CHIP-3

Concepts and history in psychology

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http://tiny.cc/CHIPdraper

http://www.psy.gla.ac.uk/~steve/courses/chip.html

Lecture 3:

Experiments (cont.)

Discussion questions for previous lecture

1. What are the cases (the kinds of cases) where experiment is not used in psychology.
   How do the objections apply to each or not?
2. Does experiment have the same power if you don't manipulate causality, but just select different types of people for the two groups (e.g. different personality types)?
3. What examples can you think of or find, where statistics act like a telescope: to see things that otherwise we could never know.

Recap: the "Newtonian triad"

1. A theory
2. Calculation / prediction: generate testable consequences from the theory
3. Observation, experiment

Why experiment? (recap)

The "Newtonian triad" only requires observation / data / empirical studies for its 3rd leg We might, perhaps, distinguish 4 stages for the triad leg of observation:

1. Collect and remember any cases you come across
2. Enhanced: you go out of your way to do more: collecting trips, measure properties (not just remember seeing them) e.g. rainfall measures.
3. Learn by exploration: fiddle with new and unexpected cases to reveal more of their properties. Dissection. Reassembly. [Henry Cavendish]
4. Full-on experiments to isolate causal factors.

Why do some people (especially in psychology) think experiments are strongly preferred for the role of observation?

Step 1 of observation:

Cases you came across and remember

Anecdotes

The two people you happen to know with depression

Step 2 of observation

Active collection and measurement

Collecting butterflies

Bird watching

Recording rainfall daily

Pasteur observing incubation periods, scum on top of ferments, ...

Depression and sleep: asking a depressed person if they are sleeping all right.

Step 3 of observation

Active manipulation and invasive observation (and measurement)

Dissection. Taking something apart (and reassembling it)

Cavendish: not just making hydrogen, but burning it in air to re-make water.

Pasteur: what kills bacteria? how much heat? differences between species, differences with/out acid.

None of these explain the effects, but accumulate knowledge.

Step 4 of observation

Experiments

In reality experiments can be done for multiple reasons.

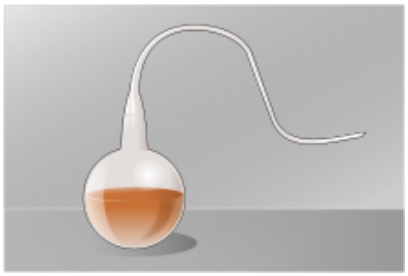
Pasteur seems to have lived and breathed experiments: it is what he wanted to do 16 hours a day, all his life.

We might call all of them experiments because they all used similar apparatus, were done in the lab when possible (but in the field when not).

But he commented on how they served three different purposes:

a. Giving him ideas, changing his understanding
b. Convincing other neutral scientists
c. Convincing (crushing) his opponents

Swan-necked flask (Pasteur)



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Why experiment? (1)

This is really (only) using experiment for Pasteur's 3rd goal: crushing opponents; compelling belief.

Expt. does 2 things:

A] Isolates one factor from all others

B] Establishes causal direction.

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Why experiment? (2)

A] Isolating one factor from all others

Expt. isolates one factor and varies it independently [the independent variable], and shows the links of that factor independently of others.
For these purposes, demonstrating causation is only useful as one means to the end.
If you have established what factors are independently active, then you can consider creating new combinations which haven't occurred naturally (at least in your samples).

We never know all the factors.

Does this work even if it is not you manipulating, but pre-selecting subsets of people? [Homework 2]

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Why experiment? (3)

B] Demonstrating causal direction

Correlation vs. experiment.
Fixes the direction of causation.

BUT:
Bertrand Russell: the most advanced science does NOT talk about causes but relationships.

Causation (apart from establishing the independence of factors) is for applied projects.

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Why experiment? (4)

How important is experiment?
It can show things you could never prove from passive observation, from naturally occurring cases. [ethology, spontaneous generation]

But: there are few experiments in astrophysics, or evolution, or epidemiology. So there is a lot of science that doesn't use expt.

Bertrand Russell: the most advanced science does NOT talk about causes but relationships. So arguably, causation is what engineers need to know, but isn't important in most pure science.

Homework: in what areas does psychology NOT use experiment? Is this OK?

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Causation (cont.)

2-way causation; 3 part relationships

Even if you are focussing on causation, it may not be 1-way

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Causation (cont.)

I pointed out that establishing causation and its direction was one of the special properties of experiments.

But I also raised the view that causation is NOT the central feature of science. It is in fact essential to applications, not to all theory.

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Multiple Causes

Even simple events always have multiple causes, even though ordinary conversation (and the blame game) almost always assigns a single cause. Why? because most of the time we are deciding what one thing to change.

A glass falls and shatters. Why?

Who thinks there is really one main cause for an event?

Multiple causes corresponds to studies with more than one independent variable
Brown & Harris. Multiple interacting causes.

3-part relationships where not one but 2 independent vars determine the person's behaviour e.g. in deep and surface learning.
=> So an experiment that demonstrates one cause may not tell the important story. (Effect size.)

Correlation and causation

- A causes B
- B causes A
- A third factor C causes both A and B not necessarily at the same time (the electrical discharge of lightning causes both flash and boom, light and sound arriving at different times).
- A and B both increase (cause) the other, as in any positive feedback loop (vicious circle). Or each decreases the other (negative feedback loop cf. homeostasis). *(See next slide.)*
- A ≡ B. Tautology / identity. A and B have to occur together because they turn out to be the same by definition. E.g. miles and kilometres measure the same thing, and are always perfectly correlated. (Mass and weight.)

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Causation not 1-way

A and B both increase (cause) the other, (positive feedback loop)

- Two adjacent blocks of explosive: if one goes off, it will set off the other
- If person A annoys B, B is likely to retaliate
- If a student's motivation is high they are more likely to learn, but if they succeed at learning their motivation will rise (so motivation is often an effect, a symptom, not a prime mover)
- If A sees B as beautiful A is more likely to be attracted to B, but if A loves B then A is more likely to see B as beautiful.

Such 2-way causation is usual in human psychology. Arousal, .. group laughter, perceived attractiveness, ...

Negative feedback loop

Dieting: the forces of stability. Mood self-remediation. Student auto-compensation for bad lectures.

Why experiment? — recap

A] Isolates one factor from all others

B] Establishes causal direction.

A] is central to "pure" science

B] is central to applied science

Causation is NOT the central feature of science. It is in fact essential to applications, not to all theory.

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Discussion questions for homework

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Discussion questions for homework (1)

1. What cases can you think of parts of psychology where in reality 2-way causation is probably important?
2. Is is irrational, or sensible, when scientists do not accept apparent disproofs of theory?
3. Can you think of cases of this in psychology?

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A place to stop

For the slides, handout etc. see:

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or:

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