TOPIC TWO: THE SCIENTIFIC METHOD

Science – developing and discovering… explanations
Laws – universal, deterministic relationships, without qualification… truths
Theories – truths with boundary conditions, qualification, limitations, circumstances… especially if there are multiple interacting causes – we often simplify theories into models ("cause and effect truths")

Asking the right question is more important than providing the right answer

Induction

Specific/general. We do it naturally through associations, assumptions and generalizing (e.g. stereotypes and superstitions) – forming opinions about people/situations

Induction is flawed because:

- It is usually wrong (confirmation bias)
- Inferential reasoning – forming conclusions after limited examples (stereotyping/generalisations)
- *Probabilistic generalisations* (absolute predictions) – doesn't exist

Should We Dump Inductive Reasoning?

No! It's how we develop research ideas!

- Noticing distinctive features of case studies
- Noticing paradoxical/counterintuitive incidents
- Noticing what practitioners or experts have/do in common…the rules of thumb

Deductive Reasoning

Three-part syllogisms *(premise + premise = conclusion)*

1. Major premise (rule of law defining a set) eg. all swans are white
2. Minor premise (rule about a member of the set) eg. this is a swan
3. Conclusion (valid or invalid) eg. this swan must be white

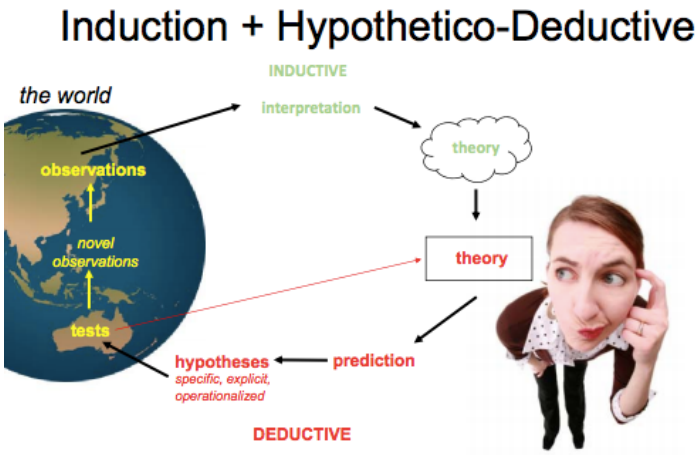
- Hypotheses need to be able to disconfirm AND differentiate the theory from competitor theories
- Deductive is not natural and therefore you don't do it in everyday life (need to consciously do it)

AFFIRMING THE ANTECEDENT	AFFIRMING THE CONSEQUENT
If A is true then B is true ***A is true therefore B is true*** e.g., If it is a swan, then it is white. *This thing is a swan, therefore this thing is white.*	***If A is true then B is true*** ***B is true therefore A is true*** e.g., If it is a swan, then it is white. *This thing is white, therefore this thing is a swan.*
DENYING THE ANTECEDENT	**DENYING THE CONSEQUENT**
If A is true then B is true ***A is NOT true therefore B is NOT true*** e.g., If it is a swan, then it is white. *This thing is not a swan, therefore this thing is not white.*	***If A is true then B is true*** ***B is NOT true therefore A is NOT true*** e.g., If it is a swan, then it is a white. This thing is not white, therefore this thing is not a swan.

- Antecedent = cause
- Consequence = effect
- If you do the top left but not bottom right then you are engaging in flawed application of deductive reasoning – not falsifiable -> useless theory

Problems with Deductive Reasoning:

- *You might not be right* – just because deduction is logical, doesn't mean your premises are correct, that your use of deductive reasoning is correct or that your observations are correct or relevant
- *You might not even be wrong* – you can't ever prove a theory through replication/confirmation only disprove it – ***Falsifiability is the criterion of good science***
- You need to go beyond affirming the antecedent. You need to deny the consequent



Types of Hypothesis Testing

- ***Validation*** – testing a theory by confirmation
  BUT confirmatory/positive test bias; competing theories; you can't prove theories
- ***Falsification*** – testing a theory by disconfirmation
  Theories can't be proven, but can be disproven
  BUT not often done…and all theories have exceptions
- ***Qualification*** – identifying boundary conditions of theory
  Nice! That's what theories are all about!
  BUT what if the theory is simply incorrect? When does qualification make way for falsification?