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Inductive Knowability of the Modal

Limits to Feel Good about

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Abstract

This paper scrutinises the limits of *a posteriori* induction in acquiring modal knowledge. I focus on my similarity-based account (Roca-Royes [2017]); an inductive, non-rationalist epistemology of modality about concrete entities. Despite the explanatory merits of the account in relation to a vast range of modal claims, this inductive epistemology has been found incapable of yielding knowledge of a certain, other range of modal claims. Here, two notions of knowability are distinguished which reveal some of these limitations to be not only accidental to the method but also virtuous. Additionally, the scrutiny suggests a recipe for increasingly pushing back, as modal *enquirers*, some of these limits. Limits will irremediably remain. But, as modal *epistemologists*, it is to explain what lies *beyond* these irremediable limits (not within) that we should look somewhere else.

Keywords

essentialist knowledge; inductive modal knowledge; knowability; modal non-rationalism; non-uniformism

1 Introduction

A central question in the epistemology of modality, made salient by Hale [2003, 2013] and Lowe [2008, 2012], turns on the epistemic priority of essences. Does our capacity for modal knowledge depend on a capacity for essentialist knowledge? I advocate for a negative

answer. And yet most forms of Modal Rationalism cannot avoid such dependence: the extent to which rationalist methods deliver extensionally right results depends on the extent to which they are informed, on some level, about the essential. This is an instance of what Vaidya and Wallner [2021] diagnose as The Problem of Modal Epistemic Friction.[1] And a recurrent criticism is that, while they presuppose, rely on, or are hostage to, the knowability of essential facts, thus incurring the further explanatory burden of accounting for our capacity for essentialist knowledge, they perform poorly at this task. In addition, in making possibility knowledge epistemically posterior to (an exercised capacity for) essentialist knowledge, this poor performance in turn jeopardises the epistemic explanations that these accounts offer of our knowledge of possibility.[2] The extent of this jeopardy thus reaches far beyond what any epistemologist of modality can afford. A remedy is needed. Which one?

One might think that the problem is just one of a mere explanatory *deficit*. If so, the remedy could simply consist in aiming for better performance at explaining our capacity for essentialist knowledge, and the rest could remain as is. Unfortunately, not so. The problem with such "essence first" epistemologies is deeper than that of a mere unfulfilled burden: remedying the explanatory deficit would simply not solve it. The reason is that the explanations of *possibility* knowledge that they engender, in representing this type of knowledge as epistemically posterior to (our capacity for) essentialist knowledge, are *inadequate* tout court. Possibility knowledge is more robust than essentialist knowledge, but this fact can't be accommodated by an essence-first epistemology.[3]

In this context, explanations of *possibility*-knowledge that are independent of a capacity for essentialist knowledge are a better remedy, and the recent literature has reacted accordingly. As Thomasson notes, "in response to the difficulties of rationalism, there has been a recent resurgence of interest in empiricist approaches to modal epistemology"

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[1] This problem, as they make clear, spans beyond Modal Rationalism—it is for instance very poignant in Williamson's epistemology of modality too.

[2] It is not coincidental that recent rationalist developments in the epistemology of modality focus explicitly on our knowledge of essence. See for instance Goff [2021], Hale [2013], Jago [2021], Kment [2021], Mallozzi [2021a], Peacocke [2020] and Tahko [2018].

[3] See Roca-Royes [2021: §4] for more on this. The manifestation of this problem varies in degrees across the affected range of accounts, depending on how explicit or implicit the accounts are about the epistemic priority of essentialist knowledge (or our capacity for it). The bold rubric of the problem is, nonetheless, as briefly stated in the main text.

([2021: S2079]);[4] and a salient feature of this empiricist turn (as we shall call it) is the insistence on the need for a bottom-up, or possibility-based, epistemology. One effect of this is that modal knowledge has been brought closer, in nature, to scientific knowledge as Fischer [2017] articulates.[5]

By now, *it would appear*, the literature has overcome the Blackburn/Craig idea that how things are cannot ground modal knowledge; an idea that no doubt fuelled contemporary modal rationalism.[6] I write 'it would appear', and there's some truth in that appearance: for, precisely, non-rationalist accounts are teaching us *how* modal knowledge can be grounded on causal affection and still transcend actuality, much like scientific knowledge can be so grounded and still transcend empirical data: simply by using *ampliative* methodology on the available data.

Still, there's something pressing that remains of the Blackburn/Craig idea: do these non-rationalist epistemologies give us *enough*? Thomason [2021] is representative of a general concern that they don't give us enough.[7] In connection to Vetter's Dispositionalism (but then generalising) she writes that:

> [D]ispositions and counterfactuals are the modal properties of interest to *science* more than to *metaphysics*—and are crucially different from the modal claims typically at issue in metaphysical and other strictly philosophical debates.
>
> It is [not] clear that anything along the lines of an empirical account of modal knowledge

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[4] For a sample, see: Bueno and Shalkowski [2015], Fischer [2015], Hawke [2017], Leon [2017], Nolan [2017], Roca-Royes [2017], Strohminger [2015], Tahko [2017] and Vetter [2016, 2023]. Also Dohrn [2019], Rasmussen [2014] and Williamson [2007] incorporate crucial, *a posteriori*, justificatory elements, although these views aren't explicitly presented with the rationalism/empiricism prism in mind.

[5] The connection between modal and scientific knowledge can be a lot more intimate than this bare methodological minimum. For instance, on Vetter's Potentialism (or on Dispositionalist accounts more generally) modal knowledge *is* knowledge of dispositions, and thus the methods of scientific discovery *are* the methods of modal discovery. Similarly, as we shall see later in the main text, some inductive *de re* modal knowledge (at least) is knowledge of causal powers and effect susceptibilities. See Fischer [2015], Roca-Royes [2007, 2017] and Vetter [2016, 2023].

[6] In the cases of Blackburn and Craig themselves, it fuelled also a belief in the mind-dependence of the modal realm (see Craig [1985] and Blackburn [1986]). But others have envisioned rationalist accounts of modal knowledge with emphasis on the attempt to safeguard the mind-independence of modality. See Peacocke [1999].

[7] Hawke [2011] has similar worries in relation to his thorough reception of van Inwagen's scepticism [1998].

> can be of use for specifically *metaphysical* modal claims. [Thomasson 2021: S2082]

Are (philosophical) zombies possible? What about transparent iron or naturally purple cows? Are biological origins essential? Can there be coincident entities? The suspicion, flavoured as an objection, is that empiricist epistemologies cannot answer these philosophically central questions.

For Thomasson, there's a *metaphysical* lesson to be learned from how the epistemology of modality has developed in the last three decades. The inadequacy of modal rationalism, followed by the limits of empiricism, should recommend, according to her, the endorsement of *modal normativism*—a radically different modal metaphysics on which modal truths are not there to be discovered.[8] This paper is in part a reaction to Thomasson's epistemological and metaphysical diagnosis. Two immediate comments.

First, as a reaction to the limits of modal empiricism, Thomasson's revisionary metaphysics is premature. The sheer existence of limits, which Thomasson presents as a problem, need not be problematic. Whether it is, will largely depend on the problematicness (or lack of it) of non-uniformism in the epistemology of modality. And it is not coincidental that non-rationalist accounts have emerged in parallel with a reasoned call for non-uniformism as a new desideratum, mostly by the same theorists.[9] When Thomasson writes "that there is a better approach to the problems of modality on which these [epistemic] challenges clearly can be met" ([2021: S2079]), she's comparing her modal normativism to an empiricist epistemology *on its own*; but the relevant *relatum* of this comparison should be, I contend, a *non-uniform epistemology that includes it*. It remains to be seen how the two right *relata* compare (but this is not this paper's task).[10]

Second, despite not necessarily problematic, it is nonetheless urgent to assess the extent and nature of these limits. The extent, because this will let us know how much there is left to be explained *by other means*. And the nature, because (as we shall see) the scrutiny will reveal some of the actual limits to be *contingent*. And more than this, these contingent limits can also be argued to be *virtuous*—something to feel good about—and something that, to some extent, can be pushed back.

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[8] See Thomasson [2020].

[9] For more on uniformism *vs.* non-uniformism in the area, see Roca-Royes [2021] and Sjölin Wirling [2020].

[10] For my contribution to this issue elsewhere, the seeds of my non-uniform epistemology that I submit as the right *relatum* are found in this triad, along with the present paper: Roca-Royes [2017, 2018, 2019].

It is this urgent task that I tackle in this paper. I do so by focusing on my similarity-based account (Roca-Royes [2017]); an inductive, non-rationalist epistemology of possibility about concrete entities. Despite the explanatory merits of the account, I emphasised (already in [2017]) its limitations. There, I argued for two main claims:

(1) The inductive methodology adequately explains knowledge of a certain range of *de re* possibilities; but

(2) It cannot deliver knowledge of a certain other range of possibilities (somewhat removed from everyday life), which in turn prevents the inductive knowability of related impossibilities, necessities and essentialist claims.

The significance of (1) should not be overlooked: limits aside, the adequacy that the account achieves in explaining *possibility* knowledge is—as per the inadequacy complaint summarised above—out of reach for the "essence first" epistemologist. Against this background, what I shall do here is scrutinise and qualify claim (2). To do this, I will distinguish two notions of knowability that the nature of the debate makes unprecedentedly urgent to have distinguished. Once the distinction is on the table, I can reassess claim (2) with each of the two knowability notions in mind, and draw appropriate lessons.

By the end of the paper, we will have achieved a battery of things: a better understanding of the similarity method itself, as well as of its virtues; a recipe for pushing back some of the *contingent* knowability limits we face in using it; and a better appreciation of its *irremediable* limits.

The plan is as follows: in §2, I summarise the main claims in Roca-Royes [2017], with emphasis on the reasons supporting (2) above. Taking it from there, I shall (§3) distinguish two notions of *knowability* that are particularly relevant in the context of the current developments within the epistemology of modality. In §4, I run a first application of the two notions and draw the main lessons from it. In §5, I reflect on how to act on those lessons as modal *enquirers*. Section 6 runs a second application of the knowability notions, with a view to identifying where our future efforts in the area should be put, as modal *epistemologists*. This all is followed by a concluding section.

2 Inductive epistemology of modality

I shall only summarise the key aspects of this methodology.[11] The core idea in Roca-Royes [2017] is that we know about unrealized *de re* possibilities because we've seen their kinds—in a broad sense of 'seen' but fundamentally *a posteriori*—realized somewhere else. For instance, we know we could survive a 6-hour cardiac arrest because we know that this has happened to another person. The focus of the sketch is *possibility* knowledge about *concrete* entities.

A central notion of the account is that of an *epistemic counterpart*. This notion is reminiscent of Lewis's counterpart theory (Lewis [1986]) but with the critical difference that mine is solely epistemic: others' experiences are not what modal truths about us consist in; similarly, my table's breaking is not what your table's possibility of breaking consists in either. Rather, and solely epistemically, those facts let us know (inform us about) what could happen to us, your table, etc. Generalise widely, and the same holds.

These epistemic routes to possibilities, afforded by this methodology, are *inductive*. They heavily rest on the uniformity of nature, taking it that similarity in both causal powers and effect susceptibility is a matter of (actual) *qualitative similarity*, thus yielding epistemic routes from the latter to the former. As such, this notion of similarity is central to the account. Examples of possibilities that, I contended, can be (and typically are) known inductively include ([2017: 225]):

(i) The possibility that the wooden table in my office breaks
(ii) The possibility that John Kennedy dies of a heart attack
(iii) The possibility that Gandhi is born on 1/10/1869
(iv) The possibility that Obama is born in Washington

In each of these cases (and in general) the specific routes that the inductive methodology delivers all instantiate, at bottom, a common pattern: one transitions to a possibility, $\Diamond\psi(a)$—for instance: that my table can break—from an *actual* qualitative state, $\varphi(a)$—continuing with the example: that it is a wooden table. And this transition is justified, ultimately, on the basis of our knowing that an *epistemic counterpart* of a, b, was at some point φ too, and then ψ; where the latter grounds $\Diamond\psi(b)$ by means of the principle that actuality implies possibility ($p \rightarrow \Diamond p$). In such transitions, therefore, one essentially relies on the

[11] For expanded details, Roca-Royes [2017] is the piece to go to.

uniformity of nature because what allows us to go from the *b*-knowledge—$\varphi(b)\rightarrow\Diamond\psi(b)$—to the *a*-knowledge is a general principle grounded in our *b*-knowledge, bottom-up, and warranted by such uniformity: $\forall x(\varphi(x)\rightarrow\Diamond\psi(x))$. This is what makes the methodology at hand an *inductive* one, allowing us to extrapolate from observed cases to unobserved ones.

Importantly, despite the method's reliance on induction in establishing the general principle mentioned above, the methods by means of which we acquire knowledge of the inductive base—that is, knowledge of the φ- and ψ-facts—need not be inductive. Instead:

> Ampliative methods of potentially all sorts will be involved, depending on the cases, in grounding the categorical knowledge of the epistemic counterparts that then inductively grounds the [given] principle. [Roca-Royes 2017: 230]

That this account is not a rationalist one is due to the fact that, when it comes to *de re* possibilities about concrete entities—which is, to recall, my focus in [2017]—the categorical φ- and ψ-facts will typically be known fundamentally *a posteriori*.

Now, like any other method, *a posteriori* induction can be adequately applied as well as inadequately. As I unfold in the [2017] piece, all *adequate* applications of this inductive route will have in common that the φ-fact is a *relevant* respect of similarity between *a* and *b*, relative to the possibility at issue, $\Diamond\psi$. Additionally, it is also common to the adequate applications that, for any *a*, the actualization of $\Diamond\psi(a)$—that is, the fact that $\psi(a)$—is (or would be, in cases where the possibility has not been actualized) temporally posterior to (the beginning of) $\varphi(a)$. This temporal order between $\varphi(a)$ and $\psi(a)$ is important because it correlates with an *epistemic* priority order too.[12] Jointly, the two orders result in the following: in cases where *a* has not realized the possibility of ψ-ing, it is *antecedent* knowledge of $\varphi(a)$ which (partially) grounds our knowledge that *a* can (*subsequently*) be ψ ([2017: 236]).

In all *adequate* applications of this inductive route, and only then, the property φ (that is: the relevant respect of similarity) is called 'an *epistemic anchor*' because this is what they are; they are items that *ground* our transitions to possibility *knowledge*. Indeed, provided other pieces of information (about the fate of epistemic counterparts) are in place, an *epistemic anchor* is a *safe*, known place from where we can discover unrealized possibilities.

The centrality of this notion—*epistemic anchor*—stems from the fact that it allows us to explain *both* the adequacy of the adequate applications of this methodology as well as

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[12] Temporality plays a fundamental role also in a Potentiality-based account of metaphysical possibility (see especially Vetter [2016]).

the inadequacy of some inadequate attempts. It is the lack of epistemic anchors (as per our current evidence), for instance, what explains the inductive undecidability about the possibility of naturally purple cows, of transparent iron, of different origins, or of different fundamental kind membership.

To illustrate this, and as part of my argument for claim (2) above, I argued ([2017: §12.4]) that, regardless of their truth value, the following possibility statements are *not* knowable by means of this inductive methodology:

(v) Malala could have had my neighbour's origins (sperm *s* and egg *e*)
(vi) Gandhi could be a cat

In my argument for these unknowability results, I envisioned inductive routes that, I still maintain, are indeed inadequate. And they are inadequate, precisely, because the routes envisioned (unlike what I developed for cases (i)-(iv) above) fail to involve genuine *epistemic anchors*. For instance, the specific epistemic route I considered in the case of (v) goes by means of the principle Hx→◇Ox*se*, where 'Ox*se*' is to be interpreted as *x originates from sperm s and egg cell e*, and where 'H' is interpreted as *being human* ([2017: 237–8]). The inadequate reasoning in this case would go as follows: 'My human neighbour, *b*, originated from *s* and *e*. Thus, humans can originate from *s* and *e* (Hx→◇Ox*se*). Malala is human. Therefore, she could have originated from *s* and *e*'. And, as anticipated, the notion of an epistemic anchor helps us indeed explain the inadequacy of this reasoning: relative to specific origin properties, *being human* is not an epistemic anchor. And, given the temporal order mentioned above, what goes for *being human* goes for any other property:

> The problem with the possibility in (v) is that, in searching for a potential [epistemic] anchor, we would need to go so far back in time that we would lose Malala altogether and, with her, we would lose also any qualitative character she's ever had. There is—and there could be—no φ such that, in virtue of knowing Malala to be (or have been) φ, she can be known to be able to *subsequently* originate from [*s*] and [*e*]. [Roca-Royes 2017: 237]

To recall, epistemic anchors are epistemically *safe* places from where to transition to the ψ-possibilities at issue. This reveals that the step at which the envisioned reasoning goes wrong is the one where it generalises from *the neighbour's specific origins being s and e* to those origins being a possibility for humans in general—Hx→◇Ox*se*—which is, precisely, the inductive one. And indeed, given the possibility at issue, this route would not respect the temporal order found to be common in the adequate applications: origin-events are not

temporarily posterior to (the beginning of) the instantiation of *humanity*.

Reflection on the type of cases that the account seems to struggle with suggests that its limits *are* of the type that worried Thomasson: the method might successfully explain everyday modal knowledge, but it seems to struggle with philosophically central modal claims. (Note also the close relation between (v) and (vi), on the one hand, and two of the most discussed essentialist principles in the literature: respectively, the *essentiality of origins* and the *essentiality of kind*.)

I shall not dispute the existence of the limits. But I will qualify them by distinguishing different types of limits. As we will see, the way in which I motivated the (unqualified) limits back in [2017], and the way they have been received by Thomasson [2021], suggests a more intimate connection than there really is between the methodology itself and the unknowability results. These two things are in need of being disentangled.

With this aim in mind, the next step is to distinguish two notions of *knowability* that appear to be conflated but that the current context makes urgent to distinguish.

3 Knowability notions

Our topic is the epistemology of *modal* facts, and our context is that of a *non-rationalist* epistemology. These two ingredients combine in interesting, novel ways that the literature, in being only recently shifting away from rationalism, has not yet properly explored. As we shall see, knowability truths themselves—in particular, truths as to whether a given *modal* truth (Mp) is know*able* or not—are in the current context more prone to contingency, even when the modal truth at issue might itself be necessary ($\Box$Mp).[13] Let me unfold.

In general, what can or cannot be known with a given method is a complex matter that depends on things such as the features of the methodology at hand, and/or the evidence available (current, future or possible). When this evidence is to be acquired *a posteriori*, furthermore, how the world *is* will have a heavier impact on (un)knowability than otherwise. And yet, how heavy that impact is depends on the exact notion of knowability at play. The following will witness these general claims.

I cannot know by means of smelling what are the colours of the three spots displayed by my mobile's screensaver right now: my sense of smell is unfitting for these purposes. This

[13] Crudely, when the methodology is a rationalist one, knowability facts are not to be expected to vary from world to world as much as we're about to diagnose for *a posteriori* methodologies.

illustrates how knowability by means of a given method sometimes depends on features of the method itself. At the same time, given that they are red, not even by looking I can know that they are blue. Thus, some other times, knowability depends not on the method but on how the world is (and consequently the evidence it provides). And yet, in another, more strictly modal sense, I *could* still know by looking that the dots are blue: it's possible *that they are blue and I know (see) them to be so.* Indeed, if they *were* blue, that would be an ordinarily discoverable truth: I would know by looking in the appropriate direction. As I shall motivate, given our topic and context—*modal empiricism*—this latter sense of knowability (even when modal *truth* might be constant across worlds) should be paid attention to when assessing the explanatory potential of a suggested epistemic method.

To anticipate: in a rationalist context, and as far as modal matters are concerned, the two notions of knowability I'm about to distinguish are substantially harder to come apart (extensionally) than in our current, empiricist context. And because of this, knowability questions that, I contend, ought to be distinguished after the empiricist turn, have nonetheless remained conflated. Clarification has thus become urgent. We need to clarify the knowability questions, as well as the knowability claims with which we answer them, since a proper assessment of the epistemic worth of non-rationalist methodologies is impeded otherwise.

Let me then distinguish those two notions of knowability: one is (indexedly) factive and the other is non-factive. I here introduce them in general terms to then apply them (§§4-6) to the current context and topic. The factive one—which is in fact a schema—goes as follows:

> Knowability$_w$ ($\Diamond K_w$): $\Diamond K_w p$ if and only if p_w and a w-human satisfies that if she attempted to know p (with the evidence made available by w), she *might* come to know it.
>
> where 'p_w' means that p is true in w.

(I am interested in what *us* humans can know, and this is why I'm defining Knowability$_w$—as well as Knowability$_\varnothing$ (below)—the way I'm defining them. A world, w, without humans automatically makes all its facts unknowable$_w$. This is an inessential, simplifying move, and it's intended.)

In this factive sense, it is not possible to know falsities. This is the sense involved in my

first unknowability claim about the dots: I cannot-know$_{@}$ the dots to be blue (where '@' stands for the actual world). The presence of the subscript in that notion (being used as a variable) is to mark the strong world-dependence of the extension of that notion: what is knowable$_{w}$ in a world, w, strongly depends on what is true at w, including facts about the cognitive capabilities of its human inhabitants and the evidence provided to them by that world. Due attention ought to be paid to the counterfactual on the right-hand side of ($\Diamond K_{w}$): if a given w-inhabitant attempted to know *p* (with the evidence made available by w), she *might* come to know it. Because of this, the w-humans' cognitive capacities and the evidence provided *by the world* (as well as what is true in it) are largely held fixed in the worlds of evaluation of that counterfactual: they are largely as they are in w. It will help to bear this in mind when assessing knowability$_{w}$ facts.

In this factive sense, it is not possible to know falsities. However, this factive notion—*i.e.*, knowability$_{w}$—does not imply that all w-truths are knowable$_{w}$. Falsity is certainly one source of unknowability$_{w}$ (a *guaranteed* one), but there might be other sources, compatibly with the truth of the proposition at hand. There might be truths, *p*, for instance, whose knowability$_{w}$ conditions from the given w-world exceed the cognitive capacities of its human-inhabitants, or the strength of the evidence that w *will ever* provide them with. In these cases, at such world, no human *would* come to know *p* upon attempting to do so, and this renders *p* unknowable$_{w}$ (despite true).

The case of (un)knowability$_{w}$ that is most relevant for us is that of (un)knowability$_{@}$; that is, the case where the w at issue is the actual world. Used from within the actual world, any truth, *p*, about which we're actually sceptic is (for all we know) a plausible example of an unknowable$_{@}$ truth. In these cases, it is appropriate to say that it is unknowable$_{@}$ whether *p*.

As hinted at above, though, there is a different notion of *knowability* that we should consider and, according to it, in a different but equally plausible sense, it is possible to know propositions that are, in fact, false (or else true but unknowable$_{w}$):

Knowability$_{\varnothing}$ ($\Diamond K_{\varnothing}$): $\Diamond K_{\varnothing}p$ if and only if $\exists w \exists x(Ixw \wedge Kxp)$

Where 'w' ranges of possible worlds, 'Ixw' stands for 'x is a human inhabitant of w' and 'Kx*p*' stands for 'x knows that *p*'. According to this other notion of knowability, something *p* is knowable$_{\varnothing}$ iff there is a possible world, w, in which a human knows *p* (which, by the facticity of knowledge, implies that *p* is the case at that world). Here, the subscript '$_{\varnothing}$'—not used as a variable—marks that what is knowable$_{\varnothing}$ at any given world, w, is either not *world*-sensitive

at all (if S5 holds) or, if it is, it is not so strongly dependent (as with $\Diamond K_w$) on what is the case at the given w. Instead, what is knowable in this sense is *modal-space*-sensitive, as the following remarks should clarify.[14]

For current purposes, the most salient difference between these two notions is that knowability$_w$ tracks what is known (by humans) in some *w-closest* worlds (*i.e.*, the worlds of evaluation of the counterfactual that features on the right-hand side of the characterisation of ($\Diamond K_w$)), whereas knowability$_\varnothing$ tracks what is known (by humans) in some *possible* world (where the facts and our cognitive capacities might be very different from what they are in the actual world). As anticipated, therefore, knowability$_\varnothing$ is modal space sensitive: it tracks what is known (by humans) somewhere in the entire modal space.[15]

To get fluent with these two notions let me focus first on non-modal propositions. Actual examples of propositions that are unknowable$_@$ but knowable$_\varnothing$ will easily be found among contingent falsehoods. The blue dots scenario from above provides one such example. Analogously, that *John Kennedy died of a heart attack* is unknowable$_@$, since it is false, but (under the assumption that Kennedy could have died of a heart attack) there are some possible worlds in which it is true and known that he died of a heart attack; therefore, that proposition is knowable$_\varnothing$ even at our world.

But, as hinted above, actual *truths* can also fall under this category—of unknowable$_@$ yet knowable$_\varnothing$. And, as the following sections will clarify, when it comes to assessing the limits

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[14] The contrast between these two notions, as intended, is purely modal for now. But focusing on different aspects, such as *time*, or *space*, analogous contrasts can be drawn. To illustrate it with the temporal case: it might *now* be unknowable (undiscoverable) how many penguins there were in the Antarctica on 1st March 1324, at noon. But that might have been discoverable for a human suitably located in time (and space). One could easily capture this contrast with more fine-grained notions. I won't go into them, but I assume that the subscripts I'm using next can hint at them sufficiently well: knowability$_{w,t}$ and knowability$_{w,\varnothing}$. Arguably, knowability$_{w,\varnothing}$ and knowability$_w$ are coextensional, and I'm treating them as such in the main text.

[15] These two notions are very close to knowability notions distinguished in Heylen and Morales Carbonell [2023]. While it is exciting to see something like $\Diamond K_\varnothing$ being considered by these authors, the excitement (for my purposes) drops when seeing it quickly discarded on account of its non-facticity: "In many cases we worry about what is knowable about the actual state of the world, not about what is knowable in purely counterfactual scenarios. To address this point, we require a factive concept of knowability" ([2023: 4]). This is a natural thing for them to do in the context of their paper. As suggested in the main text, however, when one brings into the context of enquiry the knowability of *modal* matters by *non-rationalist* means, the non-factive notion becomes relevant (it has an illuminative role to play), even when assessing the actual (*modal*) state of the world.

of an epistemic *method* as far as our discovering *truths* with it is concerned, reflection on unknowable$_@$ yet knowable$_\varnothing$ truths will prove vital. For an example of a *true* proposition (still non-modal) that is unknowable$_@$ yet knowable$_\varnothing$, think (intensionally) of any true p whose knowability conditions are, *contingently*, out of reach for us (be this contingency due to *how* we are or *where*—in which world—we are). Since it is *contingently* out of reach, p is knowable$_\varnothing$. But since it is *out of reach* for us, no attempt to know p (with our actual cognitive capacities and actual evidence) would bring us to know that p, which means that the condition for knowability$_@$ is not met. On pain of Moorean tension, I cannot commit *de re* to any such p, but the recipe just given is informative enough.

I turn next to applying the notions with a view to informing our assessment of the limits of (*a posteriori*) induction as far as *modal* matters are concerned. To avoid the Moorean tension just mentioned, I will assume the truth of certain modal claims, and I will assume also S5: in particular, that modal matters are not themselves contingent. The target is to motivate, under those assumptions, that some modal truths are *inductively* unknowable$_w$ in some worlds, but only contingently so. In other words, that knowability$_w$ and knowability$_\varnothing$ fall apart, even on (necessarily) true modal matters.

4 Applying the notions

Before proceeding, a methodological remark is pertinent. I shall be using *relativised* versions of the knowability notions: namely, relativized to the inductive methodology under scrutiny. I will thus narrowly focus on what is knowable$_w$ or knowable$_\varnothing$ by means of similarity-based reasonings. The move is innocuous and its reason is clear: I am assessing what we can and cannot know by means of such inductive method, regardless of what other methodologies might afford.

4.1 Unknowable$_@$ yet knowable$_\varnothing$ *possibilities*: Case 1

As a first example, I shall focus on a modal claim that, by the lights of the non-rationalist inductivist, is, *at once*, a plausible example of an unknowable$_@$ yet knowable$_\varnothing$ possibility. The possibility of purple cows, taken from van Inwagen [1998] yet adapted to being *de re*, will be my running example.[16]

[16] Other examples that have called the literature's attention would be, if true, the possibility of transparent iron and the possibility of zombies, among others.

Plenty of cows live in my village. None of them is purple, let alone naturally. In fact, none of the cows we know of, from my village or beyond, is naturally purple. And neither are any of the furred non-cow mammals that are DNA-closest to them. Yet, assume that Grassy—one of my cow co-villagers—could have been naturally purple. (As anticipated, for Moorean reasons this needs to be an assumption; a dialectically innocuous one.) Is this (assumed) *modal truth* knowable$_{@}$ inductively? I shall motivate that it is not.[17]

The case for unknowability$_{@}$. We start by motivating that, as per our current state of evidence, the inductive method doesn't allow us to establish Grassy's possibility of having been naturally purple. So let us motivate this. Natural purple pigment is rare in the animal kingdom: none to be found among mammals. As it happens, those animals that develop into being naturally purple are quite distant from cows and, as such, they are unfit to play the role of epistemic counterparts of Grassy (in relation to her possibility of having been naturally purple): there isn't a respect of similarity between them and cows, prior to their development of surface pigment, that could epistemically ground the extrapolation. Add to this (and bear with me) the additional assumption that the world *will never* provide us with stronger evidence on the matter than we currently have. Once this additional assumption is in place, Grassy's possibility of having been naturally purple comes out as unknowable$_{@}$ (by induction). This is so because the property *being an animal* (despite having naturally purple instances) is not an epistemic anchor—in the specific sense from §2—relative to Grassy's possibility of being a specific colour: purple. Our evidence, in short, isn't strong enough.

Before turning to knowability$_{\varnothing}$, let me lessen two potential concerns. First, the additional assumption—that the world *will never* provide us with stronger evidence—is inessential: regardless of whether it's our world or not, there is *some* world, w, where the strength of the evidence doesn't (ever) go beyond that of our current evidence. Thus, there is some world, w, where Grassy's possibility of having been naturally purple is unknowable$_{w}$. Second, one might believe that our current evidence *is* strong enough to underwrite inductive knowledge of Grassy's possibility. In this case, simply consider a world, w, where there is no natural purple pigment at all. These two alternative worlds are equally suitable for my purposes: namely, to argue that, by means of empirical inductions, some *true*, *modal* claims

[17] In agreement with what I thought about this possibility in [2017]: "I know that some animal embryos develop to being naturally purple animals. But could the actually existing cows have been naturally purple? I believe that our current state of empirical knowledge does not allow us to confidently answer these questions" (Roca-Royes [2017: 235]). It should be clear that knowability$_{w}$ (in particular, knowability$_{@}$) is the notion at play in these considerations.

are unknowable$_w$ (for some w) yet knowable$_\varnothing$. That is, that knowability$_\varnothing$ and knowability$_w$ (can) come apart. For vividness, I have chosen to motivate this by focusing on the actual world, but this is inessential.

Let's turn now to knowability$_\varnothing$. I will argue that Grassy's possibility of having been naturally purple *is* inductively knowable$_\varnothing$ (under our current assumptions). Under the assumption that Grassy can be naturally purple, surely there are worlds where she is so. These worlds, however, are not the ones I should focus on to answer my target question. My target question is whether Grassy's possibility is knowable$_\varnothing$ by the inductive means we're scrutinising. To answer *this*, I need to focus on a world where that possibility is not known to be *actualised*, yet it is known *to be a possibility* by the inductive means under scrutiny. I'll thus focus on a world from where that possibility is a *mere* possibility. A world, w_1, that makes it very easy for me to motivate the positive answer is a world where Grassy is brown but has a naturally purple sister (as well as several other naturally purple co-specimens), from where I derive Grassy's possibility of having been so as well. This is enough to settle the knowability$_\varnothing$, by induction, of Grassy's possibility of being naturally purple. So I am done. But to add to this: notice that knowability$_\varnothing$ doesn't require such an epistemically generous world: somewhat weaker evidence could do as well. In order to reveal more faithfully the potential of the methodology, let me focus also on a different world, w_2, where there are no naturally purple cows. This world will need to be one that provides us with (inductive) evidence on the matter whose strength falls in between that of the evidence provided by our world and that of the evidence provided by w_1. So let it be a world where there are no purple cows, but where about 80% of the furred mammal species have naturally purple specimens, as well as specimens of any other colour, x, such that there are x-coloured cows in w_2. I submit w_2 as a world where *being a furred mammal* is an epistemic anchor—again, in the technical sense from §2, of being capable of underwriting possibility knowledge—relative to Grassy's possibility of having been naturally purple. (Derivatively, also relative to the *de dicto* possibility that there are purple cows.)

This concludes the current case. To recall, the purpose of this case has been to motivate that, for all we know, there are possibilities that are, at once, inductively unknowable$_w$ for some world, w, but inductively knowable$_\varnothing$. For vividness, I have motivated it by taking our own world, @, as an instance of this phenomenon. The next subsection draws the lessons that the Grassy-case alone already makes available.

4.2 Lessons: *virtuous* accidental limits

That Grassy could have been naturally purple—under the working assumption that she could—is thus (let us grant) inductively unknowable$_{@}$. But there are possible worlds where it is inductively known. Because of this, such possibility is knowable$_{\varnothing}$ at the actual world (as well as any other world from where w_1 or w_2 are accessible). For simplicity, I will present the results exploiting the S5-assumption. Doing this, let me restate the result from §4.1:

> **RESULT**: The possibility that Grassy had been naturally purple is, by means of the inductive methodology, *contingently unknowable$_{@}$ but necessarily knowable$_{\varnothing}$*.

Where the phrase 'contingently unknowable$_{@}$' should *not* be red in the rigidified sense that renders RESULT obviously false. Rather: a proposition, *p*, is contingently unknowable$_{@}$ iff it is unknowable$_{@}$ and there are worlds, w, accessible from @, where *p* is knowable$_{w}$. (In some such worlds, *p* is also known.)

There are several lessons to be learnt from this result. First, generalising it: *knowability$_{w}$ facts* about modal matters (*Mp*) are among the kind of facts that can hold merely contingently and, crucially, *even* when the given *Mp* is not itself contingent, and when the epistemic methods (as well as, for all the argument requires, the knowers' cognitive capacities) are held fixed too.

That this is so is largely a consequence of the fact that there will be variation across worlds about the *types* of possibilities they actualise: not each world actualises any of its *de dicto* possibilities. Indeed, there are bound to be categorical differences between worlds where there aren't (*de dicto*) modal ones. And, as this first lesson makes vivid, with this type of categorical variation comes too an epistemic one: the more generous a world is in relation to the variety of general (*de dicto*) possibilities it actualises, the more *epistemically cooperant* it will be in relation to the discoverability, by *a posteriori* methods, of modal matters (be those methods inductive or otherwise, for that matter). And this will be so even when—as permitted by the argument above—the cognitive capacities of the knowers are also constant.

Let us appreciate this lesson more deeply. What we have just encountered are cases of *true, modal* propositions, *Mp*, such that their unknowability$_{w}$ can be contingent even when the truth itself but also both the methodology and the knower's capacities are kept fixed. When this happens, the source of this contingency lies solely in the variability of the *a posteriori* evidence provided by each of the worlds involved. In other words, such contingency cannot be explained by appeal to a variation in truth-value, methodology, or

cognitive capacities; for there might be no such variation.

To some extent, the phenomenon of contingent (un)knowability$_{w}$ by *a posteriori* induction should be hardly surprising. After all, what *a posteriori* methods allow us to believe strongly depends on what we perceive (in a broad sense of the term). And what we perceive (even in that broad sense) is largely dependent on how the world is, categorically. But despite hardly surprising, these cases of contingent (un)knowability$_{w}$ are nonetheless a novelty in the epistemology of modality: a phenomenon that was *not* to be expected in a context where *modal rationalism* was a dominant default, for the limits of rationalist methods are not comparably contingent. And it would be a mistake—a contextually new type of mistake—to attribute these limits to the methodology. I am, in effect, defending the methodology from such dismissive judgements.

Indeed, the second lesson is that when it comes to the discoverability of modal facts, at least some of the limits of *a posteriori* induction are accidental to the method. They are not, for instance, the type of limitation that smelling has in relation to the discoverability of colour-features. It is *within the power of the methodology* to settle matters about the possibility of purple cows, flying pigs or transparent iron, even if not all worlds will facilitate the unfolding of its full potential. In other words, the limit of what we can achieve using it is largely placed by the categorical features of the world in which we use it: what the method can (in a given world) deliver as outputs strongly depends on what the world can feed it with as inputs.

One further, and important, lesson for now is that, if these accidental limits are to be used at all when measuring the virtues and vices of the method, they should signal, I contend, a virtue rather than a vice. A comparison with modal rationalism should help us see why. While the literature was heavily under the influence of modal rationalism, the issue about the virtuosity of accidental limits could hardly have arisen simply because, as mentioned above, rationalist methods will not see knowability$_{w}$ and knowability$_{\varnothing}$ vary so easily when the knower's capacities are held fixed. But what this has suggested to many critics is a disconnect between the method and the subject matter; a disconnect that has long been at the core of a general dissatisfaction with rationalist methodologies. In terms of the Integration Challenge, the dissatisfaction stems from appreciating how difficult it is to meet this Challenge with *rationalist* epistemologies of an *objective* modality (see Peacocke [1999]). This is a general problem that Mallozzi, Vaidya and Wallner [2021] compile, in surveying different rationalist proposals, under the label of 'the Connection Question', here quoted (for illustration) in relation to their discussion of conceivability:

> **The Connection Question**: Given that metaphysical modality is an objective modality that is mind-independent, while conceivability is subject-sensitive and mind-dependent, how are the two connected such that conceivability may entail, or at least provide evidence for possibility?

What we have seen in §4.1 is, precisely, that the inductive method doesn't suffer from mystifying such connection. On the contrary: the limits—in particular, their *contingency*—enable an explanation *why*, for instance, the more generous a world is in relation to the general possibilities it actualises, the more *epistemically cooperant* it will be in relation to the inductive discoverability of *its* modal facts. Against this background, the suspicion that emerges is that this contingency is needed to satisfactorily meet the integration challenge for objective modalities. It is the *accidental* limits what give rise to such contingency. And because of this, these accidental limits—while *limits*—are to be diagnosed, I contend, as virtuous; something to feel good about.

5 Acting on the lessons: the power of actualising evidence

There is more good news emerging from the above: *to some extent*, it is up to us what is, and what is not, knowable$_{@}$. For we have the power to actualise some possibilities and, as I shall next motivate, some knowability$_{w}$ facts are among these possibilities.

Let me start by noting that what holds for the modal dimension holds for the temporal one too. What's *now-knowable*$_{@}$ (a more fine-grained notion than *knowable*$_{@}$ and that we can notate, as suggested in footnote 14, with 'knowable$_{@,t}$') can easily come apart from what's (atemporarily) *knowable*$_{@}$. Indeed, as mentioned in §4.2, the *a posteriori* nature of induction means that what the method delivers as outputs largely depends on what the world feeds it with as inputs. But this applies to the total evidence that a given world atemporarily offers no more than to the evidence that an initial segment of the world offers.

Add to all this our *agency*; that is, our capacity to actualise a given world rather than some other (or, more strictly: a given future). This capacity surely has limits; I can manipulate the world only to some extent. For instance, I can decide to change, and thus change, the decoration of my office, but I cannot change the laws of physics.

But within those limits, our *agency* means that (to an extent) we can manipulate the world to make it more and more generous: *metaphysically* in the first instance, but *epistemically* as an intended result. That is, we can *generate* a larger and larger body of evidence, potentially suitable to feature in the inductive base of modal reasonings.

The accidentality of the (accidental) limits of induction thus means that, to the extent that we can manipulate the world, we can push back those limits. We therefore have a *recipe* for us, qua modal *enquirers*, to extend our modal knowledge. And this is something that hasn't gone unnoticed by parts of the philosophical community; for instance, those working on scientific modelling, especially modal modelling. Modal modelling is a practice that delivers modal knowledge in precisely the terms of the recipe.[18] What we, as modal *epistemologists*, can contribute to this practice is a better understanding of the epistemological adequacy (when adequate), or else inadequacy (when inadequate), of particular implementations of the recipe.

Undeniably, regardless of the amount of directed agency, limits *will* remain. Some things that are now-unknowable$_{@}$ by inductive means will, regardless of the future, remain unknowable$_{@}$ forever; regardless too of whether this unknowability$_{@}$ is contingent or not (*i.e.*, regardless of knowability$_{\varnothing}$).

How to assess *these* (irremediable) limits will largely depend (as stated in §1) on whether one ought to have uniformism as a desideratum or not. With non-uniformism as an emerging, and arguably legitimate default, the irremediable limits of induction are not a problem. What they do however is provide a reason to look somewhere else in order to explain that portion of our modal knowledge that induction *can't* deliver (or therefore explain). It is pertinent to stress that they provide *no* reason to look anywhere else to explain what induction *does* manage to deliver. In addition, in view of the contingency of some of these limits and of how our agency can work towards pushing them back, a stronger suggestion is that we have no reason either to look anywhere else in order to explain what induction *will-possibly* manage to deliver.

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[18] Sjölin Wirling [2021] develops in a lot more detail, and very much in the way envisioned here, how these manipulations are done. I am very sympathetic to this approach. She conceives however modal modelling as *creating epistemic counterparts* of a sort not allowed (or excluded) by my [2017]. I disagree on this. Created models have never been ruled out from playing the role of epistemic counterparts. Indeed, model and target can be *overall* very dissimilar to one another, so long as they share *the relevant respect of similarity*. The task for us is not (simply) to make room for this, but to *explain why* the relevant respect of similarity is such. As already contained in [2017]: "When we try to generalize beyond [the simple] cases we might soon realize [...] that similarity in intrinsic character will not always be the (only) relevant sort of similarity. [...] A lot remains to be done [...] The hope of the project is that we can nonetheless generalize beyond the simple cases to cover more complex cases in saliently analogous ways" (Roca-Royes [2017: 235]).

6 So what is there left to be explained?

As mentioned in §1, it's urgent to know—not just the nature but also—the extent of the limits, so that we know what's left to be explained by means other than induction. Given the above, a natural question at this point is whether we can identify some *necessary* limits of the current methodology. For, in relation to those, we definitely need to look somewhere else. However, the following explains why it is better to focus instead on the notion of *irremediable* limits—regardless of whether they are so because they a necessary, or because they are contingent but *we cannot* push them back. The reasons might seem subtle, but they are methodologically important.

Were we to focus on necessary limits, the first difficulty would be to identify where these are; and it comes as a comparative advantage that irremediable limits are easier to identify. This might come as a surprise. For the inductive epistemology has so far been employed (as in Roca-Royes [2017]) as an epistemology of *possibilities* for concrete entities. Given this, it might be suggested that *im*possibilities and *necessities* (including essential truths) will constitute at least some of the method's necessary limits. For it might be thought that it is *by design* that the method won't deliver these. I myself understood it like this in the past ([2017: 239]), but wrongly, I now believe. Understanding better what makes the current inductive methodology *inductive* (*i.e.*, understanding better its nature) should make us at least cautious not to endorse such a bold claim about its necessary limits: the 'by design' reason is incorrect, and there are things to be learned from understanding why.

What makes the methodology inductive is the way in which it extrapolates from otherwise established *de re* possibilities to other, newly discovered *de re* possibilities (and, derivatively, to some *de dicto* ones as well). What the epistemology is, by design, is a *de re first* epistemology. As it happens, all the cases discussed in Roca-Royes [2017] involved *de re* possibilities that had been antecedently known, unproblematically, as derived from actuality, by means of $p \rightarrow \Diamond p$. For instance, from an actually broken table we settled the breakability of (the actually unbroken) Messy; from a human actually having died of a heart attack, we settled Kennedy's possibility of having died of a heart attack, etc.

These are all very good first applications of the methodology. Especially when following the methodological recommendation "to start with *simple*, *basic* cases of *de re* possibility knowledge to then see how far the explanations could be extended to other, less simple cases (of still *basic* modalizing)" ([2017: 238]). But once we appreciate that, as just mentioned, what the epistemology is, by design, is a *de re first* epistemology, it's easy to identify two inessential features in the [2017]-applications. First, it doesn't need to be *possibilities* that

we extrapolate from. Second, when we do extrapolate from possibilities, it doesn't need to be the case that they have been *straightforwardly* derived from actuality.

Abstracting away from these two inessential features, the essence of the inductive methodology is thus this: that once we have somehow established a *de re* modal fact about an individual, *b*, this allows us to discover other *de re* modal facts of the same type, about individuals/entities that are relevantly similar to *b* and of whom/which we don't antecedently know that type of modal fact to hold. There's thus nothing in the methodology *per se* that places all *de re* necessities and impossibilities, as a category, *necessarily* beyond its limits. I shall next witness this by means of an example.

6.1 Unknowable$_@$ but knowable$_\varnothing$ *necessities*?

I will make use here of a far-fetched scenario, but its far-fetchedness should not distract us from the point being made. All I need is that the scenario is not obviously incoherent (if incoherent at all). It will be a scenario where the method would deliver knowledge of necessities (and of associated impossibilities).

> Case 2: Suppose that biological origins are essential to humans. Suppose, in addition, that the same individual can biologically *recur* several times, in the same world; so long as it's always (as per the first assumption) from the same biological origins; *e.g.*, a given sperm and a given egg cell. Suppose further that humans typically remember their previous biological lives. Let now w_3 be a (generous) world where all those possibilities are realised. Humans in w_3 can know, in a distinctively *de re first* manner, that biological origins are essential. For instance, their memory would help those humans who have already recurred several times to know that they always recur with the same appearance, or even the same DNA. From here, an abduction to the necessity of *one's* origins would be licensed. And from here (combined if need be with testimonial further cases), induction would deliver knowledge of the necessity of origins of *other* humans—even of those for whom either recurrence, or else the constancy of their origins, have not been established. The far-fetchedness ends here.

Now, there's all the reason to believe that *our* world is not like w_3. Our not having the kind of evidence that w_3-inhabitants have is (abductive) evidence for this. Moreover, there's also the strongest reason to believe that, even if origin essentialism was true, actualising w_3, if such world is possible at all, is beyond the limits of our agency: that type of recurrence

(with or without memory, for that matter) would be among the things that *happen* to us; not something we *do*. However, it would take worlds like w_3 for us to know inductively that essentiality of origins is true. As a consequence, and as anticipated, in all likelihood, the *de re* necessities that *would* be implied by the truth of essentiality of origins lie *irremediably* beyond the knowable$_@$ by means of induction. Far-fetched as is, the current case allows us nonetheless to see that it is not *by design of the method* that those limits are in place. For, for all we know and Case 2 illustrates, those *irremediable* limits might not be *necessary* limits. As anticipated above, we more easily have (epistemic) grounds for *irremediable* unknowability$_@$ than for *necessary* unkowability$_@$ (*i.e.*, unknowability$_\varnothing$). The latter requires ruling out strictly more possibilities.

Those who believe world w_3 to be not just far-fetched but *impossible* should consider the necessity of one's origins to be, not just *irremediably unknowable*$_@$ by induction but also *unknowable*$_\varnothing$ (*i.e.*, *necessarily* unknowable$_@$). But I don't need to break neutrality on this. The mere coherence of w_3 is enough to illustrate why, as mentioned at the end of §2, the connection between the methodology and the unknowability results is less intimate than suggested in Roca-Royes [2017] and why *irremediable unknowability*$_@$ might still fall short of *unknowability*$_\varnothing$.

Regardless, the thing to note for current purposes is that irremediable unknowability$_@$ is strong enough of a limit: what is irremediably unknowable$_@$ by induction calls for an alternative epistemology. And it is on explaining knowledge of *any* modal truths in *this* class that future efforts should be put.

6.2 Irremediably unknowable$_@$ *possibilities*?

By now, we have motivated that there is nothing in the methodology *per se* that places all *de re* necessities and impossibilities, as a category, *necessarily* beyond its limits. And yet reflection on the case above suggests that many of them—arguably including the distinctively metaphysical ones that Thomasson worries about—will nonetheless be *irremediably* unknowable$_@$ by inductive means. So we do need an alternative epistemology for the traditionally salient *de re* necessities. In the other direction, the class of modal truths that are irremediably unknowable$_@$ by induction need not be exhausted by necessities (and neighbouring impossibilities and essential facts). There's no impediment for some *possibilities* to be irremediably unknowable$_@$.

The preceding section has paved most of the path for similar results about possibilities. These are indeed the limits that I illustrated in [2017] by means of claims (v) and (vi)—on

Malala's and Gandhi's possibilities. But a qualification will be called for. For, recalling from §2, back then I identified those limits as *necessary*: I thought that "there is—*and there could be*—*no* suitable anchor" to inductively ground knowledge of them (my emphasis now). By reasoning analogously to §6.1 we can see very quickly however that there's no need to break neutrality here either. If the limits can be determined to be *irremediable*, that's strong enough of a limit. The qualified diagnosis should then be that "there is—*and there will be*—*no* suitable anchor". If that can be established, we have enough reason to be looking for alternative routes to such possibility knowledge. So, are those possibilities irremediably inductively unknowable$_@$? Let me avail myself of another far-fetched scenario.

> Case 3: Suppose this time that biological origins are *in*essential to humans. Suppose, in addition, that the same individual can biologically *recur* several times, in the same world, from different biological origins. And suppose further that humans can remember their previous biological lives. Let now w_4 be a world where all those possibilities are realised.[19] Humans in w_4 can know, in a distinctively *de re first* manner, that one's biological origins are *in*essential. For instance, their memory would help those humans who have already recurred several times know that they recur with different biological origins. From here, an inference to the inessentiality of *one's* origins would be licensed. From here (plus maybe testimonial knowledge of further cases), inductive knowledge of the inessentiality of origins of other humans would be licensed too, including those for whom either recurrence, or else the variation of their origins, had not been established. The far-fetchedness ends here.

As with w_3, whether w_4 is really possible or not is beyond the point. What is relevant is that it would take a world like w_4 to know inductively, in a *de re* first manner, that origins are inessential. And, as above, in all likelihood, our world is not like w_4. And even if such world *was* possible (something on which I decide to remain neutral), actualising it would not be up to us. As a result, the unknowability$_@$ of claims such as (v) is irremediable (regardless of whether it is also necessary or not).

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[19] For what is worth it, here is a somewhat provocative note: once assuming the non-essentiality of biological origins, it is only the memory-feature that I find far-fetched in Case 3; not the recurring one. For, I contend, a Principle of Recombination makes *non-essentiality with recurrence* to be more in equilibrium than *non-essentiality without it*.

7 Concluding remarks

I have accomplished what I wanted: namely, assessing the nature and extent of the limits of induction. There *are* limits, and this has never been disputed (§2). But we have seen that, whether necessary or contingent, its limits—as far as *de re* modal knowledge about concrete entities is concerned—are not *in* the methodology (§§4–6). The method should thus be vindicated as a powerful one, that might (or might not) unfold its full potential depending on the *world* of application.

In addition, the contingency of the limits signals a virtue of the method: the method of inquiry is connected to the (objective) subject matter in a way that rationalist methods have been criticised for not being (§4).

We also have seen that some of these limits are *remediable*: to some extent, it is in our power to actualise evidence (§5). Limits *will* remain though. Some limits (regardless of whether necessary or contingent), are irremediable from our world (§6). But in the current context—where the need for a non-uniform epistemology of modality is increasingly acknowledged—this is hardly a reason against induction (§1). Rather, what we need to do is determine what are, from our world, the irremediable limits of induction (§6), and *if* there's modal knowledge beyond them, seek to explain it somehow else.[20]

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