

V0D 2016 Classifying Studies 1

## Classifying Studies: Features and Benefits

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Fall, 2016  
Slides at [www.StatLit.org/pdf/2016-Schield-Studies-Slides.pdf](http://www.StatLit.org/pdf/2016-Schield-Studies-Slides.pdf)

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## Influences on Statistics

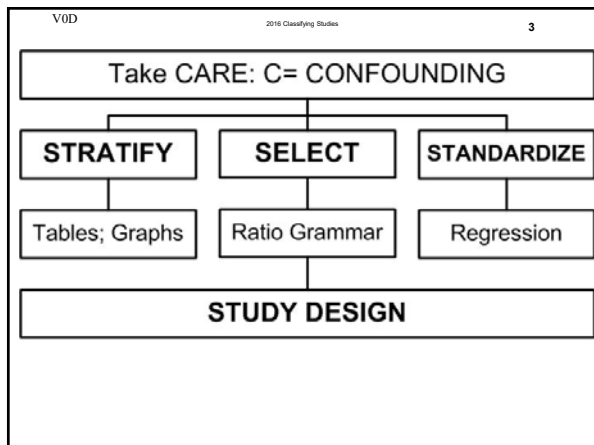
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Typically, statistics are used as evidence for causal connections.

Statistics are numbers in context they can be influenced – if not determined – by their context.

Their influences have been grouped into four categories: Confounding, Assembly, Randomness and Error (Bias).

The following slide reviews confounding:



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## Classifying Studies

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**Experiment:** Requires manipulation by researcher

- Scientific: Homogeneous subjects; manipulation is repeatable
- Randomized controlled trials (RCT): Subjects are heterogeneous; one-time manipulation

**Quasi-experiment:** Manipulation by researcher or intervention (current or past) by nature.

**Observational study:** Researcher is passive.

- Longitudinal: Measurement before & after exposure
- Cross-sectional: All measurements for same time.

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## Study Design Benefits: Resists Confounders

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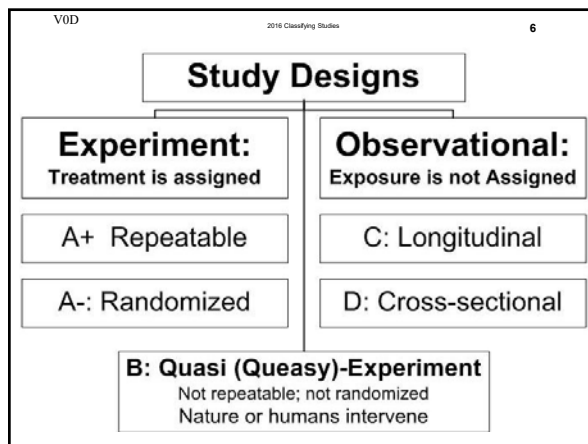
**Experiment:**

- Scientific: Can resist all confounders.
- Randomized controlled trials (RCT): Statistically controls for all pre-existing confounders.

**Quasi-experiment:** Researcher or nature initiates. Controls for time-dependent & constant confounders

**Observational study:** Researcher is passive.

- Longitudinal: Controls for constant confounders
- Cross-sectional: Controls for time-dependent CF.



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### Famous Science Experiments

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Galileo: Falling velocity  $\sim$  time-squared  
 Harvey: Heart drives blood circulation  
 Newton: White light is a combination of colors  
 Lavoisier: Discovery of oxygen  
 Faraday: Showed light was electro-magnetic  
 Joule: Showed that heat was really motion  
 Source: [www.telegraph.co.uk/news/science/science-news/3341042/Top-ten-greatest-experiments.html](http://www.telegraph.co.uk/news/science/science-news/3341042/Top-ten-greatest-experiments.html)

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### More Science Experiments: Repeatable

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*Approximate boiling point of water, by elevation*

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### More Science Experiments: Density of Water vs. Temp

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### Randomized (Clinical) Trial: 1946: Salk Polio Vaccine

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Randomly assigned to second-graders.

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### Observational Studies: 1948: Framingham Study

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MI =myocardial infarction (aka heart attack).  
 Systolic/diastolic: 130/90

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### Famous Quasi-Experiments: 1799: Bloodletting:

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Dec. 13, 1799: George Washington awoke with a bad sore throat and began to decline rapidly. He asked to be bled. Physicians drained an estimated 5 to 7 pints in less than 16 hours. Normal blood volume per adult is 8 to 12 pints. Despite their best efforts, Washington died on December 17, leading to speculation that excessive blood loss contributed to his demise.

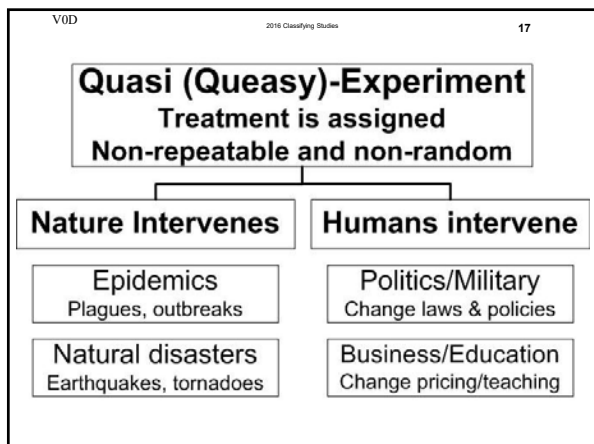
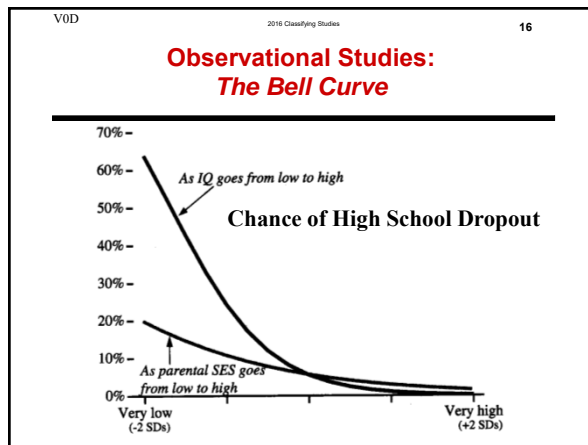
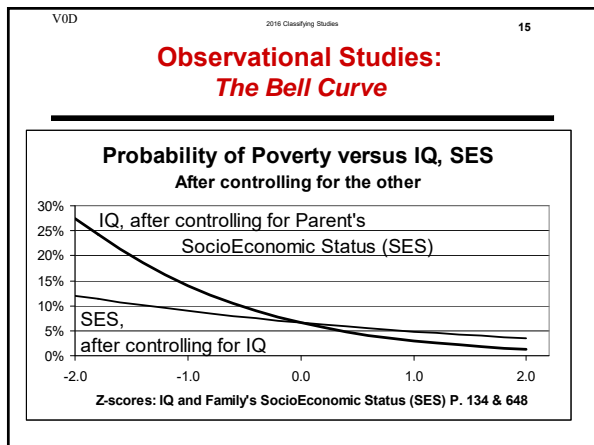
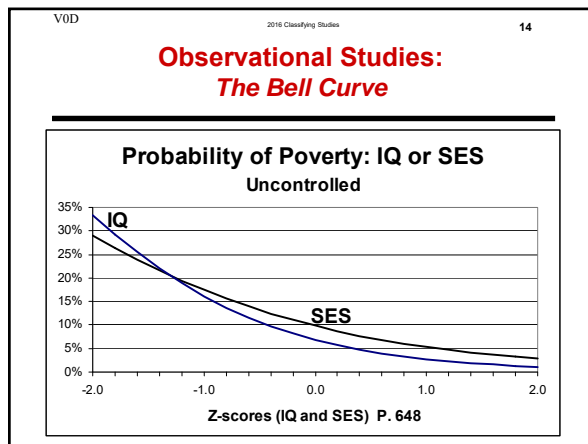
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**Observational Studies:  
1979: National Longitudinal Study of Youth**

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Followed youth (ages 14-22) for 26 years.  
Tracked employment status and other social outcomes (prison, marriage, divorce, etc.)  
<http://www.bls.gov/nls/NLS-50th-Anniversary-Conference-Horrigan.pdf>

Most controversial result was “The Bell Curve.”  
That book claimed that intelligence was real, hereditary and had high explanatory value.



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**Quasi-Experiments:  
Examples**

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Longitudinal:  
Auto fatalities before+after change in speed limits.  
City gun sales before+after sensationalized killing.  
Student activism before+after awareness campaign.

Cross-sectional:  
College drinking levels at two similar colleges:  
one with alcohol orientation; other without.

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**Quasi-Experiment:  
Changing Concealed Carry Laws**

In “More Guns; Less Crime”, John Lott used multivariate analysis to argue that passing concealed-carry laws for handguns reduced crime.

**Crime Vs. Guns**  
Serious violent crimes vs. gun ownership

Crime, left scale, in millions

Guns, right scale, per 1000 persons

Source: Dept. of Justice

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**California Handguns and Violence**

Violent Crime Rate

Handgun Sales

2013, 2014 extrapolated from FBI gun ownership reports

Violent Crime rate Handguns

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**Quasi-Experiment:  
Policing by Helicopter**

# burglaries

days

A - Car patrol only  
B - Helicopter + car patrol

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**Conclusion**

Quasi-experiments are better than observational studies because the researcher or nature controls the assignment or the timing.

Essential for studying those natural interventions or disasters that are one-time only: floods, typhoons, hurricanes, plagues, etc.

Essential for those human interventions that are one-time only: surgery, training programs, changing advertising, changing price/discounts/specials, etc.