WHAT IS CAUSAL INFERENCE?

PROF. SEBASTIÁN VALLEJO VERA

- This class is Regressions and Causal Inference.

- This class is Regressions and <mark>Causal Inference</mark>.

- Let's take a step back…

THE SCIENTIFIC METHOD

MR. MORTON: IT'S NOT FUN, IT'S SCIENCE.

- What is the scientific method?

- Methods in the sciences systematically studying a specific field.

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- Methods in the (social) sciences systematically studying (scientifically) a specific field (e.g., politics).

- The *systematically* is where we find the scientific method.

THE SCIENTIFIC METHOD

01

Question (relevant to the field)

02

Theory or Model (explaining the theory)

03

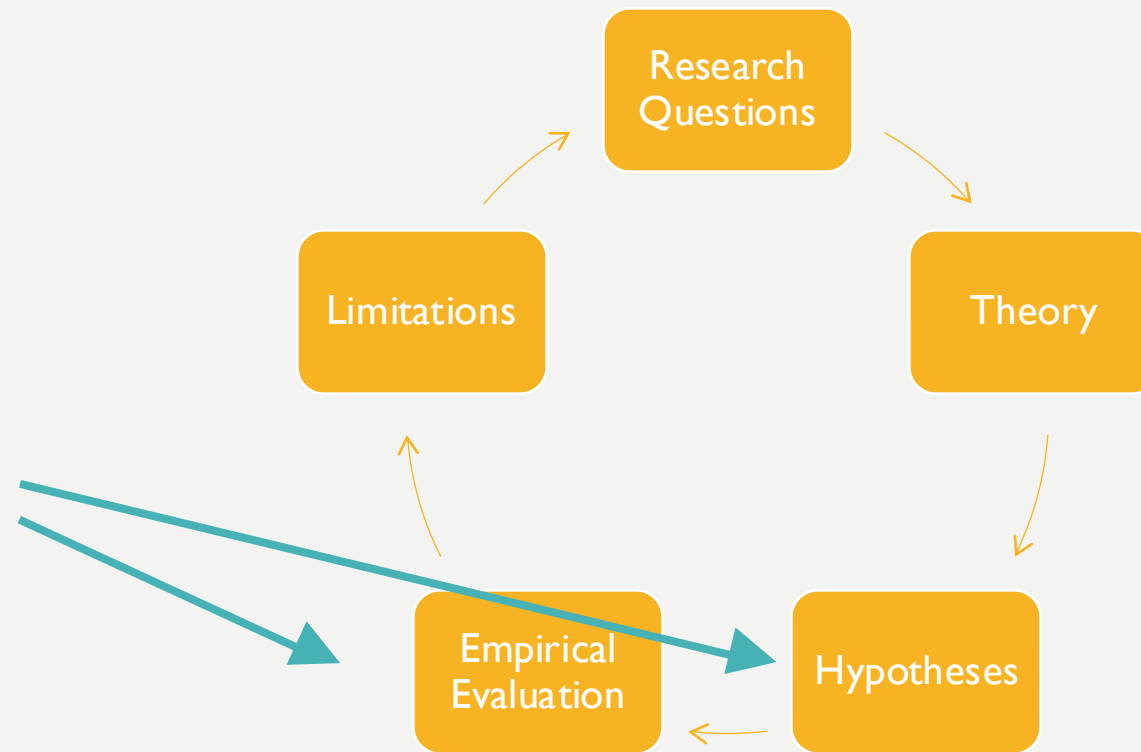Observable Implications (Hypotheses)

04

Observe the World (Reject the Null)

05

Evaluate

MORE THAN ANYTHING, A CYCLE:

Research Questions

Theory

Hypotheses

Empirical Evaluation

Limitations

HYPOTHESIS

(OK, WE ARE TAKING THE LONG WAY TO GET TO CAUSAL INFERENCE, BUT WE WILL GET THERE... EVENTUALLY)

HYPOTHESES

- Hypotheses are the observable implications of our theory.

- In our theory, we explain our understanding of the world and the conditions under which this understanding answers our research question.

- Thus, our theory will have certain observable implications.

- For example, if I argue that democracy requires a strong middle class, an observable implication of my theory would be that… (?)

+ MIDDLE CLASS $\longrightarrow$ + DEMOCRACY
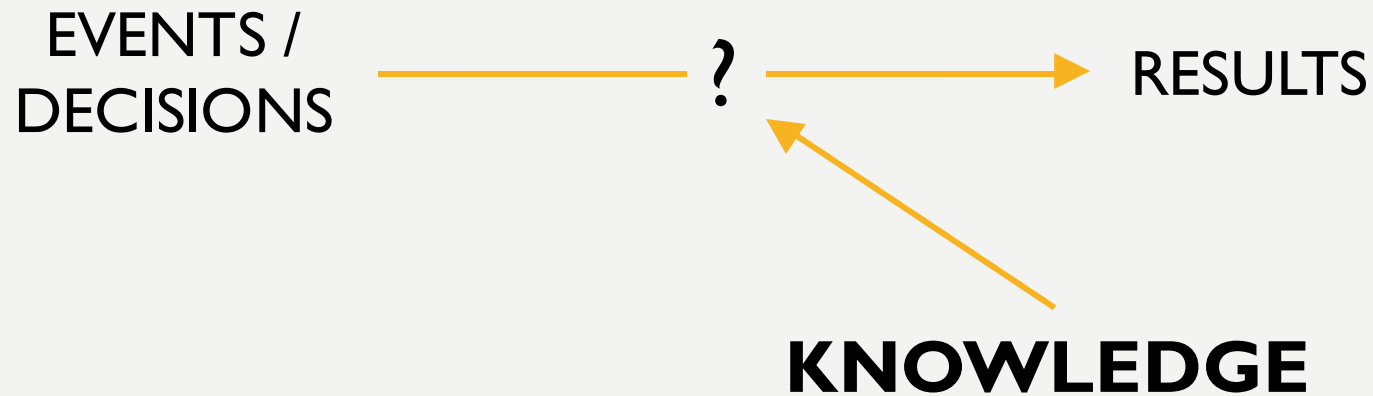
A $\longrightarrow$ B

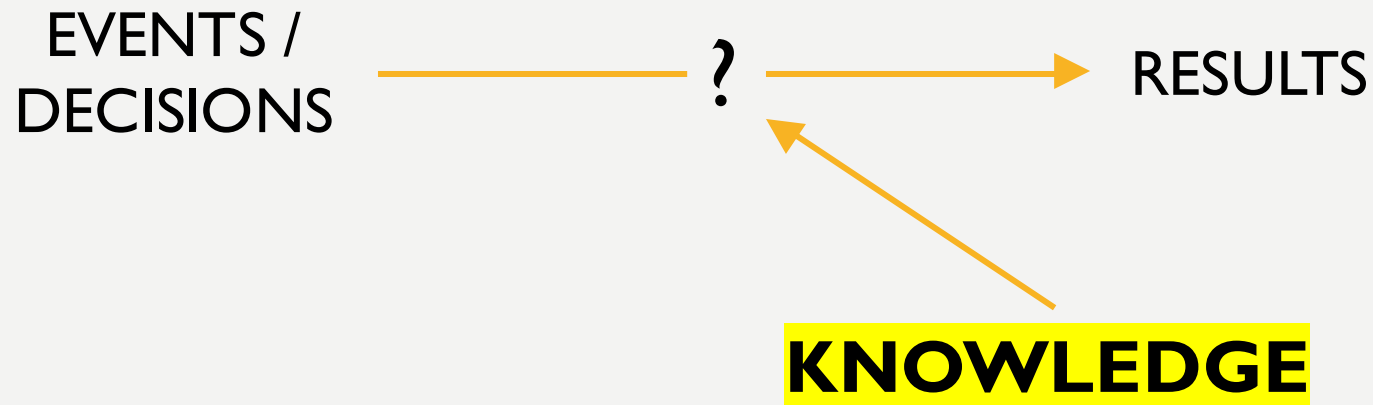# OBSERVING THE WORLD

(GETTING CLOSER TO CAUSAL INFERENCE)

- When we observe the world (i.e., quantitatively and qualitatively) to reject our null, we are also looking for methods that can remove uncertainty around our expectations of A → B.

WHAT IS CAUSAL INFERENCE?

EVENTS /
DECISIONS ——————→ **?** ————→ RESULTS

KNOWLEDGE

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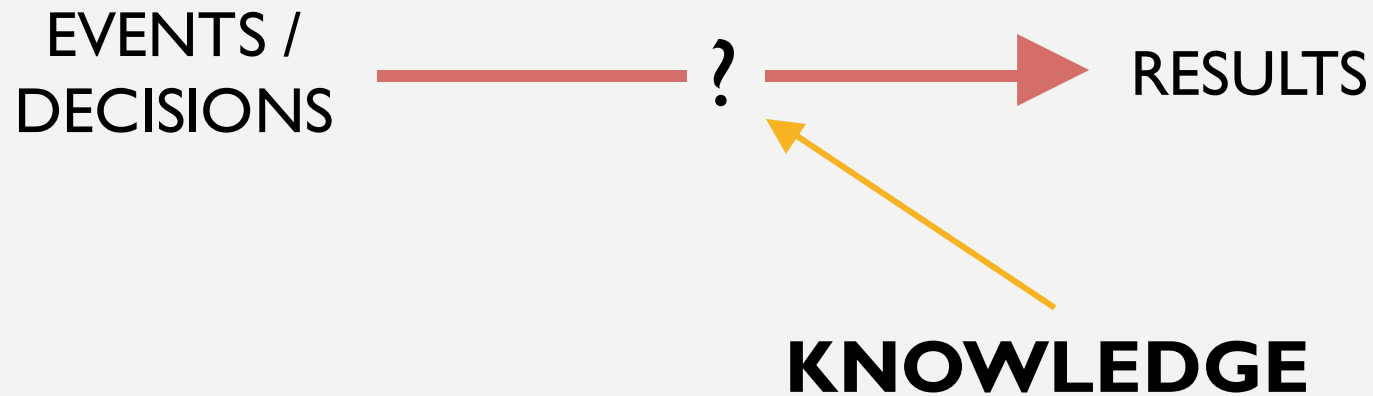DECISIONS ——————— **?** —————→ RESULTS

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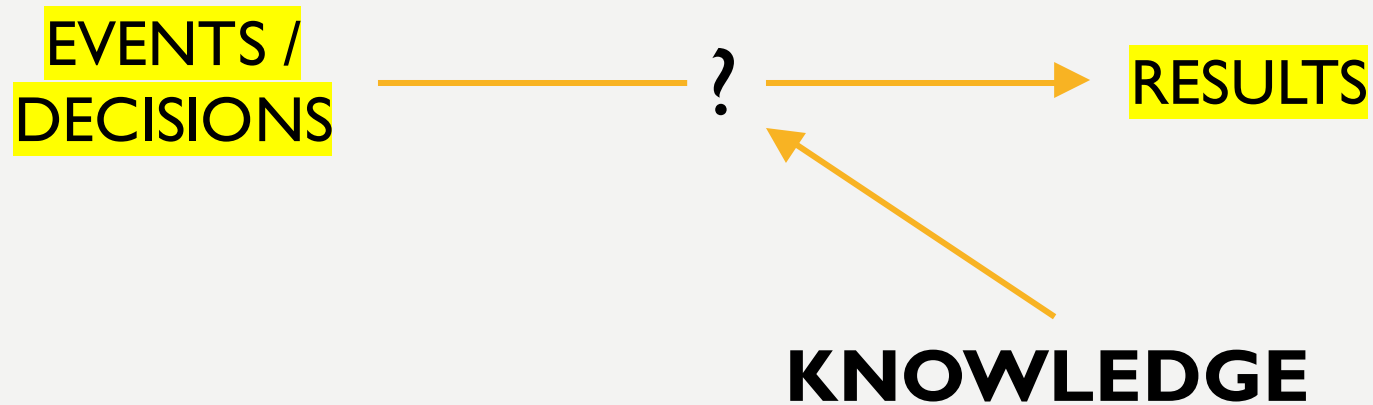EVENTS / DECISIONS ——— **?** ——→ RESULTS

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THE PROBLEM: CORRELATIONS AND CAUSALITY

- Rarely will observational data (the data that we obtain by observing the world) reflect the causal relations we want to prove.

CORRELATION =/= CAUSATION

- Por example:
  - The rooster sings and the sun comes out. Can we **assert** that the rooster makes the sun come out?
  - A couple rents an apartment, and the oven breaks down. Can we **assert** that the couple broke the oven?
  - The most prosperous countries are also the most democratic. Can we **assert** that development makes country democratize?

NO CORRELATION =/= NO CAUSATION

- For example:
  - The Federal Reserve raises interest rates to avoid high inflation. Inflation remains at the same level. The fact nothing happened could be the result of the actions from the Federal Reserve, despite seeing no correlation.

OTHER PROBLEMS: EXPERIMENTAL VS. NON-EXPERIMENTAL DATA

- We obtain experimental data from controlled spaces, similar to the data we obtain in a laboratory setting.

- We obtain non-experimental data (i.e., observational data), from the world we observe.

- When we want to infer causality, what is the problem with observational data?

- That's right! Observational data is endogenous.

- This means that DECISIONS are *not independent* from the RESULTS.

  – Examples?

- In other words, it is difficult to establish a counter-factual: situations where, under the same circumstances, units with the same characteristics would have taken different decisions that led to different results (*what if…*).

- In this class we will learn about causal inference, randomized experiments, and why we can infer causality from randomized experiments.

- We will learn about the problems with observational data, how to estimate correlations in observational data (i.e., through regressions), and how to approach causal inference using observational data (e.g., regression discontinuities, difference-in-difference).

- (We we also learn about best practices when applying these methods).

https://www.youtube.com/watch?v=iZxCjkLS6Mw