CHIP-4
Concepts and history in psychology

Steve Draper, Glasgow University

http://tiny.cc/CHIPdraper

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

CHIP-4 25 Sep 2014

1

Lecture 3:

Experiments (cont.)

2

Discussion questions for previous lecture (repeated)

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.

3

Discussion questions for previous lecture

1. What cases can you think of parts of psychology where in reality 2-way causation is probably important?

4

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.

5

Kuhn, critical thinking, RMS

6

Kuhn

Thomas Kuhn "The structure of scientific revolutions"
Buzzword "Paradigms"

[N.B. you will find both Popper and Kuhn discussed in the Brysbaert textbook; and indeed in almost any book about philosophy of science.]

In fact in real life scientists can be very slow to abandon disproved theories. Why?

- Personal vanity, inability to change ideas, …
- Science as sociology, anthropology [Read Bruno Latour] Kuhn was vastly more important to social scientists than to physicists

But perhaps there is a different angle on this: Critical thinking, "reason maintenence systems", ….

7

"Reason maintainence systems"

A little considered everyday mental activity, which is also a version of critical thinking aimed at decision making under uncertainty, is "RMS": maintaining provisional knowledge as a network of linked ideas. When contradiction is detected, this is adjusted by finding an assumption that can be abandoned to retain the maximum overall probability of the revised network.

We do it to understand everyday stories.
In CT we do it to give our best overall judgement on balance.
In science, it would lead to what Kuhn described: it usually takes more than one little data point to abandon a big network that explains a lot, and is supported by a lot of other data.

8

Pure and applied science are different

9

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 <u>characteristic logic</u>.
Its measure of success is benefit to real people in real contexts.

10

1.2) Pure vs. applied

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

"Applied" on (achieving) a single effect and dealing with 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, in applied research you <u>can</u> ignore true things if they are small:
Effect size, not universal truth is what matters.
[Effect size is a stat.: roughly, the difference in the means divided by StdDev]

11

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).

12

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]* 13

2.1) Shayer (1992)

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).

----

4. Roll-out of an innovation.
   When adopters cannot be forced into using it, it may take a whole roll-out project (marketing campaign?) to get it used. 14

Do you think that practical innovations come from theory?

15

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. Kline calls this "the linear model": see reading list.)

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

Who does?

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

16

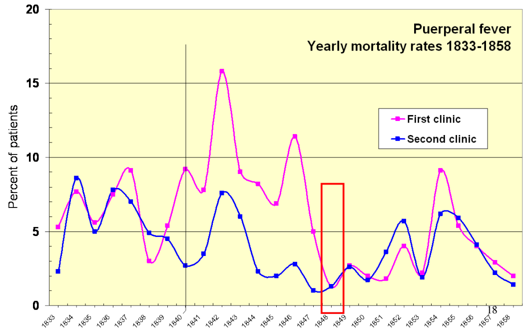
3.1) The fallacy that pure must precede applied

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

- Vaccination (cowpox vaccination by Jenner 1796)
- Steam engines (thermodynamics by Carnot 1824; Kelvin 1851)
- Semiconductor technology ("whisker" detectors for radios 1906)
- Radium
- Superconductors (especially "room temperature" ones)
- Much of metallurgy / materials.
- Exercise as a treatment for depression
- Semmelweis (1847) and childbirth deaths through sepsis

Semmelweis' graph

Line: start of dissection work. Box: start of hand disinfectant use.



18

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.

19

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).

20

4.3) Testing for the unexpected

If we believe Petroski then could we test for the unexpected?

Open-ended observation and its largely undiscussed importance.

21

5) Construction-ism

Papert & Harel (1991)

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.

22

Discussion questions for homework

38

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?

39

A place to stop

For the slides, handout etc. see:

http://tiny.cc/CHIPdraper

or:

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

40