

NUMBERS IN BUSINESS AND INDUSTRY

Union College Academy for Lifelong Learning

Class 4 (UCALL)

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QUIZ

The language of business is

- a. English
- b. Money
- c. Numbers
- d. All of the above



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THE ANSWER

GE Annual Report
2007

- Earnings per share (EPS) of \$2.20, an increase of 18%
- Global revenue growth of 22%
- Equipment backlog of \$49 billion
- Financial services assets growth of 16%

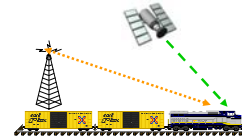
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NUMBERS: BEYOND THE FINANCIALS

- Advances in capture and storage of large data sets
 - Remote tracking of products → *Reliability*
 - Internet traffic → *Marketing, Sales*
 - Credit card transactions → *Risk management*



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NUMBERS: PART OF EVERYDAY BUSINESS

- Ease of access to data
- Easy to use tools (e.g., excel)
- Drive for data-based decision making

“In God we trust; all others bring data”

or

“Show me the data”

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OUTLINE

Part I

- Illustrations of common misuses

Part II

- Application examples



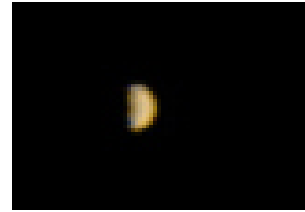
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Part I

- Illustrations of common misuses

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Illustration #1: Mars Climate Orbiter



The only image received from the spacecraft before it smashed into Mars (23 Sept 1999)

Project cost in 1999: \$125 Million

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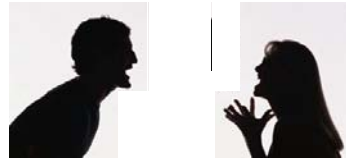


“Find out how numbers were defined”

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What Went Wrong?

“One team used English units while the other used metric units for a key spacecraft operation. This information was critical to the maneuvers required to place the spacecraft in the proper Mars orbit.” (MCO Failure Board Report)



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Illustration #2

A “Generic” Pitch by a Sales Manager

“... enabled a dramatic increase in overall sales volume by improving online sales conversion rates and maximizing average order size.”

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“Numbers are highly useful”

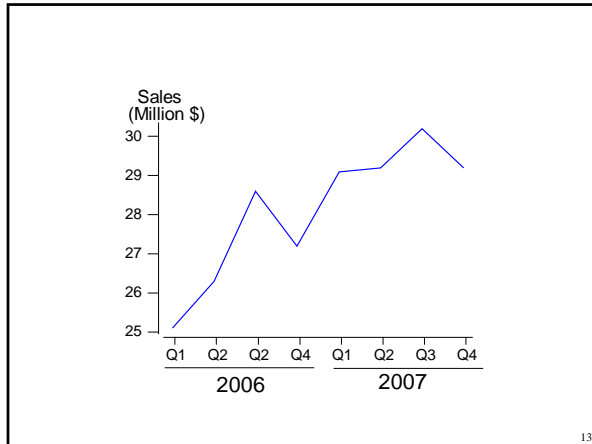
or

“In God we trust; all others bring data”

or

“Show me the data!..”

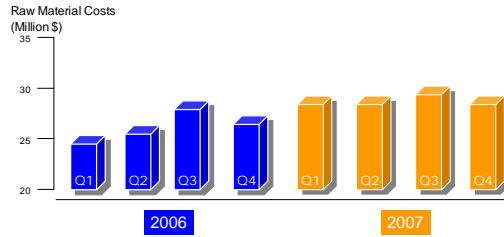
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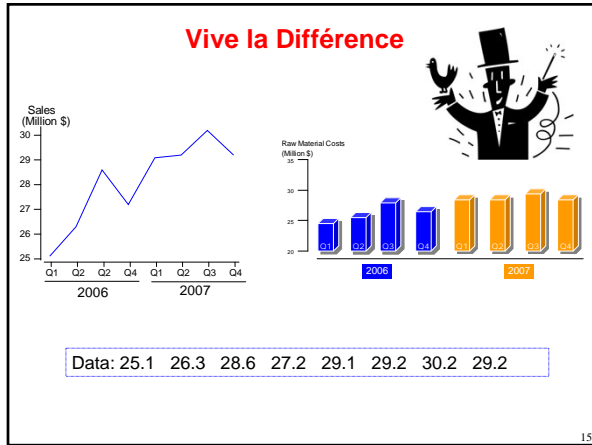
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A "Generic" Report by a Sourcing Manager

"... achieved a **remarkably flat** cost position despite gradual build up in inflationary pressures."



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"Numbers are highly useful, but can be readily abused!"

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Illustration #3: Numbers in Advertisements

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"Be wary of advocates with numbers"

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Numbers in product advertising



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Who is Your Wireless Provider?

at&t Cingular has the fewest dropped calls of any network*

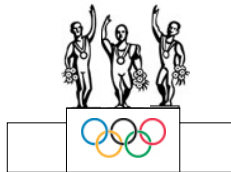
We're #1! T-Mobile has the fewest dropped calls and the highest call clarity nationwide.

verizonwireless America's Most Reliable Wireless Network®

Sprint Sprint Leads Again in Network Reliability for Ninth Year; Best Service Uptime Record Benefits Network Customers.

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So who is telling the "truth"?



Probably they all are.

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Some questions

- Dropped call?
- Data collection?
- Margin of difference?
- How about calls that don't go through, static, echoes, voice distortion, peak vs. non-peak, location?



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Some answers

- Research by Telephia, a third party contract research company
- Did not release data / research methodology
- Telephia assumed responsibility for data but not for Cingular's conclusions.

"While we can't evaluate the specific analysis Cingular uses as the basis of its nationwide claim, Telephia can confirm that Cingular does have a statistically significant lower dropped-call rate than the competition across some market/time period groupings."

- Cingular (now AT&T) ended the campaign August '07

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A Tale of Two Advertisement Claims



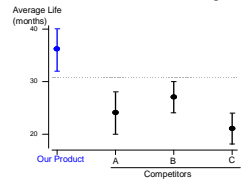
A

"Based on a statistical study, our product has an average life that is longer than that of any of our major competitors."

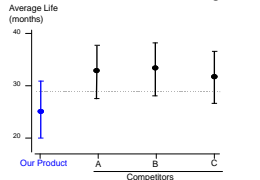
B

"Based on a statistical study, no major competitive product has an average life that exceeds our product's."

95% Confidence Intervals for Average Life



95% Confidence Intervals for Average Life

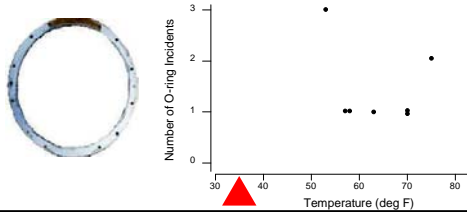


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Illustration #4

The 1986 NASA Space Shuttle Challenger Disaster

- To launch or not to launch?
- Potential concern: Impact of cold weather on O-rings
- Data reviewed by NASA management to make decision



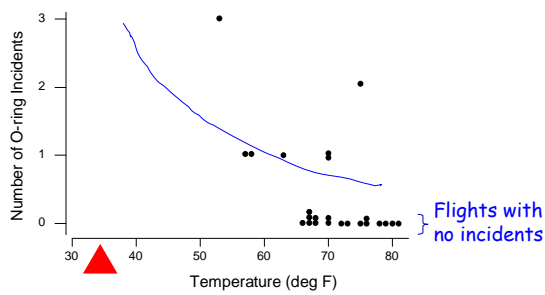
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Find out how numbers were obtained

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All Data Which Was Available at the Time

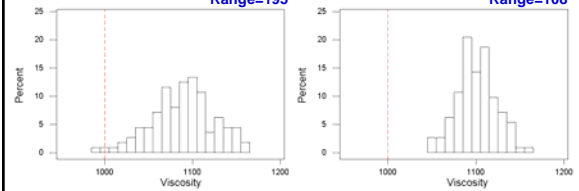


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Illustration #5: Thermoplastic Resin Manufacturing

Plant A (U.S.A.)
Min=965
Max=1160
Range=195

Plant B (Japan)
Min=1050
Max=1158
Range=108



“Plant B makes better product than Plant A”

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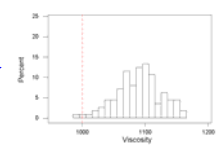
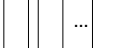
“Beware of comparisons”

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Process Differences Revealed

Plant A

Manufactured Lots

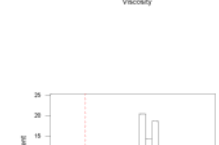


Plant B

Manufactured Lots



Mixing and Blending



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Part II

- Application examples

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QUALITY OF CAPTIONS

- All television broadcast stations in the U.S. are required to caption English-language programming.
- There are no preset quality standards on captioning.

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BEHIND THE SCENES: REAL-TIME CAPTIONING PROCESS



- Real-time captioning for live shows by court stenographers

- News (studio, weather, sports, field reports)
- Sporting events
- Game shows

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CHALLENGE

Program Audio

Captions

How can we “measure” captioning quality beyond “pass/fail”?



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COMPONENTS OF CAPTIONING QUALITY

- Complete
- Accurate
- Readable
- Timely
- Other
 - Speaker identification
 - Auditory cues (music effects, whispering, etc)

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CAPTION QUALITY MEASUREMENT

Program Audio

Captions

1.	"I'd like to begin by saying that we're here today to celebrate the 100th anniversary of the National Aeronautics and Space Administration."	✓
2.	"After the official introduction, we'll have a special performance by the Star Line Orchestra, featuring the Star Line Orchestra."	✓
3.	Good evening, ladies and gentlemen.	✓
4.	We're here tonight to recognize the many contributions of the Star Line Orchestra to the world of music."	✗
5.	"I'd like to begin by saying that we're here today to celebrate the 100th anniversary of the National Aeronautics and Space Administration."	✓
6.	"I'd like to begin by saying that we're here today to celebrate the 100th anniversary of the National Aeronautics and Space Administration."	✗
7.	"I'd like to begin by saying that we're here today to celebrate the 100th anniversary of the National Aeronautics and Space Administration."	✓
8.	"I'd like to begin by saying that we're here today to celebrate the 100th anniversary of the National Aeronautics and Space Administration."	✓

Overall Score → $\frac{6}{8} \rightarrow 75\%$

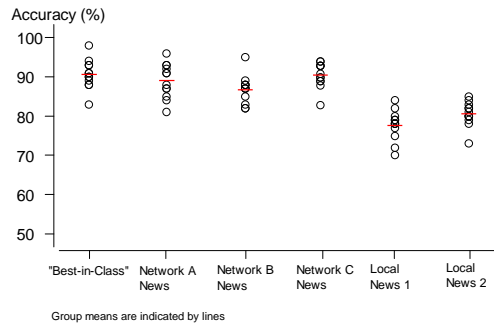
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STUDY PLANNING

- New programs
 - Best in class (public channel)
 - 3 network news
 - 2 local news
- 12 news programs (morning and evening) from each over the same 4 week period
- Program length=30 mins
- Commercials and other pre-captioned material excluded

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RESULTS



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NUMBERS...

- Helped localized the problem
- Provided insights on root causes
- Established benchmarks for improvement

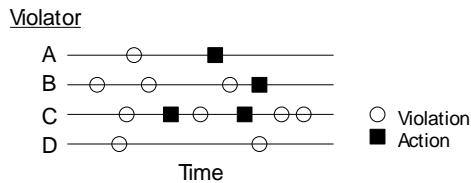
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PREVENTING FRAUDULENT INTERNET ACTIVITIES

- Illegal distribution of copyrighted files of music, videos, software, games and books on Internet.
- Businesses use various tools to track such activities and then take appropriate action to discourage these.
- Counter-actions range from sending warning letters to launching lawsuits.

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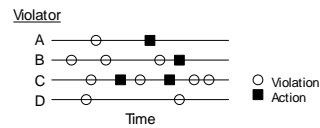
Effectiveness of Actions



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Are the Actions Effective?

Group	Sample Size	Mean Number of Violations per Violator
No-action	52,321	4.2
After action	42,154	5.3



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Violator

A —○—■—

B —○—○—■—

C —○—■—○—■—○—○—

D —○—

Time

○ Violation
■ Action

“Appreciate limitations of observational studies”

- Highly active violators were more prone to actions than low activity violators
- Action timing differed greatly from one violator to the next

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“Controlled, randomized study is gold standard”

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Notice Effectiveness: Randomized Trial

- Tagged 3,600 “new” violators
- Randomly assigned to “action” and “no action” treatments.
- Tracked activity in both groups.

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RESULTS

Group	Sample Size	% Subjects with One or More Further Violations in 3-Month Period
No Action	1,200	42
Action	2,400	12

Relative risk of no-action = $42/12=3.5$
95% confidence interval = 3.1 to 4.0

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COURSE TAKE-AWAYS

- Beware of simple before/after comparisons
- Don't confuse statistical relationship from observational study with cause and effect
- Controlled, randomized study is “gold standard”
- Find out how numbers were obtained/defined and limitations of study--be wary of number advocates
- Margin of error quantifies statistical uncertainty

NUMBERS ARE HIGHLY USEFUL, BUT CAN BE READILY ABUSED—ASSESS WITH CARE!

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