

AMS 7 - Lecture 4.19.18

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* ANNOUNCEMENTS

→ LSS Tutoring

Wed 5:30-6:30pm

Fri 2:45-3:45pm

Sign up on
sigug success

* Small groups 8 or less

→ MSI sessions

Just show
up!

Questions >>> email Evan H. (ehetland@ucsc.edu)

THIS TIME: Experimental Design

NEXT TIME: Probability

L-69

Psychobiology case study

▷ Goal of assignment of experimental subjects to treatment (T) or control (C)

↳ T & C groups should be as similar as possible in all relevant ways EXCEPT for T/C distinction

* Simplest method to achieve this GOAL is to assign to T or C at random

Deer & CWD

Population (Deer)

Unsample } Sample
 U } S

Control Treatment

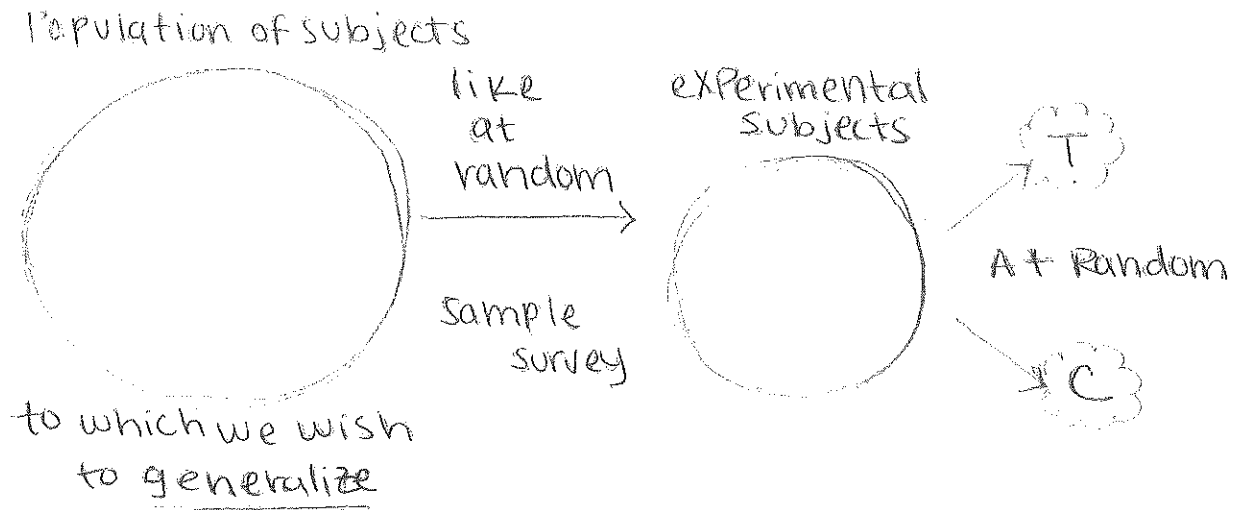
1925 R.A. Fisher (UK)

↳ Promoted random assignments along with

J. Neyman

4.19.13

(2)



→ Completely randomized design (CRD)

* A design is VALID if it is unbiased

* A design is unbiased if...

a) no bias has crept in when (e.g.) assigning subjects to T/C & choosing subjects in first place

b) If many people replicated our design, an average across these replications, you would be able to identify the truth

* bias = a systematic tendency to get wrong answer on high or low side

• Is CRD valid? (for drawing cause & effect conclusions)

↳ yes, no bias anywhere to be seen

• Might there be other designs that are also valid but more accurate than CRD?

↳ yes

outcome variable (Y)

treatment variable (X) (supposedly causal factor)

SCF

Potential confounding factor (Z)

PCF

(3)

* In experimental design, PCFs are the enemy, because without controlling for them, they can bias the causal results

→ How to test if a Z is a PCF

1) might it be true that Y, Z are associated with each other (either positively or negatively)

if yes, passes first test.

2) Might it be true that Z & X are associated?

if yes, to both, 1 & 2, Z is a PCF

PLAN AREA...

Two variables U & V are associated if, when one goes up, the other tends to go up or down

Psychobiology case study

Y → cortex weight

X → Psychological environment enriched T vs. deprived C

Z → Genetics

▷ CRD defeats PCFs by breaking link between X & Z

* to defeat PCFs even more thoroughly, hold them constant in the T/C comparison

↳ a genetically pure strain of rats

↳ chose litters at random

↳ from any chosen litter, with 22 males, they chose 2 males at random: (T, C)

* assignment inside each pair was at random

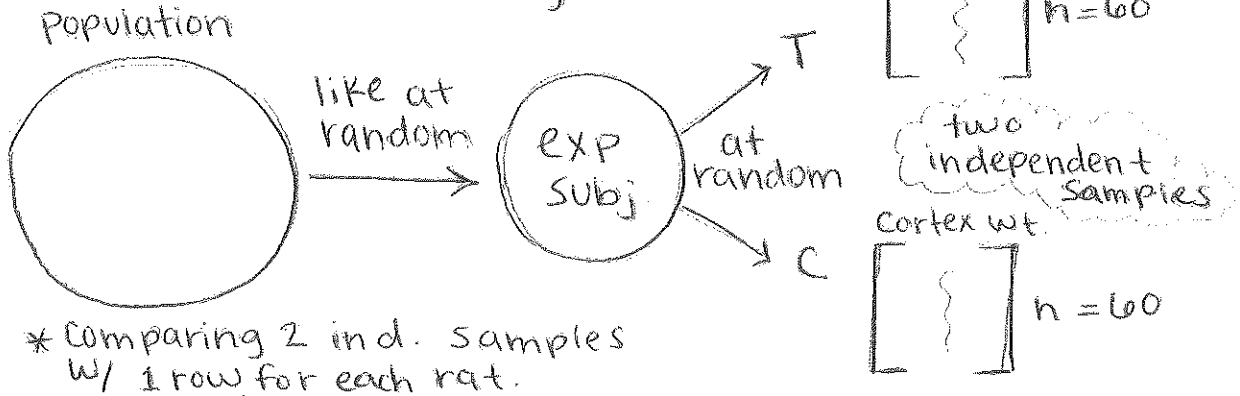
NB All rats were male

Not completely randomized...

More accurate

4

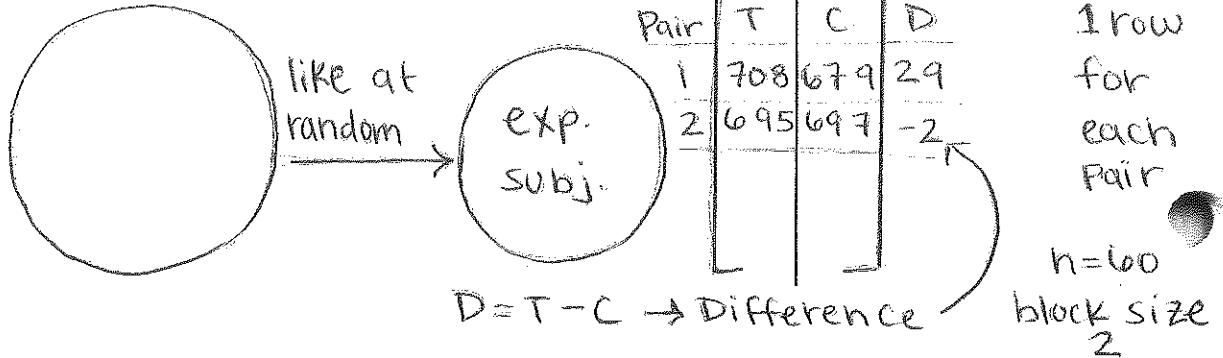
* CRD → analyze T, C columns independently



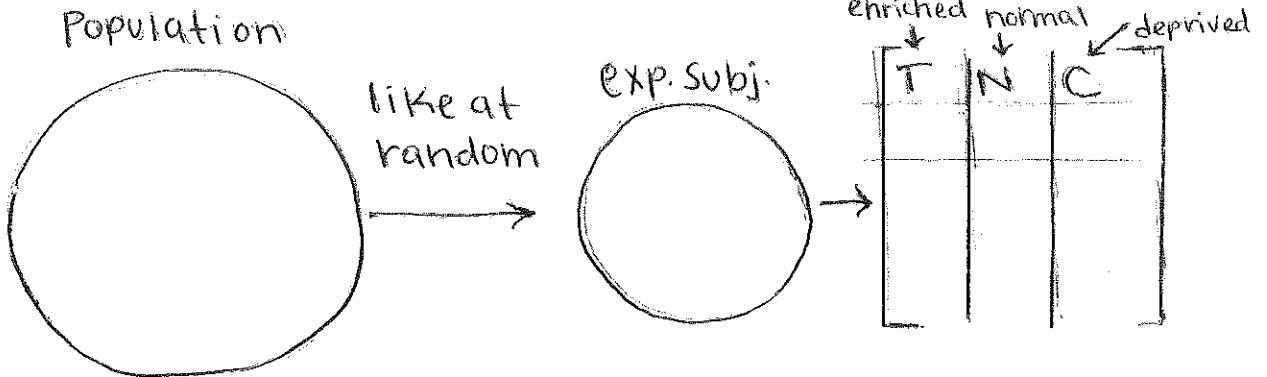
* Comparing 2 ind. samples w/ 1 row for each rat.

Population

* Matched Pairs Design



* Randomized Blocks



- CRD: valid, not as accurate as possible
- Randomized Blocks design: valid, likely to be more accurate than CRD
 - ↳ special case: Matched Pairs design
 - randomized blocks with block size of 2.

▷ Repeated measures design

ex: T = drug to help with insomnia

outcome Y : hours of sleep

treatment X : take new drug vs don't take it

↳ or take current

* take T & C pills look identical best drug

→ IF C pill has no active ingredient, it's called a placebo

* Reason for worry : Placebo effect

↳ People tend to respond to the idea of treatment, in addition to or instead of the T itself

* Hawthorne effect

↳ People change behavior when they know they're being watched

* Blinding subjects to T/C status

↳ T, C pills look identical

* also good idea to blind experimenters to T/C status

* Both blinds : Double-blind experiment

• often not ethically possible to randomize people

↳ T (smoking) vs. C (not smoking)

Y : health status (lung cancer? heart disease?)

X : T (smokers), C (nonsmokers)

Z₁, Z₂, ... lots of PCFs (observational studies)

R-36

Flowchart for classifying Experimental Designs

* randomized controlled trials
strongest design

CRD
simple