Research methods 03

Experimental Design I

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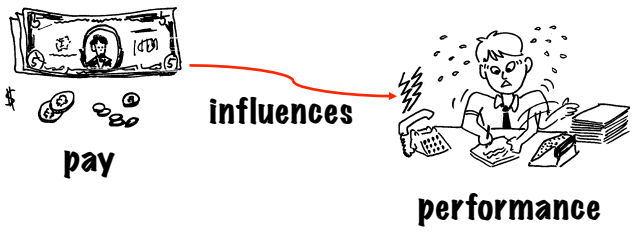
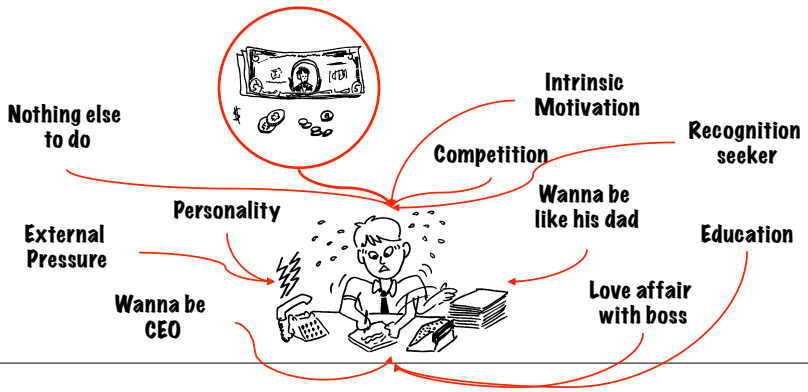
Experimentation in a nutshell

In experiments, we want to be 100% sure that A causes B!



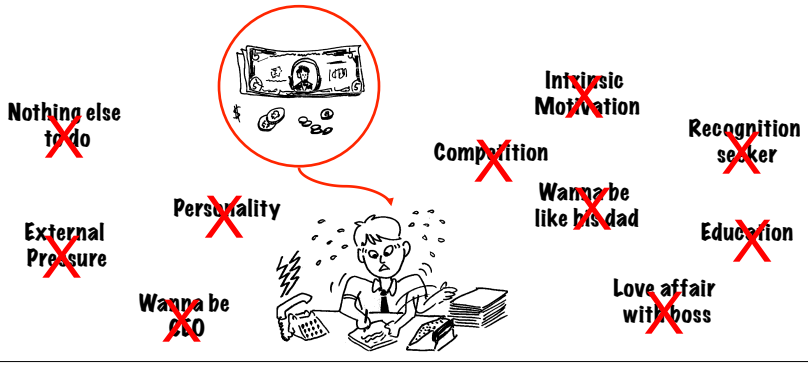
Experimentation in a nutshell

How can we prove that A causes B?
By showing that ONLY A and no other variables cause B!



Experimentation in a nutshell

In other words, we have to show that A causes B while eliminating all other possible influences on B.



Experimentation in a nutshell

The ultimate goal in experimentation is to isolate and control the influence of ALL other variables so that only A could have caused B.

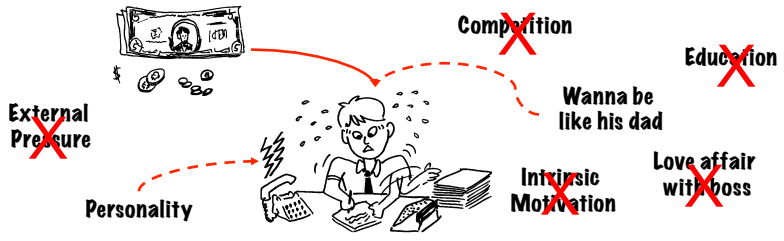
Internal validity

There are no variables other than A that could have had an effect on B.

Experimentation in a nutshell

Threats to Internal validity

Some experimental designs allow for **alternative explanations** of what have caused B in addition to A.



Threats to Internal Validity

The 8 mortal sins
(Campbell&Stanley)

Maturation
History
Instrumentation
Regression
Testing
Selection
Mortality
Interaction of Selection and Maturation

Pre-experimental designs

- The One-Shot Case Study
- X O

\+ No advantages from experimental perspective

− No control of internal or external validity

Pre-experimental designs

- **The One-Group Pretest-Posttest Design**
- **O_1 X O_2**

Internal Validity

- \+ Selection, Mortality
- – History, Maturation, Testing, Instrumentation, Interaction Selection & Maturation, (Regression)

Threats to Internal Validity

- **History**

Hypothesis: **O X O**

Rival Hypothesis: **O Historical Event O**

- Events that take place during the course of research that influence the posttest scores.
- Can be different in different groups!

Threats to Internal Validity

- **Maturation**

Hypothesis: **O** **X** **O**

Rival Hypothesis: **O** **Natural Changes in Subject** **O**

- Naturally occurring changes in person over time that influence the posttest scores.

Threats to Internal Validity

- **Testing**

Hypothesis: **O** **X** **O**

Rival Hypothesis: **O** ⟶ **O**

- Pretest measurement influences posttest measurement

Threats to Internal Validity

- **Instrumentation**

Hypothesis: **O X O**

Rival Hypothesis: **O Changes in measurement instrument O**

- Differences in how scores in pretest and posttest were measured.

Threats to Internal Validity

- **Regression toward the mean**

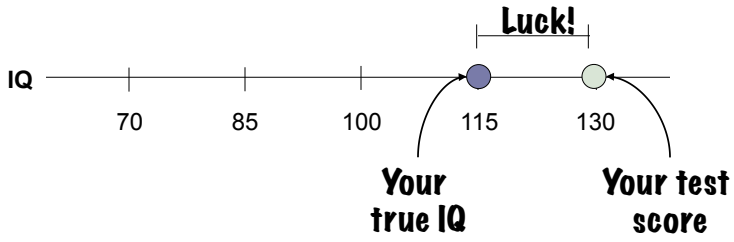
Hypothesis: **O X O**

Rival Hypothesis: **O Statistical regression O**

- Extreme scores in the pretest tend to regress toward the mean in the posttest

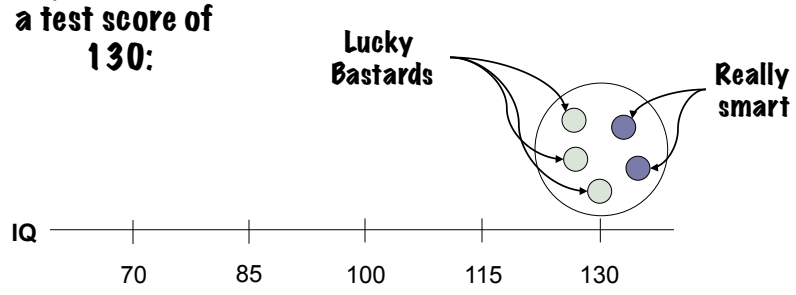
Regression toward the mean

Any psychological measurement is imprecise.
Your score is partly determined by chance.



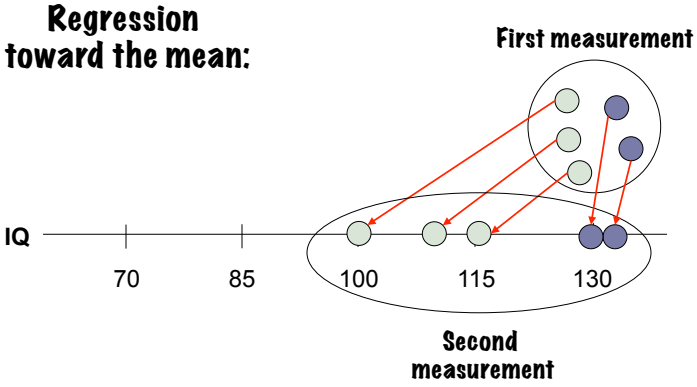
Regression toward the mean

People who have a test score of 130:



Regression toward the mean

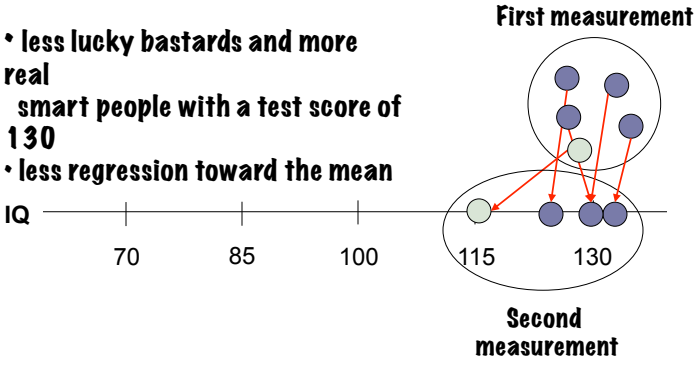
Regression toward the mean:



Regression toward the mean

A more precise test means:

- less lucky bastards and more real smart people with a test score of 130
- less regression toward the mean



Pre-experimental designs

- **The Static-Group Comparison**
- **X** O_{1A}

  O_{1B}

Internal Validity

+ History, Testing, Instrumentation, Regression

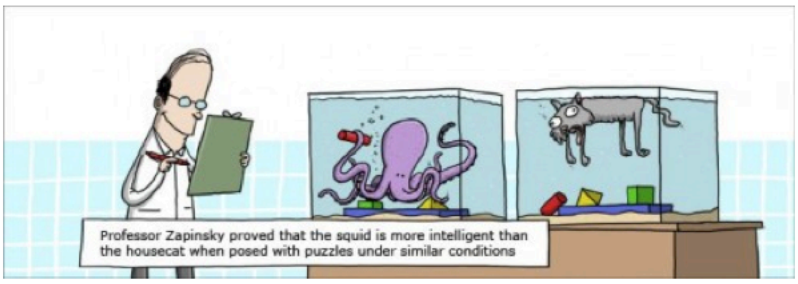
− Selection, Interaction of Selection & Maturation

Threats to **Internal Validity**

- **Selection**

Hypothesis:	(O)	X	O	Differences due to treatment X
	(O)		O	
Rival Hypothesis:	(O)		O	Differences due to unequal groups
	(O)		O	

- Differences in posttest scores exist because of preexisting group differences

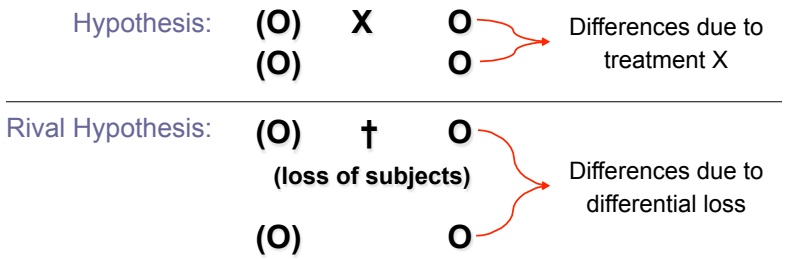


Random assignment

- The only way to make two or more groups equal **on all possible differences**
- Random assignment is not random sampling
- Techniques based on assignment rules are no random assignment
- The larger the sample, the less likely are failures of randomization

Threats to Internal Validity

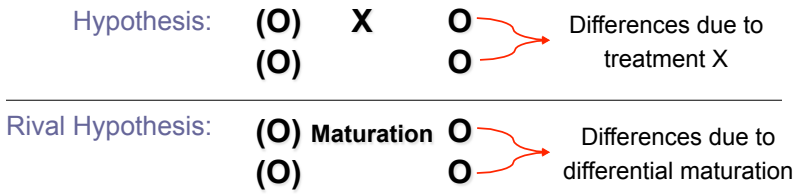
- **Mortality**



- Attrition of participants is different in experimental and control group
- Differential mortality cannot be ruled out by random assignment

Threats to Internal Validity

- **Selection by maturation**

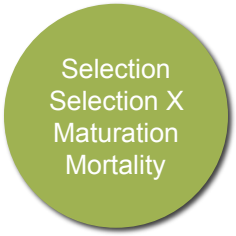


- Differences between groups that cause changes in the groups at different rates

Threats to Internal Validity

Non-treatment factors that change participants and their scores

Factors that do not change participants but do change average scores on the posttest



Factors that challenge the assumption of equal groups

Experimental Designs

- Goal is to demonstrate that IV caused DV
- Have control over extraneous variables (via control group)
- Make sure groups are equivalent (via random assignment)
- Can manipulate IV

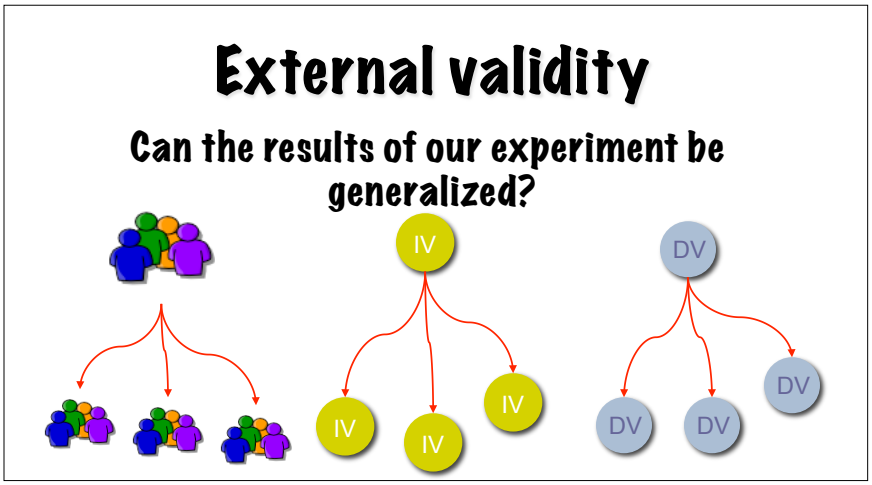
Experimental designs

- **The Pretest-Posttest Control Group Design**
- $R \quad O_{1A} \quad X \quad O_{2A}$
  $R \quad O_{1B} \qquad O_{2B}$

+ Control of all threats to internal validity

− External validity: Interaction of (Pre)-Testing and X

Experimentation in a nutshell

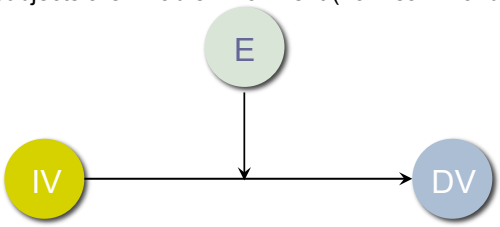


External validity a la Campbell

- Interaction of IV with elements of the experimental situation itself
- Think of experimental situation as a set of moderators we don't like
- **Threats to external validity:** The IV causes the DV…

…only when…

…the experimental sample is tested (no 'real' people).
…subjects are primed by pretest (no 'real' conditions).
…subjects are in lab environment (no 'real' world).



Experimental designs

- **The Salomon Four-Group Design**
- ***R*** O_{1A} **X** O_{2A}
  R O_{1B} O_{2B}
  R **X** O_{2C}
  R O_{2D}

\+ Control of all threats to internal validity & Interaction of Testing and X

\− ???

Experimental designs

- **The Posttest-Only Control Group Design**

- ***R*** **X** O_{1A}
  R O_{1B}

+ Control of all threats to internal validity & Interaction of Testing and X

− ???