Social Science Inquiry II

Week 2: Course introduction, part II

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Is social science *science*?

- In discussing methods for social science research, we should think about what social science is, and what its goals are.
- What is science?
- What is social science?
- Is social science *science*? Why?

Definition of scientific research [KKV]

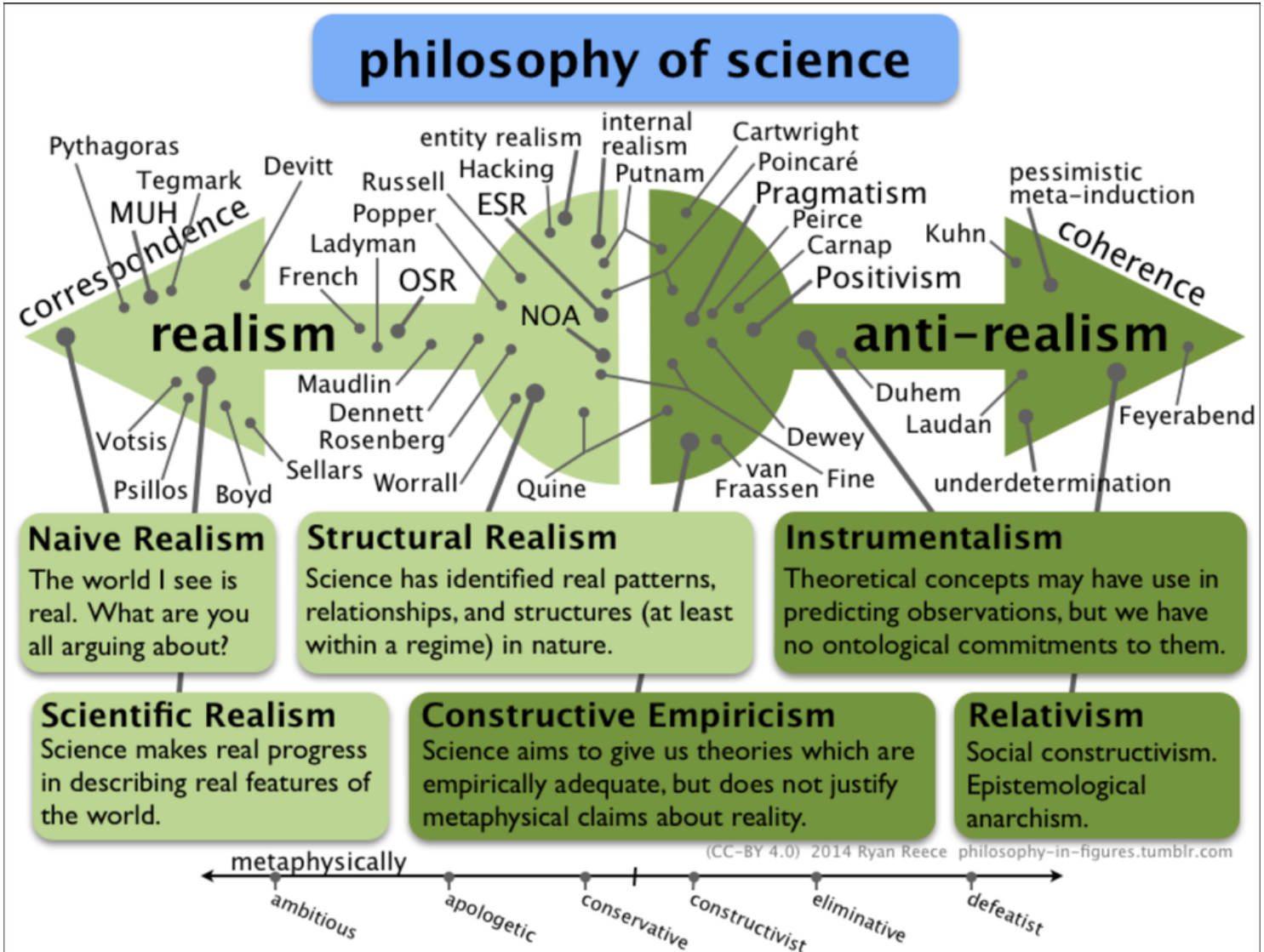
1. The goal is inference.
2. The procedures are public.
3. The conclusions are uncertain.
4. **The content is the method.**

Definition of social science [KKV]

"Social science constitutes an attempt to make sense of social situations that we perceive as more or less complex."

Philosophy of science

- These terms do not have definitions that are universally agreed on.
- . . . and there is a whole field on the philosophy of science.



Approach

- We will focus on study that is empirical, where scientific knowledge is built based on observed, measured phenomena.
- There are other approaches.

The content is the method.

- Claim: Research is science if it uses a scientific method.

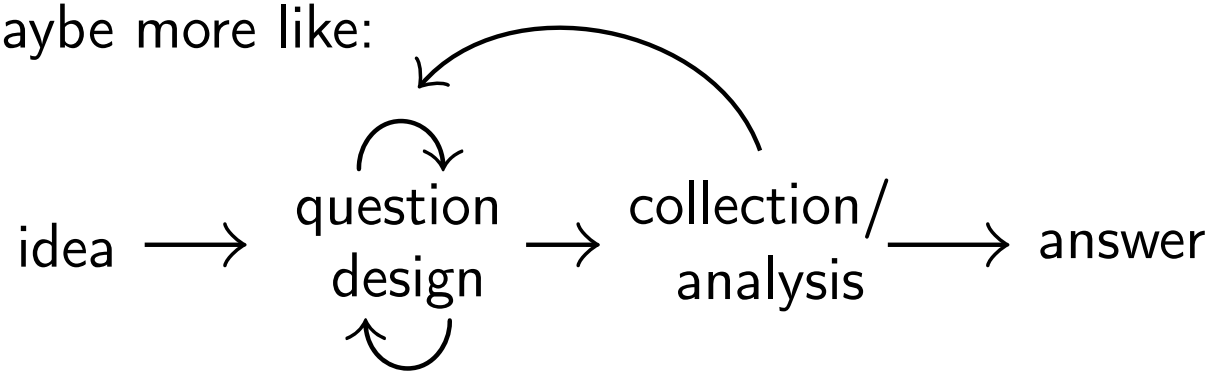
Path of research development

A common linear paradigm for a research project:

question ⟶ design ⟶ collection ⟶ analysis ⟶ answer

Tukey (1980) framing:

Maybe more like:



Proposing theories [KKV]

- Propose theories that are *falsifiable*.
- If you want to be able to test this theory, it should have *observable implications*. (The more the better.)
- Clarity and precision in your theory is helpful.

How does this inform how we think about data?

- Data is not something that is handed down to us in its complete and final form–we select and shape our data.

Principles of data collection [KKV]

1. Record and report data generation process.
2. Collect data on as many observable implications as possible.
3. Maximize the validity of measurements.
4. Ensure that data-collection methods are reliable.
5. Data and analyses should be as replicable as possible.

Observable implications

- What are these?
- How do observable implications relate to causal inference?

Inference

- What is descriptive inference?
- What is causal inference?

Elements of (descriptive/causal) inference [Holland]

- Define a population of interest. U
- Determine a variable that is defined over this population, for which there is variation. A
- Define response variable "of interest." Y

We can consider how A and Y vary together. Without further assumptions, this is just correlation.

What does it mean for something to cause something else?

What does it mean for something to cause something else? [Rubin]

- Possibility for multiple values of treatment–*for each individual*. Treatment *could have been different*. $S(u) = t$ OR $S(u) = c$
- Some temporal element: outcome variable is realized after "exposure" to treatment variable. $S(u) \rightarrow Y(u)$
- Conceptual possibility for multiple different versions of response variable–*for each individual*. $Y_t(u)$ may not equal $Y_c(u)$

Consider the individual *causal effect*

$$Y_t(u) - Y_c(u).$$

No causation without manipulation [Holland]

- Causes are only things that could (hypothetically) be treatments in experiments.
- NOT attributes–e.g., race and biological sex can't plausibly be manipulated, because there is no meaningful *counterfactual*.
  - What we can manipulate: others' *perception* of race/sex (Bertrand and Mullainathan, 2004)
  - To the extent that sex/gender are social constructs, can we consider counterfactual socialization?

Fundamental problem of causal inference

- We only see the response variable under one version of treatment.
- Why does this matter?

Resolution (?) of the fundamental problem of causal inference

- Causal inference is not impossible.
- But making causal inferences without making assumptions IS impossible.
- So we need to depend on some assumptions.
- The crux: how plausible are these assumptions?

Some special cases of causal inference

- Temporal stability
- Causal transience
- Unit homogeneity
- Constant causal effect
- Independence

Temporal stability and causal transience

- The value of response will not change based on *when* you apply treatment to an observation.
- The value of response will not change if you had at some point previously applied a different treatment to an observation.

Unit homogeneity

- The value of response under a given treatment is the same for two observations; and the value of response for a different treatment is also the same.
- You can observe response on the comparable units under one of each version of treatment.

Constant causal effect

- The difference between the value of the response variable under one version of treatment as compared to another version of treatment is the same for *every* observation.
- How does this relate to the unit homogeneity assumption?
- Does this allow us to back out the value of the causal effect, without other assumptions?

Independence

- There are a "large" number of observations.
- On average, the units that are assigned one version of treatment look like the units that receive another version of treatment.
- (What does $\mathrm{E}[Y_s|S = t]$ mean?)

The special role of experiments

- In experiments, treatment is randomly assigned by the researcher.
- So we know independence holds by design.
- We can compare groups and get the *average* causal effect.
- (When can we also get the *individual* causal effect?)

References I

Bertrand, M. and Mullainathan, S. (2004). Are emily and greg more employable than lakisha and jamal? a field experiment on labor market discrimination. American economic review, 94(4):991–1013.

Tukey, J. W. (1980). We need both exploratory and confirmatory. The American Statistician, 34(1):23–25.