

CHIP-13

Concepts and history in psychology

Reductionism; Course wrap-up

Steve Draper, Glasgow University

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

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1

A) Systems and levels of explanation

(Reductionism)

2

The feeling of explanation

Humans seem to like the feeling that something is explained. However there is reason to think we are poor judges of the quality of an explanation (Kieras & Bovair, 1984)

Generally speaking, explanations are deductions, where some general rule is used to deduce (post hoc) some specific (observed) case.

One special type of these is a set of axioms e.g. in geometry; or the rules of chess.

Those cases show how a very small number of simple rules can give rise to complexities that can occupy clever people for generations.

3

Types of (deductive) explanation

- A. Axioms or game rules: explanation in a closed system, at one level.
- B. Reduction: explaining one level by a lower level that implements it e.g. atoms explain molecules, which are all made up of combinations of atoms; DNA “explains” genes, which are all expressed and transmitted in DNA code.
- C. The pure → applied cascade of research.
The notion is that if we have the theory, then we can deduce applications, which are particular uses of the theory in particular cases. The cascade is logical, but often not how it happened historically.
Logic = a justification of the idea.
Logic ≠ Causation of the idea in a person or scientific field.
- A,B,C all use and exalt deduction, though they use it differently.

Examples of levels, hierarchies

Reductionism requires the existence of a hierarchy of levels. E.g.

Disciplines: Politics → Sociology → **Psychology** → Neurology → Biology
→ Chemistry → Physics

Biological groups: Population → Clan or group → **Organism** → Cells →
Organelles

Psychological systems: All humans → Nation state → Groups of acquaintance
→ Family → Dyad interacting → **Individual** → Parts of one person's
mind?

Evolution: Natural selection → Genes → DNA

Matter: Materials → Phases of matter (solid, gas, ...) →
Molecules → Atoms → Particles (e.g. protons) → Quarks ...

Reductionism

Many people feel instinctively that reductionism (type B above) is the best kind of explanation. This is not a rational feeling because:

- Each level of explanation can be independent, with its own rules (just like chess is).
- A level can sometimes be reduced to more than one alternative lower level e.g. the wave equation (physics) explains sound waves, light, ocean waves, the jet stream (a special kind of waves keep it intact), and quantum mechanics.
- Some levels just do NOT reduce to another e.g. especially when they have self-correcting mechanisms (homeostasis).
- Above all: whether as individuals or societies, we are born into the middle of things. We can't wait until a theory for a lower level arrives.

Reductionism (2)

Some things that currently don't seem to fit into levels very well:

- a) Lamarckian inheritance, "epigenetic" factors. [cf. start address]
- b) Prions. Is infection a phenomenon independent of organisms as infectious agents?
- c) Migraine [Sacks]. Physiology doesn't precede "psychological" / psychosomatic causes in any clean way.
- d) Genes and learning as causes of behaviour [Hailman]

7

Behaviour as an independent subject?

Genes do not directly control behaviour: they control only proteins and RNA molecules: they don't even control sugars or bones directly. Behaviour is, and must be, shaped mainly by other mechanisms.

So one view of psychology is that it is a level of explanation with a logic mainly independent of the mechanism of natural selection (and genes, and DNA). And probably in the end that is why brains evolved: to get that independence.

8

Evolutionary psychology: A contradiction in terms?

Thinking about scope again: one might almost say that psychology is defined as exactly those aspects of being human that are NOT controlled by evolution.

The whole point of perception and learning is so an organism can adapt its behaviour faster than the genome can.

Human behaviour is not inherited, at least not through genes. And that is, presumably, precisely its adaptive evolutionary advantage.

[Jack Hailman]

9

Reductionism (3)

We individually as critical thinkers, or a discipline as a whole, has to consider whether and when a reductionist approach is useful and can be made to work. And whether it adds anything. Most often, a discipline is defined by looking at a particular level because the lower levels do not seem likely to help in detail.

In psychology, there are some impulses to try to reduce the 3 types of data to each other e.g. explain behaviour by physiology, the social by individual attitudes. This may work in some cases, but in general the job is to relate them. This probably means finding how the causal links run in both directions, not just in one.

More work on this is probably a good heuristic; As is looking for self-stabilising systems / feedback loops that make a level relatively self-contained.

E.g. Brain plasticity vs. fixed, determined brain areas ¹⁰

Psychology ?

Where does Psy fit in the levels of explanation?

Why is it a separate autonomous level?

Politics →

Sociology →

Psychology →

Neurology →

Biology →

Chemistry →

Physics

11

Reductionism

Reductionism in general is the irrational belief that explanations of mechanism are more real than explanations of relationships at one level.

Newton and action at a distance.

Is chemistry just physics?

Is biology just chemistry?

Is psychology just biology?

⇒ Psychology is just physics

⇒ Study physics for the real explanations.

Evolution → genes → DNA

Brain plasticity vs. fixed, determined brain areas

12

What is my real point about reductionism?

- We each need a reason for seeing psychology as a discipline, not some lower level as holding the real explanations.
- Appreciation of rules at one level, not just reductively
- Keller (?): even at one level: emergent systems thinking, self-organising systems show patterns that produce patterns and complexity spontaneously.
Getting away from thinking that there is just one cause that “explains”.

Emergent phenomena.

13

Critical thinking tip

Are the (3) major types of data being used reductively to explain each other, or collaboratively?

Look for self-stabilising systems / feedback loops that make a level relatively self-contained.

Test for whether causation runs in both directions?

14

B) Drawing it together:

What is distinctive about psychology?

[Take a minute and write your own list.]

15

What is distinctive about psychology? (1)

General style of argument is critical thinking, backed by empirical data

Broader than most in content area

It has approx. equal emphasis on pure and applied (unlike medicine which is mostly applied, or physics which is mostly "pure")

It could be seen as also at the centre point between arts and science, in that it strives for a 3rd person objective stance, yet addresses human meanings and goals: and so how the same material event can mean quite different things to different people.

It is one of the "reflexive" disciplines whose subject matter is us humans (others include medicine that tells us about our bodies and illnesses, politics, ...)

16

What is distinctive?: data types (2)

It is generally built on not one type of data, but on trying to relate at least 3 main types, perhaps 4:

- Behavioural
- Physiological
- Introspection (asking people to tell you the contents of their attitudes, thoughts, intentions) [Also: 1st, 2nd, 3rd person views.]
- "Functional": working out the function, the reason, we think and act in the ways we do e.g. why do we get angry? why don't we all have the same personality traits (surely evolution should make us converge on the one optimum?), why are we so prone to social comparison?
- Structural: there is still some legacy of structuralism in brain science: the idea that one area of the brain performs one function, the same in everyone. Size of STM / WM.

What is distinctive? (3,4,5)

What about argument schemas? Discipline type?
Psychology isn't unique exactly, but like all disciplines it:

- 3) Favours some styles of argument schema, and not others.
- 4) It is located in its own particular place on:
 - a) the pure-applied dimension
 - b) the Humanities – Science dimension.
- 5) Unusually it requires in some topics not just a 1st and 3rd person perspective; but a 2nd person one as well.

18

What is distinctive? (6) The Variance

Not just the mean, but the variation is often the message. Most students, like journalists, only remember the mean difference. Studying, remembering, the variation is a marker of your being a psychology student. For 4 reasons:

- A measure of the noise obscuring the signal in the data.
- Individual differences i.e. knowing about real differences within the population: as in Botany too.
- Effect size: is the (significant) difference important?
- Shape of the distributions / is the SDev the same in expt. and control groups? What stats will be valid?

Measures of signal and noise: SigDiff

The first reason for looking at some measure of the variance, is to see how clear (certain) is the signal given noise (random variation).

A convention in psychology is to require a probability $p < 0.05$ i.e. less than 1 chance in 20 of it being noise. (which is 1.645 SDevs)

In particle physics, the convention is for 5 standard deviations: $p < 0.000\,000\,5$ i.e. half a chance in a million of being by chance.

Psychology can seldom eliminate the noise.

20

Explanatory Success: Effect size

In an idealised, pure, experiment we are able to control everything except the causal factor we are focussing on. Effect size is a measure of this.

Effect size means, basically, expressing results in units of the StdDev: by how many SDs does the treatment change the mean. This also shows how much of the variance is explained (and how much is not).

Most of psychology isn't like this. Still there are some successes even on these terms.

Although now unfashionable, IQ tests predict something like 65% of the variance in academic performance (SATs, GCSEs).

21

NewSci on gender diffs (next slide)

Explanation of graphic:

Diff. between **males** and **females** (effect size in StdDev units)

Colour shows which sex does better

There are 6 more items in (bottom of) original table

22

NewSci on gender diffs

From: *New Sci*, 8 March 2011 "Boy brain, girl brain"

| TRAIT | Effect size |
|----------------------------|-------------|
| Gender identity | 11.0 -13.2 |
| Sexual orientation | 6.0 - 7.0 |
| Preference for boy's toys | 2.1 |
| Height | 2 |
| Preference for girl's toys | 1.8 |
| Physical aggression | 0.4 - 1.3 |
| Empathy | 0.3 - 1.3 |
| Fine motor skills | 0.5 - 0.6 |
| Mental rotation | 0.3 - 0.9 |
| Assertiveness | 0.2 - 0.8 |

Effect size (2)

So for pure research, effect size measures whether you have isolated the important factor from that experiment.

For applied research, effect size tells you how much you are changing what you want to change: is it an important intervention or one that doesn't change much? You want to work on the things with the biggest effect size, because those are the ones that do the most good to your "clients".

The statistics measures of effect size tell you that in terms of variance But in each context there will be other measures of "bigness" of effect. E.g. in education, moving marks up one fine grade would be a small effect; one coarse grade (C2 to B2) would be medium to large effect. Doubling the total amount learned would be BIG.

24

B2) Overall assessment of psychology as a body of knowledge

25

Other kinds of success

Beck's inventory (a paper test) does nearly as well as a trained psychiatrist in diagnosing the mental illness of depression. I.e. using psychometric methods to replace a human skill.

Cognitive Behaviour Therapy (CBT) is about as effective as the best drugs and as exercise.

This demonstrates that psychology is able to compete, in a very important applied field, with both biochemistry and non-scientific approaches in originating practical solutions.

At the very, very least, psychology seems to be an essential part of the mix of necessary approaches.

26

Again

Perhaps as important, is showing that ...

- inherited characteristics;
- developmental issues (e.g. early childhood neglect)
- persistent traits in general (e.g. the big 5 personality dimensions);

... are all influential in people on average. The effect sizes are not huge, yet the influence is pervasive.

I.e. it seems the nature of psychology is NOT simple mechanical causes;

BUT significant biases / predispositions. It is not that we are doomed by them, but that unless something actively counteracts them, then their influence will be seen.

27

Positive psychology manifesto

The positive psychology movement represents a new commitment on the part of research psychologists to focus attention upon the sources of psychological health, thereby going beyond prior emphases upon disease and disorder.

Positive Psychology is the scientific study of optimal human functioning. It aims to discover and promote the factors that allow individuals and communities to thrive.

This amounts to a criticism of the last 50 years of academic psychology as too focussed on disease, and failing to study normal mental functioning. What is normal functioning, apart from the absence of clear disease?

28

Well-being

What is "well-being"?

A basic idea is that happiness isn't just pleasure;
Nor joy (the name of the transient emotional reaction to an unexpectedly favourable event)
But involves "meaning" i.e. goals beyond the physical

However "well-being" seems to emphasise a less conscious balance than "happiness", both in body and mind.

The recent finding that exercise is as effective as the best anti-depressants, seems to show that people generally are not aware of well-being and what supports it.

29

Psychology: overall review from outside

Prior standards: can we read others' minds?
Can we predict what they will do, say, feel, ...

For each topic: How does the research relate pure and applied studies? Applications?

For each topic: How does the research relate to the arts-science spectrum; or rather: the expectation of permanent unresolved complexity vs. the attainment or expectation of a consensual single conclusion?

For each topic: how is the research relating measures of:
Behaviour, Physiology, attitudes and beliefs (thinking and speaking)

30

B2b) Psychology as distinctive, not by results, but by approach to the distinctive difficulties of the subject area

The taken-for-granted definition of a discipline (1): Its attitude to method and expected variability

Landauer:

"There are two very elementary but fundamental methodological facts that are taken for granted by all experimental psychologists, but astonishingly often fail to be appreciated by others. The first is that behavior is always quite variable between people and between occasions. The second is that it is feasible to obtain objective data on behavior."

The taken-for-granted definition of a discipline (2): Its attitude to influence vs. control of factors

Significant biases / predispositions:

It is not that every individual is doomed by them, but that unless something actively counteracts them, then their influence will be seen.

So psychology has ...

An approach to research; a way of destroying lay psychology myths.

Dealing with a research domain where multiple inseparable causal factors are the norm.

34

C) Summing up the course

C1) Learning objectives

C2) CT tips

C3) Exam questions

35

Different ways of a person having, historically, an impact on a discipline

1. New theory;
2. New empirical techniques;
3. Kuhn and social-organisation (not logic of the theories)
creating social structures like a new HE department,
4. Writing a good textbook, a synthesis.

36

Aspects of a discipline

What features define a discipline?

- Scope / topics within its purview
- Pure vs. applied
- Data types (3 or 5)
- Methods.
- Preferred argument formats

37

Learning objectives

The learning objectives are what the handbook says. More generally, the overall learning aims are something like:

To equip students with the ability to review psychology as a whole by taking a step back (as opposed to the view from the heart of the discipline): by considering what philosophy of science might say about it, how it compares to other disciplines, how it measures up to what people would like psychology to be able to explain.

Another way of saying this, is that the aim is to equip students with more and wider strands of critical thinking, including being able to critique both specific bits of research and the whole discipline.

38

C2) Critical thinking tips

39

Critical thinking tip (Lecture 2):

[Relating the 3+ main types of data]

A lot of psychology can be criticised for dealing only with one or two of these types, rather than scrupulously reporting and discussing what is lacking (so far) in “theories” of a given area. [e.g. emotion]

- Observed behaviour
- (neuro/) physiological measures
- Internal experience: self-reported attitudes

- Functional: what any agent must do; adaptive-ness
- Social, group requirements

40

Critical thinking tip (L 3):

[causation]

Is a given paper assuming causation is 1-way, not testing the reverse direction?

Is it assuming there is only 1 cause, not discussing others?

Has it considered a self-regulating system (cf. homeostasis)?

Is it using the right line of argument for a pure paper?

for an applied paper? Or confusing the 2?

(Pure: one cause, all contexts; Applied: all causes, one context)

41

Critical thinking tip (L 4):

(arg. schemas)

Is the argument schema in a given published paper valid? or is it an unnatural shape for the real nature of the argument? Is it introducing more than one new thing simultaneously? (new theory, new prediction/hypothesis, new data?)

42

Critical thinking tip

One way of thinking about CT is in stages; and perhaps the most advanced of these is (unlike Aristotle) proposing an experiment to get new knowledge which your CT analysis decides is not yet achieved, but needed.

- Note that there is more than one reasonable opinion or view
- Arrive at a judgement (EJ) on which view is, on balance, the best (don't sit on the fence, or suggest that no-one can ever know)
- Design and propose an expt. to resolve the issue.

43

Critical thinking tip (L 6)

[Reductionism]

Are the (3) major types of data being used reductively to explain each other, or collaboratively?

Look for self-stabilising systems / feedback loops that make a level relatively self-contained.

Test for whether causation runs in both directions?

44

C3) Sample exam questions

45

Exams

I have, on my web page for these lectures, a link to a page with sample exam questions and outline answers for lectures 1-6 ONLY. (I may further update this page soon.)

Past exam papers for the whole CHIP course are available on line via the library.

In general, all exam answers should ideally show:

- Further reading, not just reproduction of what was mentioned in the lectures;
- Critical thinking: discussion of the extent to which arguments and "facts" can reasonably be believed.
- Illustration by specific examples; even better if they are not examples given in the lecture.

46

Exams (2)

Lectures 6-12 on the history of psychology focus mainly on issues of a few key people; and a few key "schools"

(e.g. functionalism);

but also on caveats about not taking this focus too simply and uncritically.

47

Exams (3)

Lectures 1-6 ONLY

Obviously, the material in lectures 1-6 is not about facts supported by citing experimental studies. It is about arguments that may apply to some degree. Your exam answers need to exhibit critical thinking: a reasonable argument, that discusses both the points that support it and points that undermine your conclusion. Illustrating them with examples is particularly important.

(E.g. in discussing how psychology tends to try to relate the 3 main types of data, an example of work that fails to do that, and another example of work that does do that would show you had thought about the issue. Extra marks if they are not examples given by me.)

48

Sample exam qu.1

Taking the case of memory, what would be the difference in treating it as an applied as opposed to a pure topic of research?

Sample exam qu.2

Pick a topic in psychology which you think would make a good subject for new research.

Briefly state why you think so.

Then discuss it with respect to each of the following:

- Fashionability in the academic literature
- Pure vs. applied research
- Whether it covers all the main types of evidence that psychology as a whole deals with.

Sample exam qu.3

Discuss the contributions towards mental health services that have come from within psychology.

Sample exam qu.4

What is induction as a research process?
Give at least one example.
What objections may be made against it becoming more prominent in psychology?

52

Sample exam qu.5

Where would you place psy. on the spectrum from Humanities to Sciences, and why?

53

A place to stop

For the slides, handout etc. see:

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

54
