

COURSE
INTRODUCTION

WHY DO WE NEED STATISTICS?



Statistics is the science of collecting, analyzing, and drawing conclusions from data in a sensible way.



Statistics offers us powerful tools for gaining insight into the world around us.



“It is the mark of a truly intelligent person to be moved by statistics”
- George Bernard Shaw



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...

While we always want to be careful, it drives me 🤔🤔 the way people do their risk analysis. We must consider risk of blood clots with [#covid](#) not just [#CovidVaccine](#)





WHAT ARE YOU
GOING TO LEARN

MY GOALS FOR THE CLASS



Statistically literate

understand inference (e.g., study design)

know when something is causal and when it is just associated

know what a p-value indicates and what it doesn't

know the assumptions about basic tests and what the consequences are if they are ignored



Appreciate visuals

see the value of graphs at the beginning of an analysis

see the value of graphs for disseminating your research



Know when and where to seek help

resources on campus

BOOK VERSION

Why are statistical procedures necessary at all?

How can statistics help in planning experiments?

Which procedure should I employ to analyze the results?

What do the statistical results actually mean when I've got them?

ON TEENAGERS, ADULTS:

Statistics show that teen pregnancy drops off significantly after age 25.

*Mary Anne Tebode, Republican state senator from Colorado Springs
(contributed by Harry F. Ponce)*

MONDAY DECEMBER 1999

THE IMPORTANCE OF STATISTICAL LITERACY

Surprising Cancer Causes – stuff.co.nz

“There may be a darker reason a pet dog is a cancer patients' best friend. Analysis of breast cancer cases by researchers at the University of Munich showed that 79.7 percent of all breast cancer patients had regular contact with dogs before diagnosis. Only 4.4 percent of the patients did not have pets at any time, compared to 57.3 percent of a healthy control group. According to researchers, that's a **29-fold** increased risk for pet owners.”

HEADLINES

(COURTESY OF [HTTP://WWW.STATSCCHAT.ORG.NZ/](http://www.statschat.org.nz/))

FIDO AND CANCER

- Lifetime risk of breast cancer – 10%
 - 29-fold increase?
- Actual relative risk reported in paper – 3.5
- Reported in “Medical Hypotheses”
 - self described as “intended as a forum for unconventional ideas without the traditional filter of scientific peer review”
- *“We compared the frequencies of dog and pet ownership with data from public available statistics on women (N=1320) of the same age group in Bavaria”*
 - Detail questionnaire about contact with dogs for subjects, but one simple question for controls.

METHODS FOR STATISTICAL ANALYSIS



Bias,
Inappropriate
method

General method
with stated
assumptions

Most statistically
rigorous method
that evaluates
most/all
assumptions

- What is the norm in the field?
- A spectrum of alternative statistical methods



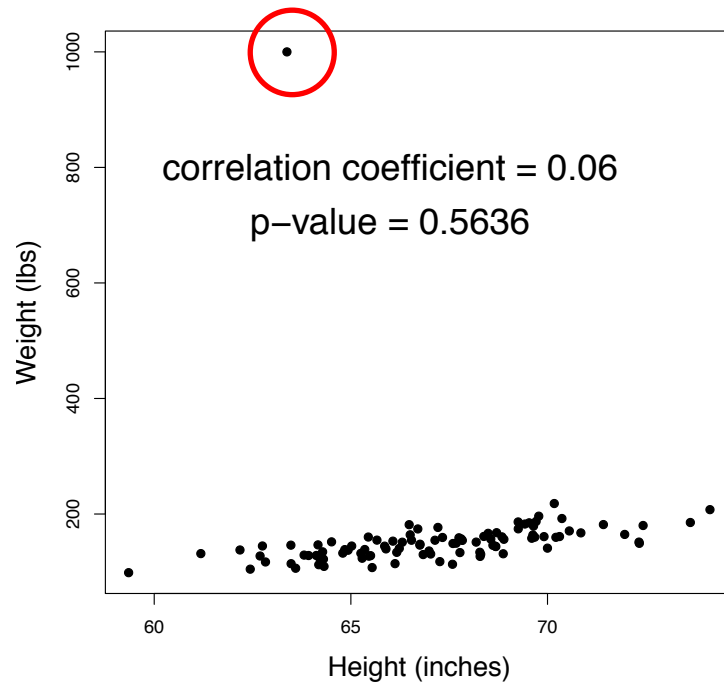
Increasing scope
Increasing monetary and time costs
Increasing precision



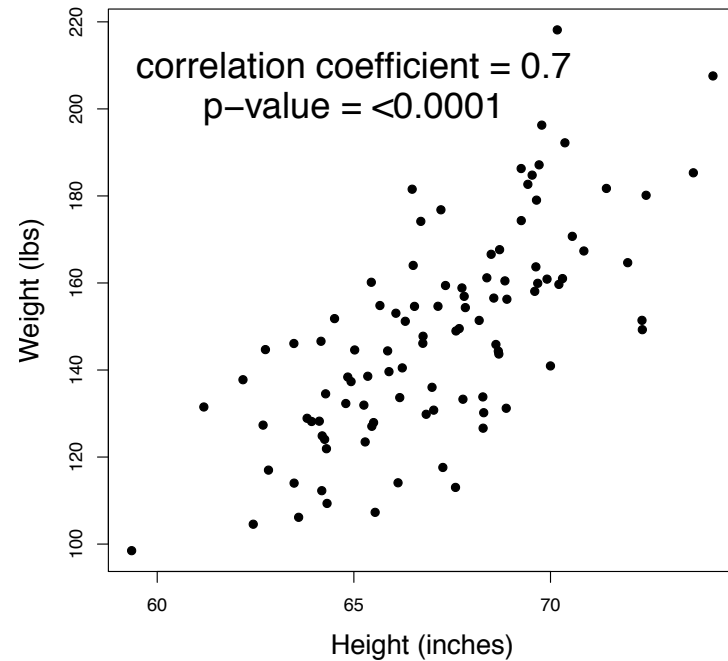
GRAPHING YOUR DATA

BEFORE ANALYSIS – e.g., OUTLIERS

With Outlier

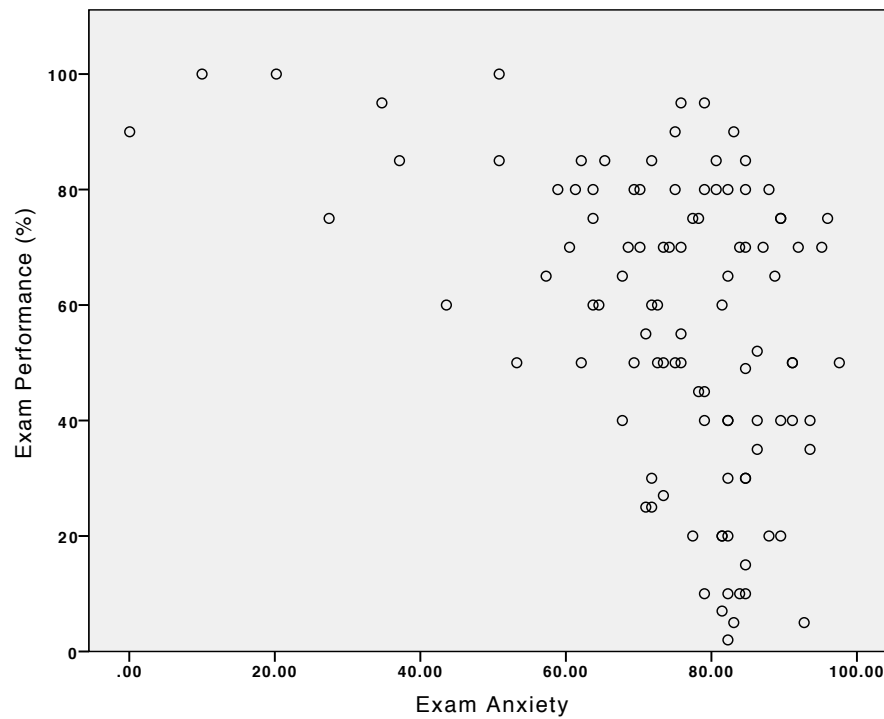


Without Outlier

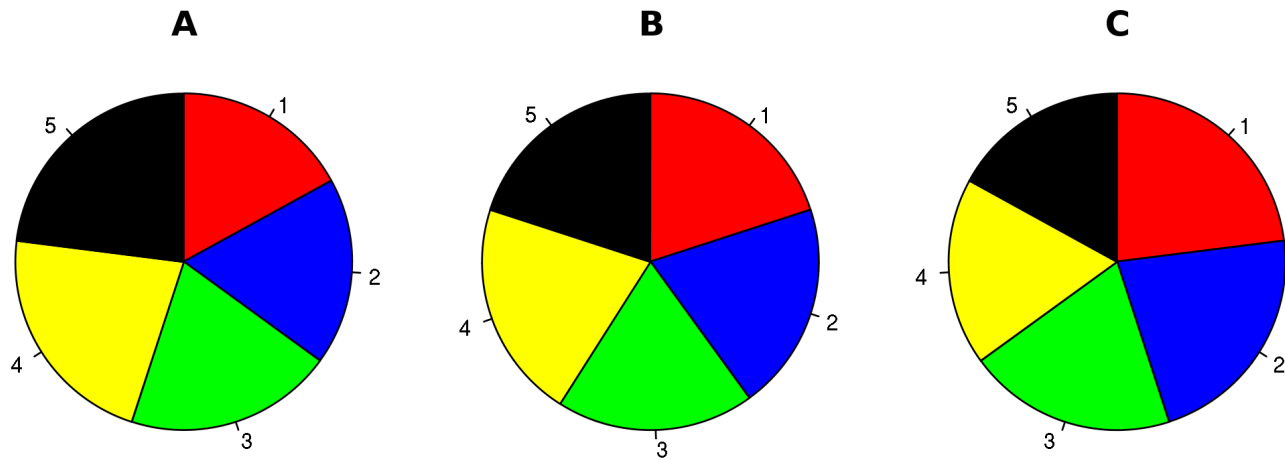


BEFORE ANALYSIS

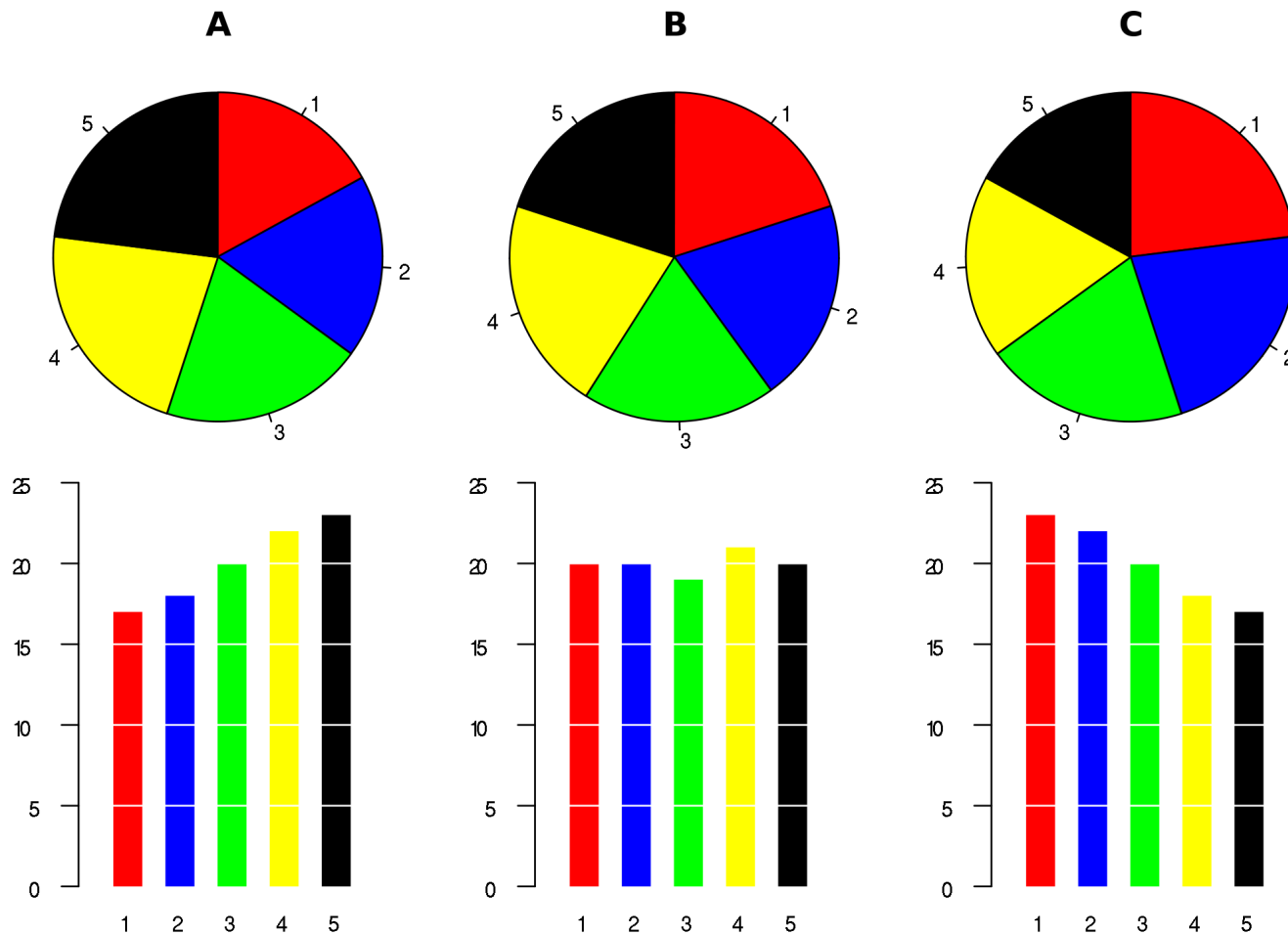
UNDERSTANDING YOUR DATA



AFTER ANALYSIS



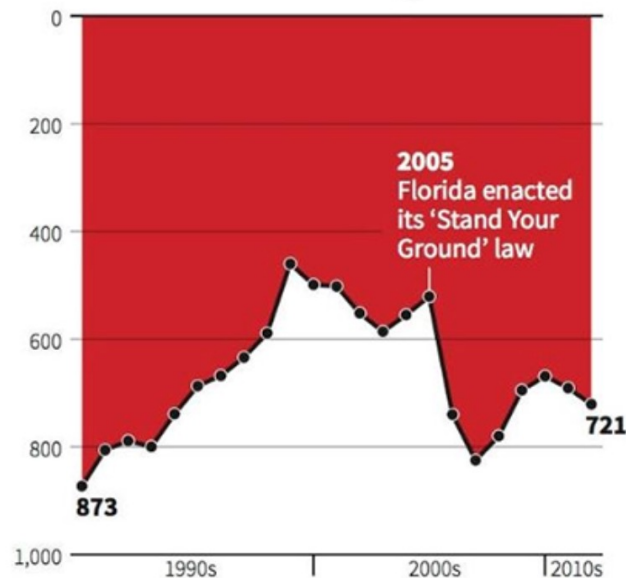
AFTER ANALYSIS



TRULY UNFORTUNATE REPRESENTATION OF THE DATA

Gun deaths in Florida

Number of murders committed using firearms



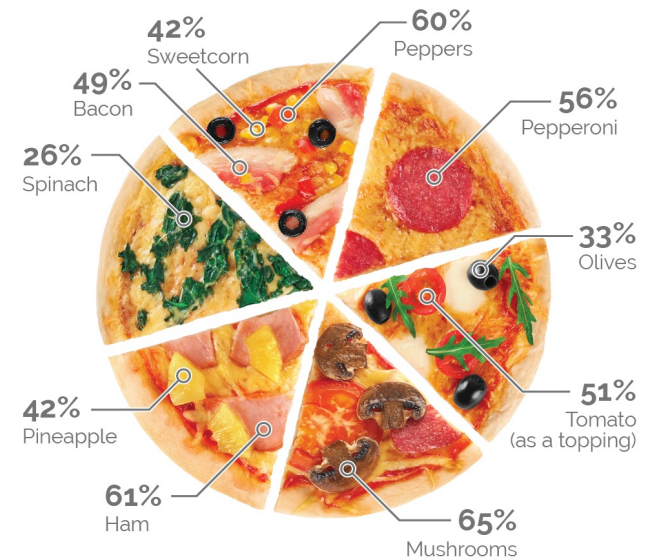
Source: Florida Department of Law Enforcement

C. Chan 16/02/2014

REUTERS

Mushroom is the UK's most liked pizza topping

Generally speaking, which of the following toppings do you like on a pizza? Select as many as you like



Other items not depicted include: onions (62%), chicken (56%), beef (36%), chillies (31%), jalapeños (30%), pork (25%), tuna (22%), anchovies (18%). 2% of people say they only like Margherita pizzas

YouGov | yougov.com

February 26-28, 2017



WHERE TO SEEK HELP

YOUR RESOURCES

- The book
- Google
- Other students/lab mates
- Me
- Center for Innovative Design & Analysis (CIDA) at Colorado School of Public Health