CHIP-3

Concepts and history in psychology

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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

Causation (cont.)

Last time 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.

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 theother (negative feedback loop cf. homeostatis).
- 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.

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.

Pure and applied science are different

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1) They have a different logic

The Newtonian triad applies to pure science; where the aim is to uncover universal laws that are true everywhere for all time, but may be negligibly small in their effects in some contexts. The approach is to isolate the one law you are interested in ("control" away all other causal effects). Truth over as many contexts as possible is the goal, not effect size.

Applied science is fundamentally different in its characteristic logic.
Its measure of success is benefit to real people in real contexts.

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1.2) Pure vs. applied

"Pure" focusses on a single cause and all its consequences

"Applied" on (achieving) a single effect and all its causes (necessary and sufficient conditions)

Applied success depends not on one law/factor, but on all the factors with significant effects in the context: just like running a business.

On the other hand, you can ignore true things if they are small: Effect size not universal truth is what matters.

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1.3) Applied: how it works

The first step in any problem is to find out what the biggest factors are; or the biggest factors you could possibly influence.
(Why effect sizes are important in applied science.)

The measure of success is not discovering truth but helping people (patients cured, learners attaining more, bridges that carry traffic).

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2) They entail different research programmes

The different logics for conclusions entail different research programmes i.e. sequences of studies. This is important in conducting research, and in doing relevant critiques.

A programme for pure research will tend to go for identifying one single cause, learning how to control away all other causes, and then showing that (with appropriate controls and counter-balances) this factor is active in as wide a range of populations and contexts as possible.

A programme for applied research will tend to go for developing a procedure that is effective in real life contexts: e.g. a drug works on cells, then on rats, then on humans in the lab, then when given by a paramedic in remote rural village without safe water or electricity to keep it in a fridge. *[my first aid training]* 11

2.1) Shayer

Three stages for applied educational research:

1. Studying the primary effect
   (establishing that with the new method a gain is possible at all)
2. Replicating it without the original researcher.
   (Generalising to A.N.Other teacher, showing it can transfer.)
3. Generalising it = Teacher training
   (rolling it out to teachers who were not volunteers).

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3) The fallacy that pure must precede applied

Many people think applied derives both logically and historically in each case from pure research. (A spontaneous misconception)

E.g. Theoretical physics - experimental physics - applied physics - mechanical engineering - engineers (building machines) - garage mechanic.

Who does?

Probably because explanations (that we here) are deductive: from the general to the particular, from theory to cases and applications.

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3.1) The fallacy that pure must precede applied

Sometimes pure does lead to applied.
But sometimes it is the other way round e.g.

- Vaccination (cowpox)
- Steam engines,
- Semiconductor technology
- Radium
- Superconductors
- Much of metallurgy / materials.

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4) Bottom up research: observing the unexpected and/or untheorised

When applied precedes pure research, it is one kind of bottom up research, where observation precedes theory (induction driven research).

This is actually important everywhere in science.
E.g.
- Zoology
- Astronomy
- AIDS / HIV

In this kind of research programme, it goes:
- Observe
- Develop empirical categories and concepts
- Work “down” to theory as well as “up” to applications.

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4.2) Petroski's argument

His argument in effect was that engineering learns largely from disasters (obviously unexpected).

Engineers learn mostly from disasters because we do not, and cannot, know all the factors that matter in advance. When we stray beyond the region where some unknown factor was small then a disaster tells us there is a new factor in town. Because there are literally an infinite number of factors, we can't in general discover them in advance.

Thalidomide (birth defects from a sleeping pill).

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5) Construction-ism

A major class of evidence is the construction of a new artifact (or process). This is an existence proof. If it exists then it is possible and can be built. (In pure science, you must stay with what nature happens to have provided.)

Applied science, engineering, …. Medicine, education, ….

An artifact is a special case of an existence proof (cf. Popper): the very existence of an object proves it is possible, and disproves any assertions that it cannot be.

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6) Testing for the unexpected

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