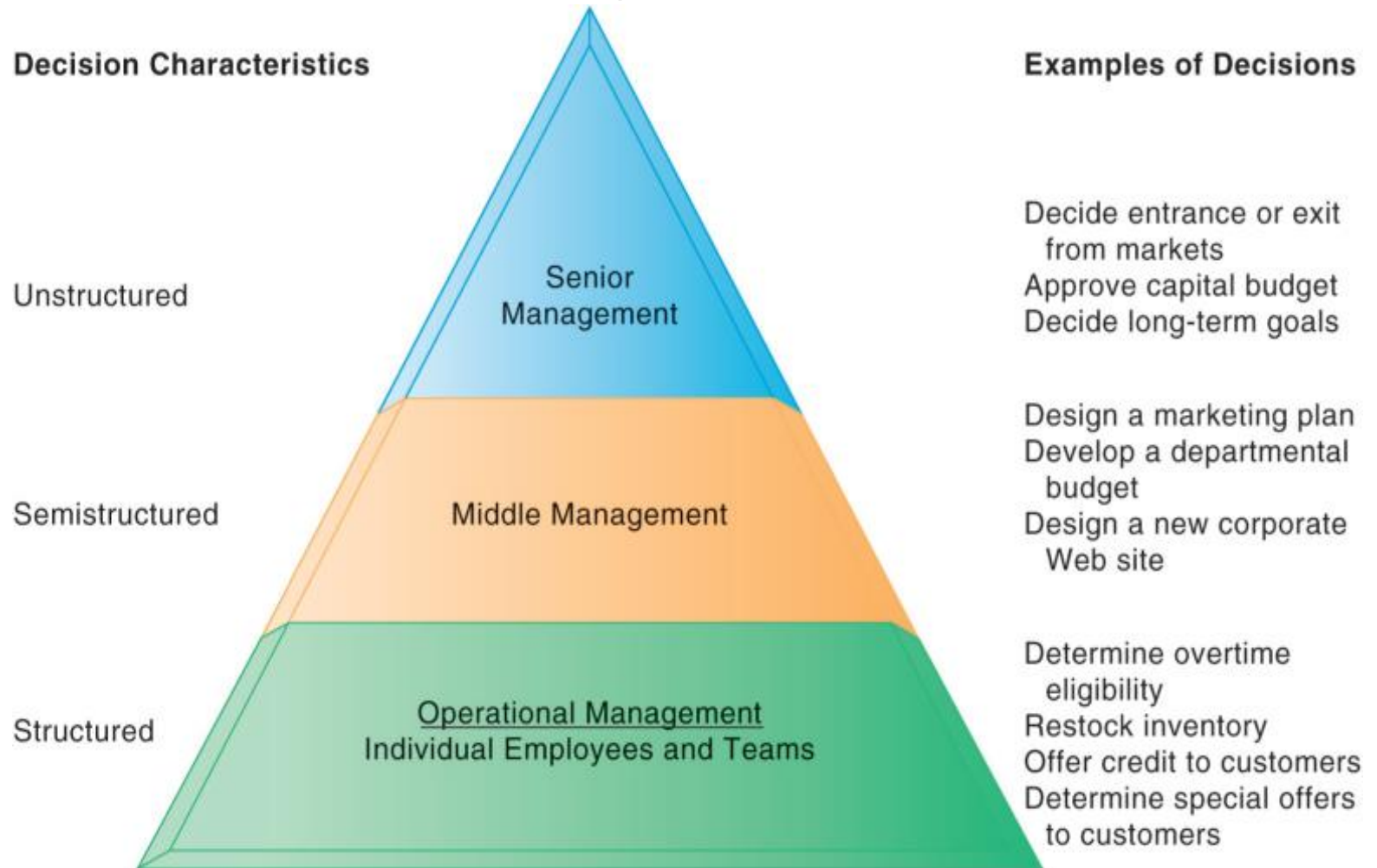
What Are the Different Types of decisions, and How Does the Decision Making Process Work? (2 of 2)

- Senior managers
 - Make many unstructured decisions
- Middle managers
 - Make more structured decisions but these may include unstructured components
- Operational managers and rank and file employees
 - Make more structured decisions

© Laudon & Laudon, 2018



Figure 12.1: Information Requirements of Key Decision-Making Groups in a Firm



© Laudon & Laudon, 2018

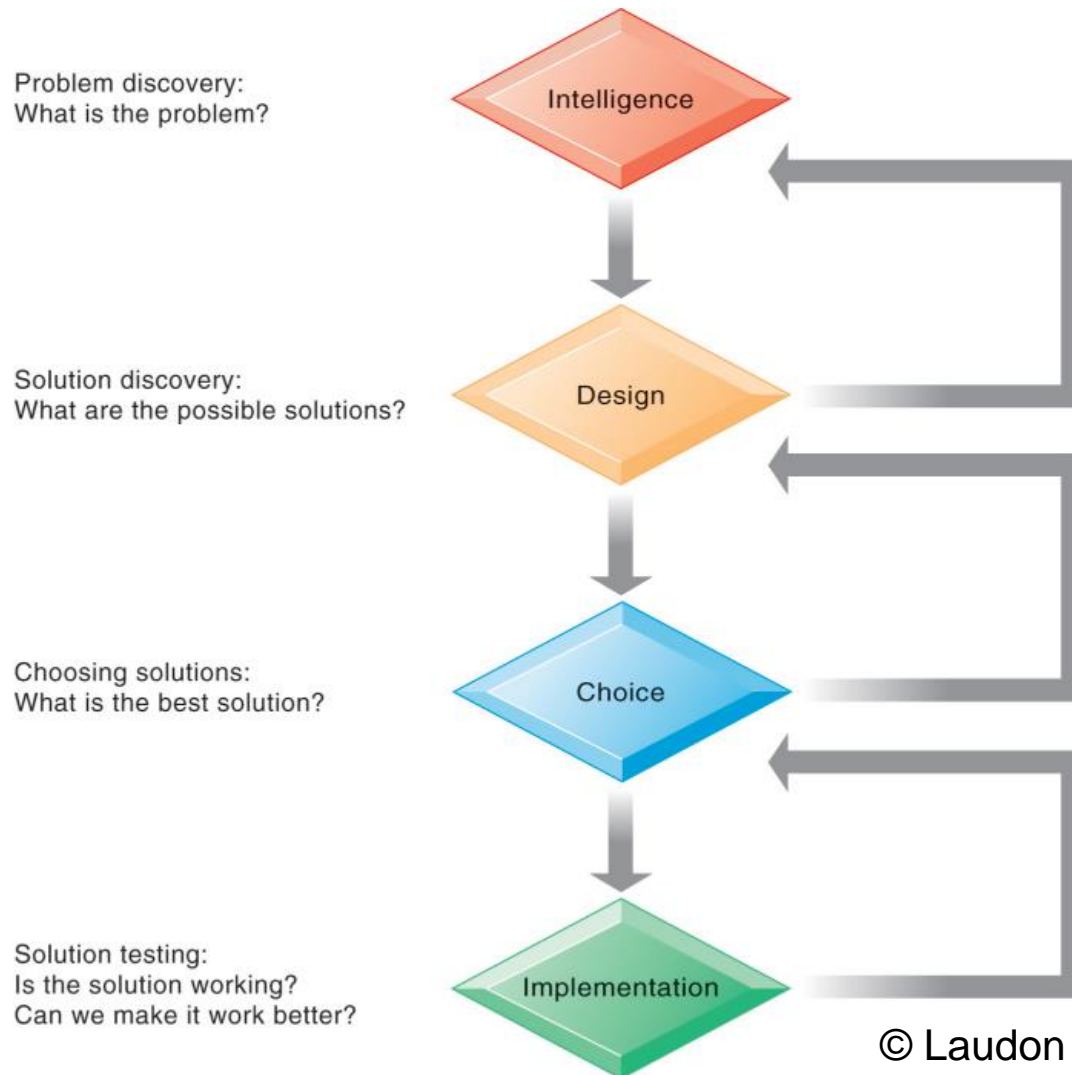
The Decision Making Process

- Intelligence
 - Discovering, identifying, and understanding the problems occurring in the organization
- Design
 - Identifying and exploring solutions to the problem
- Choice
 - Choosing among solution alternatives
- Implementation
 - Making chosen alternative work and continuing to monitor how well solution is working

© Laudon & Laudon, 2018



Figure 12.2: Stages In Decision Making



© Laudon & Laudon, 2018

Managerial Roles

- Information systems can only assist in some of the roles played by managers
- Classical model of management: five functions
 - Planning, organizing, coordinating, deciding, and controlling
- More contemporary behavioral models
 - Actual behavior of managers appears to be less systematic, more informal, less reflective, more reactive, and less well organized than in classical model

© Laudon & Laudon, 2018



Mintzberg's 10 Managerial Roles

- Interpersonal roles
 - Figurehead
 - Leader
 - Liaison
- Informational roles
 - Nerve center
 - Disseminator
 - Spokesperson
- Decisional roles
 - Entrepreneur
 - Disturbance handler
 - Resource allocator
 - Negotiator

© Laudon & Laudon, 2018



Real-World Decision Making

- Three main reasons why investments in IT do not always produce positive results
 - Information quality
 - High-quality decisions require high-quality information
 - Management filters
 - Managers have selective attention and have variety of biases that reject information that does not conform to prior conceptions
 - Organizational inertia and politics
 - Strong forces within organizations resist making decisions calling for major change

© Laudon & Laudon, 2018



High-Velocity Automated Decision Making

- Made possible through computer algorithms precisely defining steps for a highly structured decision
 - Humans taken out of decision
- For example: High-speed computer trading programs
 - Trades executed in 30 milliseconds
- Require safeguards to ensure proper operation and regulation

© Laudon & Laudon, 2018



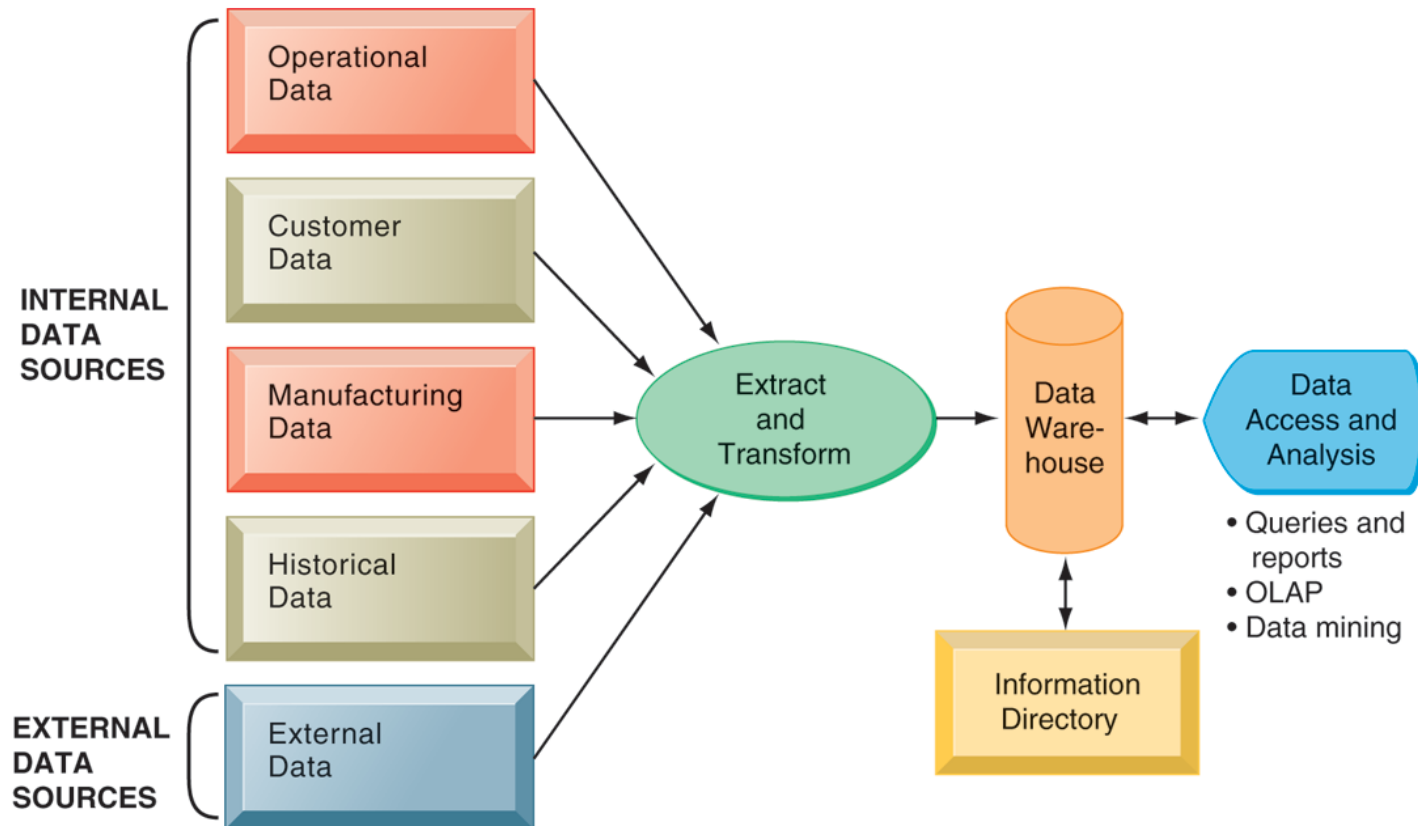
What Is Business Intelligence?

- Business intelligence
 - Infrastructure for collecting, storing, analyzing data produced by business
 - Databases, data warehouses, data marts
- Business analytics
 - Tools and techniques for analyzing data
 - OLAP, statistics, models, data mining
- Business intelligence vendors
 - Create business intelligence and analytics purchased by firms

© Laudon & Laudon, 2018



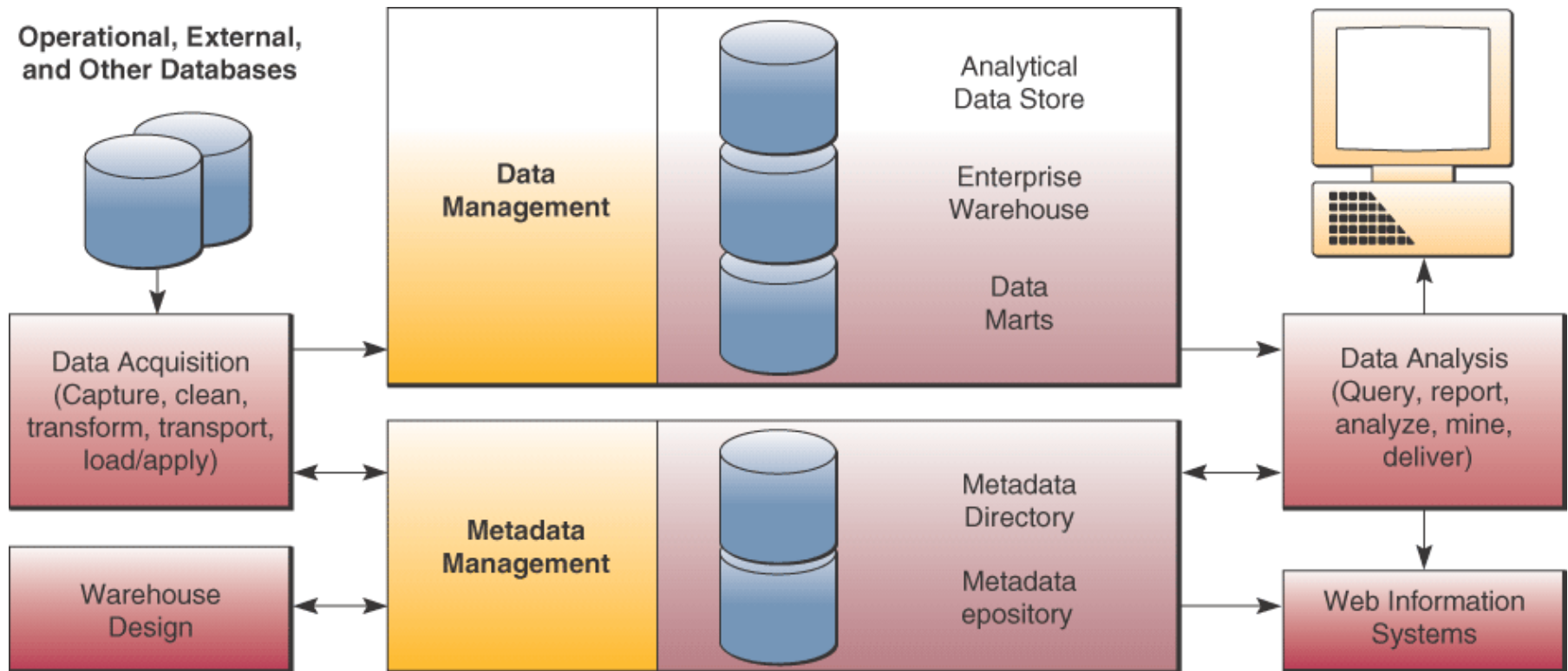
Data Warehouse Components



O'Brien e Marakas, 2011

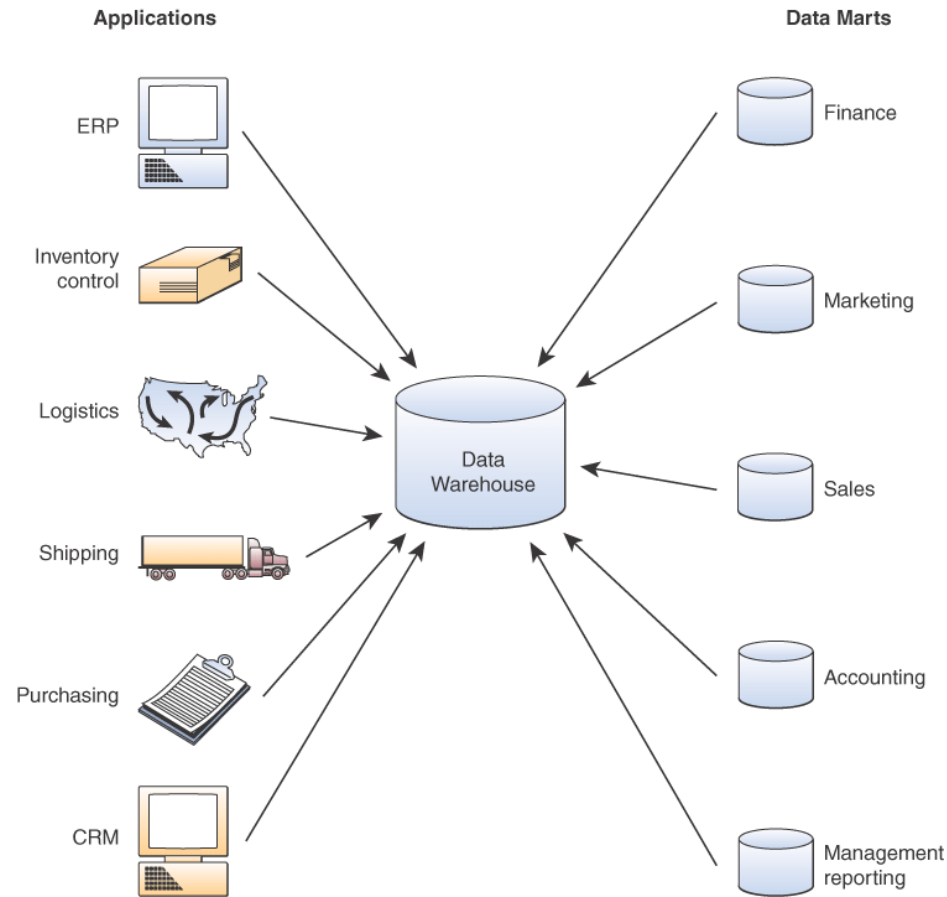


Data Warehouse Components



O'Brien e Marakas, 2011

Applications and Data Marts



O'Brien e Marakas, 2011

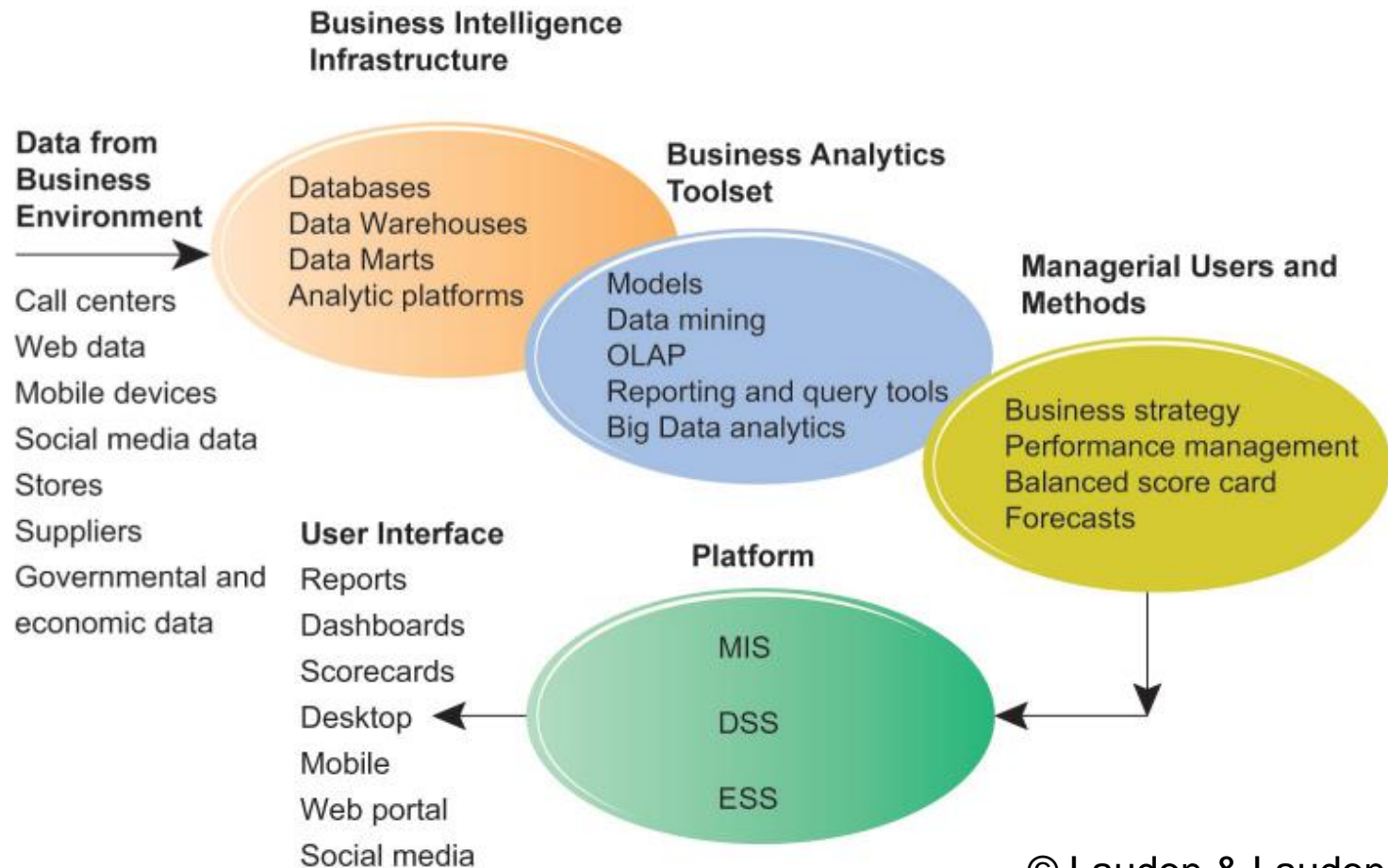
The Business Intelligence Environment

- Six elements in the business intelligence environment
 - Data from the business environment
 - Business intelligence infrastructure
 - Business analytics toolset
 - Managerial users and methods
 - Delivery platform—MIS, DSS, ESS
 - User interface
 - Data visualization tools

© Laudon & Laudon, 2018



Figure 12.3: Business Intelligence and Analytics for Decision Support



© Laudon & Laudon, 2018

Business Intelligence and Analytics Capabilities

- Goal is to deliver accurate real-time information to decision makers
- Main analytic functionalities of BI systems
 - Production reports
 - Parameterized reports
 - Dashboards/scorecards
 - Ad hoc query/search/report creation
 - Drill down
 - Forecasts, scenarios, models

© Laudon & Laudon, 2018



Using Databases to improve Decision

- Online analytical processing (OLAP)
- Multidimensional Model

- Data Mining
- Big Data

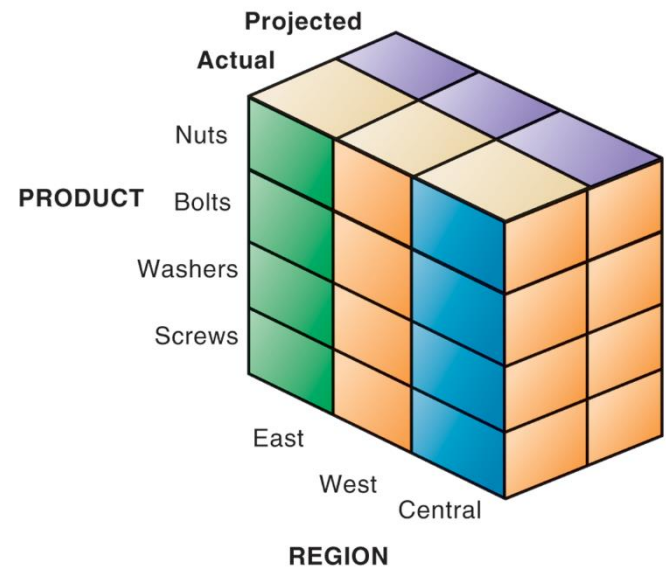


Table 12.4: Examples of Business Intelligence Predefined Production Reports

BUSINESS FUNCTIONAL AREA	PRODUCTION REPORTS
Sales	Forecast sales; sales team performance; cross-selling; sales cycle times
Service/call center	Customer satisfaction; service cost; resolution rates; churn rates
Marketing	Campaign effectiveness; loyalty and attrition; market basket analysis
Procurement and support	Direct and indirect spending; off-contract purchases; supplier performance
Supply chain	Backlog; fulfillment status; order cycle time; bill of materials analysis
Financials	General ledger; accounts receivable and payable; cash flow; profitability
Human resources	Employee productivity; compensation; workforce demographics; retention

© Laudon & Laudon, 2018



Predictive Analytics

- Uses variety of data, techniques to predict future trends and behavior patterns
 - Statistical analysis
 - Data mining
 - Historical data
 - Assumptions
- Incorporated into numerous BI applications for sales, marketing, finance, fraud detection, health care
 - Credit scoring
 - Predicting responses to direct marketing campaigns

Big Data Analytics

- Big data: Massive datasets collected from social media, online and in-store customer data, and so on
- Help create real-time, personalized shopping experiences for major online retailers
- Smart cities
 - Public records
 - Sensors, location data from smartphones
 - Ability to evaluate effect of one service change on system

Operational Intelligence and Analytics

- Operational intelligence: Business activity monitoring
- Collection and use of data generated by sensors
- Internet of Things
 - Creating huge streams of data from web activities, sensors, and other monitoring devices
- Software for operational intelligence and analytics enable companies to analyze their big data

Location Analytics and Geographic Information Systems

- Location analytics
 - Ability to gain business insight from the location (geographic) component of data
 - Mobile phones
 - Sensors, scanning devices
 - Map data
- Geographic information systems (GIS)
 - Ties location-related data to maps
 - Example: For helping local governments calculate response times to disasters

© Laudon & Laudon, 2018



Interactive Session: Management: Data Drive Starbucks Location Decisions

- Class discussion
 - How important is location data to Starbucks's business strategy? Explain your answer.
 - How do location analytics help Starbucks managers make better decisions? Give examples of two decisions that the Atlas system helps support.
 - Compare Starbucks decisions about store location in 2007–2008 and 2012. What made the later decisions more successful? What management, organization, and technology factors were involved?
 - What is the value to Starbucks of a good decision about where to open a Starbucks store? Explain your answer.

Management Strategies for Developing BI and BA Capabilities

- One-stop integrated solution
 - Hardware firms sell software that run optimally on their hardware
 - Makes firm dependent on single vendor
- Multiple best-of-breed solution
 - Greater flexibility and independence
 - Potential difficulties in integration
 - Must deal with multiple vendors
- All BI and BA systems bring high switching costs

Figure 12.4: Business Intelligence Users

**Power Users:
Producers
(20% of employees)**

Capabilities

**Casual Users:
Consumers
(80% of employees)**

IT developers

Production Reports

Customers/Suppliers
Operational employees

Super users

Parameterized Reports

Senior managers

Business analysts

Dashboards/Scorecards

Managers/Staff

Analytical modelers

Ad hoc queries; Drill down
Search/OLAP

Business analysts

Forecasts; What if
Analysis; statistical models

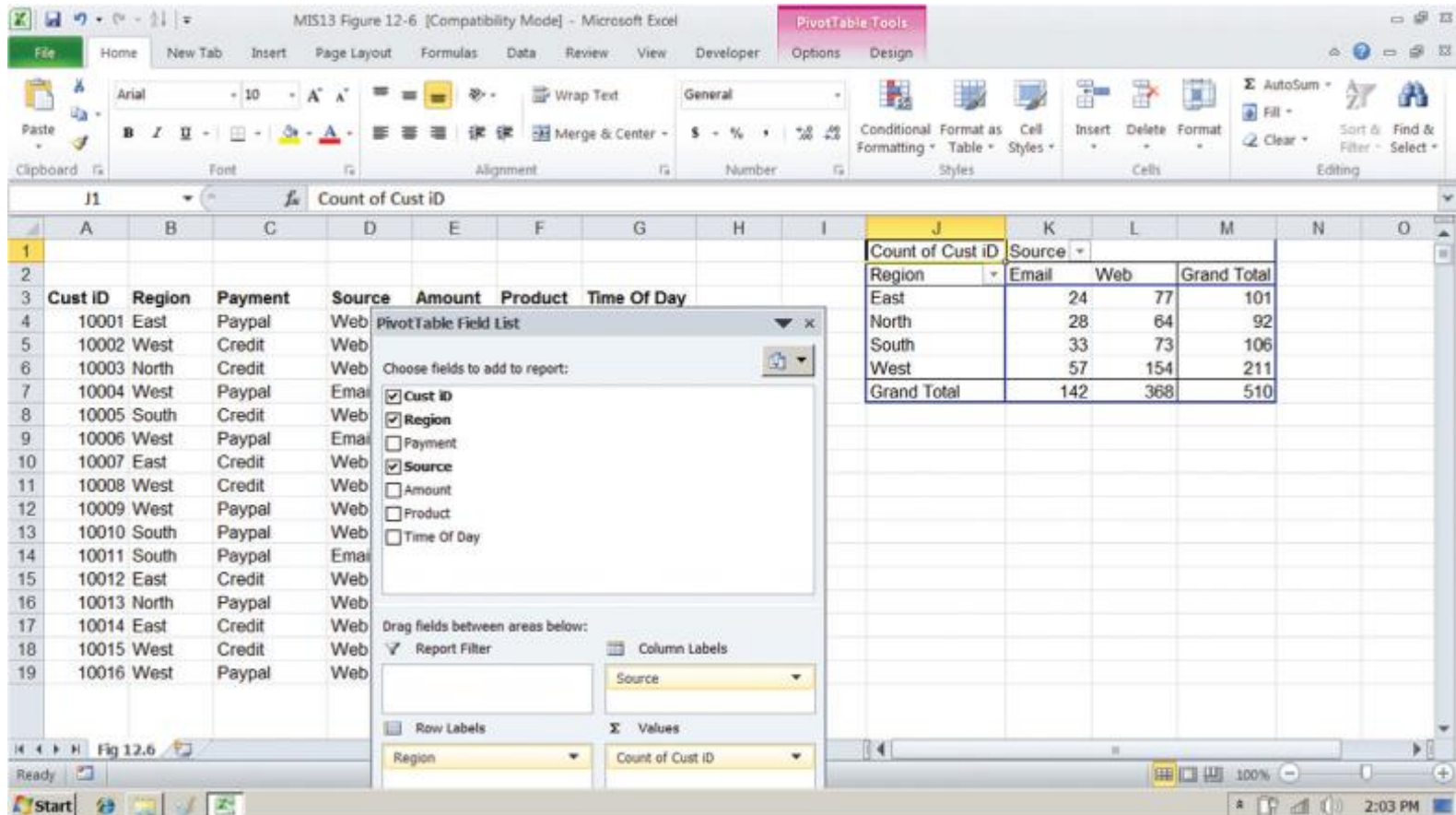
Support for Semistructured Decisions

- Decision-support systems
 - Support for semistructured decisions
- Use mathematical or analytical models
- Allow varied types of analysis
 - “What-if” analysis
 - Sensitivity analysis
 - Backward sensitivity analysis
 - Multidimensional analysis / OLAP
 - For example: pivot tables

Figure 12.5: Sensitivity Analysis

Total fixed costs	19000					
Variable cost per unit	3					
Average sales price	17					
Contribution margin	14					
Break-even point	1357					
		Variable Cost per Unit				
Sales	1357	2	3	4	5	6
Price	14	1583	1727	1900	2111	2375
	15	1462	1583	1727	1900	2111
	16	1357	1462	1583	1727	1900
	17	1267	1357	1462	1583	1727
	18	1188	1267	1357	1462	1583

Figure 12.6: A Pivot Table That Examines Customer Regional Distribution and Advertising Source



Decision Support for Senior Management (1 of 2)

- ESS: decision support for senior management
 - Help executives focus on important performance information
- Balanced scorecard method
 - Measures outcomes on four dimensions
 - Financial
 - Business process
 - Customer
 - Learning and growth
 - Key performance indicators (KPIs) measure each dimension

© Laudon & Laudon, 2018



Figure 12.7: The Balanced Scorecard Framework



© Laudon & Laudon, 2018

Decision Support for Senior Management (2 of 2)

- Business performance management (BPM)
 - Translates firm's strategies (e.g., differentiation, low-cost producer, scope of operation) into operational targets
 - KPIs developed to measure progress toward targets
- Data for ESS
 - Internal data from enterprise applications
 - External data such as financial market databases
 - Drill-down capabilities

Group Decision-Support Systems (GDSS)

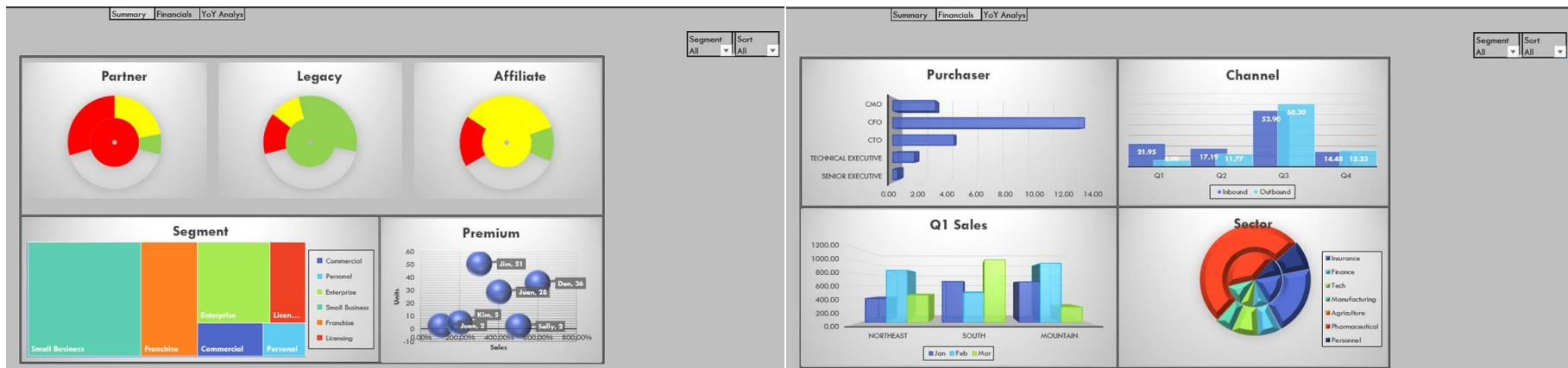
- Interactive system to facilitate solution of unstructured problems by group
- Specialized tools
 - Virtual collaboration rooms
 - Software to collect, rank, edit participant ideas and responses
- Promotes collaborative atmosphere, anonymity
- Cisco's Collaboration Meeting Rooms Hybrid (CMR)
- Skype for Business

© Laudon & Laudon, 2018



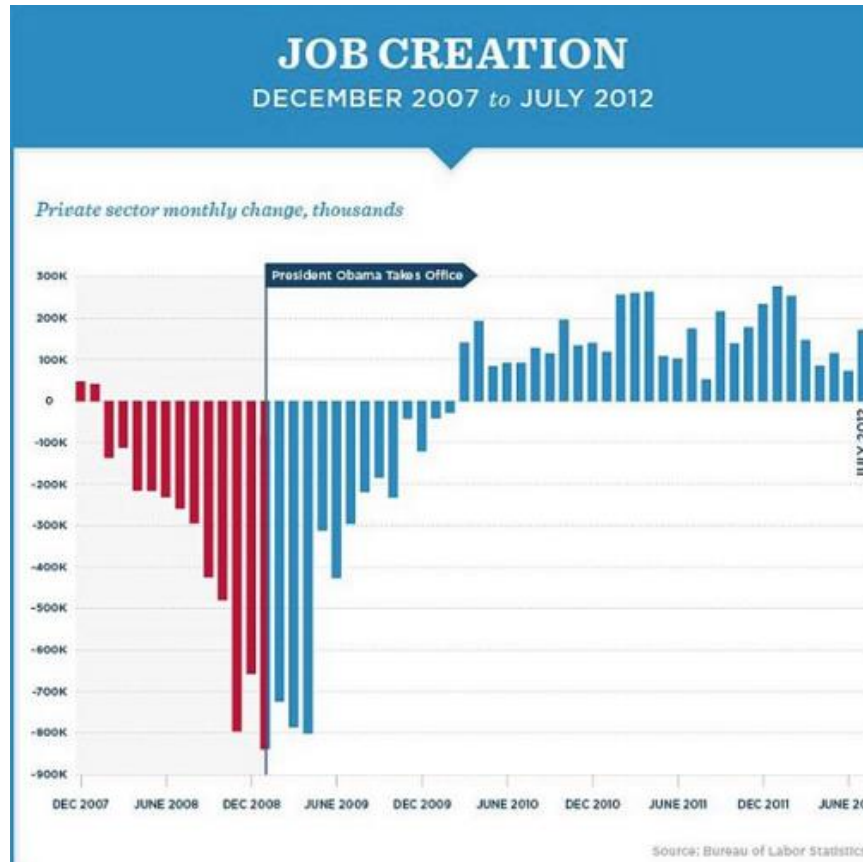
Telling a Story using data

Some reports have problems



- No story
- Weak visual quality
- Shadows and 3D some times are noise
- Colour schema
- Character fonts
- Not the more adequate graphs

What is telling a story with data?



For a visual to work, they need to tell the story the author intended.

Source: Bureau of Labor Statistics | Nathan Yau

What is telling a story with data?

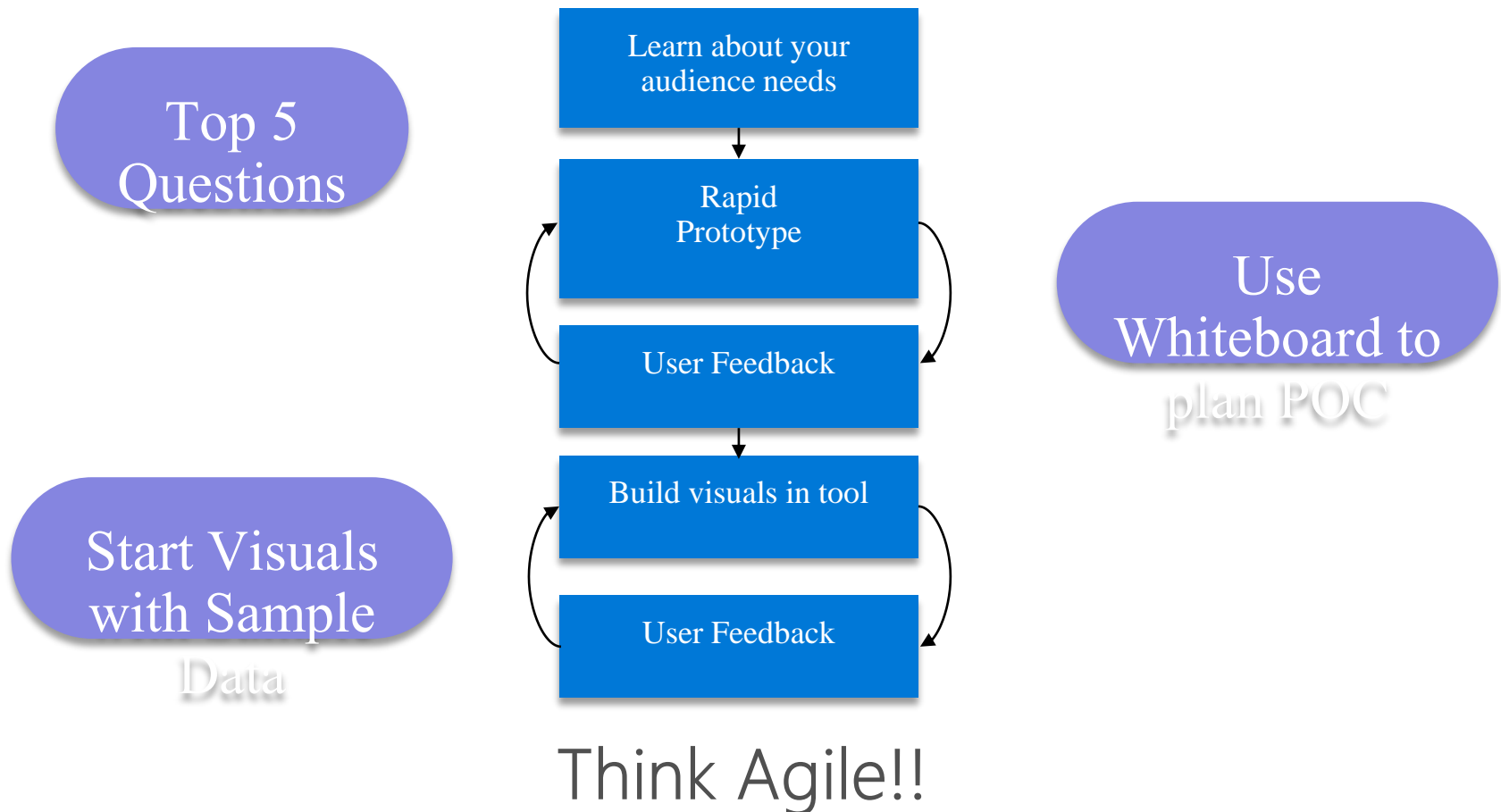
Are there other ways to tell a great story through data?



Source: The Gap minder foundation, BBC, Youtube.com

Image Source: <http://img.youtube.com/vi/jbkSRLYSojo/0.jpg>

What is behind Data visualization?



What is a Dashboard?

- Visual representation of the most relevant information needed to achieve one or more business objectives;
- Information presented in a consolidated and organized form on a single screen in order to be more easily monitored

Few, 2006

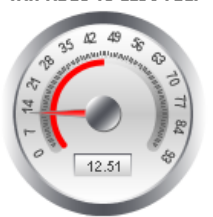
YTD Sales vs Last Year



Open Deals vs Last Year



Win Ratio vs Last Year



■ Last Year
 ■ Target Growth (40.00%)
 ■ Stretched Growth (100%)

Owner

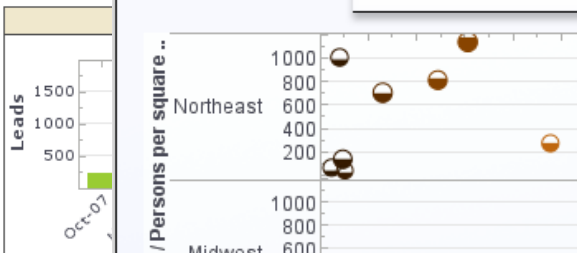
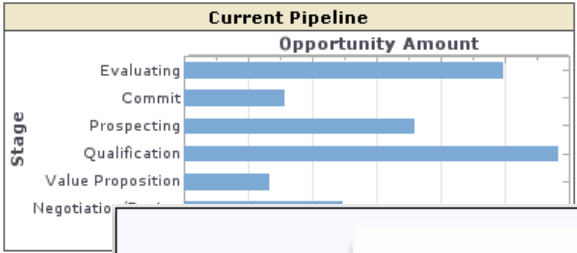
- Andy Grant
- Frank Cohen
- James Bond
- Brandon Armstrong
- George Cohen
- John Smith

Exceptions

Exception	Count
Leads Inactive For 30 Days	0
Opportunities Past Close Date	56
Opportunities Inactive For 30 Days	59

Executive

ID	Name	Account	Amount
0067000000Dr	Commun Europ	Commun Europe	\$250,000.00
0067000000Dr	SpringShield -	SpringShield	\$249,480.00
0068000000Lx	GenAsi esign -	GenAsi esign	\$207,000.00
0067000000Dr	EquAll rated - I	EquAll rated	\$159,000.00
0067000000Dr	Aspied - Gener	Aspied	\$150,000.00
0067000000Dr	EquAll rated - I	EquAll rated	\$119,326.00
0067000000Dr	Foratas - Gene	Foratas	\$110,349.00



Census Visualization

State	Value
Connecticut	41.3
Illinois	651.37.8
Indiana	809.8
Iowa	702.9
Kansas	274
Maine	7.3
Massachusetts	401.9
Michigan	274
Minnesota	274
Missouri	274

Division

- East North: 32,000 - 56,500
- Mid-Atlan: 68,000 - 252,000
- New Engl: 68,000 - 276,000
- West Nort: 0.6 - 6

Region

- Midwest
- Northeast
- South
- West

Calendar

December 2008

Sun	Mon	Tue	Wed	Thu	Fri	Sat
30	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3

0..580,000

Operational

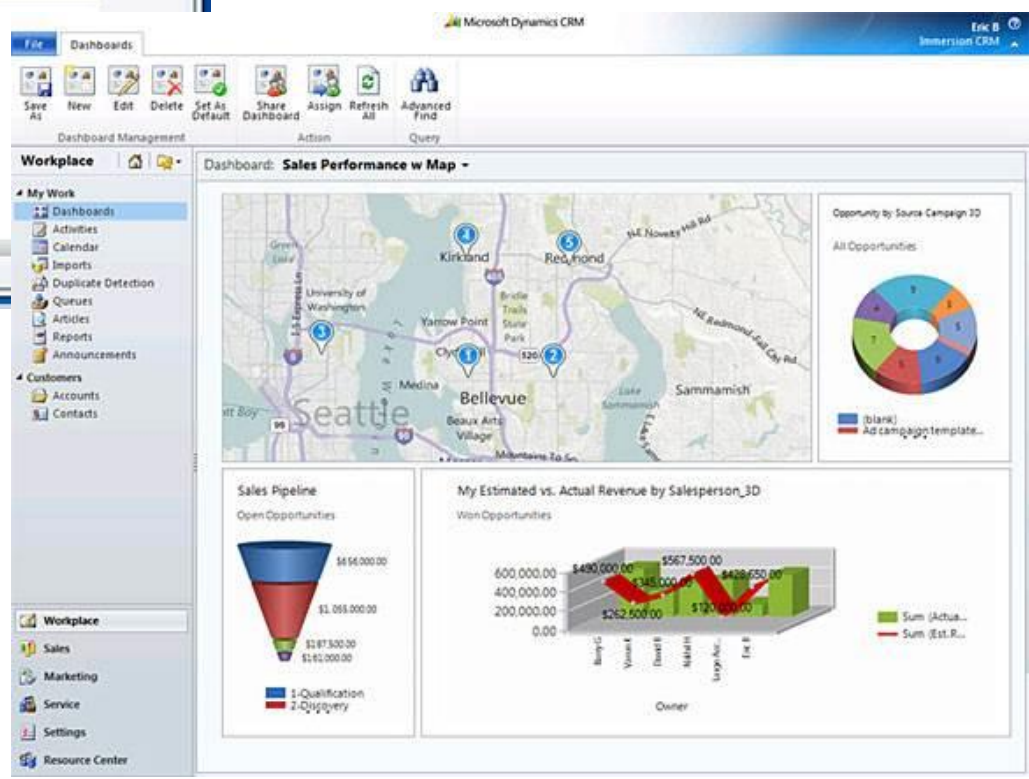
Fonte: https://www.inetsoft.com/products/business_dashboards_examples/





Oracle sales pipeline

Microsoft Sales Pipeline



Fonte: <http://searchcrm.techtarget.com/photostory/2240113011/CRM-user-interfaces-Sales-dashboard-examples/2/Microsofts-sales-dashboard>



WEATHER STATIONS (MULTIPLE SOURCES) 5

STATION	WIND SPEED	WIND GUSTS	DIRECTION	TEMPERATURE	HUMIDITY	RAIN TODAY	PRESSURE	FORECAST
CASA Office: Bloomsbury W1	8 mph	9 mph	SE ↘	11.5 °C	76%	0.0 mm	1027.9 mbar	Clear Night
Lambeth Meters: Brixton SW9	4.3 mph	4.3 mph	SW ↙	11.0 °C	83%	0.0 mm	1026.4 mbar	Clear Night
Hampstead NW3	3.6 mph	3.6 mph	S ↑	9.8 °C	84%	0.0 mm	1029.0 mbar	Clear Night

WEATHER (METAR) 848

London City Airport

Mostly clear **SW at 3 mph** **11 C**

FORECAST (YAHOO! WTH) 1748

Day	Temp	Condition
Mon	10 C	Mostly Clear
Tue	9 C	Partly Cloudy

TUBE LINE STATUS (TfL) 39

Bakerloo	Good Service
Central	Good Service
Circle	Good Service
District	Good Service
H & C	Good Service
Jubilee	Good Service
Metropolitan	Good Service
Northern	Good Service
Piccadilly	Good Service
Victoria	Good Service
W & C	Good Service
Overground	Good Service
DLR	Good Service

BIKE SHARING (TfL) 38

4.3 % Stations Full **4.9 %** Stations Empty

7354 Bikes Available **430** Bikes or Docks Faulty

Available Bikes (last 24h)

IN SERVICE (TfL) 9

7197 London buses

378 Underground trains

AIR POLLUTION (DEFRA) 1748

µg/m³ TIME AVERG	OZONE	NO ₂	SO ₂	PM _{2.5}	PM ₁₀
Bloomsbury	13	38	4	9	10
Marylebone Rd	9	16	26	22	34
N Kensington	14	40	?	12	18

RADS (CASA) 1

CASA Office Desk ‡

6 cpm (uncalibrated)

RIVER LEVEL (PLA) 248

Thames (Tower Pier)

4.13 metres

STOCKS (YAHOO) 7

FTSE 100 Index

6552.34

+0.35 (0.01%)

RANDOM TRAFFIC CAMERAS (TfL) 10

Old Kent Rd/Asylum Rd

High St/Grosvenor Rd W Wickham

BBC LONDON NEWS (BBC) 48

Rigby killer 'a soldier of Allah' Mayor bike 'scaring' claim withdrawn Murder police found grave in garden Cameron praises 'towering' Mandela Police crackdown on pirate site ads Why do we value gold?

OPENSTREETMAP UPDATES (OSM) 248

Third attempt to name the terraced cottages around the Green. Revert my change to terraced cottages as they get rendered with wrong address. Added Tibet Foundation refining Name error.

ELECTRICITY (N.GRID) 29

Demand (Great Britain)

48211 MW

MOOD (LSE MAPPINESS) 38

8% unhappier than the long term average for here

13% happier than the whole country right now

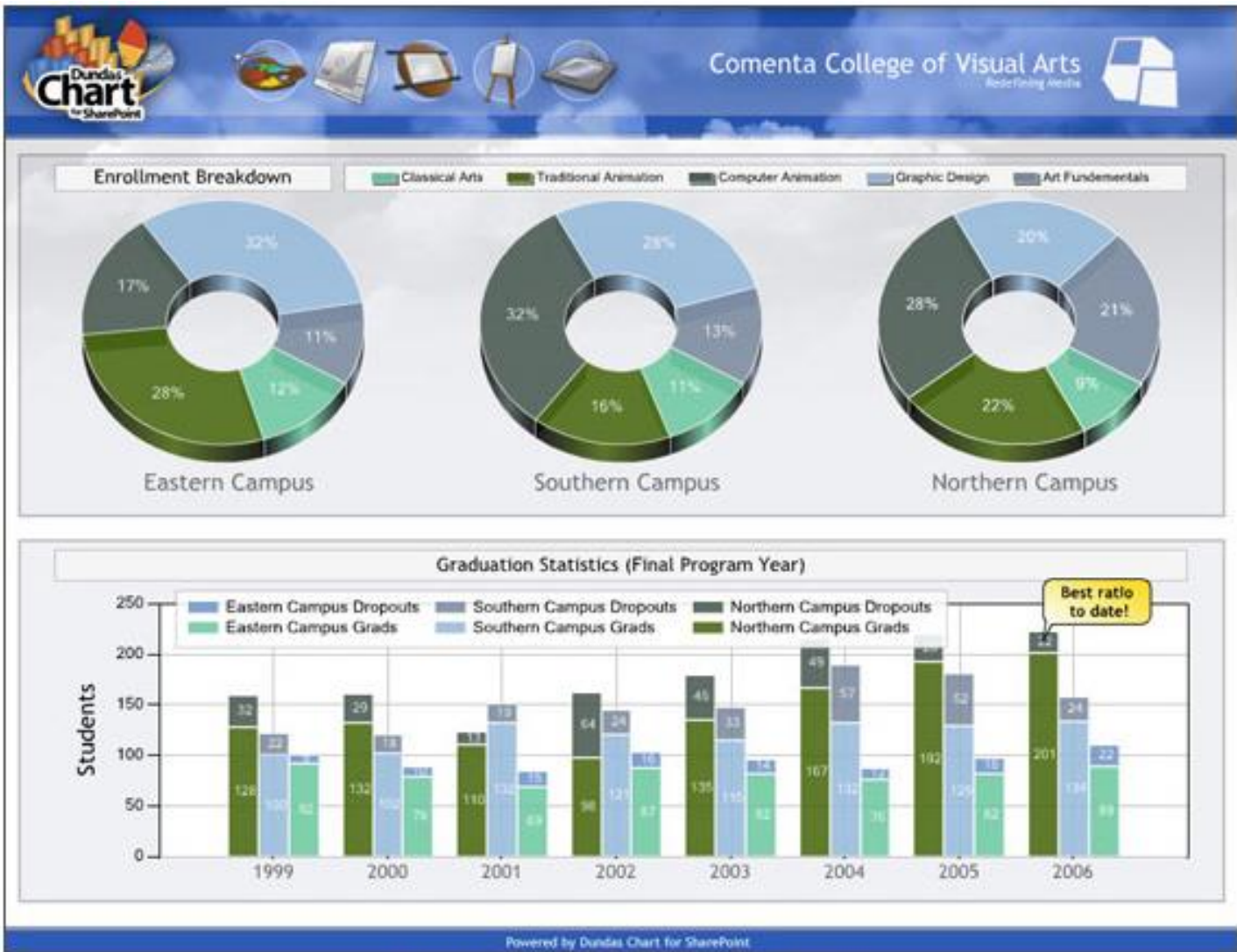
TWITTER TRENDS FOR LONDON 198

MPs **#NFL** **Christmas** **#Confident** **Xmas** **#ashes** **London**

#RIPALexTurner #12DaysofJonesDAY9 Waca

<https://www.matillion.com/insights/dashboard-examples-the-good-the-bad-and-the-ugly/>





Digital Dashboard, Education Metrics

<https://www.matillion.com/insights/dashboard-examples-the-good-the-bad-and-the-ugly/>



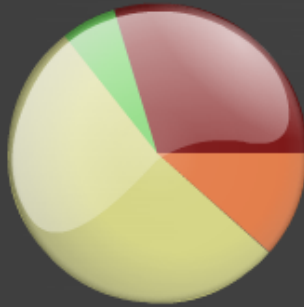
TIB At A Glance



Program Metrics

Statewide Project Inventory

Open



- Application
- Design
- Bid
- Construction
- Closeout

TIA UATA SCPP Total

Project Inventory Future Obligation Completed Projects

Active Projects

371

Rem. Commitment

\$339,003,068*

Completed (FYTD)

2

Under Construction

171

Agency Status

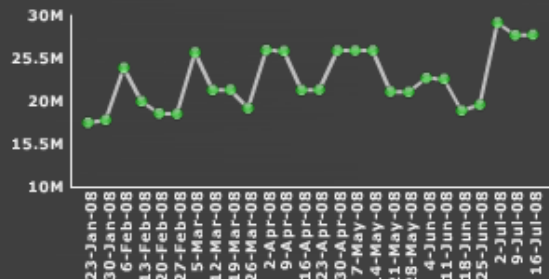
TIB Balanced Scorecard



Financial Health

Fund Balances

Open



TIA UATA SCPP Total

Fund Balances Project Expenditures Accounts Payable

TIA Fund Balance

\$15,204,017

UATA Fund Balance

\$8,842,294

SCPP Fund Balance

\$3,593,312

Transactions (MTD)

23

Payments (MTD)

\$2,769,040.91

Sustainable Financial Management

- Account Balances
- Expenditures Vs. Revenue
- Payments Vs. Allotments
- Outstanding Payments

Fund Balances are as of 07/16/2008

<https://www.matillion.com/insights/dashboard-examples-the-good-the-bad-and-the-ugly/>



Common Pitfalls in Dashboard Design

- Pitfall #1: Exceeding the Boundaries of a Single Screen
- Pitfall #2: Supplying Inadequate Context for the Data
- Pitfall #3: Displaying Excessive Detail or Precision
- Pitfall #4: Expressing Measures Indirectly
- Pitfall #5: Choosing Inappropriate Media of Display
- Pitfall #6: Introducing Meaningless Variety
- Pitfall #7: Using Poorly Designed Display Media
- Pitfall #8: Encoding Quantitative Data Inaccurately
- Pitfall #9: Arranging the Data Poorly
- Pitfall #10: Ineffectively Highlighting What's Important
- Pitfall #11: Cluttering the Screen with Useless Decoration
- Pitfall #12: Misusing or Overusing Color
- Pitfall #13: Designing an Unappealing Visual Display

https://www.perceptualedge.com/articles/Whitepapers/Common_Pitfalls.pdf

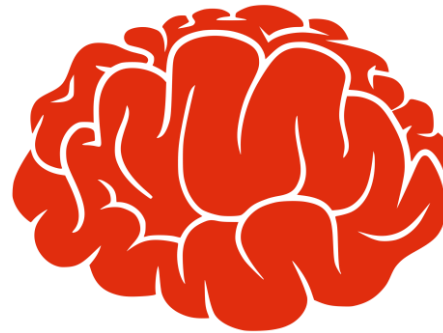


Vision dominates the sensory context

- *“Why should we be interested in visualization? Because the human **visual system is a pattern seeker of enormous power and subtlety.** (...) We can easily see patterns presented in certain ways, but if they are presented in other ways, they become invisible...The more general point is that **when data is presented in certain ways, the patterns can be readily perceived.** If we can understand how perception works, our knowledge can be translated into rules for displaying information. **Following perception-based rules, we can present our data in such a way that the important and informative patterns stand out.** If we disobey the rules, our data will be incomprehensible or misleading.”*
- Colin Ware, Information Visualization: Perception for Design, Second Edition (San Francisco: Morgan Kaufman, 2004), xxi

Our Brains – that big red thing in the middle.

We have learned to be very visual beings. We have three levels of memory to make things actual.



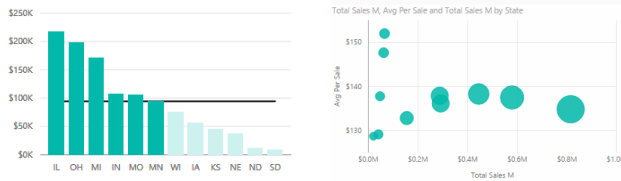
Iconic
memory

Short Term
memory

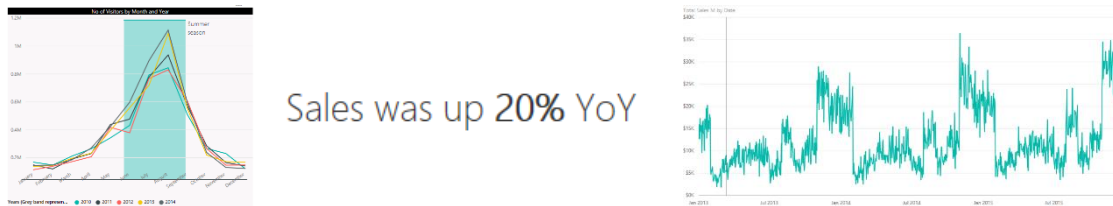
Long Term
memory

Pre-cognitive attributes

Very precise quantitative perception: 2D length and positioning



Not very precise quantitative perception: width, size, intensity, blur



Sales was up 20% YoY

Non-Quantitative Perception = Orientation, Form, Enclosure, Added Brands

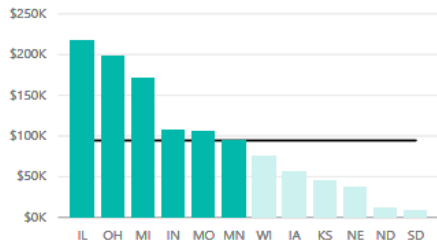
Region	Total Sales M	Sales YoY
South	\$1,566,447	10.66%
MidWest	\$992,456	5.42%
NorthEast	\$931,919	11.98%
Pacific	\$758,435	13.94%
Mountain	\$283,976	27.43%
	\$133	▼ -85.34%



Based upon Stephen Few “Information Dashboard Design”

Gestalt Principles

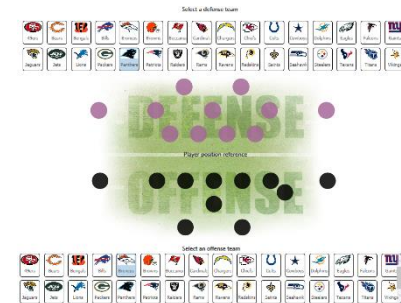
Proximity, Similarity



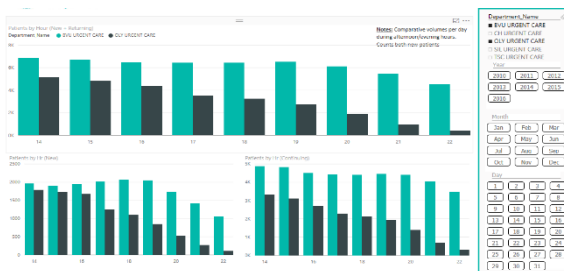
Continuity



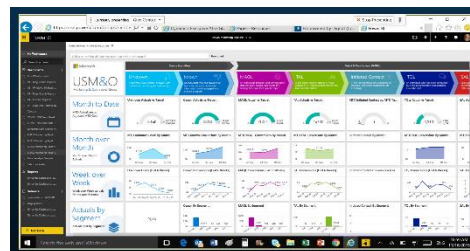
Figure and Ground



Enclosure, Symmetry



Continuity and Symmetry



Based upon Gestalt's Principles

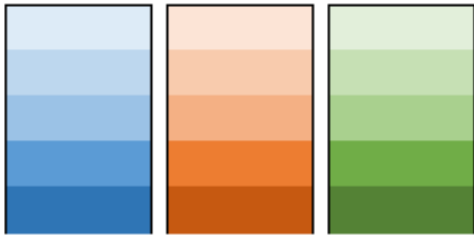


Visual Perception

- Organization of Visual perception
 - Color
 - Shape
 - Spacial positioning
 - Moviment

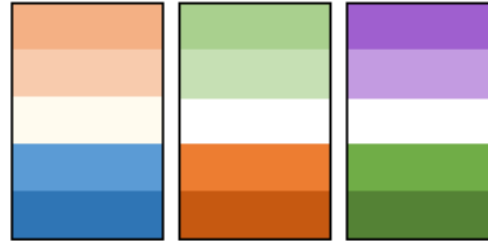
Few, 2006

Types of Colors



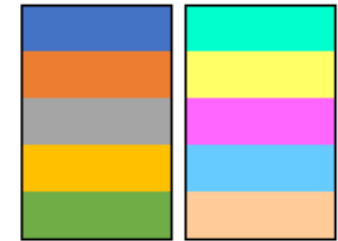
Sequential

There is a scale



Divergent

There are two
divergente spaces

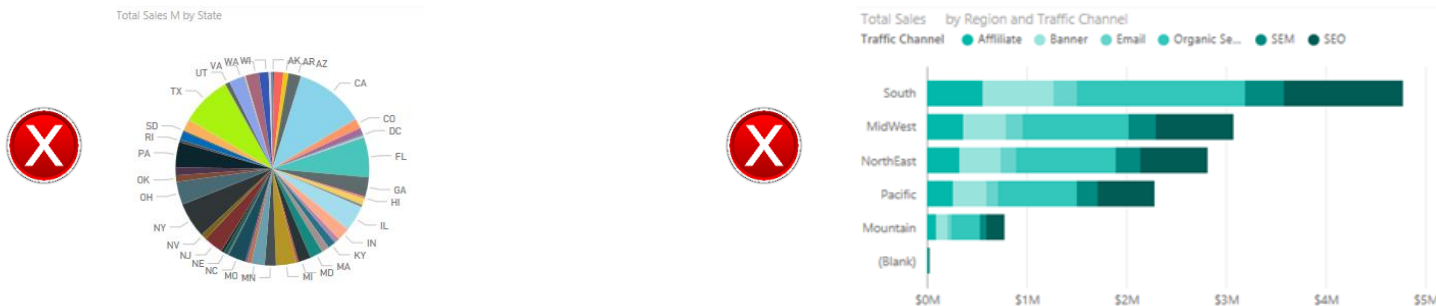


Qualitative

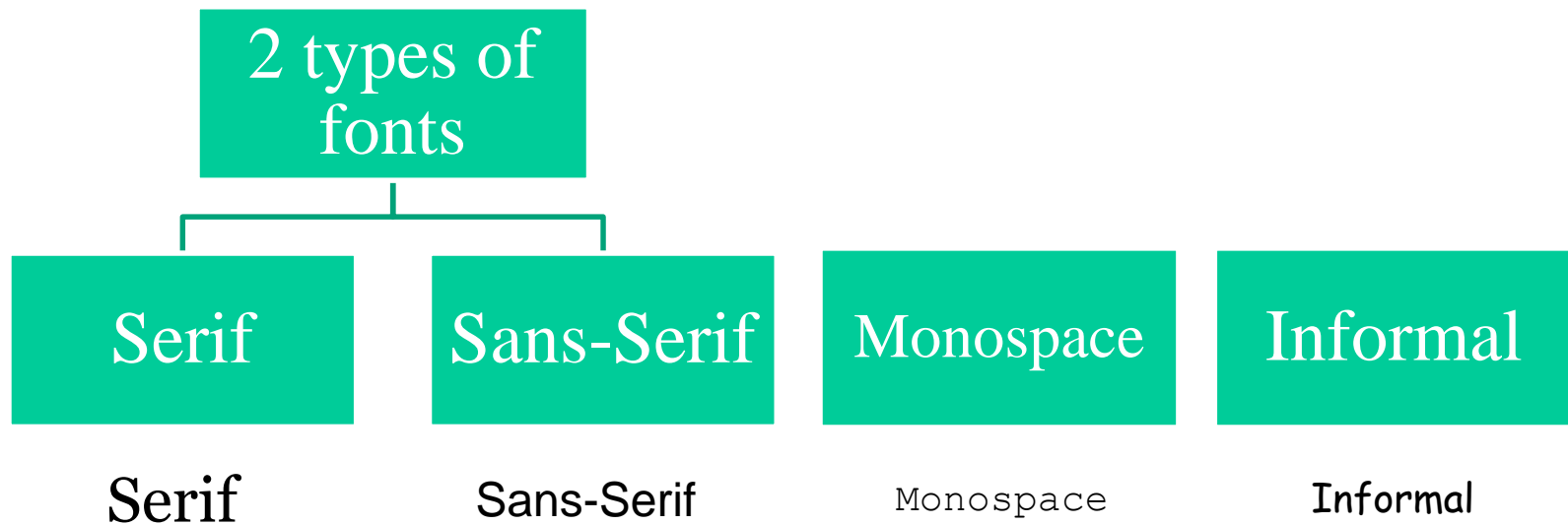
There is no
loginal
organization/or
der

Important:

- Do not have more than 3-5 colors in a single look (think short term memory)
- The eye can not differentiate more than 5 colors from the same hue
- Try to have a semantic meaning for the colors used (Red = Bad, Green = Good)



Fonts



- Sans-Serif better for Digital Media in professional context
- Ex. Segoe, Calibri, Trebuchet

You can change the font weight using three techniques

- Change the size:

Hi Power BI - Segoe UI Light 28

Hi Power BI - Segoe UI Light 24

- Choice of different fonts with greater weight of the same family

Hi Power BI - Segoe UI (Body) 24

Hi Power BI - Segoe UI Light 24

- Use bold

Hi Power BI - **Segoe UI Light 24 (Bolded)**

Hi Power BI - Segoe UI Light 24 (Non-Bolded)

Recommendations regarding the use of fonts:

- Choose at most 2-3 font types / sizes on a report page / control panel
- Choose a lighter weight source Ex. "Segoe UI Light" for
 - Axis
 - Important Data Tags
 - Text box
 - Non-titles
- Use a larger weight font from the same family for titles instead of (bold) Ex. Segoe UI Bold

Regional Sales Analysis Snapshot

[See Details](#)

Hover over and click Focus mode

Total Sales

\$992K

VTB %

-0.76 ■

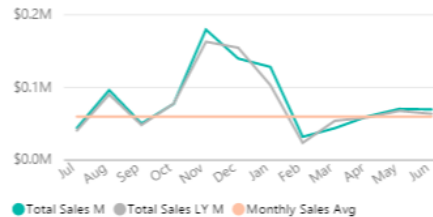
YoY %

4.90%

MoM %

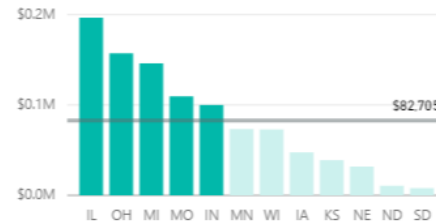
541.46%

Regional Sales This Year and Last Year



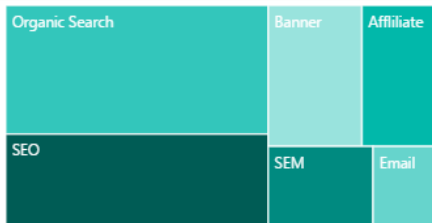
Note: Organic Search and SEO continue to drive more than 60% of Sales

Statewise Sales in Region



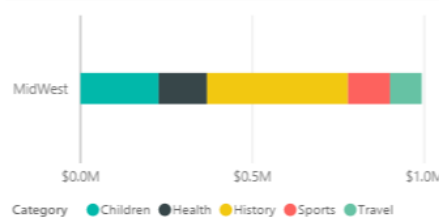
Note: Dark green States have performed above average

Sales Mix by Channel & Devices



Note: Sales dipped below Target baseline in Sep due to weaker back to school season

Sales Mix by Category



Note: Sports Category has performed weaker than expected and Children and History continue to outperform

Compare Performance Across Regions

Region	Total Sales M	YoY
South	\$1,566,447	10.17%
MidWest	\$992,456	4.90%
NorthEast	\$931,919	11.36%
Pacific	\$758,435	13.45%
Mountain	\$283,976	27.00%

Note: We had \$945 of unattributed Sales due to mismatch in Product codes in Sales systems

Year

2013

2014

2015

Month

Jul Jan

Aug Feb

Sep Mar

Oct Apr

Nov May

Dec Jun

Region

MidWest

Mountain

NorthEast

Pacific

South

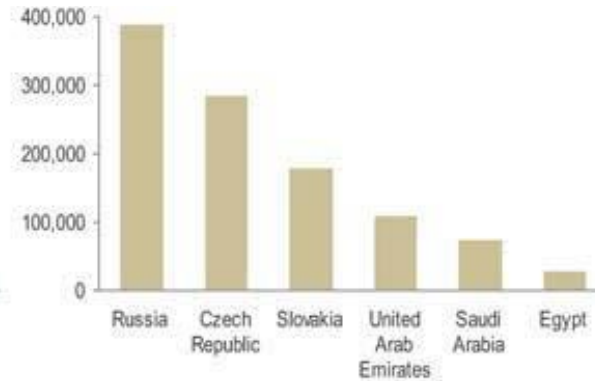
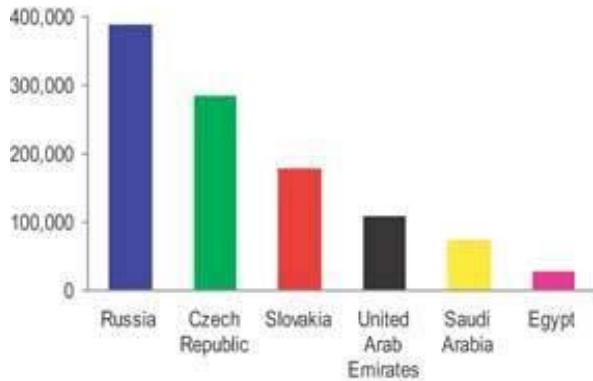
Traffic Channel

All

Main Challenges

- Main challenges:
 - Placing a large volume of useful and often unrelated information in a limited space
 - Be clear
 - Choosing the right information
- Well-designed dashboards deliver information that:
 - It is exceptionally well organized
 - It is condensed, mainly in summaries and exceptions
 - It is specific and customized to audience needs and goals
 - Presented through concise means that communicate data and message clearly and directly

Few, 2006



Colours have no meaning.



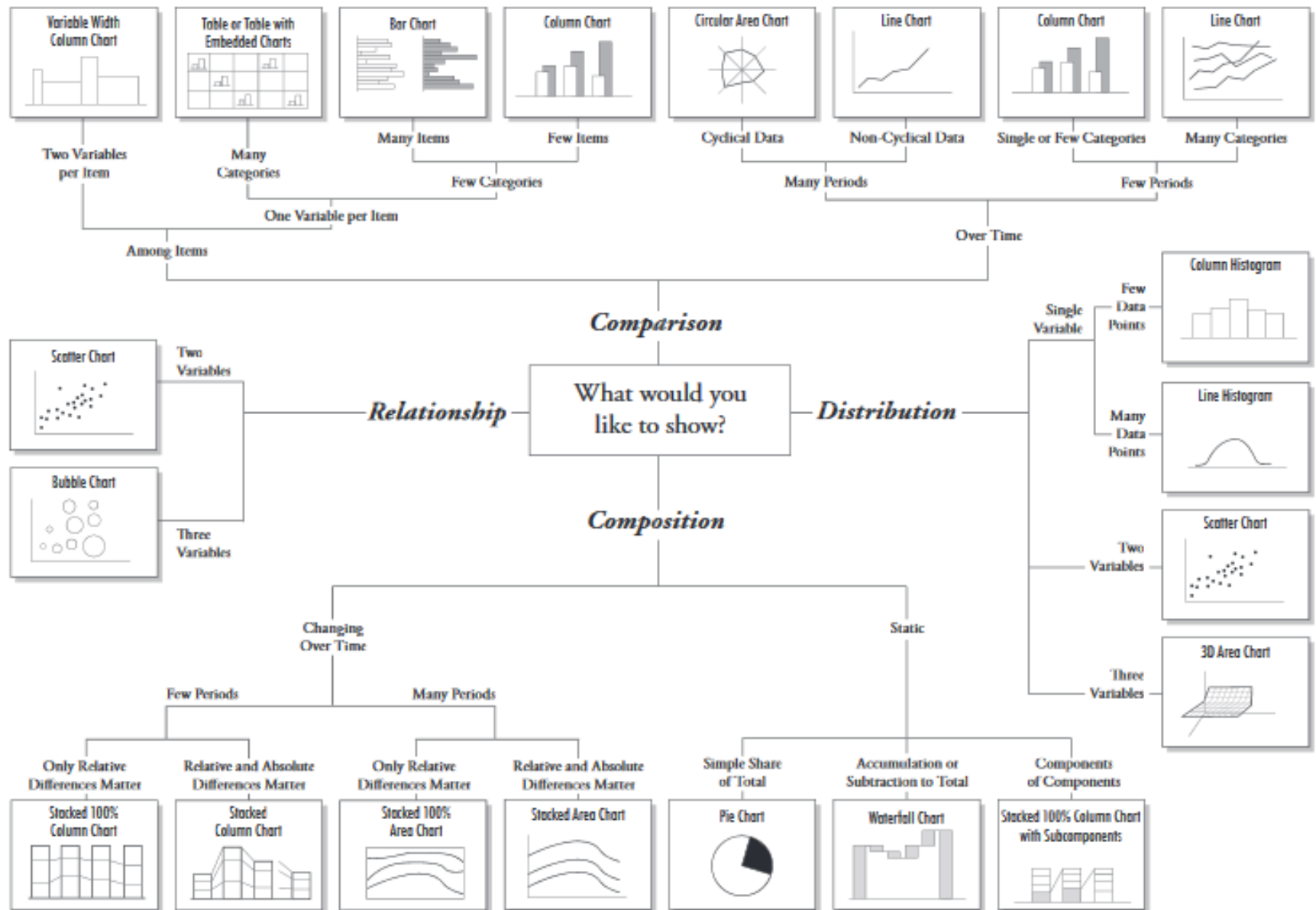
Borders are useless



Choosing the better graphics

- http://extremepresentation.typepad.com/blog/2006/09/choosing_a_good.html

Chart Suggestions—A Thought-Starter



Business Questions

1. Quais são minhas vendas totais para um ano e uma região selecionados?
2. Quais são as minhas vendas totais por ano?
3. Qual é o lucro bruto por cidade do meu país?
4. Como estão as minhas vendas por Canal, Dispositivo, Categoria para o Ano selecionado?
5. Como minhas vendas totais e crescimento anual para a região estão em comparação com outras regiões?
6. Quais são minhas vendas totais para o ano selecionado, mês por categorias?
7. Como é minha tendência de 1 mês por venda média para minhas categorias? Qual é a média mínima e máxima por venda?



1. What are my total sales for a selected year and region?
2. What are my total sales per year?
3. What is the gross profit per city of my country?
4. How are my sales by Channel, Device, Category for the selected Year?
5. How do my total sales and annual growth for the region compare to other regions?
6. What are my total sales for the selected year, month by categories?
7. How is my trend of 1 month per average sale for my categories? What is the minimum and maximum average per sale?

References

Few, Stephen (2006) “Information Dashboard Design”, O’Reilly, Italy, ISBN: 0-596-10016-7

Parmenter, David (2010) “Key Performance Indicators, Developing, Implementing, and Using Winning KPIs”, Second Edition, John Wiley & Sons, Inc. New Jersey, ISBN: 978-0-470-54515-7

Microsoft, Power BI Advanced Visualization and Storytelling Slides

Laudon, Kenneth e Laudon, Jane (2012). Management Information Systems – Managing the Digital Firm, 12^a ed., Pearson, Harlow.

Laudon, Kenneth e Laudon, Jane (2018). Management Information Systems – Managing the Digital Firm, 15^a ed., Pearson, Harlow.
(Original slides were used in this presentation)