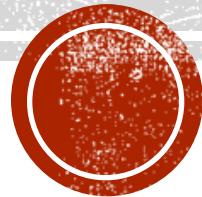


BUSINESS INTELLIGENCE & DECISION MAKING

**Claudia López
DI, UTFSM**



REFERENCES

- Wallace, 2014 - Chapter 7

DESIGN DECISIONS CAN HAVE MAJOR EFFECTS

- Picture this:

- Obama's fundraising campaign (Dec. 2007)
- New design for the splash page
- To increase the sign up rate

People who sign up to receive campaign emails
People who visit the splash page

The image shows a screenshot of the Obama '08 campaign website's landing page. At the top center is the Obama '08 logo, featuring a stylized 'O' composed of three red and blue swooshes above the word "OBAMA'08". Below the logo is a large, semi-transparent photograph of Barack Obama smiling and waving from behind a podium at a campaign rally. The podium is covered in numerous "Obama '08" signs. Overlaid on the photo is the text "GET INVOLVED" in a large, white, sans-serif font. At the bottom of the page is a white call-to-action bar. On the left side of this bar is the text "JOIN THE MOVEMENT" next to a small "JOIN" icon. To the right are two input fields: "Email Address" and "Zip Code". To the right of these fields is a large, red, rounded rectangular button with the text "SIGN UP" in white. A grey arrow points from the word "Button" to the "SIGN UP" button. At the very bottom of the page is a dark blue footer bar containing the text "PAID FOR BY OBAMA FOR AMERICA" on the left, a small circular logo in the center, and "CONTINUE to WEBSITE" on the right.

OBAMA'08

GET INVOLVED

Media

JOIN THE MOVEMENT

Email Address

Zip Code

SIGN UP

Button

PAID FOR BY OBAMA FOR AMERICA

CONTINUE to WEBSITE

SMALL CHANGES CAN HAVE LARGE EFFECTS



SIGN UP

Sign-up rate = 7.51%



LEARN MORE

Sign-up rate = 8.91%

1,000+ additional signed-up people every 78,000 visitors

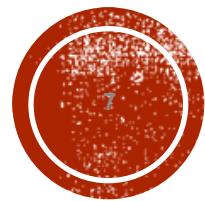
This change increased the sign-up rate by 18,6%

ESTIMATION OF THE NEW DESIGN EFFECT

- New design increased the rate by 40,1%
- Original design would have lost money and volunteers
 - Drop from 10,000,000 to 7,120,000 sign-ups
 - Losing: 2,880,000 emails
 - 288,000 volunteers
 - \$60 million in donations



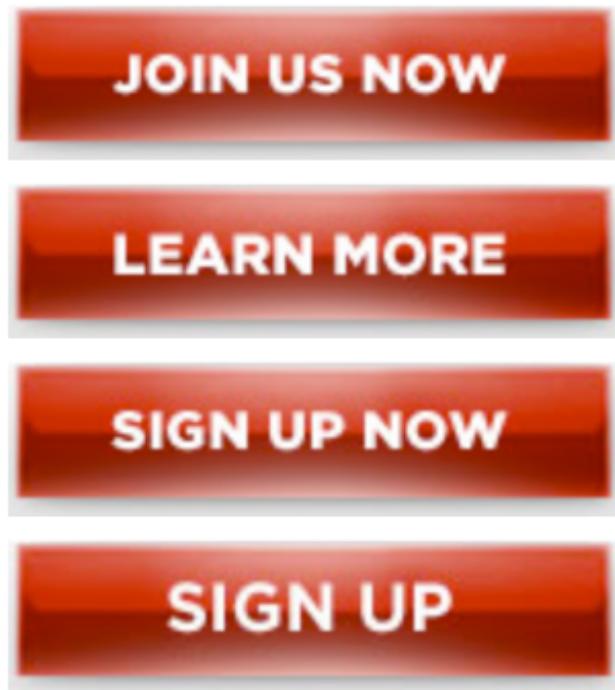
<http://blog.optimizely.com/2010/11/29/how-obama-raised-60-million-by-running-a-simple-experiment/>



HOW DID THEY MAKE DESIGN DECISIONS?

Defining alternative designs (1/2)

4 Button variations

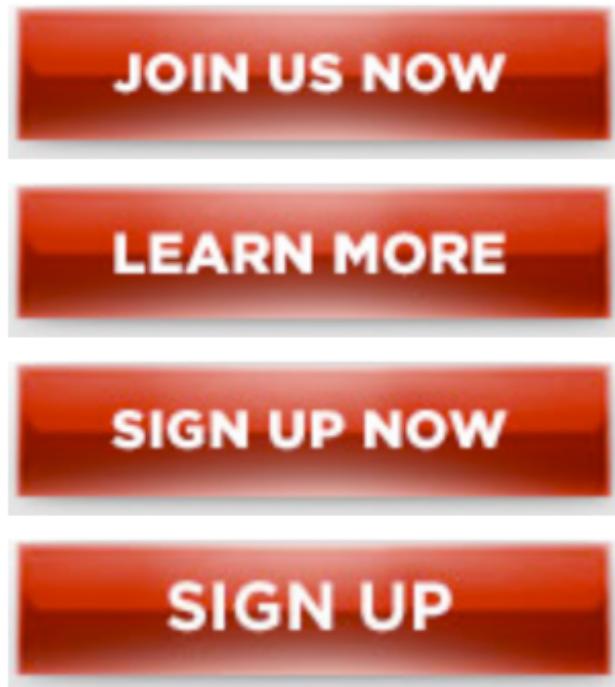


6 Media variations

- 3 images
- 3 videos (Obama's speech excerpts)
 - <http://www.flickr.com/photos/optimizely/sets/72157625300462626/show/>

Defining alternative designs (2/2)

4 Button variations



6 Media variations



+ 3 videos

COMPARING ALTERNATIVE DESIGNS (1/2)

- 4 buttons & 6 media = 24 alternative designs



B1-M1	B2-M1	B3-M1	B4-M1
B1-M2	B2-M2	B3-M2	B4-M2
B1-M3	B2-M3	B3-M3	B4-M3
B1-M4	B2-M4	B3-M4	B4-M4
B1-M5	B2-M5	B3-M5	B4-M5
B1-M6	B2-M6	B3-M6	B4-M6

COMPARING ALTERNATIVE DESIGNS (1/2)

- 4 buttons & 6 media = 24 alternative designs
- How to compare them?

Visitor A



B1-M1	B2-M1	B3-M1	B4-M1
B1-M2	B2-M2	B3-M2	B4-M2
B1-M3	B2-M3	B3-M3	B4-M3
B1-M4	B2-M4	B3-M4	B4-M4
B1-M5	B2-M5	B3-M5	B4-M5
B1-M6	B2-M6	B3-M6	B4-M6

Visitor B



Each visitor was assigned to
1 out of 24 designs

COMPARING ALTERNATIVE DESIGNS (2/2)

- 4 buttons & 6 media = 24 alternative designs
- How to compare them?
 - Each visitor was assigned to 1 out of 24 designs
- 310,382 visitors
 - Roughly 13,000 visitors saw each design
- Then, they compared the sign-up rate for each design!

INTERPRETING THE RESULTS (1/2)

Disable All Combinations (24)		Key: █ Winner █ Inconclusive █ Loser			
<input type="checkbox"/> Combination	Status	Est. conv. rate	Chance to Beat Orig.	Observed Improvement	Conv./Visitors
Original	Enabled	8.26% \pm 0.5%	—	—	1088 / 13167
★ Top high-confidence winners. Run a follow-up experiment »					
<input type="checkbox"/> Combination 11	Enabled	11.6% \pm 0.6%	100%	40.6%	1504 / 12947
<input type="checkbox"/> Combination 7	Enabled	10.3% \pm 0.6%	100%	24.0%	1340 / 13073
<input type="checkbox"/> Combination 3	Enabled	9.80% \pm 0.6%	99.7%	18.7%	1277 / 13025
<input type="checkbox"/> Combination 10	Enabled	9.23% \pm 0.6%	95.9%	11.7%	1203 / 13031
<input type="checkbox"/> Combination 8	Enabled	9.03% \pm 0.6%	91.6%	9.28%	1178 / 13046
<input type="checkbox"/> Combination 9	Enabled	8.77% \pm 0.6%	81.8%	6.10%	1111 / 12672
<input type="checkbox"/> Combination 6	Enabled	8.64% \pm 0.5%	75.3%	4.58%	1108 / 12822

3 combinations improved the sign-up rates significantly

INTERPRETING THE RESULTS (2/2)

Disable All Combinations (24) ▼		Key: Winner Inconclusive Loser ?					
<input type="checkbox"/> Combination	Status ?	Est. conv. rate ?	Chance to Beat Orig. ?	Observed Improvement ?	Conv./Visitors ?		
Original	Enabled	8.26% \pm 0.5%	—	—	—	1088 / 13167	
★ Top high-confidence winners. Run a follow-up experiment »							
<input type="checkbox"/> Combination 11	Enabled	11.6% \pm 0.6%	100%	40.6%	1504 / 12947		
<input type="checkbox"/> Combination 7	Enabled	10.3% \pm 0.6%	100%	24.0%	1340 / 13073		
<input type="checkbox"/> Combination 3	Enabled	9.80% \pm 0.6%	99.7%	18.7%	1277 / 13025		
<input type="checkbox"/> Combination 10	Enabled	9.23% \pm 0.6%	95.9%	11.7%	1203 / 13031		
<input type="checkbox"/> Combination 8	Enabled	9.03% \pm 0.6%	91.6%	9.28%	1178 / 13046		
<input type="checkbox"/> Combination 9	Enabled	8.77% \pm 0.6%	81.8%	6.10%	1111 / 12672		
<input type="checkbox"/> Combination 6	Enabled	8.64% \pm 0.5%	75.3%	4.58%	1108 / 12822		

The sign-up rate increases from 8.26%
(original design) to 11.6% (top alternative)

ESTIMATING THE EFFECT

- Chosen top alternative: 11.6% rate – 10 million
- Discarded original design: 8.26% rate
 - Estimated sign-ups: 7,120,000 sign-ups
 - Estimated loss: 2,880,000 emails
 - 10% volunteer recruitment rate => losing 288,000 volunteers
 - \$21 donation on average => losing \$60 million in donations

<http://blog.optimizely.com/2010/11/29/how-obama-raised-60-million-by-running-a-simple-experiment/>

THE WINNER



SUMMING UP

- **Data-based decision making matters**
 - It can affect the system's success
 - Identify good and bad features, compare design choices, observe effect on different user groups
- **This example used one kind of evaluation**
 - Online experiment (A/B testing)
 - There are more ways to make informed decisions

OTHER QUESTIONS

- How much should we spend for online ads this season? Which ads work best?
- Should we create more fish dishes for our menu? How much can we charge?
- When should we start our phonathon to raise money for disaster relief? Should we invite celebrities to promote it?
- How should we address the bad publicity about our product recalls? Should we ignore it?

BUSINESS INTELIGENTE (BI)

- is an umbrella term that includes the vast quantities of information an organization might use for data-driven decision making, from within its own data repositories and also from external sources.
- also encompasses the software applications, technologies, and practices that managers apply to the data to gain insights that help them make better decisions.

LEVELS OF DECISION MAKING

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LEVELS OF DECISION MAKING: OPERATIONAL

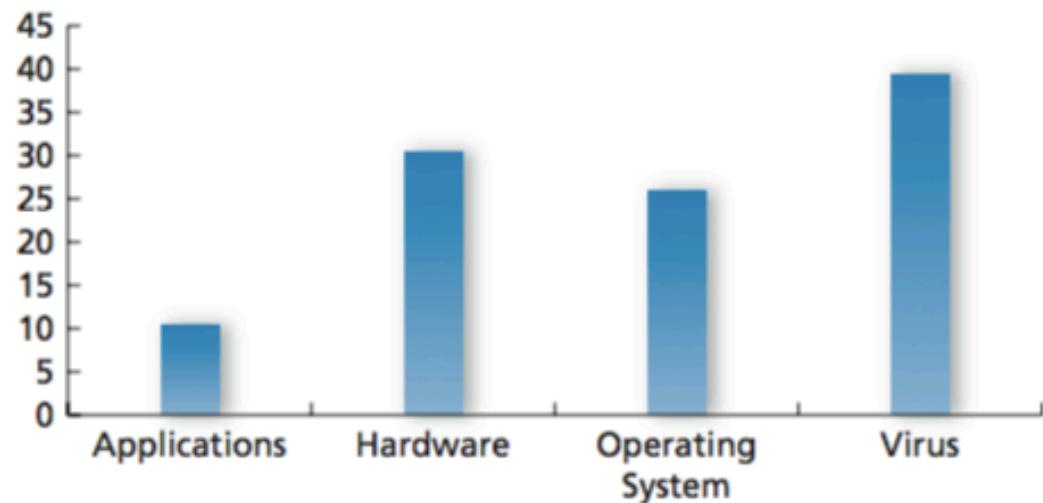
In a busy city hospital, Monica works the evening shift in the call center, scheduling appointments, referring patients, registering callers for hospital seminars, and routing calls.

- Find ways to bring meaningful, performance-related information to all employees.
- Requires detailed, structured information about actual transactions by customer

BI – OPERATIONAL LEVEL

Metric	Minutes and Seconds
Current call length	13:42
Your average call length today	12:41
Today's average call length, for all agents	10:25
This week's average call length, all agents	13:32

Average Call Length by Type of Problem



Time on current call



Average for all calls



Escalation rate



Resolved rate

LEVELS OF DECISION MAKING: TACTICAL

Colin just joined the hospital as assistant director of marketing. He will track online campaigns intended to call attention to the hospital's top-ranked specialties, such as sports medicine and cardiology.

- sees trends and summaries, sorted in different ways, to monitor success and plan
- decides about marketing plans, product development, membership drives, departmental budgets, and other initiatives

LEVELS OF DECISION MAKING: STRATEGIC

Bora, the hospital administrator, is responsible for the hospital's overall financial and operational health. She plans budgets, sets rates, recruits and hires the medical and administrative staff, and, working with the different teams, develops hospital policies.

- Info needed is often less structured than at the operational or even management level
- needs summary and historical data from their own transactional systems and data warehouses
- and draws on big data, to learn more about their rivals, their industry's landscape, and overall economic trends

SOURCES OF BI

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TRANSACTIONAL DB, DATA WAREHOUSES, INTERNAL DATA SOURCES

- Transactional systems used for daily operations
- Data warehouses extract part or all of the data from those databases, cleansing it, and then loading it to the warehouse, using the extract, transform, and load process
- email, electronic documents, filing cabinets, individually maintained spreadsheets

EXTERNAL DATA SOURCES

- Purchased or publicly accessible data
 - <http://datos.gob.cl/>
- Intelligent agents to extract useful data from publicly accessible websites
- Web 2.0. and internet of things
 - Often unstructured
 - Tags can help

ESTADÍSTICAS DE DATOS ABIERTOS

2,4k 196 23

Conjuntos de Datos

Organizaciones

Categorías

Consultas de urgencia 2016

Numero de Consultas mensual para las Unidades de Emergencia

Datos y Recursos



Consultas de urgencia Enero 2016 – Hospital Dr

Numero de Consultas para las Unidades de Emergencia



Consultas de urgencia Enero 2016 (Texto) – ...

Numero de Consultas mensual formato CSV para las Un



Consultas de urgencia Febrero 2016 (Excel) – ...

Numero de Consultas mensual formato EXCEL para las U

DATA MINING AND ANALYTICS

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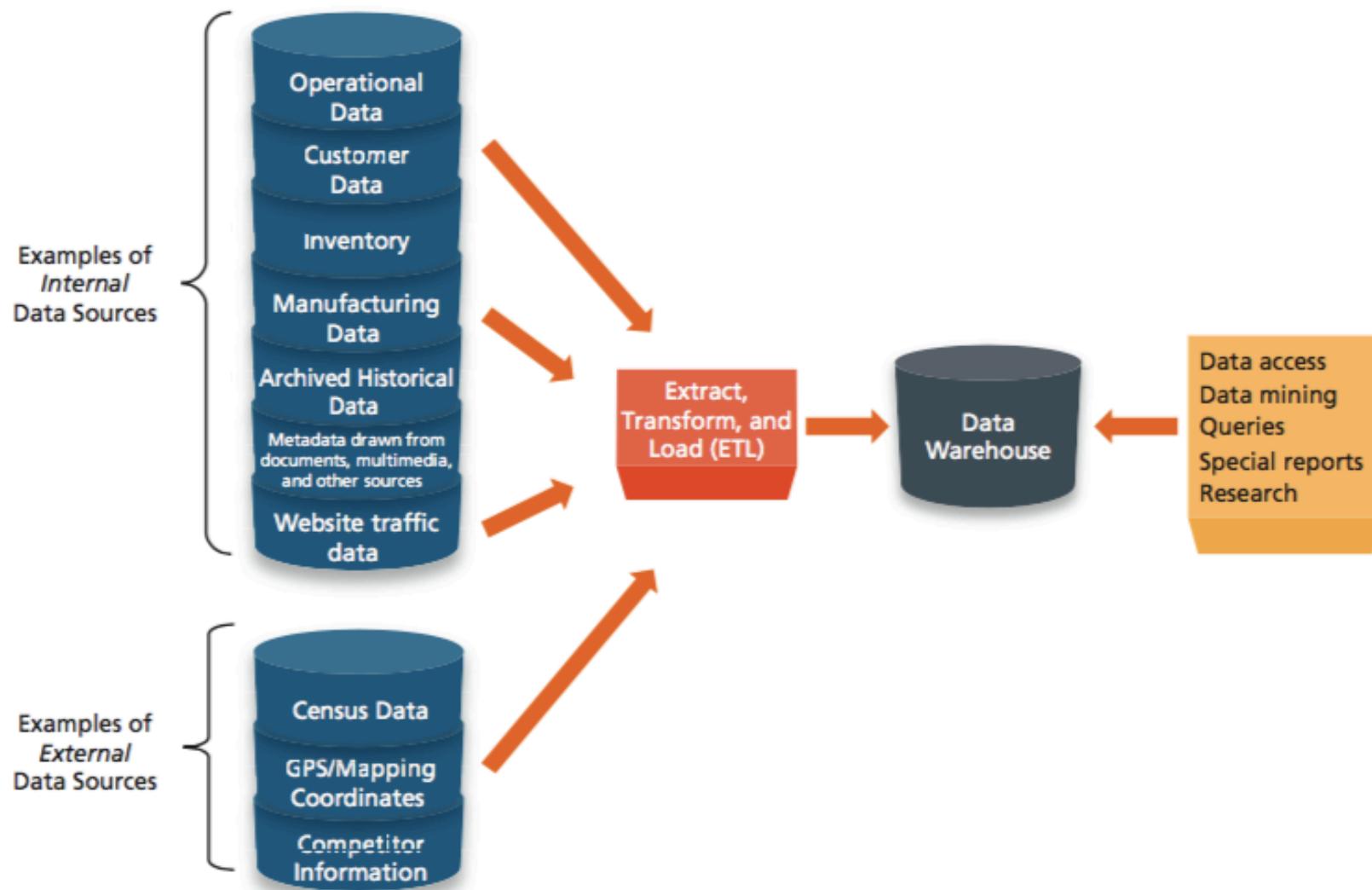
PREDICTIVE ANALYTICS

- Data mining approaches and statistical techniques used to predict future behavior, especially to unlock the value of BI for strategy
 - Which customers are most likely to renew their subscription to our service at the regular price?
 - What special offers might persuade different customers to renew?
 - What behaviors signal that a customer is about to cancel?

TECHNIQUES

1. Analyzing patterns, trends & relationships
2. Simulating, optimizing, and forecasting
3. Artificial intelligence

1. DATA WAREHOUSES



1. EXAMPLE

Customer Addresses

CustomerID	StreetAddress	City	State	ZipCode
546	321 Smith Avenue	Carson City	NV	89705

Primary Key → **ZipCode** (Source: US Census Bureau)

USZipCodes	MedianHouseholdIncome
89704	63889
89705	56129
89706	36891

Source: U.S. Census Bureau.

- ▶ Do customers from high income neighborhoods tend to shop in the evening?
- ▶ Do they respond more to radio promotions or TV ads?
- ▶ Over the past five years, has the customer income profile been trending up or down? 

1. ONLINE ANALYTICAL PROCESSING (OLAP)

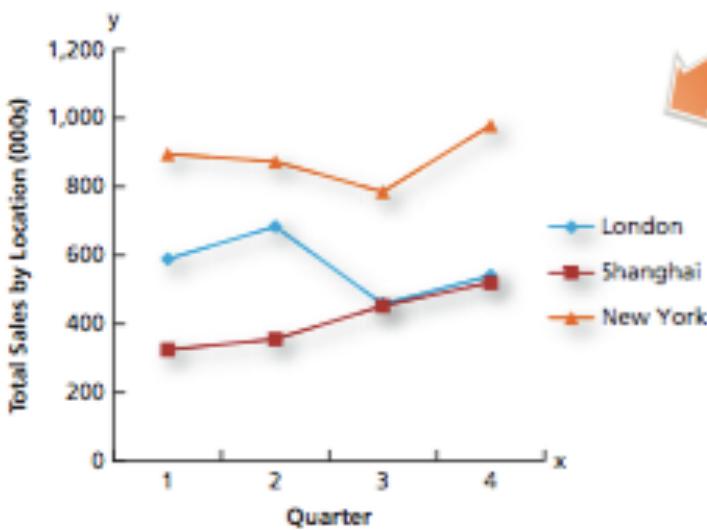
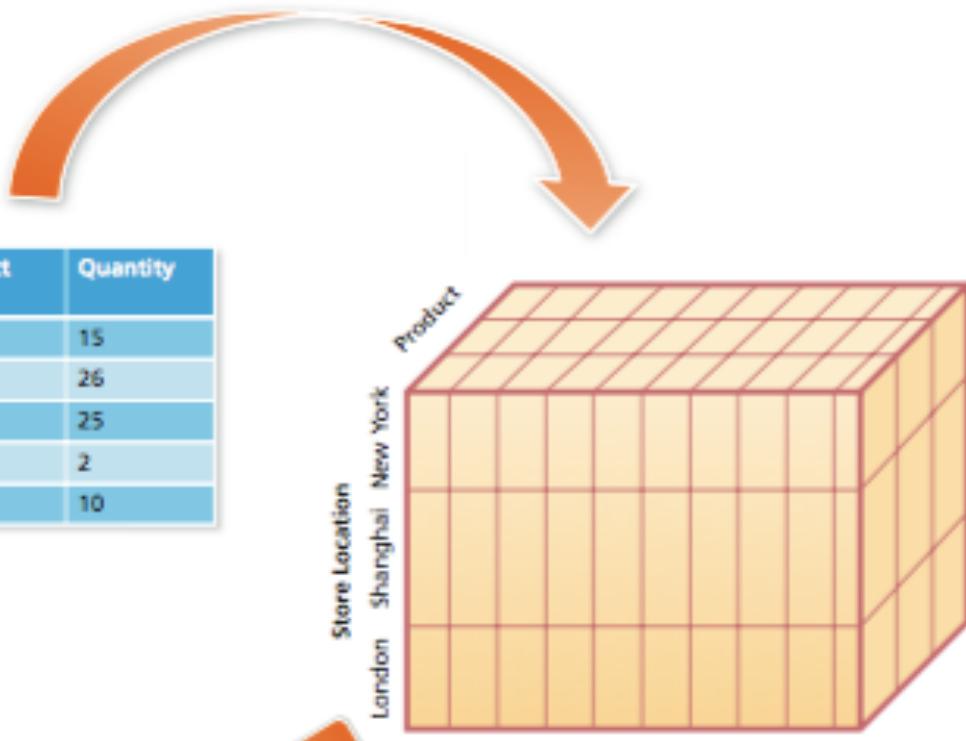
- to “slice and dice” massive amounts of data stored in data warehouses to reveal significant patterns and trends.
 - to spot suspicious activity as well
- achieve their speed and by building multidimensional cubes
 - data structures that contain detailed data, and also aggregated values for the dimensions, metrics, and hierarchies the users need.

FIGURE 7-6

Multidimensional cube created from tables in a data warehouse and used for OLAP.

1. OLAP

Date	Store Location	Product	Quantity
5/14/2012	LONDON	XB395	15
5/14/2012	LONDON	RS585	26
5/15/2012	SHANGHAI	XB395	25
5/15/2012	LONDON	RS585	2
5/15/2012	NEWYORK	XB395	10



Total Sales by Location and Time Period

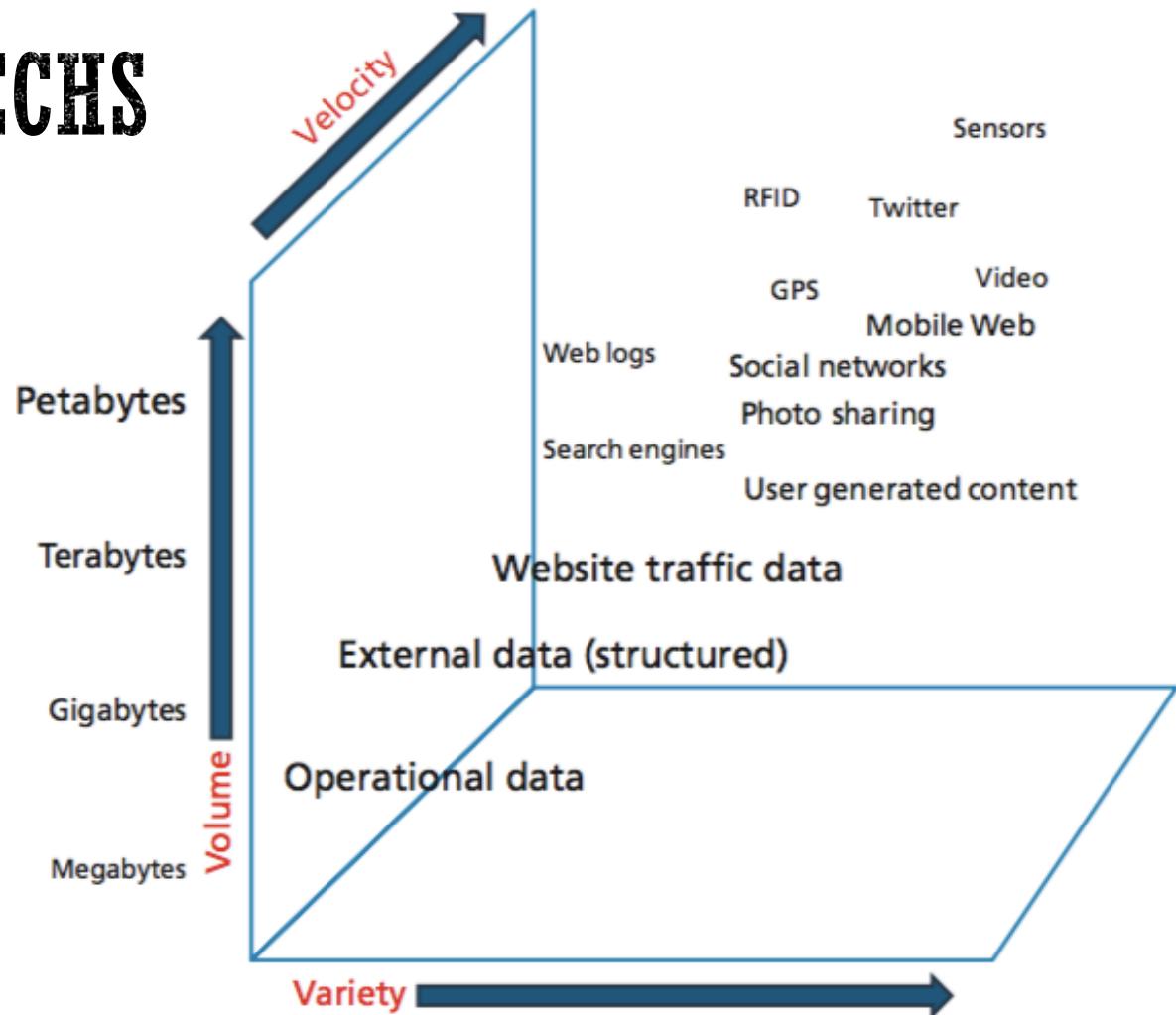
	Qtr 1	Qtr 2	Qtr 3	Qtr 4
London	589	685	458	541
Shanghai	325	356	452	521
New York	896	874	785	980

1. BIG DATA

- Collections of data that are so enormous in size, so varied in content, and so fast to accumulate that they are difficult to store and analyze using traditional approaches
 - *Volume.* Data collections can take up petabytes of storage, and are continually growing
 - *Velocity.* Many data sources change and grow at very fast speeds. The nightly ETL is not adequate
 - *Variety.* semi-structured and unstructured data

1. BIG DATA TECHS

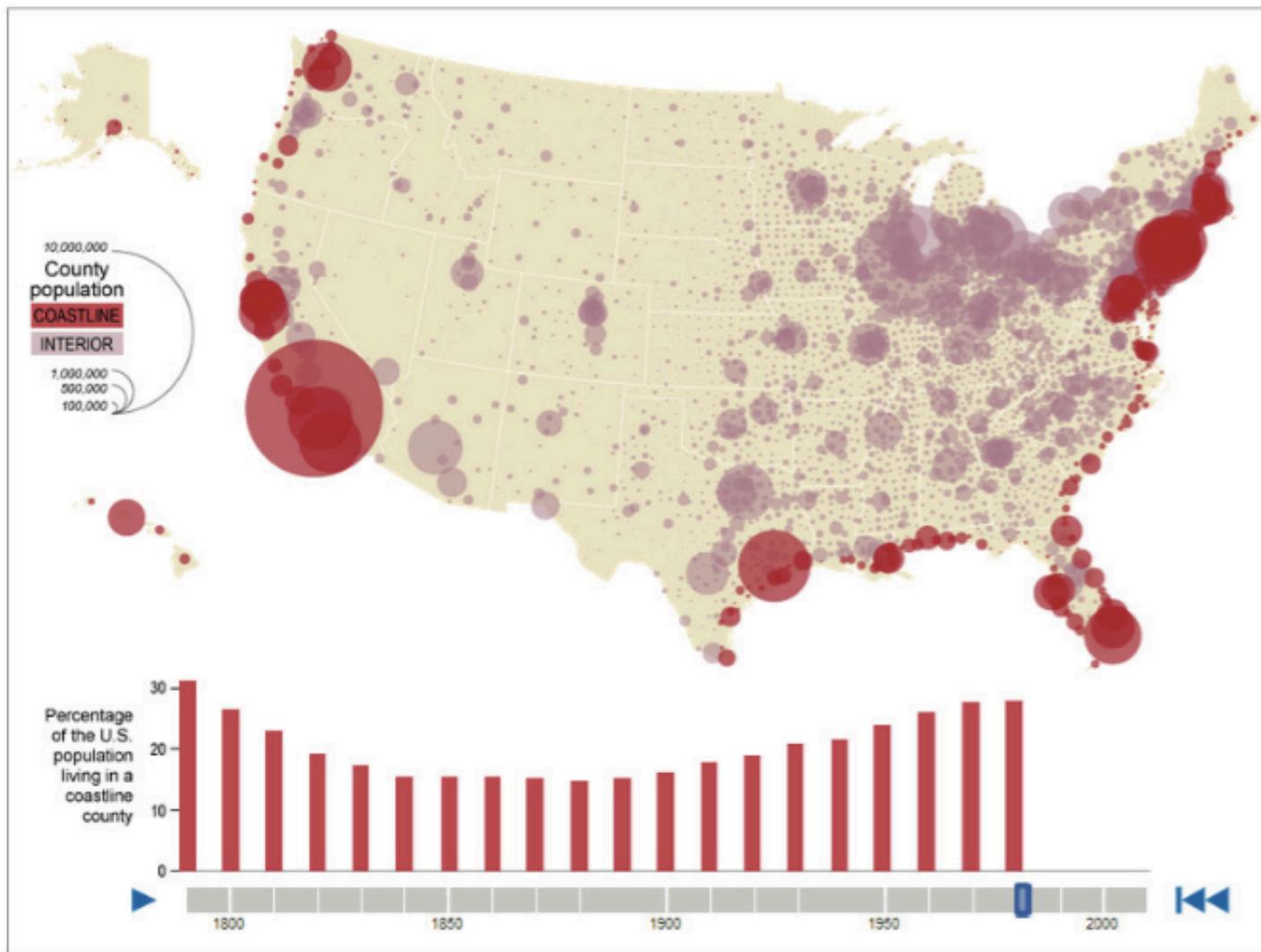
- **Hadoop**
 - open source software that supports distributed processing of big data sets across many computers.



1. TECHNIQUES

- **Statistics and modeling techniques**
 - to identify real patterns - ones that probably did not occur just by chance
 - **market basket analysis** reveals customer behavior patterns as they purchase multiple items
- **Text mining**
 - rely on key- words, semantic structures, linguistic relationships, parts of speech, common phrases, emotion-laden words, and even misspellings to extract meaningful information

1. DATA VISUALIZATION



Source: <http://www.census.gov/dataviz/visualizations/039/>.

2. SIMULATING

- Decision support systems also include tools that help managers simulate events and make forecasts for the future.
- **What-if analysis** builds a model that simulates relationships between many variables and calculates the result
- **Goal seeking** sets a target value for a particular metric, such as profit/loss, and tells the program which variable to change to try to reach the goal

2. OPTIMIZING, AND FORECASTING

- Optimization
 - to find the best solutions that require some juggling of trade-offs
- Forecasting
 - analyze historical and seasonal trends and then take into account existing and predicted business conditions to estimate some variable of interest, such as customer demand or projected revenue

3. ARTIFICIAL INTELLIGENCE (AI)

- the capability of some machines that can mimic human intelligence, displaying characteristics such as learning, reasoning, judging, and drawing conclusions from incomplete information.
- For business
 - financial monitoring, scheduling, diagnosing problems, and analyzing customer behavior.
- Watson, IBM's supercomputer
- Key for robotics, analyzing sensor data

3. EXPERT SYSTEMS & NEURAL NETWORKS

- **Expert systems**
 - mimics the reasoning of a human expert, drawing from a base of knowledge about a particular subject area to come to a decision or recommendation
- **Neural networks**
 - mimic the way the human brain works, with its vast network of interconnections
 - The neural net learns from training data selected by humans that contain cases defining the paths from input to output. The net's success depends largely on the number and quality of the cases it can learn from.

WEB ANALYTICS

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CLICKSTREAM DATA

- every single click by every visitor
 - +
- associated data revealing customer behavior
 - time spent on the page,
 - the URL the visitor just left, and
 - the visitor's IP address.
- Potentially millions of clicks per day => clickstream data adds up quickly.

ACT: METRICS

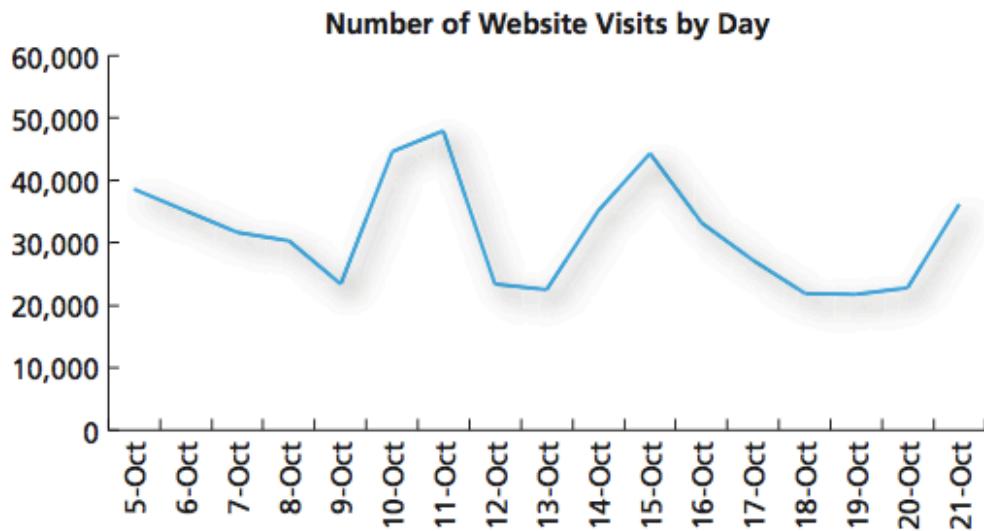
- Website metrics
 - Visitor-related
 - Content-related
- Social media metrics
- E-commerce metrics

ANALYTICS SOFTWARE

- E.g. Google web analytics
- It needs **goals & interpretation**
 - E.g., Rail Europe

FIGURE 7-18

Sample output from web analytics software, describing the number of website visitors by day and the most keywords used to reach the site.



Most Popular Keywords	Visits
Peru	987
Latin America	745
South America	158

PUTTING IT ALL TOGETHER

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DASHBOARDS

- Graphical user interface that helps people visualize information vital to the user's role and the decisions that user makes
 - Like a plane or car dashboard with its dials, gauges, and other displays of real-time data
- **Key performance indicators (KPIs)**
 - the quantifiable metrics most important to the individual's role and the organization's success

A DASHBOARD

FIGURE 7-20

A graphical dashboard example, showing summarized and updated information relevant to a project manager.



ELEMENTS OF A DASHBOARD

- KPIs
- Data quality - reliable
- Timeliness – update data as often as needed
- Density – 7 or fewer “objects”, avoid information overload
- Chart formats – small & simple
- Maps and visual displays – combine image & data

PORTALS

- gateways that provide access to a variety of relevant information from many different sources on one screen.
- Each bit of content or functionality that a user can customize and add to the display is called a “portlet.”
- Users can personalize the display, choosing, portlets (email accounts, transactional DB, dashboards, benefits summaries,...)

A PORTAL (FROM SAP)

The screenshot shows a SAP portal interface with a top navigation bar for 'Welcome, Sabine Thibodeaux' with links to 'Home', 'My Pages', 'Applications', 'Products', 'Information', 'Help', 'Personalize', and 'Log Off'. The SAP logo is in the top right. The main content area has several application tiles:

- Furiarum Declinatores**: A table titled "Operi modo oculos et finge te non humana viscera". It has tabs for "Example 0", "Example 1", "Example 2", and "Example 3". The table lists three entries:

Name	Website	Comment
Praeceptoris	http://www.horae.com	Praeceptoris colloquio
Destona	http://www.fecerunt.com	De stomachi tui recusatione nonquod
<input checked="" type="checkbox"/> Timeam	http://www.sapor.com	Timeam. Sequitur imperium si?

Line 1/12
- Tuis Obstrem**: A section titled "Mercurius Enim" with a sub-section "Sudorem ille Manibus". It contains placeholder text: "Lorem ipsum dolor sit amet, consectetur excentation [uliam corpor](#) suscipit labor dolore eu feugiat nulla facilis sit vero er. [Protestum Quemque](#)".
- Adulatores**: A list titled "Videbantur" with items: Tritonis dolore eu feugiat; Romana; Ciceronis; Pierio; Demosthenis; Artis; Ascyti; Divinen. Buttons for "Semor" and "Robam" are at the bottom.
- Non Concedare**: A list numbered 1 to 10: 1. Praeceptoris colloquio; 2. Colloquum; 3. Sublati; 4. Ne quiescitibus tuis; 5. Non considerare; 6. Petelini; 7. idem fecerunt; 8. Nec ouicquam; 9. Alak in hac; 10. Nisi tantum.
- Colloquium**: A table titled "Eumolpoque approbavi". It lists three entries:

Name	Website	Comment
Horae	http://www.horae.com	Horae fastidio Mutorum Bono conesse
Pensione	http://www.horae.com	Pensionem!
<input type="checkbox"/> Finge	http://www.sapor.com	Finge te non humana viscera

Line 1/2
- Demosthenen ad hoc Genus**: A section with a heading "Haec locutus sustulit tunicam" and a link "Eumolpoque me totum approbavi". It includes a "Choraceo" section with "Cusat" and two small images of classical architecture.

Source: © Copyright 2013. SAP AG. All rights reserved.

MASHUPS

- A more flexible approach to aggregating content from multiple internal and external sources on customizable web pages
- Relies on Web 2.0 technologies and XML to blend content and updated feeds from various inside and outside sources (e.g. web feeds)

THE HUMAN ELEMENT

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HUMAN-CENTERED DESIGN

- The people who need the information are at the center;
 - IT plays a supporting role to obtain meaningful insights
- The most successful BI projects start small
- Asking the right questions and using the answers wisely are more important than generating page after page of colorful graphs using the latest analytic software.