Abductive Knowledge vs. Abductive Preference

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- Feldbacher-Escamilla, Christian J. (2023b-06-01). *Abductive Knowledge vs. Abductive Preference*. Workshop. Presentation (invited). Rhine-Ruhr Epistemology Meeting 2023. University of Bonn: University of Bonn

- Feldbacher-Escamilla, Christian J. (2022a-07-01). *Abductive Knowledge vs. Abductive Preference*. Workshop. Presentation (invited). Alexander Birds Knowing Science - Author Meets Critics. University of Cologne: University of Cologne

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- DFG funded research unit *Inductive Metaphysics* (FOR 2495); subproject *Creative Abductive Inference and its Role for Inductive Metaphysics: Contingent Modality, Metaphysical Modelling, and Explanations in IM*.

Introduction

Key themes of Alexander Bird's *Knowing Science*:

1. . . . to establish that *knowledge* is central to
   what science is about
   (aim, accumulation, evidence)

2. . . . to reject *empiricism*
   (too narrow conception of evidence, too restrictive view about
   (meta)scientific knowledge and its accumulation)

Here we focus on *abductive knowledge*, so mainly on theme 1, but our
discussion has also a consequence for theme 2.
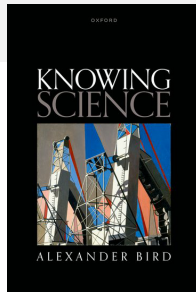
Introduction

We focus on a main ingredient of *Knowing Science*, namely on abductive knowledge via inference to the only explanation (IOE).

We will argue that Bird's justification of applying IOE is incomplete.

In order to complete his account of applying IOE for gaining *abductive knowledge*, ...

- ... he has to buy in some form of *evidential uniqueness thesis*, or
- ... he has to agree to be pushed more towards rational/abductive preference than knowledge.

The first option seems implausible; the latter counters his programme of *(Meta)Knowing Science*.
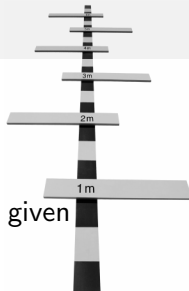
Contents

Inference to the Only Explanation

Knowledge in Science

Knowledge plays *the* dominant role in science.

How we can make any significant step forward in science given such a high epistemic standard.

Bird:

- Ad inferential basis: weaken the constraints for our evidence: E=K (no need of tracing back to observation etc.)

- Ad inference method: use one that is perfectly located at the intersection of ampliative and knowledge-preserving inferences.

We focus on the inference method: inference to the only explanation (IOE).

Inference to the Only Explanation (IOE)

Holmesian Inference

Inference to the Only Explanation (IOE)

Schema of IOE:

1. *Determinism*: A particular fact *e* has a (possible) explanation.

$$\exists h : Expl(h, e)$$

2. *Selection*: If *h* (truely) explains the fact *e*, then *h* is one of $h_1, \ldots, h_n$.

$$\forall h : Expl(h, e) \to (True(h) \& (h = h_1 \vee \cdots \vee h = h_n))$$

3. *Falsification*: $h_1, \ldots, h_{n-1}$ are falsified by additional evidence.

$$\neg True(h_1) \& \cdots \& \neg True(h_{n-1})$$

4. Hence: h_n is true.

$$True(h_n)$$

Determinism is virtually uncontested. *Falsification* can be taken for granted.

IOE: Falsification

It seems that Duhem-Quine style reasoning counters *falsification*:

Schema of Holistic Falsification:

1. Hypothesis *h* and auxiliary *a* allow for predicting *e*. $h \& a \vdash e$
2. The predicted *e* turns out to be false. $\neg e$
3. Hence: *h* or *a* are false. $\neg h \lor \neg a$

However, we agree with Bird that very often falsification is non-holistic:

Schema of Non-Holistic Falsification:

1. Hypothesis *h* and auxiliary *a* allow for predicting *e*. $h \& a \vdash e$
2. The predicted *e* turns out to be false. $\neg e$
3. We know *a* (to be true). a
4. Hence: *h* is false. $\neg h$

Still there is a problem with probabilism and falsificationism.

The Problem of Selection

IOE: Selection

Selection does the main job in IOE and seems to be mainly challenged by underdetermination.

Roughly: if theory is generally underdetermined by evidence *e*, how can we identify a particular set of alternative hypotheses

$$h_1, \ldots, h_n$$

in order to (truely) explain relevant pieces of *e*?

In more detail: underdetermination comes in two forms, a qualitative and a quantitative form.

Bird argues that qualitative underdetermination is question begging.

IOE: Selection: Qualitative Underdetermination

Qualitative Underdetermination of IOE:

1. IOE is an inference that has as premiss P some evidence e, and as conclusion C some hypothesis h, and e and h are of a different kind.

2. If an inference from P to C is justified/rational, then P is of the same kind as C (principle INF).

3. Hence: IOE is not justified/rational.

Specification:

Qualitative Empiricist Underdetermination of Theories/Inferences:

1. All evidence is observational.

2. From observational evidence only conclusions that are observational can be rationally inferred (particular instance of INF).

3. Hence: Only observational propositions can be known/rationally inferred.

Bird's criticism: Given $E=K$, premiss 1 is equivalent to conclusion (3).
$\Rightarrow$ QUESTION BEGGING

IOE: Selection: Qualitative Underdetermination

Interesting: criticism of qualitative underdetermination is not directed against (INF).

To the contrary, (INF) seems to even speak in favour of Bird's approach.

Take as kind in question *knowledge*, then it is also knowledge only which can be inferred:

Schema of Inferring Knowledge (e.g. Abductive Knowledge):

1. (E=K): All evidence is knowledge.
2. (INF): From premises that are known only conclusions that are known can be rationally inferred.
3. Hence: Only knowledge can be rationally inferred.

IOE: Selection: Quantitative Underdetermination

The main principle posing a problem for *selection* is:

(UD) For any given fact [e] and any set of evidence, there is always more than one plausible competing hypothesis consistent with the evidence that explains [e].

Basically, (UD) inflates the set of alternatives for *selection*.

This is particularly clear in the context of *falsification*:

- Let us assume that a set of alternatives $h_1, \ldots, h_n$ for explaining e is given;
- We then try to falsify $h_1, \ldots, h_{n-1}$;
- If we succeed, (UD) tells us that it is not just h_n that remains for explaining e, but that there are at least two such plausible and competing hypotheses.
- So, we "learn" that the set of alternatives for *selection* consists not only of $h_1, \ldots, h_n$, but actually of $h_1, \ldots, h_n, h_{n+1}$.
- If we go on with this line of reasoning, we see that the set of alternatives can, in principle, grow *ad infinitum*.

IOE: Selection: Quantitative Underdetermination

The challenge for *selection* by *quantitative underdetermination*:

> *Selection* given (UD): If h (truely) explains the fact e, then h is one of $h_1, \ldots, h_n, \blacksquare\ \blacksquare\ \blacksquare$.

Is there a possibility to block the regress and make *selection* manageable?

Bird: Yes: Our current theories are working so well that thinking about an alternative, as (UD) suggests, directly leads to (Cartesian) SCEPTICISM:

> *"If we are to contemplate such a possibility [of finding an alternative h_{n+1}], we must do so via the supposition of sceptical hypotheses, e.g. that we are all brains in vats being fed illusions of scientific experiments and so forth."*

Such a sceptical h_{n+1} is no viable alternative: not plausible and not taken as a real competitor by scientists.

So, we can block the regress and stop at our initial h_n.

IOE: Selection: Birds Main Argument

To take stock: the main competitor of *selection* is *underdetermination*.
Underdetermination faces two problems: it begs the question (qualitative)
or it results in Cartesian scepticism (quantitative).

Neither of these results is viable $\Rightarrow$ blame *underdetermination*

Bird's Main Argument in Favour of Selection:

1. Either *selection* or *underdetermination* holds.
2. *Underdetermination* **either** begs the question **or** results in Cartesian scepticism.
3. Begging the question is no viable way to go.
4. Cartesian scepticism is no viable way to go.
5. Hence: *Underdetermination* is not viable.
6. Hence: *Selection* is right.

We pretty much agree with all but one of the premises: 2

IOE: Selection: Contra Bird

We think that the step to Cartesian scepticism is too quick.

It's a lack of imagination to think that in important episodes of science we have no alternative to a hypothesis other than Cartesian style hypotheses.

To illustrate this by the help of an example: Mendel's abductive account of inheritance

IOE: Selection: Contra Bird
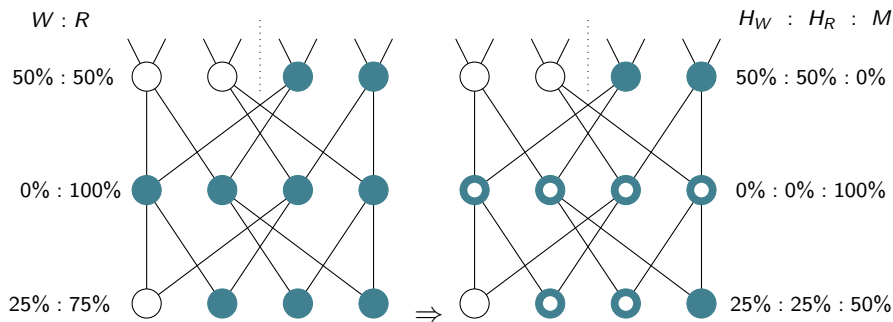
Hypothesis 1 (Mendel)

Figure: A prototypical abductive inference: Gregor Mendel's famous laws of inheritance: In 1850s and 60s, Mendel cultivated and tested about 5,000 pea plants and performed hybridisation experiments. Mendel inferred from regularities about R, W (red, white colour), laws about H_W (recessive white), H_R dominant (red), and M (mixed) traits. The data is presented on the left side. The inferred structure on the right. The edges represent inheritance. The underlying theoretical structure was simple and allowed for an empirically adequate explanation of Mendel's data.

IOE: Selection: Contra Bird

Hypothesis 2 (Pseudo-Mendel)

Hypothesis 1 was about two inheritable traits, w and r; r is dominant.
Hypothesis 2:

- ... is about four inheritable traits: w_1, w_2 as well as r_1, r_2

- the r_i dominate the w_i

- neither r_1, r_2 nor w_1, w_2 can be combined

- observationally we cannot distinguish between w_1, w_2 and r_1, r_2

We can use this theoretical structure to explain the same observations:

| Type	$w_1 w_1$	$w_2 w_2$	$r_1 r_1$	$r_2 r_2$	$w_1 r_1$	$w_1 r_2$	$w_2 r_1$	$w_2 r_2$	W	R
1st generation	25	25	25	25	0	0	0	0	50%	50%
2nd generation	0	0	0	0	25	25	25	25	0%	100%
3rd generation	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	25%	75%

There is lots of space left for *underdetermination* in order to enlarge *selection*'s set of alternatives without reference to plain Cartesian scepticism.

IOE: Selection: Contra Bird

From an observational standpoint also the more complex w_i-r_i-hypothesis does as good a job as does Mendel's w-r-hypothesis.

Oftentimes we even find that an elegant simple structure needs to be fine-grained and made more complex in order to account for an ever growing and increasingly fine-grained set of evidence.

Example: Distinction of good (HDL: high-density lipoprotein) vs. bad (LDL: low-density lipoprotein) cholesterol.

HDL ◯ good   LDL ◯ bad
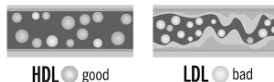
As the examples should illustrate, there seems to be lots of space left for *underdetermination* in order to enlarge *selection*'s set of alternative explanations without automatically turning into some form of plain Cartesian scepticism.

IOE: Selection: Evidential Uniqueness to the Rescue?

Given the general structure of the argumentation offered in *Knowing Science*, Bird seems to be able to amend his account of justifying *selection*.

Main Idea: Most relevant theories taken as established knowledge of contemporary science are highly complex, interdisciplinarily interdependent, and contain a diverse range of evidence.

$\Rightarrow$ It might be even impossible for us to think about alternative explanations.

So, (quantitative) *underdetermination* seems to vanish with an increasing amount and quality of evidence (in the wide sense of E=K).

This seems to amount to some form of:

Evidential Uniqueness:

If evidence *e* is rich and complex enough, it singles out a *unique* (set of) theoretical structure(s) that provide an explanation.
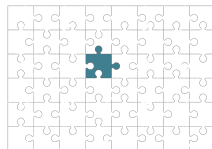
IOE: Selection: Evidential Uniqueness to the Rescue?

Result:

Main Argument in Favour of Selection Amended by Uniqueness:

1. Either *selection* or *underdetermination* holds.

2. *Underdetermination* either begs the question or results in Cartesian scepticism or counters evidential uniqueness.

3. Begging the question is no viable way to go.

4. Cartesian scepticism is no viable way to go.

5. **Countering evidential uniqueness is no viable way to go.**

6. Hence: *Underdetermination* is not viable.

7. Hence: *Selection* is right.

We pretty much agree with all but one of the premises here: 5.

IOE: Selection: Contra Uniqueness-Bird

True, given a rich and complex set of evidence, it turns out increasingly hard for us to work out alternative structures.

But such ruling out of a limited set of alternatives seems to be insignificant given the unlimited possibilities provided by mathematics.

In the light of possible mathematical structures, evidence, regardless how rich and complex it might be, will never single out a *unique* (set of such) structure(s).

In this sense, countering evidential uniqueness seems to be a viable way to go.

IOE: The Main Problem of Selection

The same way *Knowing Science* suggests a social turn, one might also think about a machine turn (Bird also hints at this) in science.

If we extrapolate to a possibly not so distant future with super computers and artificial intelligence dominating scientific theory building and justification $\Rightarrow$ we should expect also paradigmatic changes in theoretical structure

To take stock, the given justification of *selection* as a key component of applying IOE ...

- ... underestimates *underdetermination*'s power to find an intermediate spot between begging the question and Cartesian scepticism; i.e.:
- ... overestimates the role of rich and complex evidence in singling out a unique theoretical structure.

Abductive Preference to the Rescue?

Explanationism

Slogan of explanationism: Abduction is rational.

One ends up with different forms of explanationism depending on how one spells out *abduction* and *rational* (cf. Peirce 1994; Schurz 2008).

For us relevant:

		abduction	
		IBE	IOE
rational	acceptance	(Lipton 2004)	(Bird 2022)
	preference	(Bird 2022)	?

Bird: IBE & preference for the case where falsification fails.

Our criticism: IOE & acceptance problematic due to the problem of selection

Question: Can we employ IOE & preference: Abductive Preference?

Abductive Preference

We have argued that *selection* fails (because we are not able to establish that the true hypothesis/explanation is among the set of alternatives)

$\Rightarrow$ Suggestion: Shift from rational *acceptance* to *preference* (cf. Mohammadian 2019; Feldbacher-Escamilla 2022b).

Not uncommon in (contemporary) epistemology: decision theory, problem of induction (cf. Jeffrey 1983; Reichenbach 1938/1961; Schurz 2019).

If we assume *determinism* and *falsification*, one clearly has a preference for the unfalsified h_n (compared to the falsified $h_1, \ldots, h_{n-1}$) but one can do so without plainly accepting h_n.

➕ explanationism with clear epistemic potential (vs. loveliness of IBE)
➖ not helpful for the endeavour of *(meta)knowing science*

Summary

- The account of *abductive knowledge* is based on inference to the only explanation (IOE) and the claim that whatever we know can serve as evidence.
- IOE has three principles, *determinism*, *selection*, and *falsification*.
- We agreed that *determinism* and *falsification* might be in fact established in such an inference.
- We have argued that *selection* is not completely justified.
- To justify it(s use), one either needs to assume some form of *evidential uniqueness thesis*; or one shifts from explanationism in the mode of rational *acceptance* to that of rational *preference*.
- Evidential uniqueness seems implausible.
- Rational preference (*abductive preference*) falls short of supporting the programme of *metascientific knowledge*.

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