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Chapter 2: Experimental Design

2.1: Randomized Controlled Experiments

Does psychological environment affect the anatomy of the brain?

y = outcome (dependent) variable (brain anatomy)

x = treatment (independent) variable (psychological environment)

↖ enriched (1) vs. deprived (0)

- Experiment: Enriched rats (treatment group)
  - 12 to cage, given toys

  Deprived rats (control group)
  - alone, no toys

- Design 0
  - 120 rats, raised until adult maturity
  - all are put in an enriched environment

Factual Data: what actually happens
- mean cortex weight = 683

Counterfactual Data: point of comparison
- mean cortex weight of same rats if they had recieved the deprived environment

What's wrong with this design?
- there is no counterfactual data, nothing to compare the enriched rats to.

Solution: Design 1

- Design 1
  - 120 rats, raised until adult maturity
  - 60 rats put in treatment group (enriched), 60 rats put in control group (deprived)

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- now we can compare the mean cortex weight of the enriched rats to the mean cortex weight of the deprived group

- Potential Confounding Factors (PCF's)
- z = potential confounding factor (genetics)
  - in our experiment, genetics can influence cortex size
- PCFs are the enemy in experimental design because they create bias in the conclusions unless they are controlled for.
  - bias - systematic tendency to over- or under estimate the truth

Causal Diagram:

(Y) ← (X) or (Y) — (X)

x causes y x & y are associated

(Y) ··· (X) z makes X & Y look related

(Z)

positive association: u↑, v↑
negative association: u↑, v↓

- valid - if it tends to get the right answer on average across many repetitions if it has no bias

- To Defeat a PCF:
1) At design time
   - randomly assign subjects to treatment and contrd, this will break link between Z and X
   - hold it constant in comparison between T and C,

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randomization does this, but there's a better way.

2) Matched Pair Design

- use genetically pure strain of rats
- choose 60 litters at random
- choose 2 rats at random from each litter
- assign T and C status in each pair at random

* more accurate, but more work