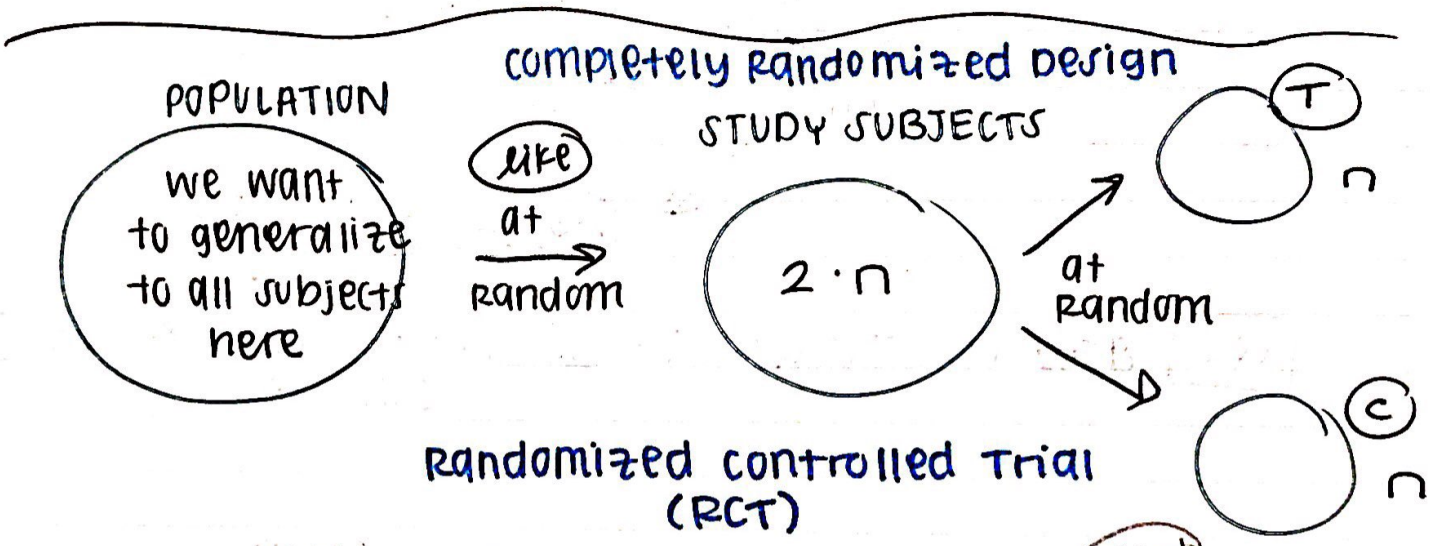
DESIGN & PROBABILITY (10/22/19)

Read: DD
(A) chpt 1-3
(B) chpt 1-8

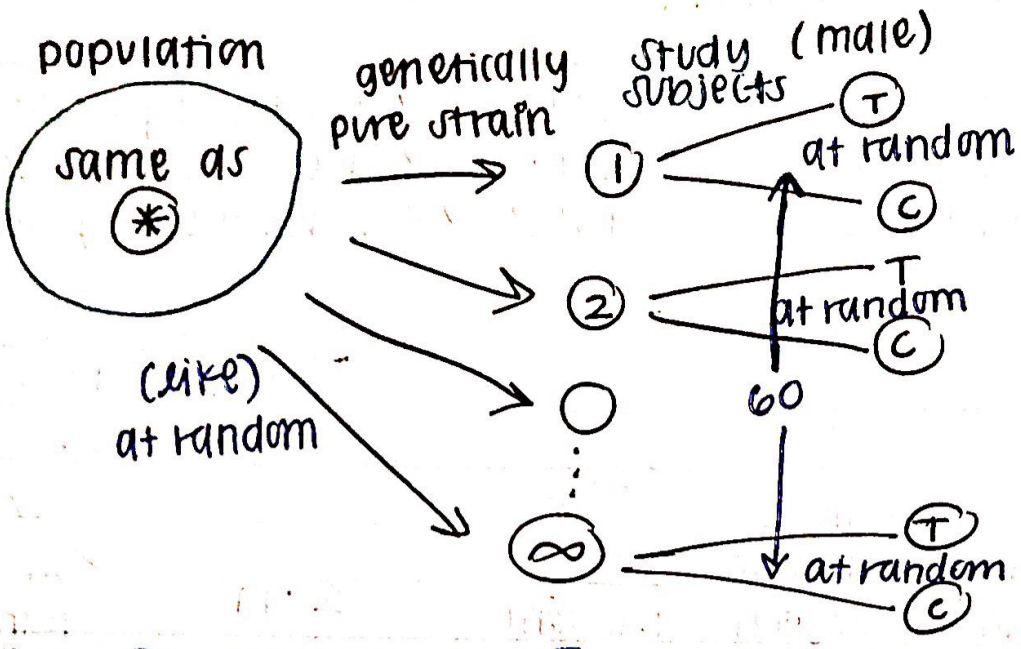
Quiz 3 → due Friday night 25th Oct
Quiz 4 → due Tuesday night 29th Oct
HW 2 → due Wednesday night 30th



DEFINITION

An experimental design is valid (good) if its unbiased. (L-33)

Q: RCT valid?
A: yes (CRD)



Q: Do changes in $\underline{X}$ cause changes in $\underline{Y}$?
(effect)

$\underline{Z}$: potential confounding factor (PCF)

here $\underline{Z}$ = genetics

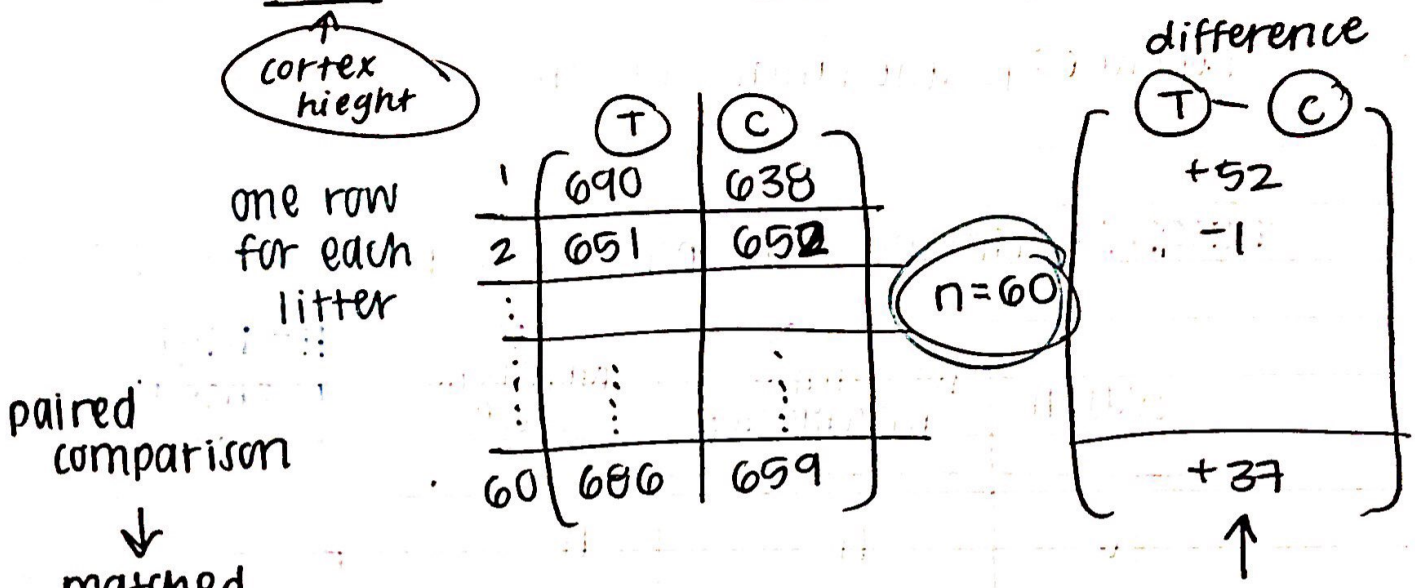
Definition Z is a PCF if and only if

(a) $\underline{Z}$, $\underline{Y}$ could be associated

(b) $\underline{Z}$, $\underline{X}$

How to: defeat a PCF | Hold it constant

2 moments to achieve this defeat:
① at design time ② at analysis time



Q_1: is this paired comparison design valid?

A_1: Yes, its unbiased

Q_2: Is paired design likely to be more accurate than CRD?

Kill PCF by hoping randomization bar made T, C groups similar on PCF this will happen high probability

A_2: Yes, because paired design kills PCF by holding it constant

$\bar{x} - \bar{y}$

New Question: If $\bar{x}$, $\bar{y}$ associated, is it always time that either $\bar{x}$ is causing $\bar{y}$ or $\bar{y}$ is causing $\bar{x}$

$\bar{x} \rightarrow \bar{y}$

$\bar{x} \leftarrow \bar{y}$

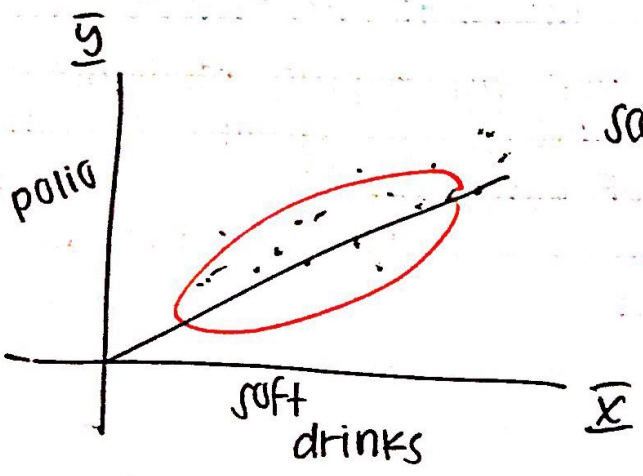
Rephrase: is association = causation?

THEORY: drinking soda pop causes polio to be spread

season	$\bar{x}$ soft drink consumption	$\bar{y}$ new polio cases
Su	H	H
F	M	M
W	L	L
Sp	M	M

H = high
M = medium
L = low

Q: Are $\bar{x}$, $\bar{y}$ associated?
A: yes



scatter plot

association is (+)

Q: does this prove that $\bar{x}$ causes $\bar{y}$?

A: no; this story was wrong

association ≠ causation

$\preceq$ ← weaker than or equivalent to

Q: Why isn't assoc. = causation?

A: PCF's

CASE STUDY R-35 : The contraceptive drug study

outcome $\overline{y}$	treatment $\overline{x}$	
blood pressure	1 = pill use	(T)
	0 = not	(C)

if obs. study, then worry a lot about PCFs

(T) b.p.

mean
SD
Histogram

(C) b.p

mean
SD
Histogram

z_1 age is a PCF

age ↑ b.p ↑ ✓

age ↑ ↓ ✓

If we don't hold age constant
("control for the PCF z = age")
this will bias results to make pill
look less harmful than it really is

After controlling for age, pill use associated w/ 5mmHg increase in systolic b.p.

Q: Is this difference practically significant?

A: No if short (time) pill use; yes if long use