this exp. time: design

next time: probability

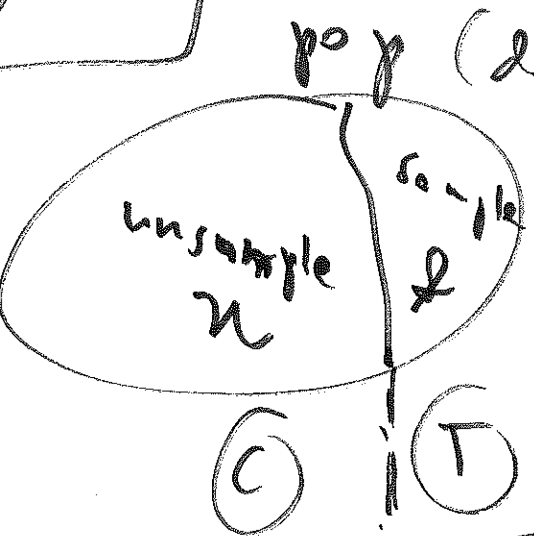
AMS 7 19 April

Q: goal of assignment of experimental subjects to (T) or (C) ①

A: (T) & (C) groups should be as similar as possible, in all relevant ways, except for (T)/(C) distinction

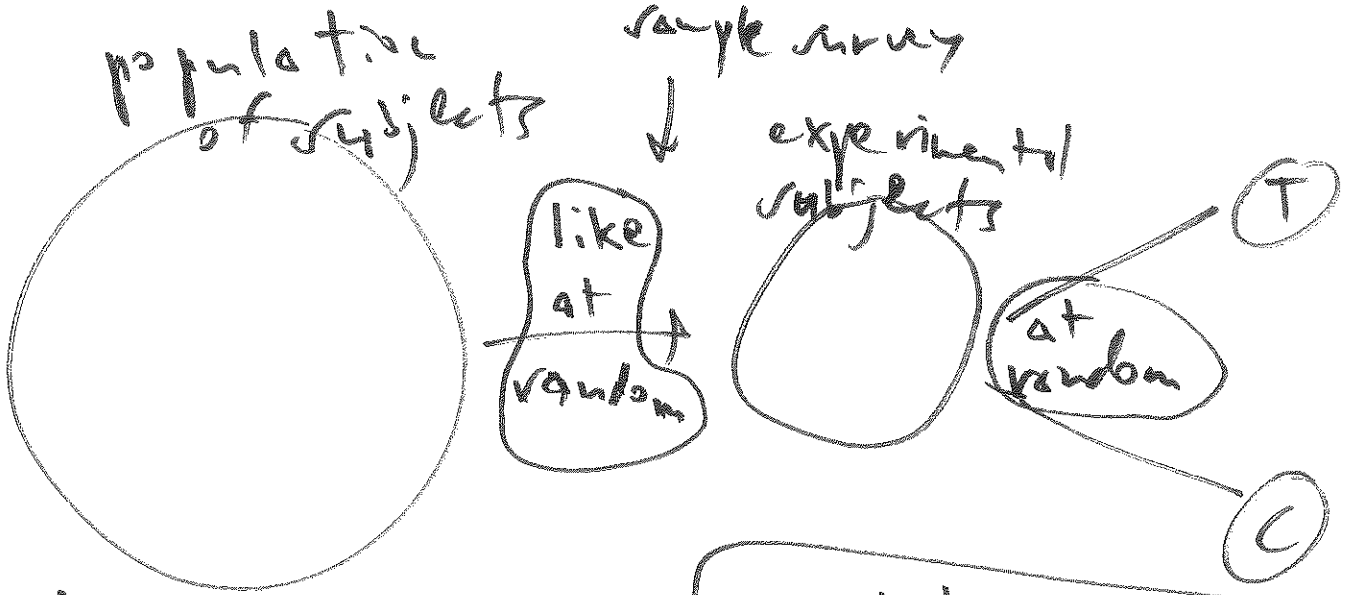
simplest method to achieve this goal → assign to T or C at random

← 1925 RA Fisher (UK)



randomization

J Neyman ~ 1925



to which we wish to generalize

completely randomized design (CRD)

Def: A design is valid if it's unbiased

Def 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)

Def: Bias = a systematic tendency to get wrong answer on high or low side

(b) if many people replicated our design, on average across these replications you would be able to identify truth

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Q1: Is the CRD valid?

A1: yes: no bias anywhere ← for drawing causal & effect conclusions

Q2: Might there be other designs that are also valid but more accurate than CRD?

A2: yes

Y (outcome)

X (treatment) (supposedly causal factor (SCF))

Z1 (potential confounding factor (PCF))

in exp. designs, PCFs are the enemy
because without controlling for them
they can bias the causal results

how to test whether a Z is a PCF

① might it be true that I, Z are associated (either positively or negatively) if yes

② might it be true that Z, I are associated?

if yes to both ① & ②, Z is a PCF

PLAN AHEAD

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

psychobiology case study

I: cortex weight

X: psychological environment enriched (T) vs. deprived (C)

Z: genetics

CPS defeats ref, by breaking links between X & Z

(NB) all rats were male

to defeat ref's even more thoroughly, hold them constant in the T/C comparison

A: for each chow litter with 22 rats, chose 2 rats at random:

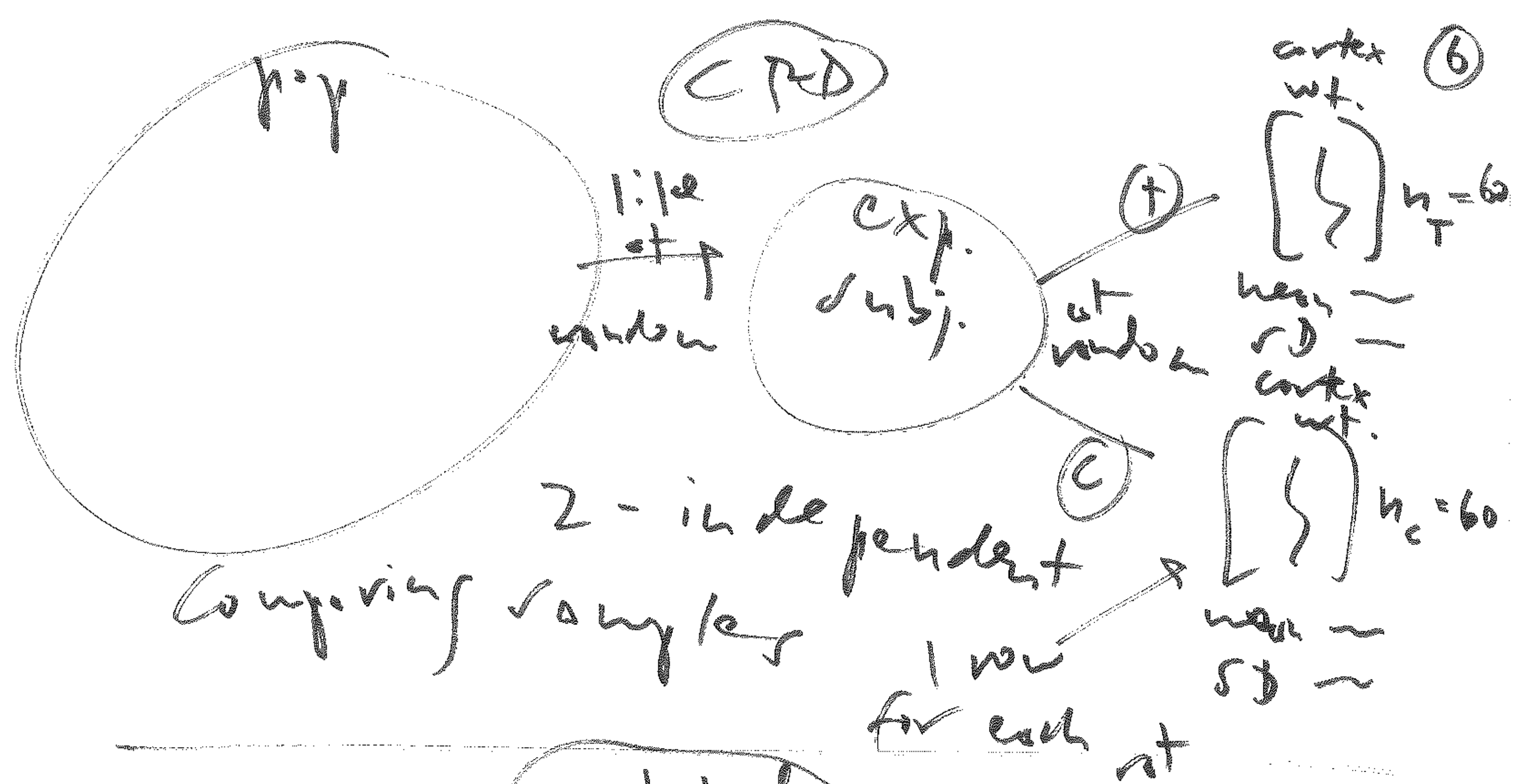
genetically pure strain of rats

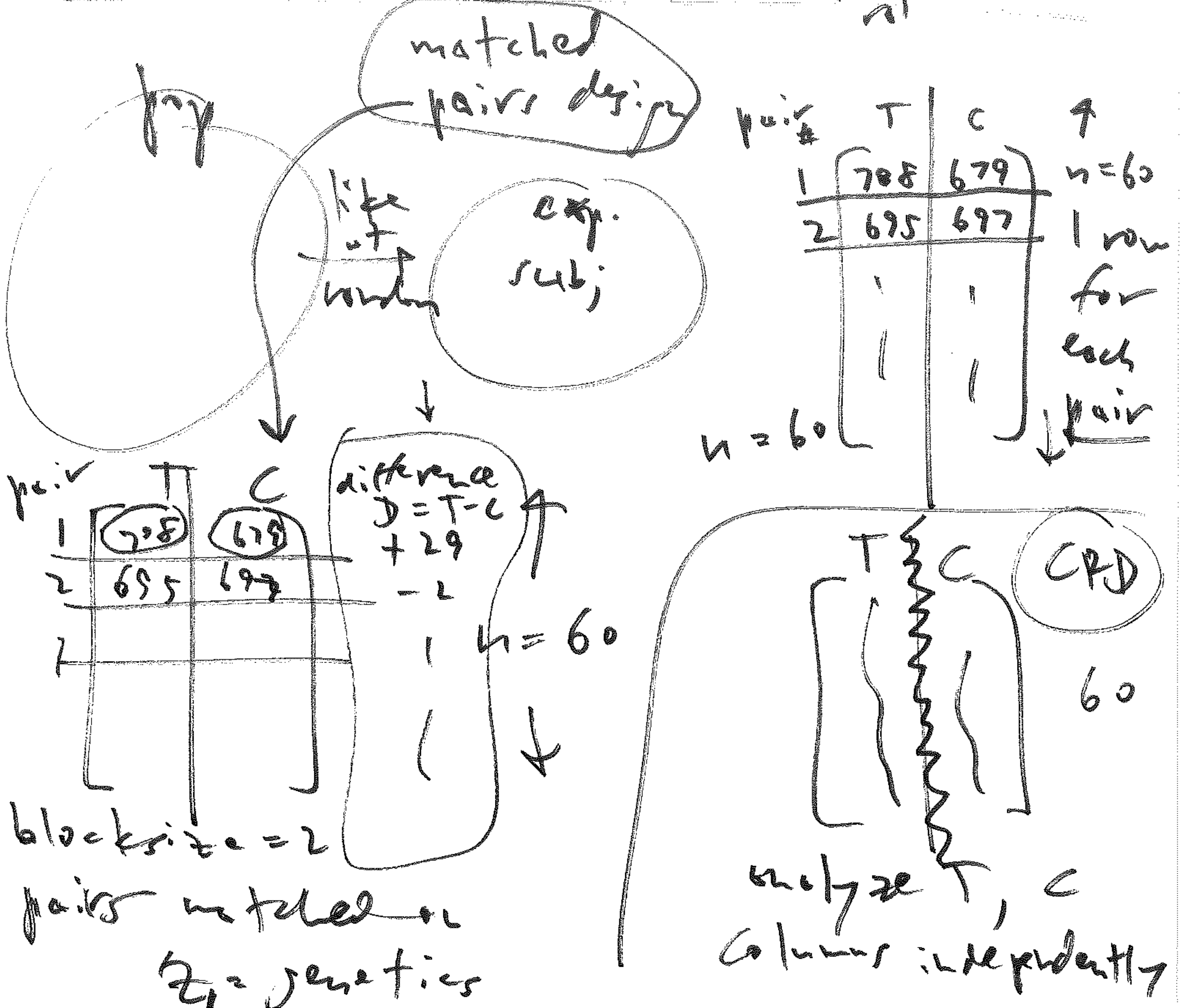
chow litters at random

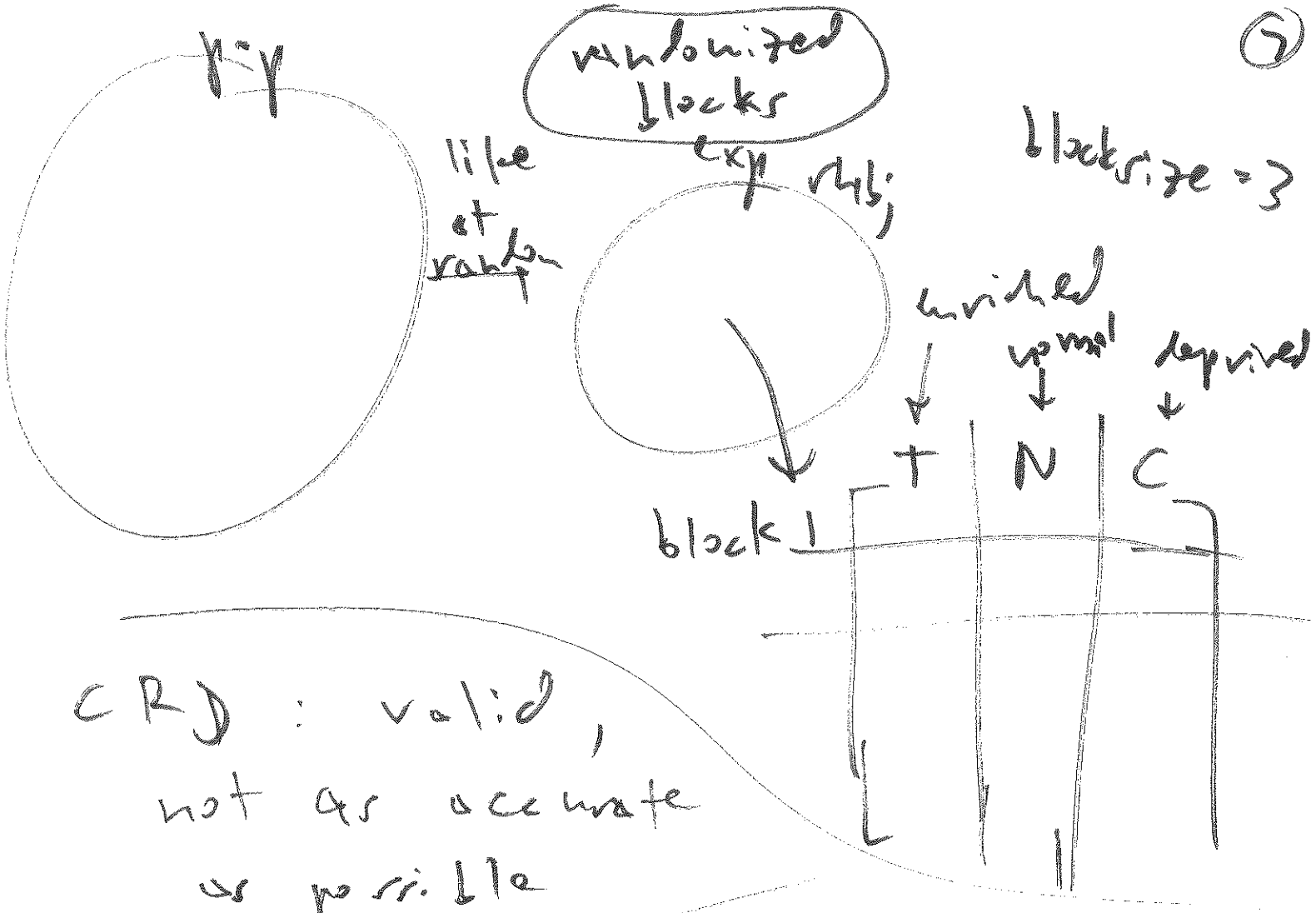
(T C)

assignment inside each pair was at random

6


CRD
pop
like at random
exp. subj.
at random
T
C
cortex wt.
$n_T = 60$
mean ~
SD ~
cortex wt.
$n_C = 60$
mean ~
SD ~
2 - independent
Comparing samples
1 row for each rat


matched pairs design
pop
like at random
exp. subj.
pair # | T | C
1 | 708 | 679
2 | 695 | 697
n = 60
1 row for each pair
n = 60
pair | T | C
1 | 708 | 679
2 | 695 | 697
difference
D = T - C
+ 29
- 2
n = 60
blocksize = 2
pairs matched on
e.g. genetics
T
C
CRD
60
analyze T, C
columns independently



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 blocksize 2)

repeated measures design

ex. T = drug to help with insomnia

outcome I: hours of sleep

treatment S: take new drug vs. don't take it

make T & C pills look identical

take current best drug

if C will have no active ingredient, it's called a placebo

reason for many: 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

T, C pill look identical: blinding

subjects to T/C status

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also good idea to blind experimenters

to T/C status } both blinds:

double-blind experiment

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often not ethically possible to

randomize people to (T) eg. smoking

vs. (C) not smoking

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

X: < (T) smokers
(C) nonsmokers

$Z_1, Z_2, \ldots$ lots of PCFs

} observational studies