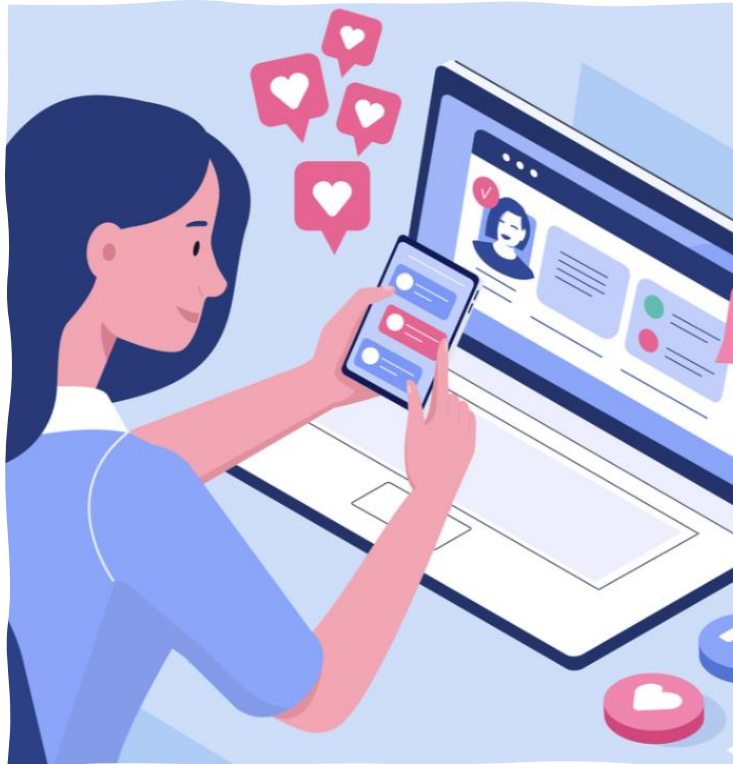




Revisiting Interference

Tuesday, December 3, 2024
INFO/STSCI/ILRST 3900: Causal
Inference

Interference: when an individual's outcome can depend on the treatment take-up of other individuals

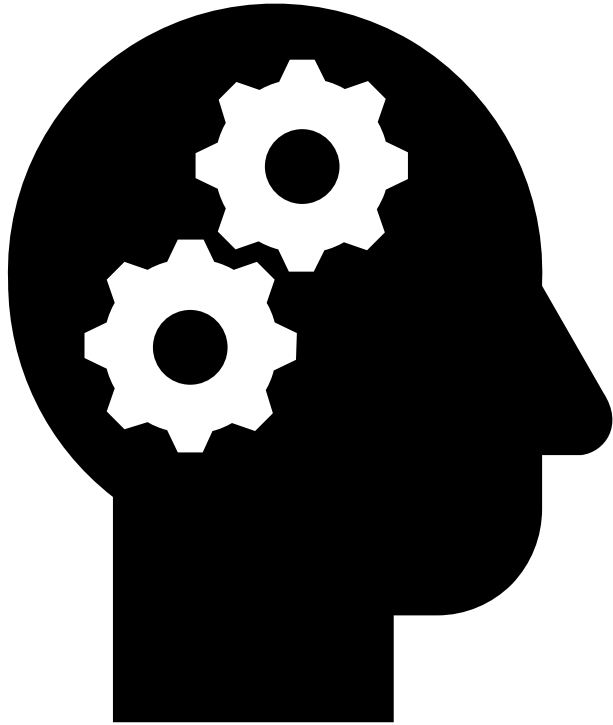


Consistency Assumption

- Observed outcome matches corresponding potential outcome

$$\text{If } A_i = a, \text{ then } Y_i = Y_i^a$$

- Implies no interference: outcome of i only depends on their own treatment assignment A_i
- To encode interference, the notation needs to be updated!



Individual Brainstorm

Thinking about your project
and causal question, could
interference be present?
Why or why not?

Causal Effects under Interference

- Without interference, average treatment effect is

$$ATE = E(Y^{a=1}) - E(Y^{a=0})$$

- Only two potential outcomes to consider
- Under interference, more potential outcomes to deal with

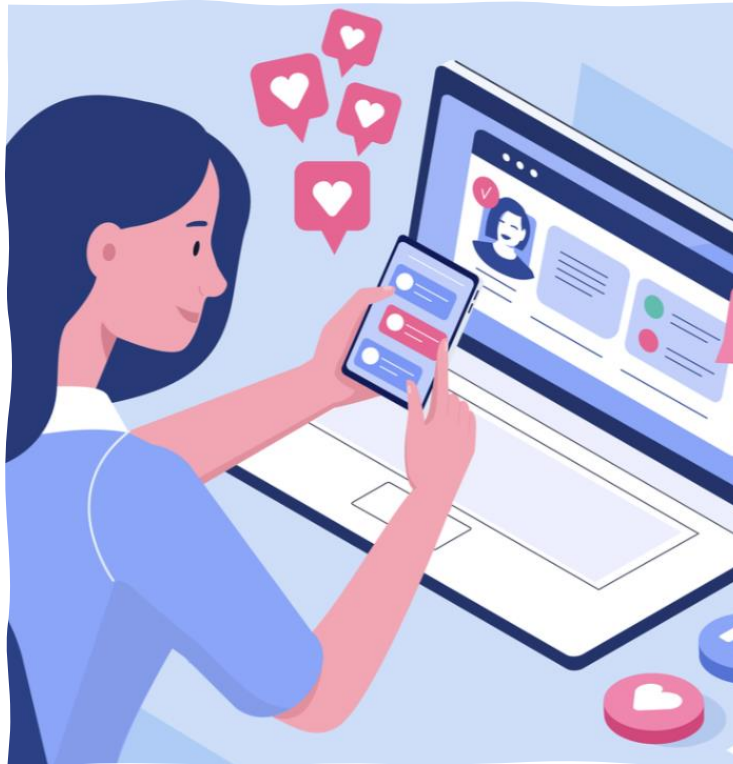
$$Y^{a_i=0, a_j=0} \quad Y^{a_i=0, a_j=1} \quad Y^{a_i=1, a_j=0} \quad Y^{a_i=1, a_j=1}$$

Causal Effects under Interference

- Which potential outcomes should I compare?
- It depends...
- A popular one is the Global Average Treatment Effect (GATE)

$$GATE = E \left(Y^{\vec{1}} \right) - E \left(Y^{\vec{0}} \right) = \frac{1}{n} \sum_{i=1}^n Y_i^{\vec{1}} - \frac{1}{n} \sum_{i=1}^n Y_i^{\vec{0}}$$

Global Average Treatment Effect: compare the two hypothetical worlds where everyone versus no one is treated



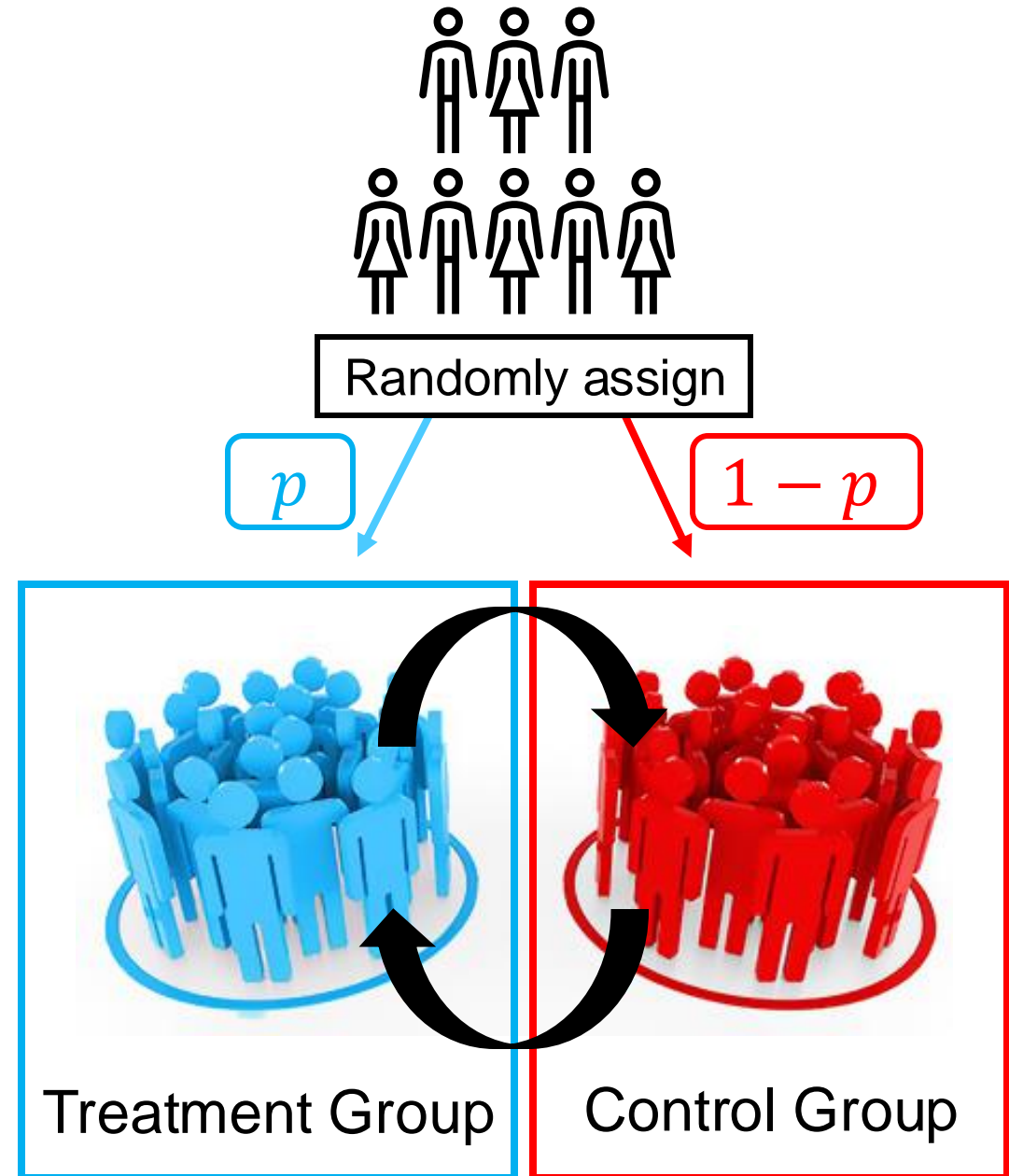


Does interference cause problems?

- We addressed consistency
- We updated the causal effect we are looking at
- Now can we just proceed as normal?

Randomized Control Trial

- Simple experiment with fair coin ($p = 0.5$)
- No confounding (at least not in the usual sense)
- Can we simply compare the means of the treated and control groups?

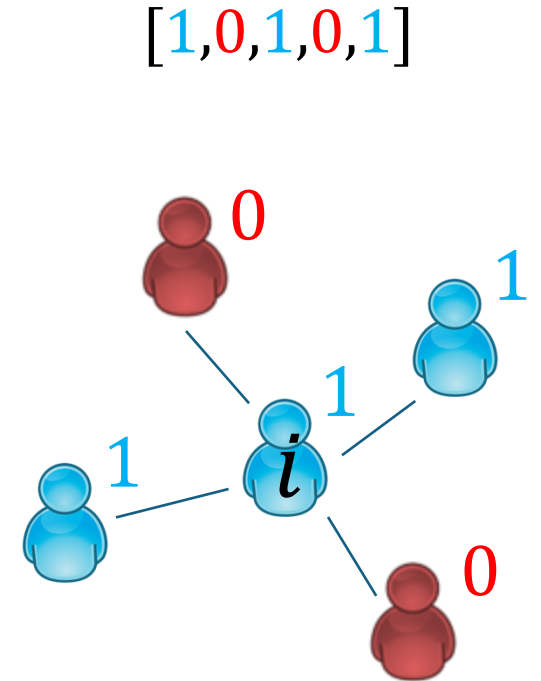


The Problem

$$\begin{matrix} [1,1,1,1,1] \\ = \frac{1}{n} \sum_{i=1}^n Y_i \vec{1} \end{matrix} - \begin{matrix} [0,0,0,0,0] \\ \frac{1}{n} \sum_{i=1}^n Y_i \vec{0} \end{matrix}$$

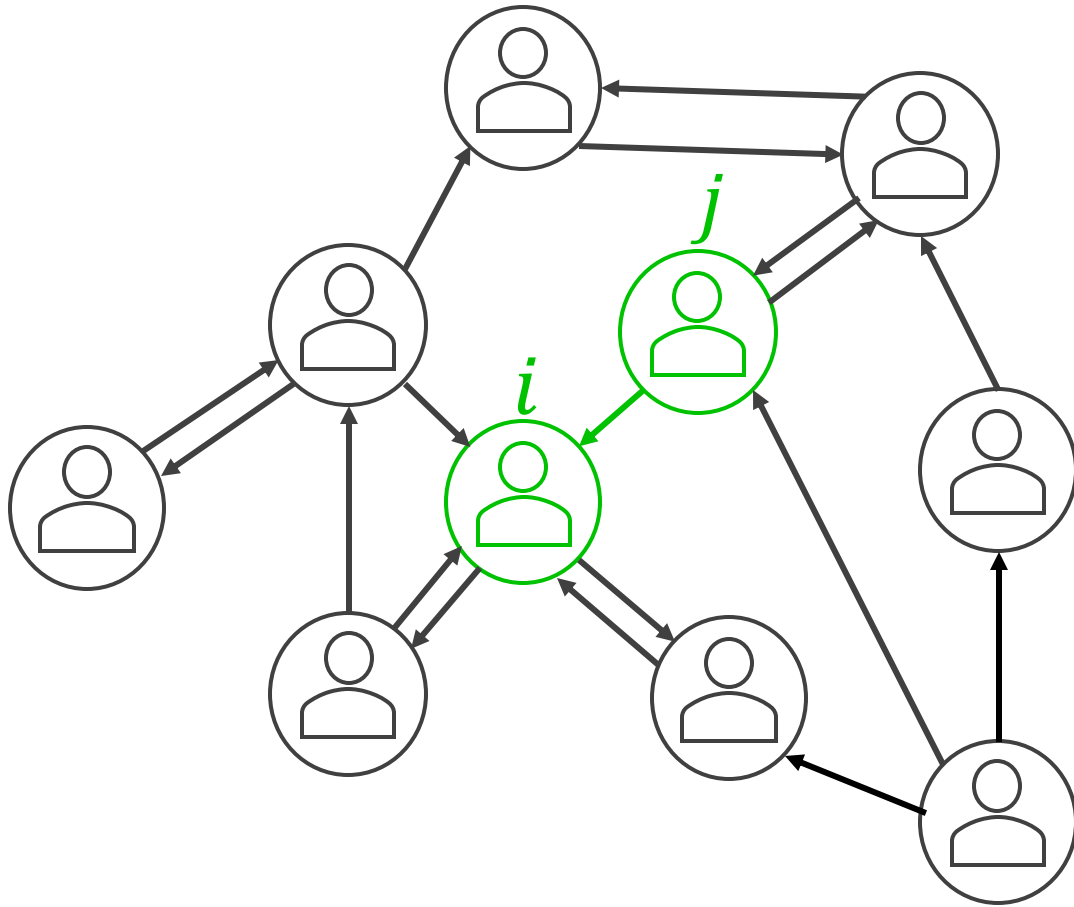
Entire world in
“treatment”

Entire world in
“control”

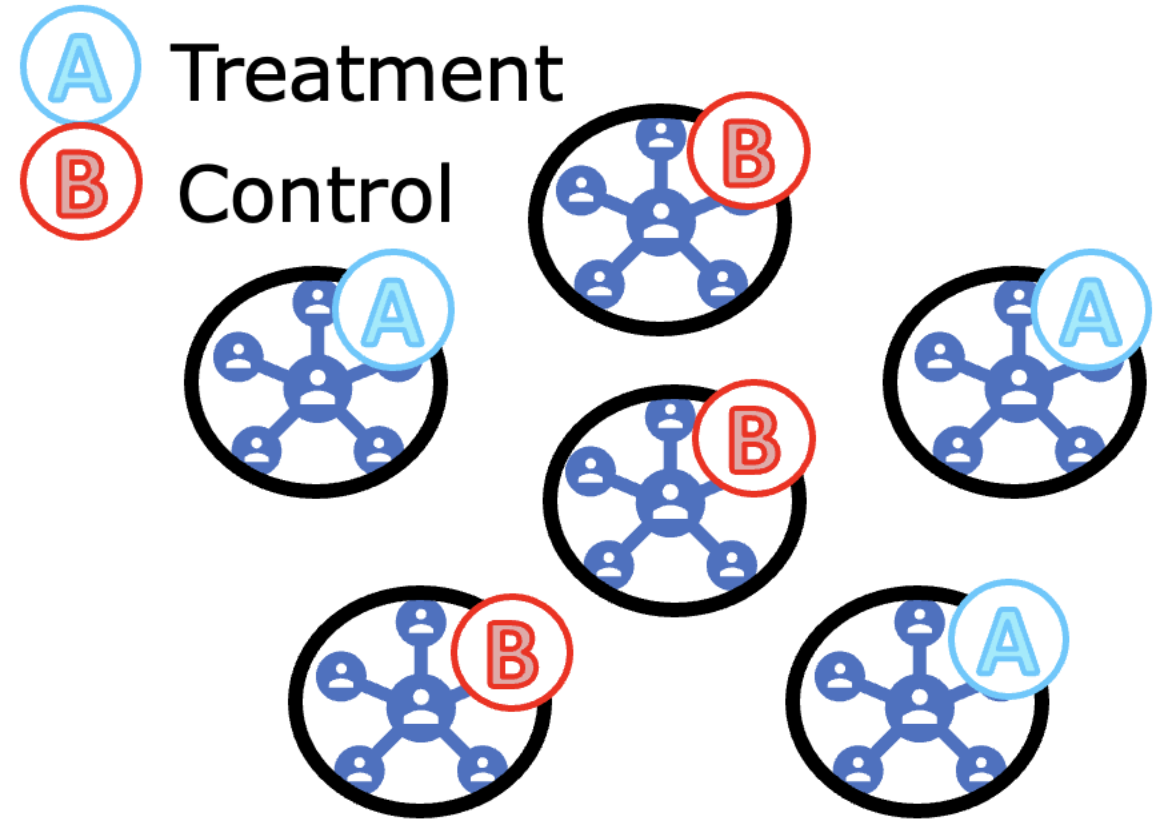


What I actually observe

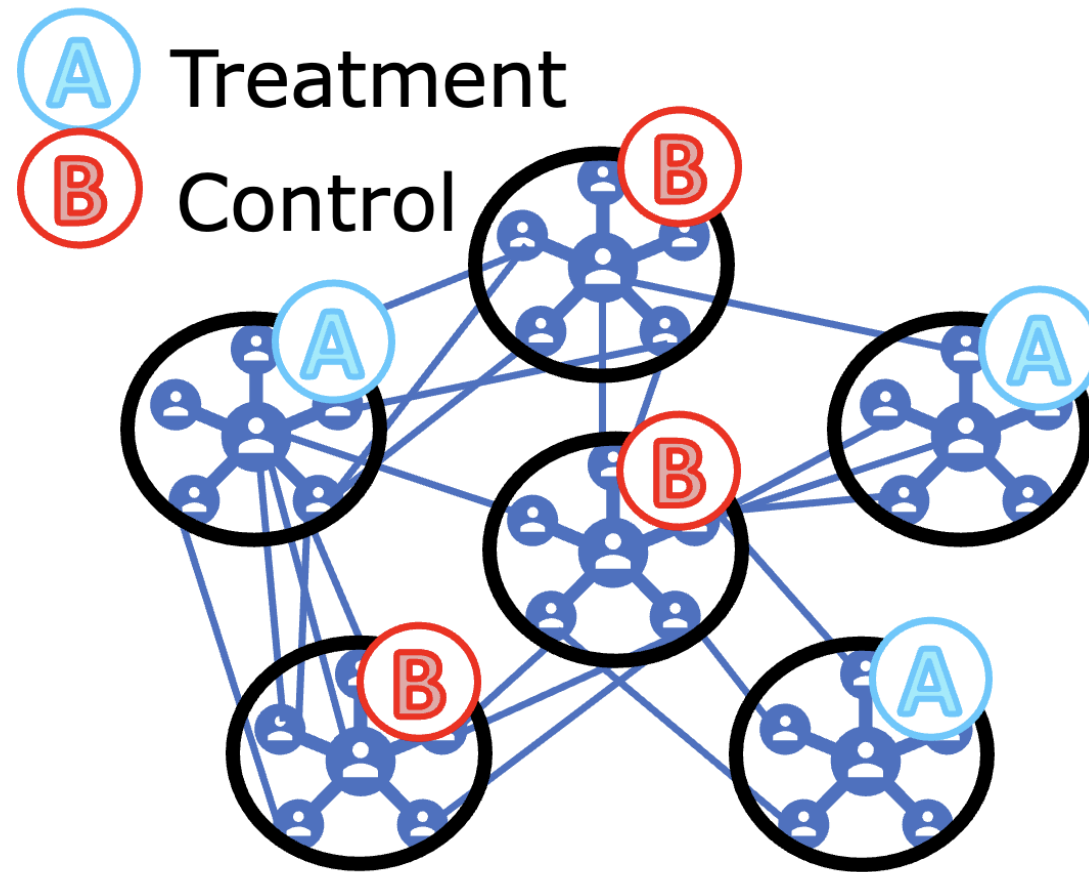
One proposed approach: graph clustering



Edges encode interference



Real world not always that simple...



What assumptions are you willing to make?

Partial
interference

Neighborhood
interference

Spatial
interference

Anonymous
interference

Interference
model

True
interference
network

- Experimental design: how should we collect the data
- Methodology: how do we use the data to get an estimate?

Finish the semester strong

<https://lsc.cornell.edu/finish-strong-2/>

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HELP WITH CLASSES STUDYING TOGETHER HOW TO STUDY FIND YOUR ACADEMIC GROOVE SUPPORT AND RESOURCES

Finish Strong

Finish the semester strong!

Great job with all of your hard work so far this semester! Now, at the end of the semester, it's time to access the resources you need to finish strong. Use the last few weeks of classes to *catch up* and *keep up* with your course work. Because you won't have classes during [finals, time management](#) will be very important, creating structure for yourself and balancing time for sleep, rest, and good nutrition. Finals can be stressful and you'll need to take care of yourself – this is a major part of preparing for any exam. Find tips and strategies for [managing stress here](#).



The LSC is here to help you think through the steps that will work for you. Read on for resources, videos, and the top 10 tips from study skills experts and LSC tutors.