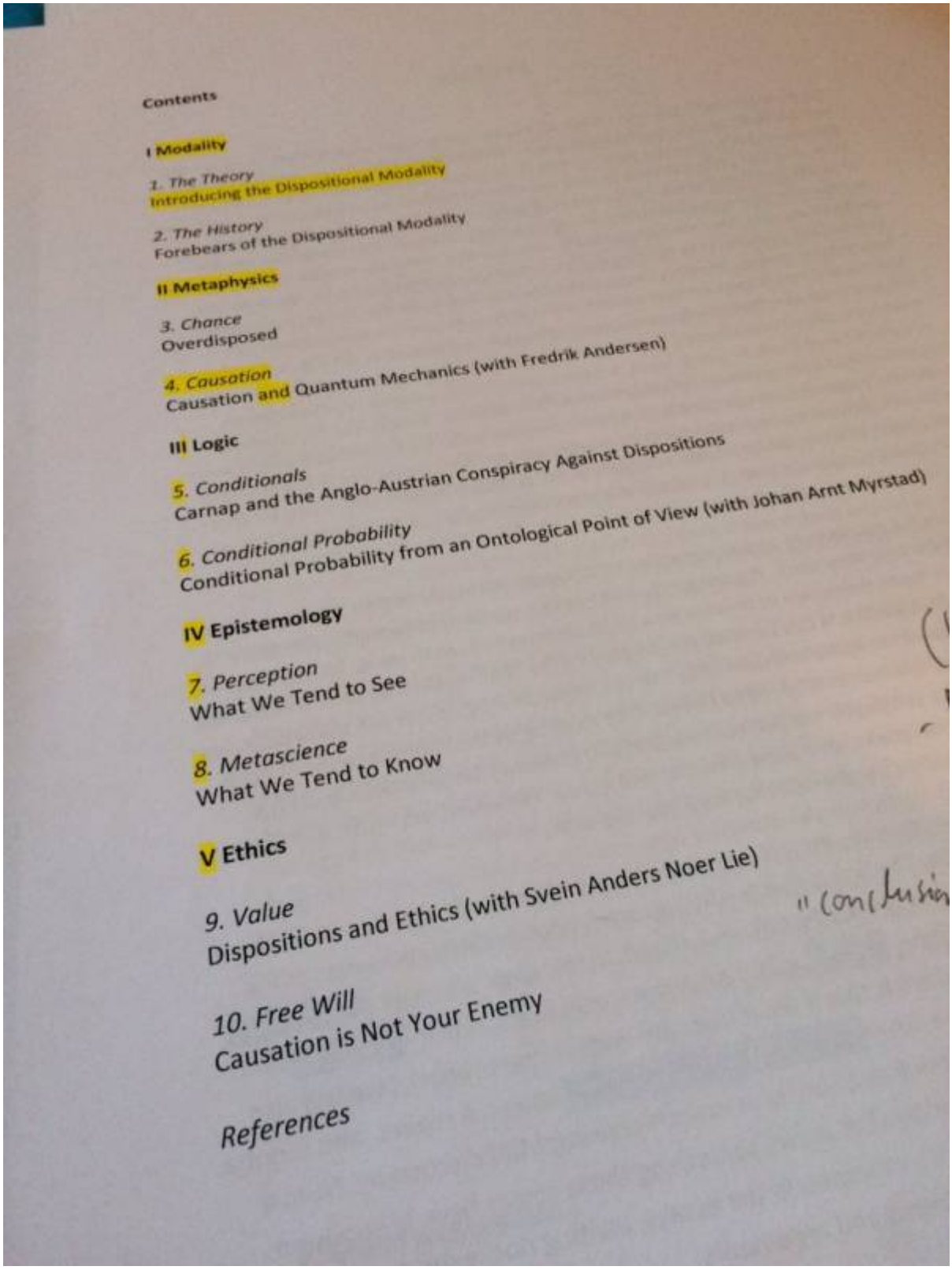
Tabla de Contenidos

#CauSciBook

Esta sección trata sobre el libro que aparecerá en 2018 Causation in Science – On the Methods of Scientific Discovery de Rani Lill Anjum y Stephen Mumford.

En el hashtag #CauSciBook de Twitter se puede encontrar información sobre el libro y la investigación de Anjum y Mumford.

La coescritora del libro explica en diciembre de 2017 en una cadena de tuits los rasgos principales del libro. Enlazo el primer tuit y, por cuestiones de formato, prefiero copiar el contenido del resto de tuits para que la secuencia se siga con mayor nitidez.



Contents

In 2016 @SDMumford & I prepared the #CauSciBook by teaching PHI302/403 at @UniNMBU with exactly this structure. 28 lectures!

It worked so well I kept the plan as the default, with possibility for minor changes. 2017 we had a day of risk with @ElenaRoccaPD.

Part I - Science and Philosophy

Ch 1 Metascience and Better Science

Ch 1 #CauSciBook: There’s philosophy in science whether we like it or not. Science rests on philosophical assumptions, incl metaphysical.

Being pro-philosophy doesn't mean one is anti-science or vice versa. #CauSciBook

There are 2 types of scientists: those who are aware of the philosophical underpinnings of science and those who are not. #CauSciBook ch 1

All methods reflect conceptual & ontological commitments about causation. These must be made explicit and critically examined. #CauSciBook

Science, unaided by philosophy, cannot decide what it is for one thing to cause something else. This goes beyond the scope of science. #CauSciBook

Our tacit, philosophical view of the nature of causation shapes the norms that we adopt for causal science, hence practice.

We should not abandon causation in science. Causation is vital for science: a precondition for its very existence.

Merely looking at physics, without its interpretation, is inconclusive about whether there is causation in science. #CauSciBook

Science and experimentation are worthy activities precisely because they involve causal interventions in the world. #CauSciBook #CausalRealism

Data requires observation, which requires causation. To count as a measurement is to be causally affected by the thing measured. #CauSciBook

Qualification: not every measurement requires such causal affectation – holding a ruler against something doesn’t – but many cases do.

By 1948 even Russell came to think of causation as one of the fundamental postulates of science: part of its foundations. #CauSciBook

Nothing counts as experience of the world unless it has been caused by it. There would be no data without causation. #Empiricism #CauSciBook

We search for causation with a tacit preconception of what we are looking for, which will influence what we can find. #CauSciBook

If we are wrong about the real nature of causation, we might be looking in the wrong places or even for the wrong type of thing. #CauSciBook

A problem is that there is no general agreement over what causation is, in philosophy or in science. #CauSciBook #Ontology

What counts as evidence of causation depends on which methods are available, accepted & promoted

by the scientific community. #CauSciBook

Different methods provide different types of evidence. Evidence is shaped and restricted by our choice of methods. #CauSciBook #causation

Evidence is not an ontologically neutral matter. Each method is developed to latch on to a certain purported feature of causation. #CauSciBook

Only if a method matches a correct understanding of causation can we say that the evidence generated is evidence of causation. #CauSciBook

Evidence of causation is not constitutive of causation. That would be to collapse ontology into epistemology. #CauSciBook

A consequence of having plural methods is that they might pick out different things: difference-makers, regularities, powers… #CauSciBook

If we have evidence from different methods, we might end up with conflicting evidence. Then which should we trust more? #CauSciBook

This concludes Part I of the #CauSciBook. Ontology (nature of causation) must inform epistemology (choice of method of discovery).

Part II - Perfect Correlation

Part II discusses an orthodox view that causation is conceptually and epistemologically linked to perfect correlations. #CauSciBook

Ch 4 Whats In a Correlation?

Ch 4 What’s in a Correlation? concerns how we separate causal from accidental correlations, while neo-Humeanism cannot. #CauSciBook

Ch 5 Same Cause, Same Effect

Ch 5 Same Cause, Same Effect questions that causation should be robust across all contexts, which is not supported empirically. #CauSciBook

Ch 6 Under Ideal Conditions

Ch 6 Under Ideal Conditions shows how causal necessitation is philosophically salvaged by stipulating ideal conditions. #CauSciBook

Ch 7 One Effect, One Cause?

Ch 7 One Effect, One Cause? warns against simplifying causes. Treating causes in isolation misses the importance of interaction. #CauSciBook

Reading through the manuscript for the #CauSciBook, I'm happy to see that it turned out exactly as I hoped it would. @SDMumford

Regularity, robustness & repeatability are thought to be integral to causation because we expect 'same cause gives same effect'. #CauSciBook

Where does the expectation of same cause, same effect come from? Seems a philosophical assumption, empirically ungrounded. #CauSciBook

Unsurprisingly, also this idea about causation comes from Hume. #CauSciBook #SameCauseSameEffect

The same cause always produce the same effect, and the same effect never arises but from the same cause. This principle we derive from experience, and is the source of most of our philosophical reasoning

Scientists have strategies to deal with less-than-perfect-regularites: exception, noise, interferer, non-respondent, outlier. #CauSciBook

The need to somehow deal with data that don’t fit the general model, suggests that a perfect model should account for all data. #CauSciBook

If same cause gives same effect, then any difference in effect must mean that there was a difference in the cause. #CauSciBook

Assumption: understanding causes is enlightening & empowering & the more generally they apply, the more they enlighten & empower. #CauSciBook

Laws of physics seem exceptionless. While reality is messy and irregular, laws of physics deal largely with ideal conditions. #CauSciBook

There are many strategies to help retain the ideal of perfect laws, also outside theoretical physics, in practice or theory. #CauSciBook

Strategies for keeping perfect laws: Probabilistic laws, nomological machines, ideal conditions or ceteris paribus clauses. #CauSciBook

None of these strategies are useful for making reliable and certain predictions in the case of application. #CauSciBook

It might be useful to single out of a factor as the cause of an effect, but causation is typically complex. #CauSciBook

Part III - Interference and Prevention

Part III of the #CauSciBook is on causal interference and prevention, presenting an alternative to the Humean orthodoxy. #CauSciBook

Ch 8 Have Your Cause and Beat It

Ch 8 Have Your Cause and Beat it explains why causation is sensitive to context by introducing additive interference. #CauSciBook

Ch 9 From Regularities to Tendencies

Ch 9 From Regularities to Tendencies argues that we should understand causes as tendencies rather than perfect regularity. #CauSciBook

Ch 10 The Modality of Causation

Ch 10 The Modality of Causation: causation involves a primitive modality less than necessity & more than pure contingency. #CauSciBook

If one is really interested in ch 9 and 10 on tendencies and the dispositional modality in #CauSciBook, read also #WhatTendsToBe.

Ch 8 #CauSciBook: Perfect regularity was never a worthy goal of a theory of causation.

A cause could be in place and start producing its effect. But that process can be interfered with so the cause need not occur. #CauSciBook

Since causes typically interact and produce different outcomes in different contexts, it is possible for us to intervene. #CauSciBook

The experimental method exploits this feature of causation. By manipulation, we produce effects that wouldn’t otherwise occur. #CauSciBook

We have 2 kinds of causal interference: subtractive (removing the cause) & additive (adding something more to the cause). #CauSciBook

Continuing my read-through of the #CauSciBook today. Up to chapter 9: From Regularities to Tendencies. (Oh yeah, a MumJum modality!)

'Imperfect regularities could ultimately dissolve into perfect regularities if we specified all relevant facts.' We deny this. #CauSciBook

The search for perfect regularities is misconceived. Causation is best understood and sought in terms of tendencies. #CauSciBook

A tendency is directed toward some effect with a certain strength. A causal tendency can thus be stronger or weaker. #CauSciBook

Tendencies, because they are causal and disposing toward an effect, are sensitive to contextual interferers. #CauSciBook

By a causal tendency, we do not mean a statistical incidence. These two will often differ and sometimes radically so. #CauSciBook

We need methods designed to identify causal tendential. These cannot automatically be inferred statistically. #CauSciBook

Part IV - Causal Mechanisms

Part IV of #CauSciBook promotes causal theories & mechanisms as an alternative to finding causation in regularity and repetition.

Ch 11 Is the Business of Science to Construct Theories?

ch 11 Is the Business of Science to Construct Theories? Besides data, causal theory is needed. Otherwise we only map facts. #CauSciBook

Ch 12 Is More Data Better

Chapter 12, Is More Data Better?, makes a case for causal singularism, where causation happens in the concrete particular. #CauSciBook

Ch 13 The Explanatory Power of Mechanisms

Ch 13 The Explanatory Power of Mechanism explain why we need qualitative & mechanistic knowledge for deep causal understanding. #CauSciBook

Ch 14 Digging Deeper to Find the Real Causes

Ch 14 Digging Deeper to Find the Real Causes? argues against the reductive project of finding mechanisms only at lower levels. #CauSciBook

At best, data can tell us what happened. But they cannot tell us why it happened, nor what would, could or will happen elsewhere. #CauSciBook

Data don't explain or predict. The data themselves will be in need of causal explanation. That's where theory comes in. #CauSciBook

Unaccompanied by a causal theory, data remain impotent, with no application beyond the particular instances in the data set. #CauSciBook

Ch 11: Theory is not the underdog of data. #CauSciBook

Can data ever be neutral? To even get to the point of data collection, we need to make a number of non-empirical choices. #CauSciBook

Observation is a conscious activity, not input/output. ‘People, not their eyes, see. Cameras, and eye-balls, are blind’ Hanson 1958 #CauSciBook

Causal singularism challenges the norm that more data is always better for finding and understanding causation. #CauSciBook

Should we have to deny Big Bang as a cause unless the same happened again many times? Hume said yes. We say no. #CauSciBook

A causal set-up can have a unique set of properties & causal powers, which challenges the Humean requirement of repetition. #CauSciBook

Ch 13 on causal mechanisms. This is the stuff that scientific theories are made of: the what, the how and the why. #CauSciBook

To learn about causal mechanisms, qualitative approaches in research are necessary. #CauSciBook

We think of something as a cause because it makes a difference. This is a reliable but not a perfect symptom of causation. #CauSciBook

Randomised controlled trials rely on causes to make a difference, but not all difference-makers are causes or vice versa. #CauSciBook

A placebo group is methodologically useful for discovering whether an intervention worked but is not constitutive of it working. #CauSciBook. This point was first offered us by @RogerKerry1 and inspired the methodological part of the @Cause_Health project.

A drug doing its causal work on those in the treatment group is unaffected by anything going on with other people. #CauSciBook

Causal discovery cannot only be targeted of events or change. Some causation produces non-change, or stability. #CauSciBook

Part V

Part V is called Linking Causes to Effects, and looks at what exactly the causal link consists in. Difference-making? Determinism? #CauSciBook

Ch 15 Making a Difference: Counterfactual theory fails for some instances of causation & defines some non-causes as causes. #CauSciBook

This shows that causation is not the same as difference-making; a problem for scientific methods that depend on comparisons. #CauSciBook

Ch 16 Making Nothing Happen: some of the most important causal situations involve no change or events. #CauSciBook

Ch 17 It All Started With a Big Bang asks whether causation is deterministic and transitive. The answer is no. #CauSciBook

Ch 18 Does Science Need Laws of Nature? No need for universal, governing laws in addition to intrinsic propensities & their interactions. #CauSciBook

Part VI

Part VI is on probability. Chapter 19 Uncertainty, Certainty and Beyond is on probability as credence, or subjective belief. #CauSciBook

We distinguish between the classical mathematical conception of probability and natural probabilities needed for causation. #CauSciBook

Assumption that the natural world behaves according to classical probability can give us a misleading image of causation. #CauSciBook

Ch 20 discusses probability as a worldly phenomenon, offering a distinctive account of propensities against frequentism. #CauSciBook

Ch 21 shows how our account of natural propensities requires revisions to the orthodox treatment of conditional probability. #CauSciBook

Beliefs should be measured on an unbounded scale (no upper or lower limit), not on the bounded scale of classical probabilities. #CauSciBook

Ch 20 What Probabilistic Causation Should Be proposes a propensity theory of chance, but one unlike Popper or Mellor. #CauSciBook

Would anyone here think of Cartwright or Anscombe as propensity theorists? I think they should be. #philsci

Ch 21 Calculating Conditional Probability? We cannot escape conditionals when estimating probabilities. #CauSciBook

Although we might speak of a probability as absolute, this does not mean that no conditions are assumed in the estimate. #CauSciBook

It is crucial that we have scientific tools to deal with probabilities conditionally. The ratio formula fails as such a tool. #CauSciBook

The ratio formula is the standard interpretation of conditional probability, but it is not the same as conditional probability. #CauSciBook

Some interpretations treat conditional probability as primitive, not calculable from unconditional probabilities. We agree. #CauSciBook

We distinguish between the tool (heuristics), the results it generates (epistemology) and the phenomenon we study (ontology). #CauSciBook

The source of the problem lies not in the understanding of probabilities but in how conditional & causal relations are analysed. #CauSciBook

We argue that conditional probabilities are primitive because conditionals and causal relations are primitive. #CauSciBook

There are no conditionals in the ratio formula: no given, if, conditions, outcomes, effect, results or even probability. #CauSciBook

We here side with Cartwright: no causation in, no causation out. The same can be said about conditionals. #CauSciBook

On RCTs: We should base decisions on the best available evidence. But what is meant by ‘best’, ‘available’ & ‘evidence’? #CauSciBook

RCTs systematically fail to take into account certain types of causally important knowledge, so cannot be the gold standard. #CauSciBook

Ch 23: Explains why we cannot trust RCTs to offer the full causal story or be sufficient for making fully-informed decisions. #CauSciBook

If an intervention poses a severe risk on the participants, one cannot run an RCT to test it. Other methods must be used. #CauSciBook

RCTs cannot be tested on risk groups, in danger of getting severe effects from an intervention: children, pregnant, sick, old, etc. #CauSciBook

Although RCTs include individual variations in their study design, this is not what the test is designed to show. #CauSciBook

Individual propensities naturally fall outside the scope of RCTs, since all they show is what happens on group level. #CauSciBook

Biases: health benefits of pharmaceutical interventions are easier to test & control in RCTs than social or psychological factors. #CauSciBook

Being explicit about what is excluded from an RCT, allows a more realistic interpretation of the results - and better decisions. #CauSciBook

For decisions to be based on the ‘best available evidence’, ‘evidence’ must include more than what we get from RCTs. #CauSciBook

Ch 24, Getting Involved, argues that causal knowledge happens in close interaction with the world, not by distanced observation. #CauSciBook

Ch 25 Uncovering Causal Powers offers an account of technological innovation, where teasing out hidden powers of things is crucial. #CauSciBook

Ch 26 Learning from Causal Failure shows how new causal knowledge can arise from unsuccessful experiments and discrepancies. #CauSciBook

Given the diminishing return in confirming evidence, after a point, breakthroughs are more likely to follow from negative results. #CauSciBook

Ch 27 Plural Methods, One Causation argues for epistemic pluralism (many methods) combined with ontological monism (one causation). #CauSciBook

Causation is one thing but primitive. We must then investigate it through its symptoms and our methods must detect those. #CauSciBook

Ch 28 Getting Real about the Ideals of Science: We cannot deal with the messy reality via idealisation & abstraction. #CauSciBook

The reproducibility crisis shows how some of our expectations of science are unrealistic, based on a mistaken notion of causation. #CauSciBook

No experiment has ever been made that is free of presuppositions so our best practice is to acknowledge what they are. #CauSciBook

We are causal agents and patients. Observations and theories are a mutual manifestation between the world and ourselves. #CauSciBook

Causation is crucial for technology. Once we understand the causal powers of things, we can harness them in new technologies. #CauSciBook

Things have more than one causal power. In designing technology for one kind of effect, we cannot ignore potentially harmful effects. #CauSciBook

Identification of the causal powers of things remains one of the most important of tasks of technology. #CauSciBook

Deep theoretical knowledge cannot progress simply by accumulating positive test results for our causal hypotheses. #CauSciBook

We should recognise the rich potential to expand knowledge from cases of causal failure; to understand how or why A causes B. #CauSciBook

There is a confirmation bias in science, to find confirmation of a theory more than is rationally warranted. This is well known. #CauSciBook

There is also a meta-philosophical bias to adopt scientific methodology based on verification through repeated confirmation. #CauSciBook

Evidence, like powers, can overdispose. It can get to the point where more evidence becomes epistemically redundant. #CauSciBook

Acknowledging that causation is complex, there should be more to the causal story of B than the fact that it was preceded by an A. #CauSciBook

Repeated positive results tell us little about complexity. Scientific progress often happens with surprising, unpredicted results. #CauSciBook

For an example of causal insights from failure in cancer research, see @ElenaRoccaPD Rocca 2016: http://onlinelibrary.wiley.com/doi/10.1111/jep.12622/abstract (Bridging the boundaries between scientists and clinicians—mechanistic hypotheses and patient stories in risk assessment of drugs) #CauSciBook

Causal contributors and preventers are both part of the causal story, and help reveal relevant factors and their interactions. #CauSciBook

If a drug is approved because it is repeatedly confirmed to produce the effect, we don't know the full story of how it does so. #CauSciBook

When we learn about some unpredicted effect of the drug, we also learn more about the causal mechanisms: how it works. #CauSciBook

Uncovering potential harms and benefits is equally important. But then we cannot test only the

positive effects of interventions. #CauSciBook

Failed prediction could also mean that there were more causal factors involved than we had taken into account in our model. #CauSciBook

While causal models are usually about the isolated context, failure typically happens in open systems and because of interferers. #CauSciBook

If we avoid being challenged, it prevent us from learning something new. Discrepancy experiences make us wiser. #CauSciBook

Learning about causes in all its complexity might be an open-ended process, like the hermeneutic circle. #CauSciBook

That concludes todays #CauSciBook tweets. Tomorrow I will read and tweet the last two chapters.

Final two chapters of the #CauSciBook: ch. 27 Plural Methods, One Causation and ch 28 Getting Real about the Ideals of Science.

In ch 27 we argue that causation is one single thing, but that we need many methods to uncover it, since none is perfect. #CauSciBook

We must investigate causation through its true symptoms. Methods are suitable insofar as they latch on to the right symptoms. #CauSciBook

Most scientific methods are thought reliable for discovering causes because they look for regularities and difference-makers. #CauSciBook

We add that the symptoms of causation should include a.o. context sensitivity, tendencies, complexity, propensity, nonlinearity. #CauSciBook

Evidential hierachies of scientific methods should reflect what we think is the nature of causation. #CauSciBook

In the #CauSciBook we have shown that our understanding of causation significantly influences how science is shaped and practiced.

The final norm of science discussed is reproducibility: that scientific findings can be independently confirmed by others. #CauSciBook

Reproducibility relates to objectivity, reliability, repeatability, robustness, generalisability, universal application, predictability. #CauSciBook

Reproducibility is considered a cornerstone of science, but it is a principle with strong commitments to Hume's causal theory. #CauSciBook

Failure to reproduce is often blamed on scientists: no transparency, bias, misconduct, error, publication pressure, poor data. #CauSciBook

We argue that the principle of reproducibility should be subject to critical scrutiny, in light of our discussion of causation. #CauSciBook

The expectation that a study can be perfectly replicated & deliver exactly the same result, is philosophically problematic. #CauSciBook

When a study is repeated & results diverge, there are 2 responses: there's a causally relevant difference between them or one study is flawed.

But there's a third response to a failure to reproduce: that causation doesn't work in this way. #CauSciBook

Reproducibility rests on 4 assumptions: same cause, same effect, causal necessitation, total cause, deterministic & closed system. #CauSciBook

In the #CauSciBook we have challenged all 4 assumptions on philosophical grounds.

Science, however, deals with open systems, unknown/uncertain factors, nonlinear interactions & chancy or hypersensitive elements. #CauSciBook

Science, however, deals with open systems, unknown/uncertain factors, nonlinear interactions & chancy or hypersensitive elements. #CauSciBook

Problem: if we don’t know which factors are causally relevant to, then everything is potentially equally important to replicate. #CauSciBook

Perfect replication holds very little power if we are interested in robustness & generalisability of the causal insights. #CauSciBook

Understood as perfect replicability, reproducibility works best if what we replicate is models, not real life events. #CauSciBook

Different approaches supporting the same causal conclusion carry more epistemic weight than replication of a study. #CauSciBook

If the theory of evolution could only be demonstrated using the same genetic string of mice in the same lab, how useful would it be? #CauSciBook

We need new, realistic norms for science; for real people, real situations, real organisms & realistic standards for prediction. #CauSciBook

First, we must think outside the box of idealised models where context, complexity & variation are enemies of causal knowledge. #CauSciBook

The conclusion of the #CauSciBook is called New Norms of Science. The norms are listed in this @Cause_Health blog: What is the Guidelines Challenge?

I have now tweeted the whole #CauSciBook, Causation in Science and the Methods of Scientific Discovery. Thanks for engaging with it!