NYC Citywide Administrative Services

Management Academy
Analytics for the Data-Driven Manager
Instructor: Richard Dunks
Course Code: C4311

13-14 January 2016

Datapolitan
Data Solutions for the Modern Metropolis

WELCOME

INTRODUCTIONS

Name
Office
One thing you hope to get out of today's class

Goals for the Course

- Discuss the data-driven decision making process as it relates to city government
- Explore the role of managers and analysts in the decision making process
- Introduce useful terminology around data and the data analytics process
- Get some hands-on experience analyzing data

Key Takeaways for the Course

- Better understand using data in the decision-making process
- Better understand how to build a data-driven culture
- Better understand the analytics process
- Better understand the value of data, particularly open data
- Better understand the role of analysts and managers in the decision-making process

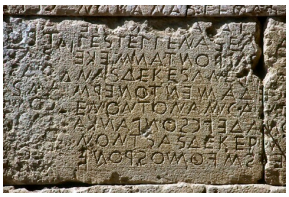
Goals for this Morning

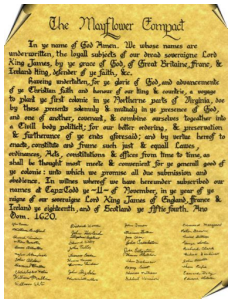
- Discuss the concept of "data-driven"
- Discuss types of analysis in city government
- Discuss the benefits and concerns around data analytics in operational decision making
- Apply an understanding of the analytic process to a New York City-specific problem

Why Do We Collect Data?

- Accountability
- Transparency
- "Can't manage what you can't measure"

Why Do We Publish Laws?





The Mayflower Compact

In ye name of God Amen. We whose names are underwritten, the loyall subjects of our dread soveraigne Lord King James, by ye grace of God, of Great Britaine, Franc, & Ireland King, defender of ye faith, &c.

Having undertaken, for ye glorie of God, and advancemente of ye Christian faith and honour of our King & countrie, a voyage to plant ye first colonie in ye Northerne parts of Virginia, doe by these presents solemnly & mutualy in ye presence of God, and one of another, covenant, & combine ourselves togeather into a Civil body politick, for our better ordering, & preservation, & furtherance of ye ends aforesaid; and by vertue hereof to enacte, constitute and frame such just & equall Lawes, ordinances, Acts, constitutions & offices from time to time, as shall be thought most meete & convenient for ye generall good of ye colonie: unto which we promise all due submission and obedience. In witnes wherof we have hereunder subscribed our names at Cape-Codd ye 11th of November, in ye year of ye raigne of our soveraigne Lord King James of England, France & Ireland ye eighteenth, and of Scotland ye fifty fourth. Ano Dom. 1620.

WHAT GOOD ARE LAWS IF WE DON'T KNOW HOW THEY'RE IMPLEMENTED?

That's what data tells us

I Quant NY

MAILING LIST RSS ARCHIVE

Quantitative Analysis of NYC Open Data: Every data set that the city releases tells a story. This blog is all about telling those stories, one data set at a time.

About Me About You Interviews Press Topics Subscribe

JUNE 2, 2014

Success: How NYC Open Data and Reddit Saved New Yorkers Over $55,000 a Year

Before Open Data:

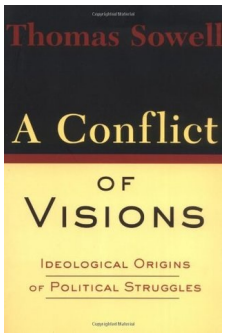
After Open Data:

http://iquantny.tumblr.com/post/87573867759/success-how-nyc-open-data-and-reddit-saved-new

---

Facts do not "speak for themselves." They speak for or against competing theories. Facts divorced from theory or visions are mere isolated curiosities.

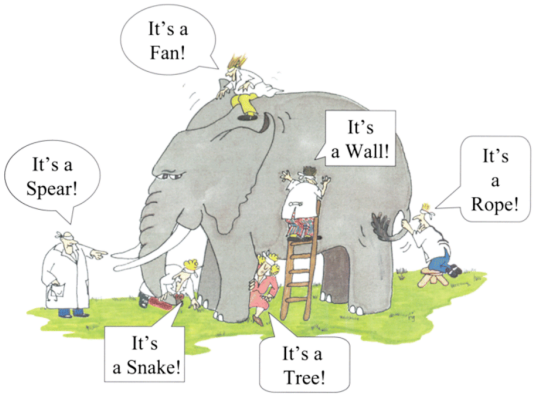
— Thomas Sowell,
A Conflict of Visions



WHAT DOES "DATA-DRIVEN" MEAN IN THE CONTEXT OF CITY GOVERNMENT?

Discuss in your group

You feelin' lucky, bud?
Go ahead, say "data-driven"
one more time and let's
see what happens.



Having lots of reports does not make you data-driven.

Having lots of dashboards does not make you data-driven.

Having lots of alerts does not make you data-driven.

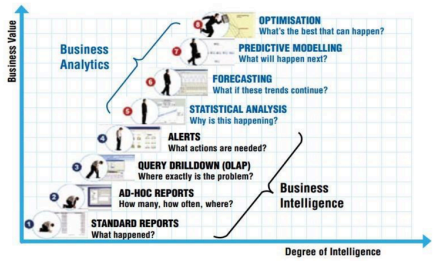
Analytics Value Chain

Source: http://adobe.ly/1HLJKGk

TYPES OF ANALYSIS

DATA ANALYTICS?
BUSINESS ANALYTICS?
DATA SCIENCE?

Levels of Analytics

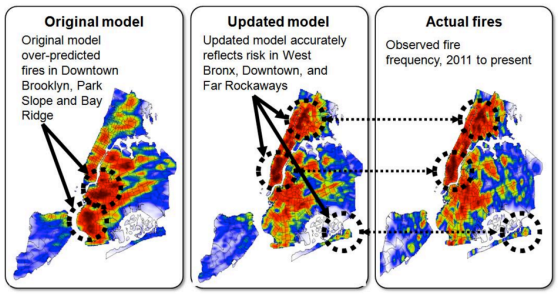


Source: https://www.sas.com/news/sascom/analytics_levels.pdf

1. Quantifying Needs

- How much of X do I need?
  - Analyzing inputs (resources, people, etc.)
- How much does my need change given a different set of conditions?
  - What are the conditions that influence X?
- Important Considerations:
  - How does X play into my organization's mission and goals?
  - What's the most meaningful way of quantifying X?

FDNY's Risk Based Inspection System (RBIS)



The three maps above of NYC represent the progress of the risk based inspection system algorithm that MODA created with the Fire Department (FDNY). At left is the original map of high-risk zones from the first version of the FDNY RBIS model; center is the updated model, weighting risk criteria based on MODA's statistical regression; at right is an actual map of recent fires in New York City.

Source: NYC Mayors Office of Data Analytics – 2013 Annual Report
http://www.nyc.gov/html/analytics/downloads/pdf/annual_report_2013.pdf

2. Operational Analysis

- What is my organization doing?
  - Assessment
- How might my organization do things better?
- Important Considerations:
  - What are your organization's mission and goals?
  - How do your employees do their work?
  - What's the best way to measure this work?

64° Sign In | Subscribe

The Charlotte Observer

BUSINESS AUGUST 28, 2015

Cincinnati racks up more than $130,000 in late fees to Duke Energy

To address the issue, workers in Cincinnati's new Office of Performance and Data Analytics identified the impact the fees were having on the city and spent three days this summer with city department heads to come up with a solution, the station reported.

City leaders spent time in what's known as the Innovation Lab, where they figured out a "new way" to pay bills on time and avoid such fees. It wasn't immediately clear what their solution was.

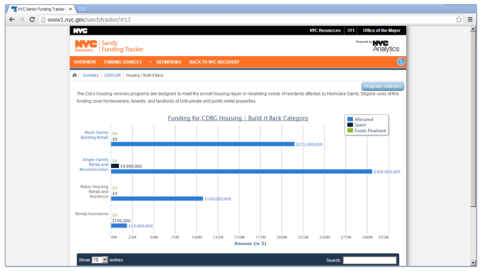
Source: http://www.charlotteobserver.com/news/business/article32617293.html

3. Performance Metrics

- How is my organization doing?
  - Monitoring and evaluation
- How do we make this data visible to the people who need it?
- Important Considerations:
  - What is most important to measure (think mission and goals)?
  - How do we best measure performance?

Tracking Hurricane Sandy Relief Funds

Tracking information on Sandy recovery funds, built by NYC analytics, is available at www1.nyc.gov/sandytracker



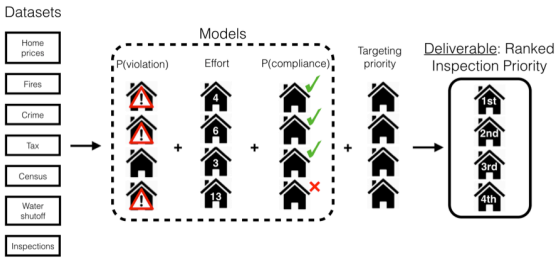
Source: NYC Mayors Office of Data Analytics – 2013 Annual Report
http://www.nyc.gov/html/analytics/downloads/pdf/annual_report_2013.pdf

Source: http://www.slideshare.net/Leananalytics/startup-metrics-toronto-march-19

4. Prioritization

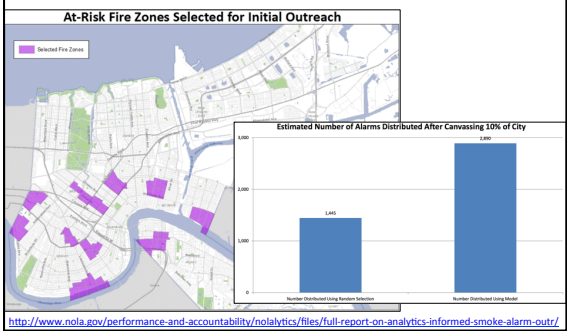
- How do I meet optimal outcomes with limited resources?
  - Optimizing allocation
- Important considerations:
  - Minimize disruption
  - Work within current workflow
  - Support existing business practices

Cincinnati Blight Prevention Model



http://dssg.uchicago.edu/2015/08/20/cincy-blight-prevention.html

New Orleans Smoke Alarm Targeted Outreach



http://www.nola.gov/performance-and-accountability/nolalytics/files/full-report-on-analytics-informed-smoke-alarm-outr/

5. Data Sharing/Empowering Stakeholders

- How could others benefit from my data?
- What other data can I use?
- Important Considerations:
  - Machine-readable formats
  - Make your data "fit" with other data sources
    - Unique IDs
    - Indexes
    - Key values

WHAT KIND OF ANALYSIS DOES YOUR OFFICE DO?

4 TYPES OF CONCERNS TO BE MINDFUL OF

1. Technical

- Having the right tools
- Having the people who can use them
- Making everything work together
- *Potential trap: having a solution in search of a problem*

2. Legal

- Laws
- Regulations
- Practices
- *Potential trap: not doing something because of mistaken assumptions*

SECTIONS The New York Times SUBSCRIBE LOG IN

HEALTH 528 COMMENTS

Hipaa's Use as Code of Silence Often Misinterprets the Law

JULY 17, 2015

Paula Span
THE NEW OLD AGE

Email
Share
Tweet
Save

How do people use, misuse or abuse Hipaa, the federal regulations protecting patients' confidential health information? Let us count the ways:

■ Last month, in a continuing care retirement community in Ithaca, N.Y., Helen Wyvill, 72, noticed that a friend hadn't shown up for their regular swim. She wasn't in her apartment, either.

http://www.nytimes.com/2015/07/21/health/hipaas-use-as-code-of-silence-often-misinterprets-the-law.html?_r=0

3. Cultural

- "We've always done it this way"
- "I'm not sure I understand how this works"
- *Potential trap: being afraid of rocking the boat*

4.Political

- Inter-departmental
- Intra-departmental
- *Potential trap: not putting the necessary effort into something that will pay dividends to the university and ultimately to the CUNY system as a whole*

Political Example – inBloom

- Non-profit company founded in 2011 by Council of Chief State School Officers
  - Supported with funding from the Bill and Melinda Gates Foundation, among others
- Sought to provide an open-source platform for combining data from various education vendor products
- Educators could use data in one consolidated system to improve learning

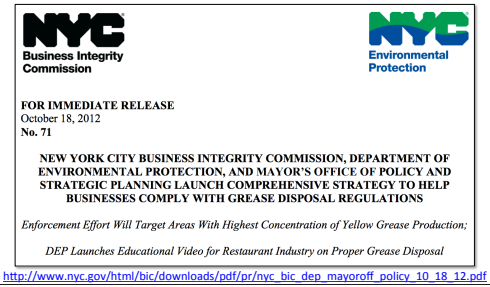
Political Example – inBloom

- Public concern over the potential use of the data by 3rd parties led states to cancel contracts
- The company began winding down operations in April 2014
- Lesson in how politics must be factored in – inBloom lost in the court of public opinion

http://www.businessweek.com/articles/2014-05-01/inbloom-shuts-down-amid-privacy-fears-over-student-data-tracking

Benefits

- Time, money, lives saved



NYC Business Integrity Commission

NYC Environmental Protection

FOR IMMEDIATE RELEASE
October 18, 2012
No. 71

NEW YORK CITY BUSINESS INTEGRITY COMMISSION, DEPARTMENT OF ENVIRONMENTAL PROTECTION, AND MAYOR'S OFFICE OF POLICY AND STRATEGIC PLANNING LAUNCH COMPREHENSIVE STRATEGY TO HELP BUSINESSES COMPLY WITH GREASE DISPOSAL REGULATIONS

Enforcement Effort Will Target Areas With Highest Concentration of Yellow Grease Production;

DEP Launches Educational Video for Restaurant Industry on Proper Grease Disposal

http://www.nyc.gov/html/bic/downloads/pdf/pr/nyc_bic_dep_mayoroff_policy_10_18_12.pdf

Benefits

- Time, money, lives saved
- Better delivery of services to stakeholders
- More transparency
- More accountability

Being data-driven doesn't mean

blindly following data.

Augment decision makers with objective, trustworthy, and relevant data.

Being data-driven means having…

an open, sharing culture

No data hoarding or silos. Bring data together to create rich contexts. Connect the dots.

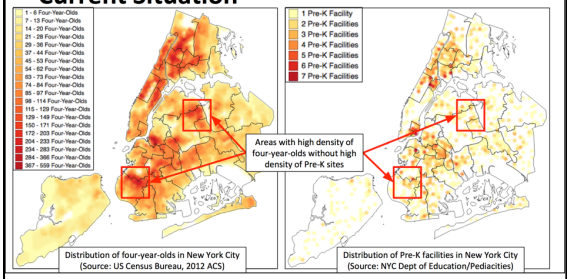
WHAT CONCERNS DO YOU HAVE WITH RESPECT TO ANALYTICS IN YOUR JOB?

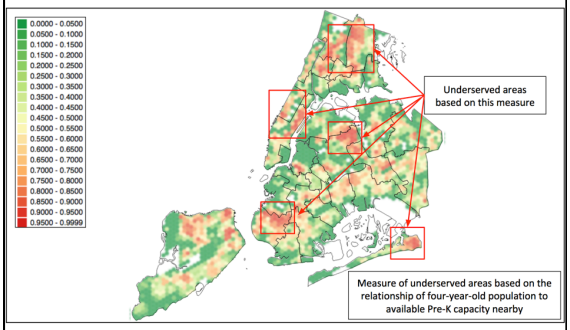
WHAT ARE SOME OF THE BENEFITS OF GOOD ANALYTICS IN YOUR OFFICE?

Group Exercise – Universal Pre-K

- Define the analytical problem in one of these key areas
  - Capacity
  - Outreach
  - Enrollment (CBOs/Students)
  - Monitoring/Evaluation
- Situation
  - ~104,000 4-year olds in NYC
  - 58,528 current seats
  - 26,364 in public schools
  - 32,164 in community based organizations
- Goals
  - Increase enrollment by 30,000 for 2014-2015
  - Increase enrollment by 20,000 for 2015-2016

Current Situation



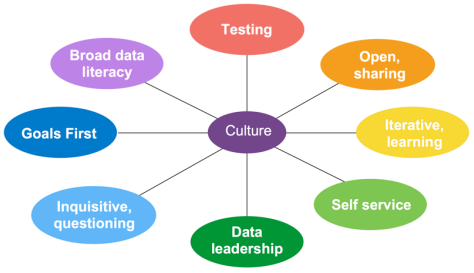


Goals for this Afternoon

- Discuss the features of a data-driven culture
- Demonstrate the value of well-designed information visualizations
- Familiarize you with exploratory data analysis and question-driven analysis
- Practice communicating analytical findings
- Become familiar with key features and issues with government open data

BUILDING A DATA-DRIVEN CULTURE

Data Driven Culture



Being data-driven means having…

a self service culture

Business units have necessary data access as well as within-team analytical skills to drive insights, actions, and impact.

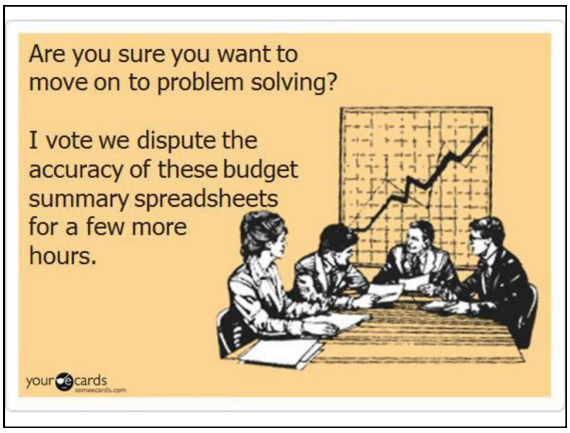
"Central Source of Truth"

Invest in data quality

1 / 3

business leaders frequently make decisions with data that they cannot trust

2009. Business Analytics and Optimization for the Intelligent Enterprise. IBM



Being data-driven means having…

a broad data literacy

All decision-makers have appropriate skills to use and interpret data.

Being data-driven means having…

an objective, inquisitive culture

‘“Do you have data to back that up?” should be a question that no one is afraid to ask and everyone is prepared to answer’—Julie Arsenault.

Being data-driven means having…

strong data leadership

A head of data to evangelize data as strategic asset with budget, team, and influence to drive cultural change.

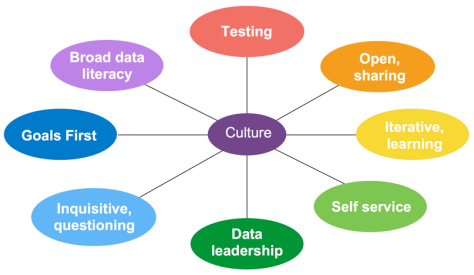
Change should not just be top-down

but bottom up too

Everyone in org has role and responsibility through "leveling up" their data skills, mutual mentoring, and embedding data into their processes.

Culture	Collaborative, inclusive, open, inquisitive
Data leadership	Chief data officer / chief analytics officer
Decision making	Testing mindset, fact-based, anti-HiPPO
Organization	Embedded, federated analytics
People	Analytics org: composition, skills, training
Data	Data quality, data management

Data Driven Culture



6 ANALYTICAL STEPS

1. Problem Formulation

- What question or need am I trying to answer?
- What's my organization's mission and goals?
- How can I best apply data to this task?

Context is King

Borough-Block-Lot:
1001210001

Building Identification Number:
1001394

Community District:
Manhattan 1

School District: 2

Latitude: 40.71306
Longitude: -74.0037

Address:
1 Centre Street
New York, NY 10007

Assessed Value:
$70,771,500

Census Tract:
36061002900

Census Blocks:
360610029004012
360610029004019

X: 983210
Y: 199016

Name: Miranda Jones

SSN: 123-45-6789

OSIS Number: 987654321

Home Address:
123 East 4th St.
Brooklyn, NY

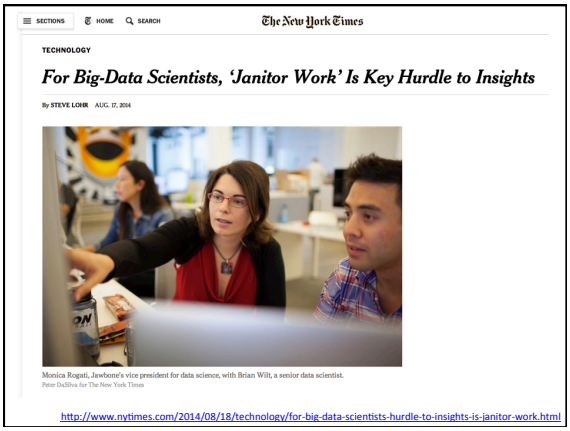
Assigned School District: 15

2. Data Gathering/Preliminary Analysis

- What data do I think I'm going to need?
- What condition is it in?
- Does it tell me what I need?
- What other data might I need?
- How much work do I need to put into the data?

3. Data Cleaning/Data Munging

- Make the data usable and compatible
- Takes up the most amount of time
- May require more sophisticated tools depending on the state and size of the data



SECTIONS HOME SEARCH The New York Times

TECHNOLOGY

For Big-Data Scientists, 'Janitor Work' Is Key Hurdle to Insights

By STEVE LOHR AUG. 17, 2014

Monica Rogati, Jawbone's vice president for data science, with Brian Wilt, a senior data scientist.
Peter DaSilva for The New York Times

http://www.nytimes.com/2014/08/18/technology/for-big-data-scientists-hurdle-to-insights-is-janitor-work.html

4. Hypothesis Testing

- Am I getting the results I'd hoped for?
- What other questions come up?

5. Verification

- Do my results make sense?
- Did I make a simple mistake?
- Check twice and you'll sleep easier

5. Verification – London Whale

- $6.2 billion lost by JP Morgan Chase & Co

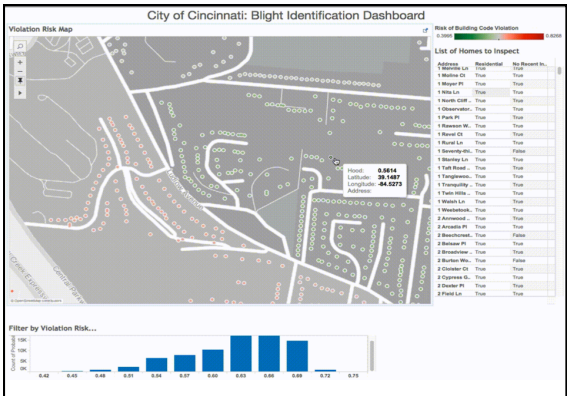
http://www.businessinsider.com.au/excel-partly-to-blame-for-trading-loss-2013-2

5. Verification – London Whale

- Caused largely by Excel mistakes:
  - Manual data errors
  - Manual copy and paste
  - Simple formula error that hid volatility
- Fined over $1 billion for poor internal oversight of trading activities

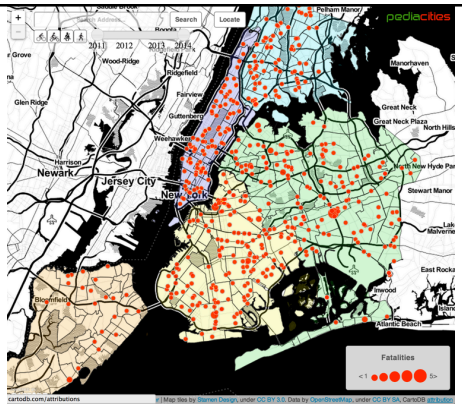
6. Visualization

- "A picture is worth a thousand words"
- Communicate results clearly and concisely
- Help to better understand your data
- The eyes have a much higher bandwidth into the brain

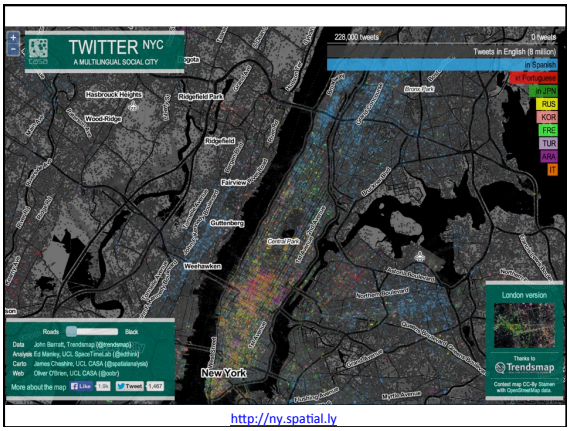


Source:
https://medium.com/backchannel/how-a-fiddler-and-an-astrophysicist-brought-predictive-analytics-to-cincinnati-c5583468f4cc

HOW DOES YOUR OFFICE ANALYZE DATA?

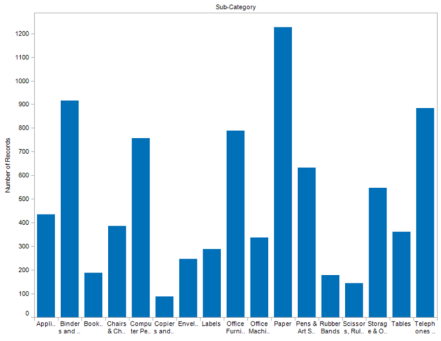


http://nyc.pediacities.com/fsmaps/VisionZero/

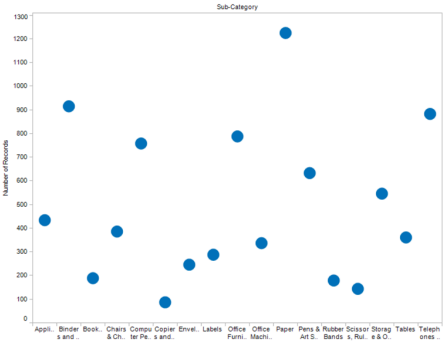


http://ny.spatial.ly

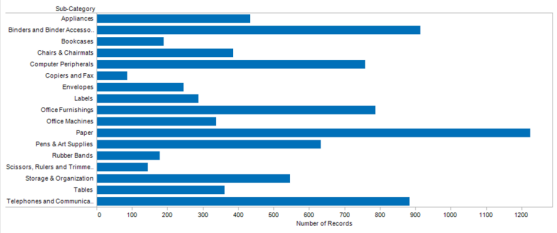
Bar Chart



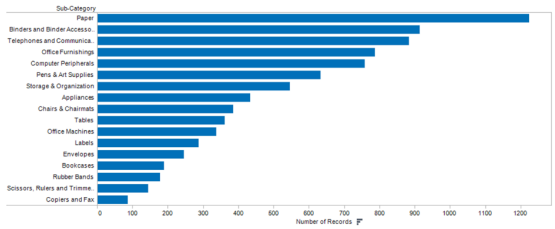
"Barless" Bar Chart



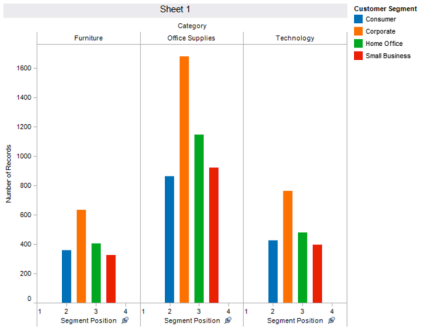
Horizontal Bar Chart



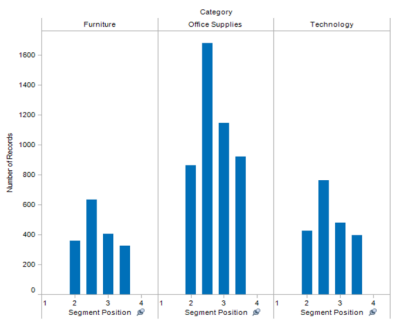
Ranked Bar Chart



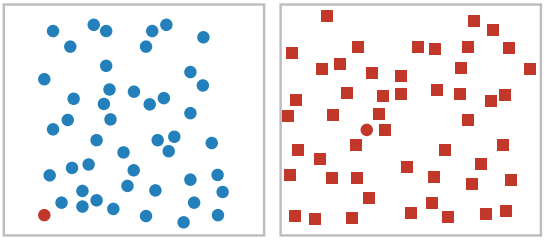
Grouped Bar Charts



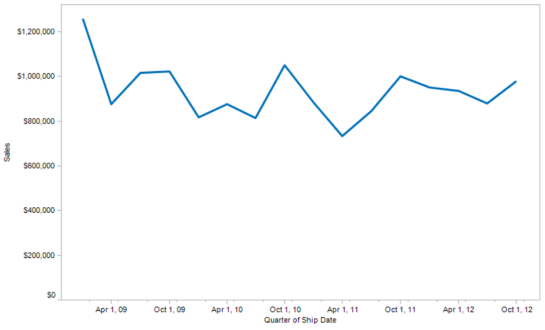
Grouped Bar Charts



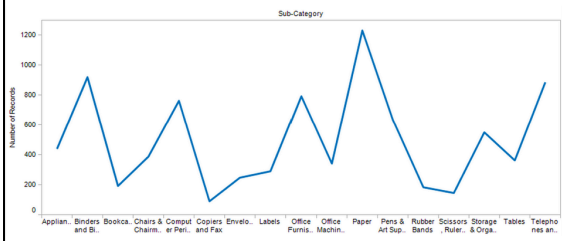
Precognitive Processing



Line Chart

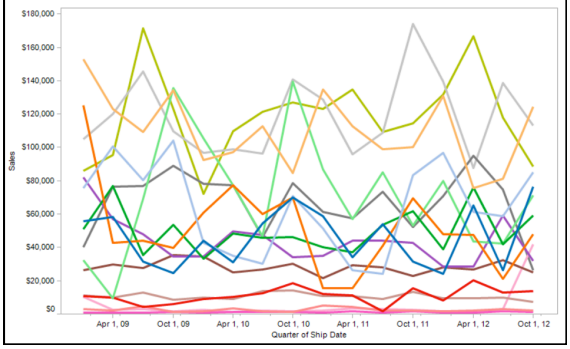


Line Chart with Categorical Data

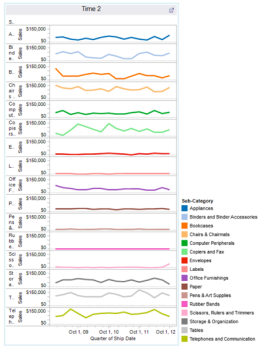


Line Chart

Line Chart

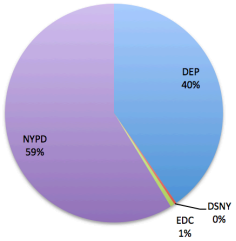


Small Multiples



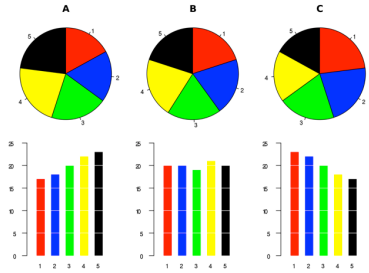
Pie Charts

Noise Complaints by Agency Responsible
1 Jan 2015 - 18 March 2015



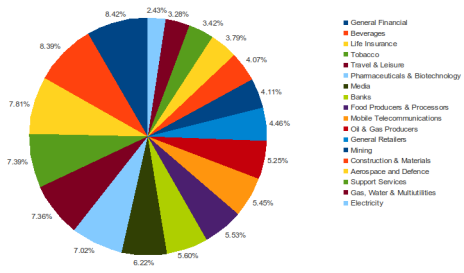
Pie Charts

Which candidate got the most votes?

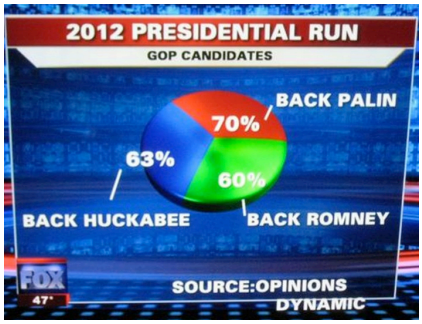


Pie Charts

Sector Weightings

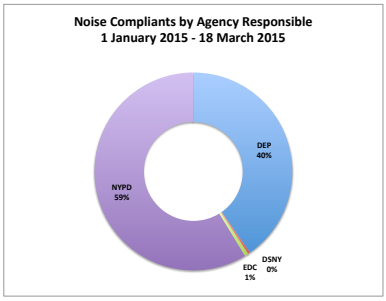


Pie Charts



http://simplystatistics.org/2012/11/26/the-statisticians-at-fox-news-use-classic-and-novel-graphical-techniques-to-lead-with-data/

Donut Charts



Design Tip

How do you learn to make good charts?

…Make a lot of bad charts

Definition of Open Data

- Definition:
  - Open data is data that can be freely used, shared and built-on by anyone, anywhere, for any purpose
- Key Features
  - Availability and access
  - Reuse and redistribution
  - Universal participation

http://blog.okfn.org/2013/10/03/defining-open-data/

I Quant NY

MAILING LIST RSS ARCHIVE

Quantitative Analysis of NYC Open Data: Every data set that the city releases tells a story. This blog is all about telling those stories, one data set at a time.

About Me About You Interviews Press Topics Subscribe

JUNE 2, 2014

Success: How NYC Open Data and Reddit Saved New Yorkers Over $55,000 a Year

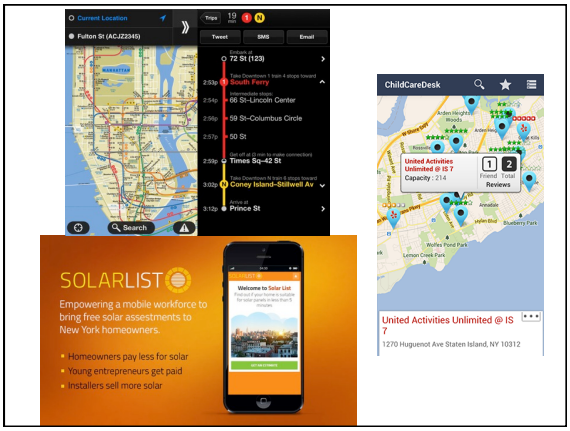
Before Open Data:

After Open Data:

http://iquantny.tumblr.com/post/87573867759/success-how-nyc-open-data-and-reddit-saved-new

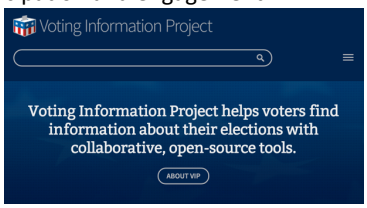
Open Data Benefits

- Transparency
- Releasing social and commercial value



Open Data Benefits

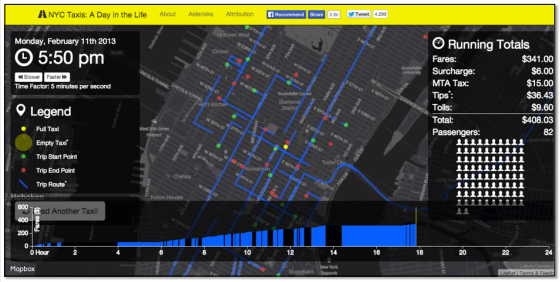
- Transparency
- Releasing social and commercial value
- Participation and engagement



https://www.votinginfoproject.org/

Open Data Concerns

- Privacy
  - Personally identifiable information (PII)
  - Mosaic Effect
- Confidentiality
- Security



http://nyctaxi.herokuapp.com/

http://gawker.com/the-public-nyc-taxicab-database-that-accidentally-track-1646724546

LINKS TO OPEN DATA PORTALS

NYC Open Data Portal - https://data.cityofnewyork.us/
NYS Open Data Portal - https://data.ny.gov
US Federal Government Open Data Portal - http://www.data.gov/

Exploratory Data Analysis

- Goal -> Discover patterns in the data
- Approach
  - Understand the context
  - Summarize fields
  - Use graphical representations of the data
  - Explore outliers

Tukey, J.W. (1977). Exploratory data analysis. Reading, MA: Addison-Wesley.

Question-Driven Analysis

- Goal -> Answer a specific problem or concern
- Approach
  - Have a question or problem in mind when analyzing data
  - "I need to know X"
  - Problem-focused discovery with the data

Question Driven Analysis

Vision Zero (dB)

Tasks:

- Given 311 noise complaint data, assist enforcement efforts by identifying community districts that have a high volume of noise complaints and the time frame enforcement resources should be deployed to combat the noise issue at its peak
- Identify the prevalent types of noise complaints in these areas to guide enforcement in each community district

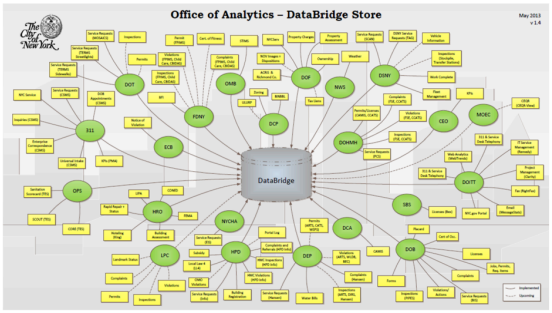
NYC Community Districts

Analytical Resources

- Internal Agency Teams
  - Offices within your organization charged with performing analysis for internal or external stakeholders
- Mayor's Office Task Forces
  - Special inter-agency efforts around critical policy areas bringing together critical skills and experience in a subject area
- NYC Center for Innovation through Data Intelligence (CIDI)
  - Conducts inter-agency research to identify areas of service need in the City of New York
  - Collaborates with all Health and Human Service (HHS) agencies and other City partners to improve services
  - CIDI values the contextual interpretation of data and respects persons' confidentiality in its research activities
  - http://www.nyc.gov/html/cidi/html/home/home.shtml

Analytical Resources

- Mayor's Office of Data Analytics (MODA)
  - New York City's civic intelligence center
  - Aggregating and analyzing data from across City agencies
  - More effectively address crime, public safety, and quality of life issues
  - Uses analytic tools to:
    - Prioritize risk more strategically
    - Deliver services more efficiently
    - Enforce laws more effectively
    - Increase transparency



The above data map illustrates the data collected, by agency, and agency system, and fed into DataBridge.

From the MODA 2013 Annual Report available at:
http://www.nyc.gov/html/analytics/downloads/pdf/annual_report_2013.pdf

What We've Covered

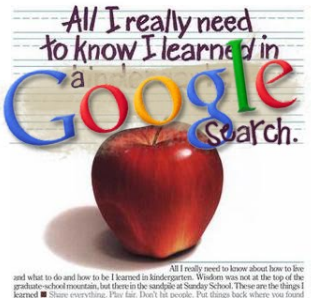
- 5 types of analysis
- 4 concerns to be mindful of
- Benefits of good analysis
- 6 analytical steps
- How to design charts and graphs
- Definition of open data
- Exploratory data analysis with 311 data
- Key features of a data-driven culture

Goals for the Course

- Discuss the data-driven decision making process as it relates to city government
- Explore the role of managers and analysts in the decision making process
- Introduce useful terminology around data and the data analytics process
- Get some hands-on experience analyzing data

Key Takeaways for the Course

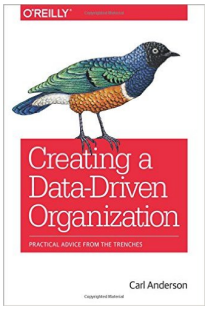
- Better understand using data in the decision-making process
- Better understand how to build a data-driven culture
- Better understand the analytics process
- Better understand the value of data, particularly open data
- Better understand the role of analysts and managers in the decision-making process

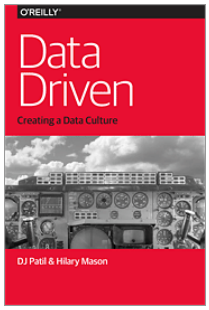


Technical Resources

- Stack Overflow
  - http://stackoverflow.com/
  - One of the best Q&A sites for technical questions of all kinds
- Microsoft Office Support
  - http://office.microsoft.com/en-us/support/
  - Documentation on various MS Office products
- Excel Tips
  - http://excel.tips.net/
  - Various tips and tricks for using Excel

Resources





Contact Information

Instructor

- Name: Richard Dunks
- Email: richard@datapolitan.com
- Website: http://www.datapolitan.com
- Blog: http://blog.datapolitan.com
- Twitter: @rdunks1/@datapolitan

THANK YOU!

REFERENCE SLIDES

(Not presented in class)

INTRODUCTION TO STATISTICS

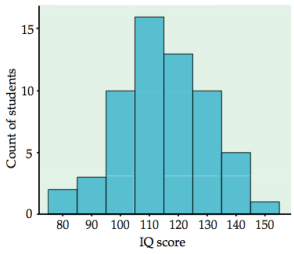
"We are drowning in information and starving for knowledge."
-Rutherford D. Roger

Why Statistics?

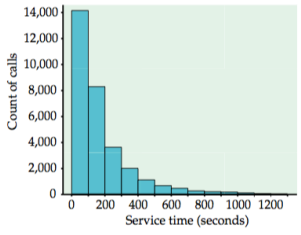
- Tools for extracting meaning from data
- Commonly understood ways of communicating meaning to others

DATA DISTRIBUTIONS

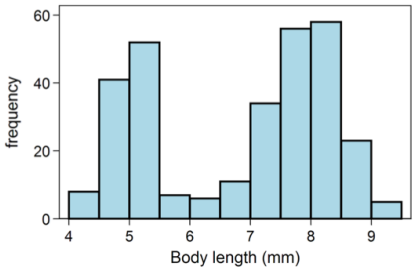
Normal Distribution



Long-tail Distribution



Bi-modal



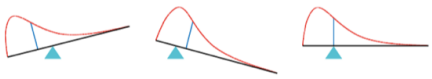
DESCRIBING DATA

Mean

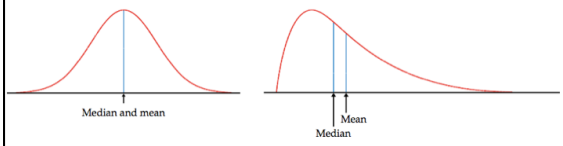
- A representative value for the data
- Usually what people mean by “average”
- Calculate by adding all the values together and dividing by the number instances
  - Example: Calculate mean height of everyone in class
- Sensitive to extremes

Median

- The "middle" value of a data set
  - Center value of a data set with an odd number of values
  - Sum of two middle values divided by 2 if the number of items in a data set is even
- Resistant to extreme values

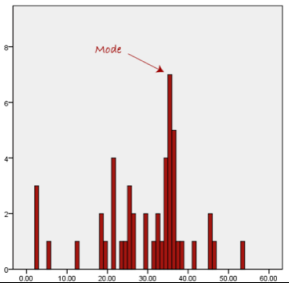


Mean vs Median



Mode

- The most frequent value in a dataset



Measures of Central Tendency

- Quantitative data tends to cluster around some central value
- Mean is a more precise measure and more often used
- Median is better when there are extreme outliers
- Mode is used when the data is categorical (as opposed to numeric)

Measures of Variability

- Describe the distribution of our data
- Help us understand how well the measures of central tendency represent the data

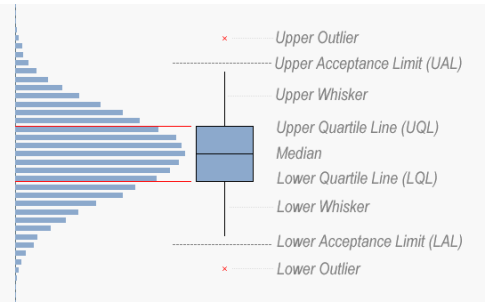
Range

- The gap between the minimum value and the maximum value
- Calculated by subtracting the minimum from the maximum

Quartiles

- Median splits the data set into two equal groups
- Quartiles split the data into four equal groups
  - First quartile is 0-25% of the data
  - Second quartile is 25-50% of the data
  - Third quartile is 50-75% of the data
  - Fourth quartile is 75-100% of the data

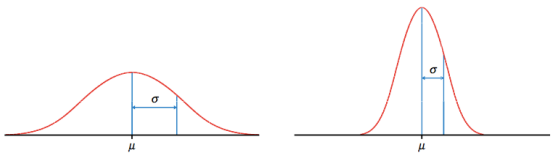
Inter-Quartile Range



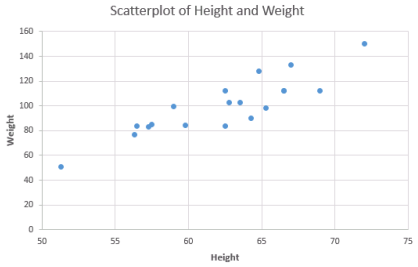
https://community.qlik.com/blogs/qlikviewdesignblog/2014/08/18/recipe-for-a-box-plot

Standard Deviation

- The average distance of each data point from the mean
- Larger the standard deviation, the greater the spread

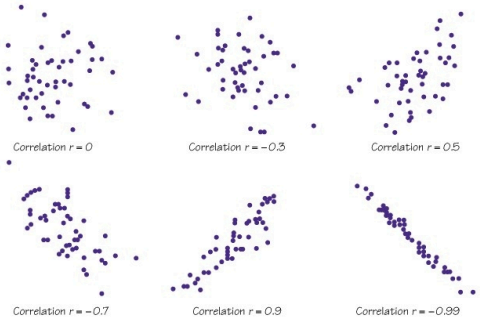


Correlations



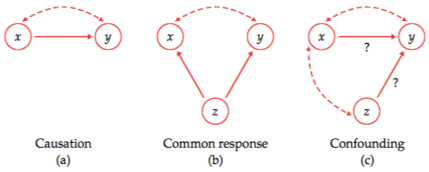
How do we measure this relationship?

Correlation Coefficient

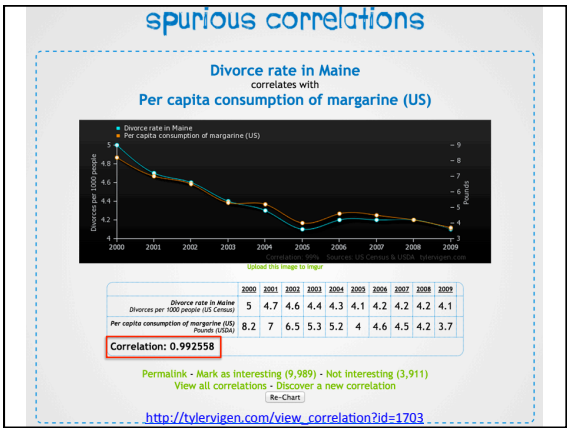


http://pixshark.com/correlation-examples.htm

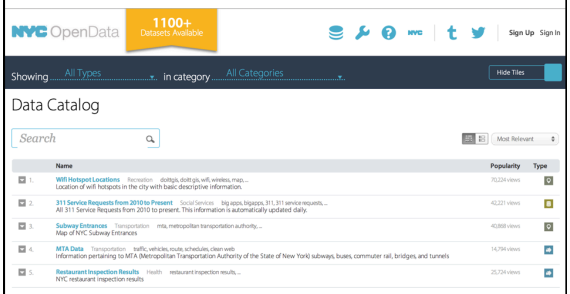
Causation



Correlation does not imply causation

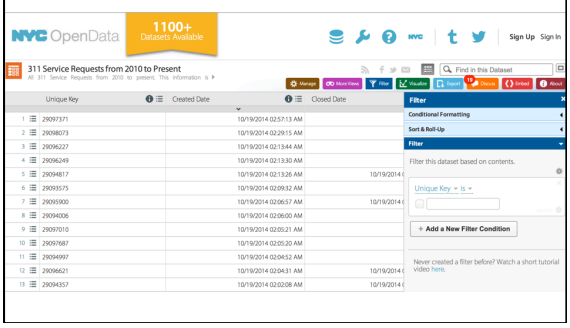


NYC Open Data Portal

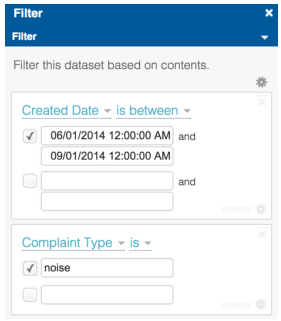


https://nycopendata.socrata.com/data

NYC Open Data Portal – 311 Data



Download 311 Data

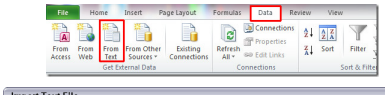


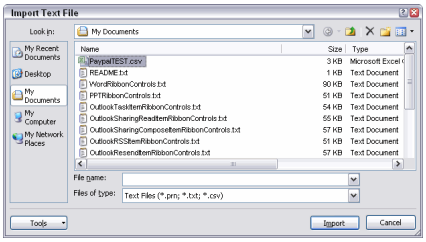
Download 311 Data

IMPORTING DATA

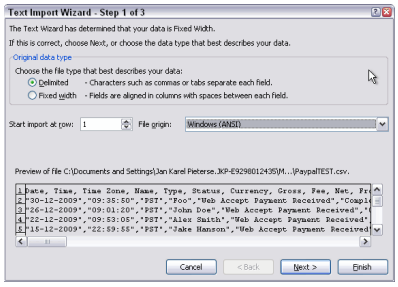
The following slides are for reference following the live demo in class

Importing Data

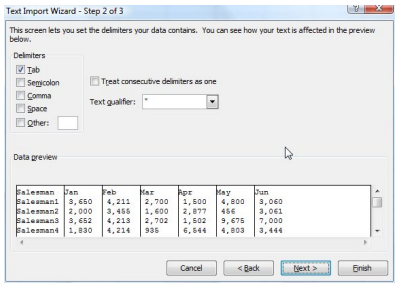




Importing Data



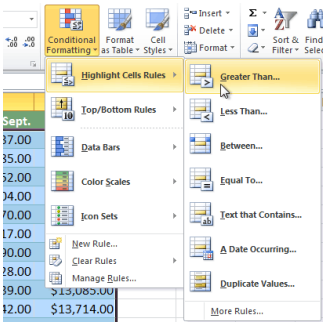
Importing Data



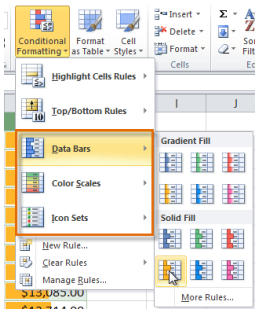
Conditional Formatting

- Format cells based on value or add content to cells that visually describe the content
- Great for quickly visualizing data
- Makes tables more “presentation-ready”

Conditional Formatting



Conditional Formatting



Conditional Formatting - Examples

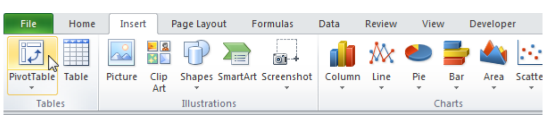
$3,863.00	$1,117.00	$8,237.00	$8,690.00
$9,355.00	$1,100.00	$10,185.00	$18,749.00
$6,702.00	$2,116.00	$13,452.00	$8,046.00
$4,415.00	$1,089.00	$4,404.00	$20,114.00

$3,863.00	$1,117.00	$8,237.00	$8,690.00
$9,355.00	$1,100.00	$10,185.00	$18,749.00
$6,702.00	$2,116.00	$13,452.00	$8,046.00
$4,415.00	$1,089.00	$4,404.00	$20,114.00

$3,863.00	$1,117.00	$8,237.00	$8,690.00
$9,355.00	$1,100.00	$10,185.00	$18,749.00
$6,702.00	$2,116.00	$13,452.00	$8,046.00
$4,415.00	$1,089.00	$4,404.00	$20,114.00

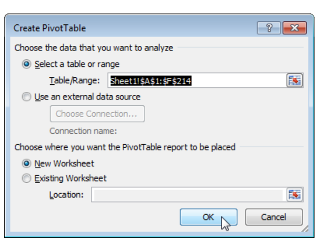
PivotTables

- What is a PivotTable?
  - A data summarization tool for quickly understanding and displaying the data you're analyzing
- How do I find it?



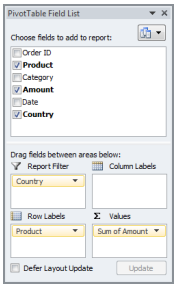
PivotTables

- Selecting range and destination



PivotTables

- Drag and drop fields to visualize
  - Row labels
  - Values
  - Filter
  - Column Labels



PivotTables