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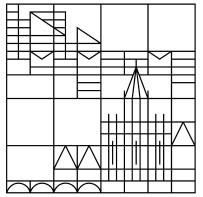

Induction and Necessary Connections in Scientific Practice

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Induction and Necessary Connections in Scientific Practice

- Background: Necessary Connections and the Old Problem
- Necessary Connections as Support for Scientific Inferences
  - Powers in Science
  - Cartwright and Munro on RCTs

Background: Necessary Connections and the Old Problem

Setup

- It has been argued that the Old Problem of Induction could be solved by introducing necessary connections.
- Allegedly, the proposed inference pattern is closer to scientific reasoning than non-necessitarian reconstructions of induction.
- This narrative seems to fit Nancy Cartwright's and Eileen Munro's attempt at reconstructing Randomised Clinical Trials as inferences to the efficacy of a drug via inferring a stable capacity quite well.
- In this talk, I will argue the introduction of stable capacities is unnecessary, and does not make the inference more secure, nor does it actually fit even with Cartwright's and Munro's reconstruction of RCTs.

Background: Necessary Connections and the Old Problem

Necessary connections to the rescue

- Basic model of the necessitarian solutions to the problem of induction:
- If there is a necessary connection between *F* and *G*, then every *F* will also be a *G*. We are justified to infer the *G*-ness of future/unobserved *F*s from the fact that *F*s necessarily are *G*s (cf. e.g. Armstrong 1983, 54-59).
- I will treat any ontologically rich notion of a necessity relation and any sort of manifestation of an essentialist disposition or irreducible power as a necessary connection.
  - This includes the Armstrong-Tooley-Dretske view, Dispositional Essentialism, and (*pace* Stephen Mumford and Rani Anjum) the neo-Aristotelian powers view (cf. e.g. Armstrong 1983, Tooley 1977, Dretske 1977, Mumford and Anjum 2011; Ellis 1998 and 2001).

Background: Necessary Connections and the Old Problem

Typically a two-stage argument:

- 1. From the fact that all *F*s have so far been *G*s (or we have consistently failed to bring about an *F* that is no *G* (cf. e.g. Hüttemann 2014, 32-33)) we infer via IBE:
  - there is a necessary connection between *F* and *G*.
- 2. From the necessary connection between *F* and *G* we infer:
  - all (future/unobserved) *F*s are *G*s. (Armstrong 1983, 104)

(Let us ignore van Fraassen's inference problem for the ADT-view (van Fraassen 1989, 166), the problem of cp-laws, and the question whether necessary connections can be time-limited (Beebee 2011) for a while.)

Background: Necessary Connections and the Old Problem

- This eliminates the enumerative inductive step from observed *F*s to unobserved/future *F*s, but introduces an IBE for why all observed *F*s have been *G*s.

- Armstrong maintains that regularities are not explanatory, hence Humeans cannot employ IBE and need to rely on enumerative induction, which they cannot justify. (Armstrong 1983, 52-59)

Background: Necessary Connections and the Old Problem

Necessitarian Standards of Justification

- The necessitarian attempts ultimately do not seek to justify inductive reasoning, but to eliminate enumerative induction.

- They seem to try to make the inferences themselves more secure by reducing them to inferences whose rationality is undisputed, up to the point where the inferences cease to be ampliative.

Background: Necessary Connections and the Old Problem

Necessitarian Standards of Justification

- This attempt to justify induction follows a common classical standard for what a justification of induction would be: an elimination of the ampliative step by demonstrating that induction is merely an enthymeme of a valid deductive inference.

- Usually the suppressed premise is some sort of uniformity thesis:

  All observed ferromagnets have so far attracted iron.
  Nature is uniform.
  If nature is uniform, ferromagnets do not change their behaviour.
  Future or unobserved ferromagnets will attract iron.

Background: Necessary Connections and the Old Problem

Necessitarian Standards of Justification

- We can analyse the necessitarian attempts to justify induction as a way to non-circularly empirically uniformity through necessary connections.

- All observed ferromagnets have so far attracted iron.
  The best explanation for this is that ferromagnets necessarily attract iron.
  Ferromagnets necessarily attract iron.
  Future or unobserved ferromagnets will attract iron.

Background: Necessary Connections and the Old Problem

Necessitarian Standards of Justification

- There are numerous problems with these attempts:
  - The inference to the effect that there is a necessary connection is ampliative itself and in need of justification.
  - The existence of a necessary connection between *F*-ness and *G*-ness does not imply that all *F*s (or *any F* for that matter) will be *G*s.
  - An elimination of induction is no justification.

- But, interestingly, the necessitarians' claim that this accurately represents scientific practice seems to be corroborated by Nancy Cartwright's, John Pemberton's and Eileen Munro's reconstruction of the inferences in randomised controlled trials or medical research in general.

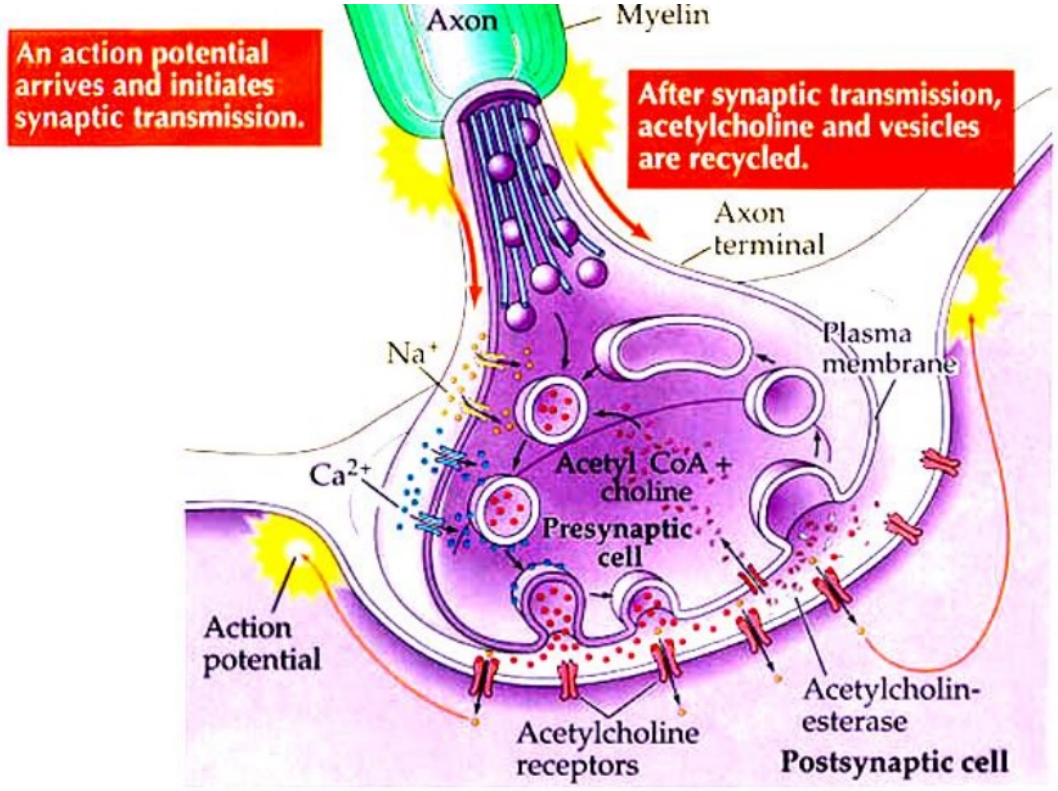
Necessary Connections as Support for Scientific Inferences

Powers in Science

- Necessitarians typically argue that necessary connections, apart from their role in justifying induction, are an indispensible feature in scientific reasoning.
- A necessitarian ontology, especially a powers ontology, is supposedly better suited to give an account of natural processes.
- Nancy Cartwright and John Pemberton (Cartwright and Pemberton 2014): it is the task of modern science to identify natural processes. These processes are sustained by the expression of neo-Aristotelian powers, i.e. dispositional properties with a causal essence, which are supposedly active and dynamic, in contrast to a Humean ontology.

Necessary Connections as Support for Scientific Inferences

Powers in Science



(Cartwright & Pemberton 2013, 100)

Necessary Connections as Support for Scientific Inferences

Powers in Science

- Natural processes have a canonical outcome, to which the powers contribute, although the canonical outcome does not need to actually come about.
- There are a lot of contributing, but also counteracting powers at play, each contributing to the actual outcome of the process.
- The actual outcome of the process is a case of mere vector-addition.
- The arrangement of particulars, each equipped with a number of powers, is a nomological machine.
- The non-strict nature of these processes (their ability to be counteracted) is supposedly hard to make sense of with the use of Humean regularity laws, for which the cp-problem has more bite.

Necessary Connections as Support for Scientific Inferences

Powers in Science

- Without going too deep into the minutiae of this account, there are a number of heavy ontological implications which might turn out problematic.
- Neo-Aristotelian powers are supposed to be inherently active, dynamic, over and above the Humean “pointilist” view of just one little thing and then another. (Groff 2013, 222).
- This gives rise to a non-reductive reading of these processes: processes are supposed to be temporally extended, enduring entities, irreducible to a sequence of static states.

Necessary Connections as Support for Scientific Inferences

Powers in Science

- However, the ontological difference between a process that is a sequence of states and one that is the active, progressive, continuous, irreducible expression of a power is irrelevant to modern science.
- Even if the analysis of processes is relevant to scientific practice, it is unclear whether this needs to entail such an ontologically rich process ontology.
- Problematically, it is exactly the continuous, irreducible character of these processes that is problematic from a perspective of temporal ontology. Very briefly: (Backmann 2018)
  - The issue is that such a dynamic reading of processes is not straightforwardly compatible with any temporal ontology that
  - 1) treats the building blocks of reality to be a selection of (past, present, or future) temporally unextended facts, or
  - 2) that does not feature an objective present in which this activity could take place, or
  - 3) that treats the present as temporally unextended (which we should do).

Necessary Connections as Support for Scientific Inferences

Cartwright and Munro on RCTs

- RCTs are a method to determine the causal efficacy of some sort of treatment.
- We draw a randomised sample from the population. That sample is split into an experimental and a control group.
- The allocation to the groups ideally is double blind and again randomised.
- If the trial is double blind, neither patient nor doctor know who is in the control and who is in the experimental group.
- Randomisation is meant to distribute possible disturbing factors evenly between control and experimental group.

Necessary Connections as Support for Scientific Inferences

Cartwright and Munro on RCTs

- Cartwright: RCTs are, *ideally*, clinchers: they rigorously determine whether a treatment is efficacious or not.
- Two reconstructions: probabilistic causation (Cartwright 2007) and capacities (Cartwright & Munro 2010).
- In both reconstructions, they argue that ideal RCTs are a *deductive* method. But in real life RCTs, the according deductive inference fails.
- This reconstruction of RCTs eliminates the enumerative step entirely.

Necessary Connections as Support for Scientific Inferences

Cartwright and Munro on RCTs

- Cartwright and Munro hold that in idealised RCTs, we *deductively* infer from the difference in outcome in otherwise homogenous groups that the treatment was a difference-maker.
- Ideally, we would *deduce* that the treatment will cause the outcome in the entire target population.
- This inference breaks down because we cannot be certain that the test groups and target population are homogenous in the distribution of confounding factors and in their causal make-up.
  - Hence, RCTs are not as externally valid as the defenders of EBM claim and their status as the “gold standard” is unwarranted.

Necessary Connections as Support for Scientific Inferences

Cartwright and Munro on RCTs

- Rather, we empirically establish that the treatment has a stable capacity to promote the respective outcome.
- Stable capacities are modally rich dispositional properties.
- But RCTs are not enough to establish the existence of stable capacities. For this, we need a host of other sources of evidence.
- Once the existence of a stable capacity has been established, we can infer that the treatment will also promote the outcome in the target population.

Necessary Connections as Support for Scientific Inferences

Cartwright and Munro on RCTs

- So far, it seems that Cartwright's and Munro's reconstruction of ideal RCTs fits the necessitarian narrative on induction:
- Instead of simply inferring that the treatment will cause the outcome in the target population from the fact that it caused the outcome in a sample, we infer that the treatment has a stable capacity, a power, to promote an outcome. We then *deductively* infer that the treatment will make the same fixed contribution to the outcome in the target population.
- Whether the treatment works for a specific person is then a simple case of "vector addition", i.e. adding all the capacities relevant for the contribution or destruction of the outcome present in that specific case. (Cartwright and Pemberton 2013)

Necessary Connections as Support for Scientific Inferences

Cartwright and Munro on RCTs

- But, against the necessitarian take on induction, the inference to the fact that the treatment will cause the outcome in the target population cannot be deductive.
- No reference to stable capacities or other necessary connections can change that.
- We still need to ampliatively infer that the treatment will have the *same* stable capacity in the future or in unobserved cases.
  - That is an ampliative inference, unless we want to make an a priori argument that it couldn't be otherwise.
  - But if we could make that argument, we wouldn't need the empirical study in the first place.
- We also do not know all causally relevant (confounding) causal factors for any particular case, so we cannot *deduce* by vector addition that the treatment will cause the outcome.
- This obviously renders our inference that the treatment will cause the outcome in the population ampliative. Cartwright and Munro accept this – which is why they claim that RCTs cannot be clinchers.

Necessary Connections as Support for Scientific Inferences

Cartwright and Munro on RCTs

- But such an analysis would hold RCTs to an unfairly high standard.
- The inference from the distribution of a feature in a sample to the distribution of the feature in the population is an archetypically ampliative one.
- We do not know whether the distribution of all causally relevant factors in sample and population is the same.
- It is simply practically impossible to collect the required data to know for certain that the distribution of confounders in sample and population is *exactly* the same.
- And when we consciously select a sample that is more homogenised that the population, of course our inference that T will cause O in the population will be ampliative.
- Our lack of exact knowledge that would make a deductive inference possible is exactly the reason why we have to do an RCT in the first place, why we have to randomise as best as possible.

Necessary Connections as Support for Scientific Inferences

That Pesky Ontology.

- Apart from the above-mentioned issues, it is unclear whether the chosen necessitarian ontology can provide the sort of properties that are needed for the sort of inferences portrayed above.
- Armstrong's necessitation relation is restricted to fundamental physical properties, so it is no help for e.g. inferences in medical research as portrayed above, which relies on macro-properties such as "Headache".
- The same holds for dispositional essentialism.
- Overpowering: It is all too easy to just ad hoc postulate macro-properties such as "the power alleviate headaches" or "the power to raise the price of a commodity" in order to get at the inference pattern described above. (Bird 2016)
- Example: MERCED. What would the relevant neo-Aristotelian power be in this case?

Conclusion

Wrapping up

- We have seen that in scientific practice, the introduction of necessary connections does not succeed in justifying induction by elimination.
- Regardless of whether scientists *actually* introduce necessary connections in the sense that proponents of the ADT-view, Powers Metaphysicians, or Dispositinal Essentialists propose aside, we would still need to ampliatively infer that:
  - The necessary connection also holds in future or unoberves cases
  - The backround conditions are such that the necessary connection actually produce the projected outcome
- It is also unclear whether the relevant ontologies actually allow for the sort of proliferated macro-properties needed for this.
- While Cartwright and Munro's stable capacities interpretation of RCTs seem to support the proposed necessitarian account of justification of induction at first sight, it does not support the view that the inference from the necessary connection to future or unobserved cases be deductive (nor is it supposed to demonstrate this).

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Thank you for your attention!

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