< Draft, November 11, 2017. >

On A Priori Knowledge of Necessity[1]

MARGOT STROHMINGER AND JUHANI YLI-VAKKURI

Abstract

The idea that the epistemology of (metaphysical) modality is in some sense a priori is a popular one, but that idea has turned out to be difficult to make precise in a way that does not expose it to decisive counterexamples. The most common way of making the idea precise has been to articulate a principle according to which the general modal status (contingency or non-contingency) of either all sentences or some broad range of sentences is knowable a priori. Thus far, nearly all such principles have fallen victim to decisive counterexamples. Recently, however, Casullo (forthcoming) and Kipper (2017) discuss principles of this kind, restricted to atomic sentences, to which no decisive counterexamples have been presented. In this paper, we show that counterexamples to these principles can be constructed in any language with that contains at least two singular terms designating concrete individuals and at least one predicate that expresses a reflexive or anti-reflexive relation that relates or fails to relate distinct individuals contingently. The prospects for an a priori epistemology of modality remain as dim as ever.

1. Introduction

The idea that the epistemology of (metaphysical) modality is in some sense a priori is a popular one, but it has turned out to be difficult to make precise in a way that does not expose it to straightforward counterexamples.[2]

The simplest idea of this general shape, which is that what is necessary is always an a priori matter, was decisively refuted in the 1970s by examples of the contingent a priori and the necessary a posteriori due to Saul Kripke (1971), David Kaplan (1977), and others. To use a Kripkean example, it is necessary, but not a priori knowable that it is necessary, that Hesperus = Phosphorus, since it might have been (in an epistemic sense) the case that Hesperus ≠ Phosphorus, in which case it would not have been necessary.

More recently, philosophers who hope to defend the view that the epistemology of modality is in some sense a priori have tended to go for principles according to which

[1] We would like to thank Jens Kipper and an anonymous referee for helpful discussions and comments. This work was supported by the Alexander von Humboldt Foundation.

[2] See Strohminger and Yli-Vakkuri (2017) for a review of the literature.

contingency (i.e., whether something is both possibly true and possibly false) rather than necessity is an a priori matter. Such principles trace their roots to a famous passage in Kripke's addenda to *Naming and Necessity*:

> All the cases of the necessary *a posteriori* advocated in the text have the special character attributed to mathematical statements: Philosophical analysis tells us that they cannot be contingently true, so any empirical knowledge of their truth is automatically empirical knowledge that they are necessary. This characterization applies, in particular, to the cases of identity statements and of essence. It *may* give a clue to a general characterization of *a posteriori* knowledge of necessary truths (Kripke 1980: 159, emphasis in the original).[3]

Kripke was right to be cautious here: although all of the examples he discussed plausibly conformed to the pattern he describes in this passage, it is now widely known that not all cases of the necessary a posteriori do. Following Kripke's conjecture—but not his caution—more recent advocates of a priori modal epistemology have tended to propose variants of the following principle.[4]

(*) If *S* knows whether φ is contingent, then *S* is in a position to know a priori whether φ is contingent.

Here 'φ' is a variable for a *sentence* rather than a proposition. Much of the recent literature (we think rightly[5]) treats sentences, or propositions under sentential guises, rather than propositions, as the bearers of a priority and as objects of a priori knowledge. Of course, it is more natural to think of propositions as the bearers of necessity, but (*) uses a sentence variable throughout for the sake of uniformity.

Casullo (2010: 357–58) describes his own version of (*) as an 'intuitively plausible, widely accepted principle that […] faces no clear counterexamples'. Yet clear counterexamples to (*) and its well-known variants are by now well known.[6] Consider, for example (to modify an example of due to C. Anthony Anderson 1993: 11-13), a necessary truth φ_N and a contingent truth φ_C such that a subject *S* knows a priori that φ_N is non-contingent, knows a priori that φ_C is necessary, but is not in a position to know a priori whether φ_N or whether φ_C is true, so is not in a position to know a priori whether $\varphi_N \vee \varphi_C$ is true. (φ_N could be any paradigmatic case of the necessary a posteriori, such as 'Hesperus = Phosphorus'.) Yet—suppose further—*S* knows, but not a priori, whether $\varphi_N \vee \varphi_C$ is contingent, by knowing whether φ_N is true. Since *S* is in a position to know a priori whether $\varphi_N \vee \varphi_C$ is contingent only if *S* is in a position to know a priori whether $\varphi_N \vee$

[3] See also Kripke (1971: 153).
[4] See, e.g., Casullo (2003: 195-96, 2010: 348, 357-58), Gregory (2011: 7) and Hale (2012: 259). Kipper (2017: 2) also attributes the view to Whewell (1840: 59-61), Chisholm (1966: 74-75), Bealer (1987), Horvath (2009) and Barnes (2007), but we found no compelling textual evidence for these attributions.
[5] See note 12.
[6] See Anderson (1993: 11-13).

φ_C is true, S is not in a position to know a priori whether $\varphi_N \vee \varphi_C$ is contingent, and the case is a counterexample to (*).

All of the well-known counterexamples to (*), like the above, involve logically complex (i.e., non-atomic) sentences. Unsurprisingly, this has encouraged the thought that true principles could be obtained by restricting (*) and other similar principles to atomic sentences. Recently, Casullo (forthcoming) and Kipper (2017) discuss such restrictions, to which no decisive counterexamples have been presented. Rather than discuss Casullo's and Kipper's principles separately, we will discuss a single principle that is not importantly different from them:[7]

The Casullo-Kipper principle

> If φ is an atomic sentence and S knows whether φ is contingent, then S is in a position to know a priori whether φ is contingent.

Kipper purports to have counterexamples to his variant of the above, but his examples are at best highly contentious: each involves either contentious assumptions concerning what is a priori knowable about natural kinds or—even more contentiously—a combination of such assumptions with a commitment to Chalmersian two-dimensionalist ideology. In this paper, we will show that the Casullo-Kipper principle can be refuted without taking on any such commitments. Counterexamples to it arise in any language that has at least two singular terms and at least one predicate for a reflexive relation that relates or fails to relate distinct individuals contingently. In §2, we will briefly survey Kipper-style examples; in §3, we will present our own argument against the Casullo-Kipper principle.

2. Natural kinds and the Casullo-Kipper principle

How might we find counterexamples to the Casullo-Kipper principle? Classic examples of the necessary a posteriori are a natural place to start, since they have served well in refutations of earlier attempts at making good on the idea that the epistemology of modal-

[7] Casullo's principle is restricted to atomic sentences that express necessary truths. (See (KB) in Casullo, forthcoming, and see his note 1 for the restriction to atomic sentences.) This introduces a complication that we discuss in note 12. The principle that Kipper discusses is

(ANC) The general modal status of any minimal sentential component of any G-necessary sentence can be known priori (Kipper 2017: 3).

By 'G-necessary' Kipper means *non-contingent* (either necessarily true or necessarily false), and the 'general modal status' of a sentence is either contingency or non-contingency. The principle, then, is this: If φ is non-contingent and ψ is an atomic constituent of φ, then it can be known a priori whether ψ is non-contingent. Note, however, that every atomic sentence is trivially an atomic constituent of a non-contingent sentence. (For example, any sentence—and therefore any atomic sentence—φ is a constituent of the non-contingent sentence $\varphi \vee (\varphi \vee \neg \varphi)$.) (ANC), then, is equivalent to the principle that the general modal status of any atomic sentence can be known priori.

ity is a priori. The clearest cases—identity sentences and their negations—will not do, because they clearly have the property Kripke highlights in the passage quoted in §1: we are in a position to know a priori that they are necessarily true if true and necessarily false if false. Atomic sentences containing occurrences of natural kind terms might seem to be the next best candidates. In a recent attempt at refuting his own principle, Kipper (2017: 5-6) considers the following sentences.[8]

(1) Water is watery stuff.

(2) The nucleus of a gold atom contains 79 protons.

(1) is, of course, not a classic example of the necessary a posteriori—plausibly, it is not even necessary—but it may nevertheless serve our purposes.

Each of these sentences is, from the perspective of certain theoretical orientations, a counterexample to the Casullo-Kipper principle. To see (1) as a counterexample to the principle, one must adopt either some version of David Chalmers' (2006, 2012) epistemic two-dimensionalism or some theoretical perspective that attaches a special, technical meaning to the word 'watery' (epistemic two-dimensionalism being the most obvious candidate). To see (2) as a counterexample to the principle, one must reject a certain view of analyticity that is suggested by Nathan Salmon (2005: 258) in his discussion of similar examples.

Let us begin with (1). We should like (1) to be a contingent truth whose contingency is only knowable a posteriori. Yet (1), interpreted as meaning whatever it means in ordinary English, is not easy to evaluate: is it even *true* that water is watery stuff? We have no idea. Our first instinct, if asked to evaluate (1) as a sentence of ordinary English, would be to turn to dictionaries—an approach that rarely yields decisive results, and in this case yields especially disappointing results.[9]

But here is a story on which (1) is a counterexample to the Casullo-Kipper principle. It is *a priori* that water is the unique substance that has certain superficial properties

[8] Kipper also discusses the sentence 'Air is airy stuff', but if it is a counterexample to the Casullo-Kipper principle, then it is one for the same kinds of reasons why (1) is a counterexample to it (except that 'Air is airy stuff' is supposed to be a necessary truth), so we will not discuss it separately. (For the record, Kipper never endorses the principle he attempts to refute.)

[9] For example, one dictionary (Merriam-Webster, n.d.) lists four readings for 'watery':

(1a) consisting of, filled with, or surrounded by water
(1b) containing, sodden with, or yielding water or a thin liquid
(2a) resembling water or watery matter especially in thin fluidity, soggy texture, paleness, or lack of savor
(2b) exhibiting weakness and vapidity

On (1a) ('consisting of … water'), (1) appears to be a necessary truth whose necessity is knowable a priori; likewise on (1b) ('containing … water'); on (2a), (1) is difficult to evaluate in light of the fact that most of the water in the universe is ice; on (2b), (1) is presumably false and can be known a priori to be contingent.

(such as being a liquid at room temperature). Let 'watery' express the conjunction of just those properties. As it happens, water is a natural kind—it is H_2O—and consequently it is contingent that water is watery. (It is possible for H_2O to manifest itself in non-watery ways.) But we are not in a position to know a priori that water is a natural kind. For all we are in a position to know a priori, water is not a natural kind, in which case it is necessarily watery. We know, then, whether (1) is non-contingent, but we are not in a position to know a priori whether (1) is contingent, contrary to the Casullo-Kipper principle.

The above sketch of a theory is a good start, but a philosopher wishing for a theoretically satisfying account of the a priori unknowabilty of the alleged contingency of (1) might wish to put more flesh on the bones it provides. For such philosophers, epistemic two-dimensionalism is the natural theoretical framework to reach for. In it, one can say that the primary (epistemic) intensions of 'water' and 'the watery stuff' are the same while their secondary (metaphysical) intensions are different in the actualized scenario (epistemic possibility) while they are the same in various other scenarios (ones in which 'Water is a natural kind' is false). One can then go on to derive the desired conclusion from these assumptions together with further commitments of epistemic two-dimensionalism: namely, the conclusion that non-contingency of (1) is not a priori, so is not knowable a priori.

Epistemic two-dimensionalism is heavy theoretical baggage, and is not to everyone's taste. But even when stripped of that baggage, the brief story about the a priori unknowability of the non-contingency of (1) packs a significant amount of other theoretical baggage that an argument against the Casullo-Kipper principle could do without. Granted, we are not in a position to know a priori that water is a natural kind.[10] From this it does not follow, without the aid of some contentious assumptions, that there is any reading of any sentence of the form 'Water is *F*' that is a counterexample to the Casullo-Kipper principle. (For the record, we find it plausible that there is such a sentence, but our point is a dialectical one: trying to argue that there is one is not likely to be an effective way to win over advocates of the Casullo-Kipper principle.)

(2) might appear to be a clearer counterexample to the Casullo-Kipper principle. In fact, we think it is a clearer counterexample to the principle (but not as clear as we would like to have). Let us suppose, following post-Kripkean orthodoxy, that it is necessary that (i) gold is the element with atomic number 79. Let us further suppose that it is necessary that (ii) the atomic number of an element is *n* if and only if the nucleus of an atom of it contains *n* protons. (i) and (ii) entail (2), so, given that (i) and (ii) are necessary, so is (2). Yet, one might think, we are not in a position to know a priori that (2) is

[10] This may be simply because water is not a natural kind. While the notion of a natural kind did a lot of heavy lifting in 1970s metasemantics, in more recent work by Lewis (1983), Sider (2011), and Dorr and Hawthorne (2013), among others, it is replaced by a comparative notion of naturalness. Plausibly the kind *water* is less natural than the kind *hydrogen*, and the kind *electron* is more natural than both but is not maximally natural. If a natural kind is a kind that is maximally natural, then few of the standard examples of natural kind terms pick out natural kinds. If a natural kind is one that is natural to a certain non-maximal degree, then the notion would seem to be too vague to be useful.

non-contingent. If that thought is correct, then (2) is a counterexample to the Casullo-Kipper principle.

But are we really not in a position to know a priori that (2) is non-contingent? Here is what Nathan Salmon says about a closely related principle.

> The term 'element' is a technical term of science, and with the advent of modern atomic theory there is at least the possibility that the term is now defined in such a way that the principle in question is ultimately analytic (Salmon 2005: 258).

Suppose that (2) is analytic in virtue of the terms 'nucleus', 'proton', and 'atom' having the kinds of definitions that make it so. One might further think that any principle that, like (2), is both analytic and contains no occurrences of indexicals is both necessary and knowable a priori to be necessary and therefore knowable a priori to be non-contingent. As before, we are not endorsing this line of argument concerning (2). The point is a dialectical one: a counterexample that requires ruling out this kind of argument for the a priori knowability of the necessity of (2) is not optimal.

3. Reflexive and irreflexive relations

Luckily for the opponents of a priori modal epistemology, it turns out that there is no need to wade into debates about natural kind terms or to take on any epistemic two-dimensionalist commitments on order to appreciate why the Casullo-Kipper principle is false. There are counterexamples to it that are as clear as Kripke's chief examples of the necessary a posteriori (identity sentences). These involve predicates for certain relations whose modal features are intimately related to identity.

In fact, as far as we can tell, *all non-mathematical reflexive relations expressible by relatively simple verb phrases in a natural language give rise to counterexamples to the Casullo-Kipper principle.* Furthermore, very many non-mathematical irreflexive (i.e., anti-reflexive) relations expressible by relatively simple verb phrases in a natural language also give rise to counterexamples to the principle. (Identity and distinctness, being logical relations, are also mathematical ones.) Here is an exercise: think of an English predicate for a non-mathematical reflexive relation. Most likely, the predicate you thought of—call it '*R*'—has the following properties.

(i) '$a = b$' is true iff 'aRb' is non-contingent.
(ii) There is a sentence 'aRb' such that we know that 'aRb' is non-contingent, but we are not in a position to know a priori that 'aRb' is non-contingent.

But then, of course (by (ii)), we have a counterexample to the Casullo-Kipper principle. Here is another exercise: think of an English predicate for a non-mathematical irreflexive relation. It is quite likely that the predicate '*R*' you thought of also has properties (i) and (ii), and thus we have a further counterexample to the principle. Let us consider some examples.

The predicates for reflexive relations you are likely to have thought of have forms like 'is at least as *F* as', 'has the same *F* as', and 'are similarly *F*'. The predicates for irreflexive relations you are likely to have thought of have forms like 'is more *F* than', 'is less *F* than', and 'have a different *F*s'. Now consider the following sentences.

(4) Eminem is at least as tall as Marshall Mathers.

(5) Eminem is at least as old as Marshall Mathers.

(6) Eminem is more famous than Marshall Mathers.

None of (4)-(6) are knowable a priori to be contingent. Nor are any of them knowable a priori to be non-contingent. Yet each is atomic, and we know that each is non-contingent (because we know that Eminem = Marshall Mathers), so each is a counterexample to the Casullo-Kipper principle.

4. Two objections

We can only think of two objections to the argument of §3.

First, some philosophers maintain, on Millian grounds, that all true identities are knowable *a priori*.[11] The idea is that, since (according to Millians) a singular term such as a proper name only contributes its referent to the propositions expressed by a sentence in which it occurs, '*a* = *b*' and '*a* = *a*' express the same proposition whenever the former is true, and since we are in a position to know the latter proposition a priori we are also in a position to know the former a priori. Arguably, then, the sentence '*a* = *b*' is a priori knowable, since the proposition it expresses is a priori knowable whenever it is true. If so, the necessity of each of (4) and (5) are a priori knowable, since it follows deductively (and therefore a priori) from the a priori knowable sentences:

> Eminem = Marshall Mathers
>
> If Eminem = Marshall Mathers, then it is necessary that Eminem is at least as tall as Marshall Mathers.
>
> If Eminem = Marshall Mathers, then it is necessary that Eminem is at least as old as Marshall Mathers.

The impossibility of (6), on the other hand, is knowable a priori, on this view, because it is a deductive consequence of the a priori knowable 'Eminem = Marshall Mathers' and the a priori knowable:

[11] Scott Soames (2002: 236-237) is a prominent defender of this view. Thanks to an anonymous referee for suggesting that we consider this objection.

If Eminem = Marshall Mathers, then it is not possible that Eminem is more famous than Marshall Mathers.

One also could argue from Millianism to the a priori knowablility of the non-contingency of (4)-(6) by noting that, according to Millianism, we preserve the proposition expressed by each of (4)-(6) when we replace each occurrence of 'Marshall Mathers' in these sentences with an occurrence of 'Eminem'.

We do not find this line of thought very plausible,[12] but no matter: even if it is correct, we will find counterexamples to the Casullo-Kipper principle among sentences of the same form as (4)-(6). Consider:

(7) Eminem is at least as tall as Kanye West.

(8) Eminem is at least as old as Kanye West.

(9) Eminem is more famous than Kanye West.

We know whether each of (6)-(9) is non-contingent (we know that each is contingent), but we are not in a position to know this a priori, because, for all we are in a position to know a priori, Eminem = Kanye West, in which case each of (7)-(9) is non-contingent.[13]

Second, someone might object to the above on the grounds that (allegedly) natural language semantics teaches us that (4)-(9) are not atomic sentences, but existentially quantified sentences in which the existential quantifier generalizes over states (such as the state of being more famous than Kanye West). It is far from clear that natural language semantics teaches us any such thing,[14] but let us suppose, for the sake of argument,

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[12] This is not because we find Millianism implausible, but because the argument relies on the assumption that φ is a priori whenever the proposition expressed by φ can be known a priori. Yli-Vakkuri and Hawthorne (2017) show that that assumption, when combined with standard Kripkean assumptions about the contingent a priori, leads to the conclusion that the logic of the a priori is extraordinarily weak: in particular, that it does not obey the K axiom (i.e., a priority is not closed under modus ponens) or the principle of necessitation (i.e., not all logical truths are a priori).

[13] These examples do not refute Casullo's principle, which is restricted to necessary truths (see note 6), but others involving proper names do. Consider, for example, a sentence of the form '*a* was born prior to *b*', where *a* is a biological parent of *b*. Given the necessity of biological parenthood '*a* was born prior to *b*' will be a necessary truth but not knowable a priori to be non-contingent, contrary to Casullo's principle. Thanks to an anonymous for suggesting this example.

[14] The view that a sentence whose main verb is an *event* verb, such as

Brutus killed Caesar

has an existentially quantified logical form like

$\exists e(\text{killing}(e) \wedge \text{Subj}(e, \text{Brutus}) \wedge (\text{Obj}(e, \text{Caesar}))$,

that it does. Even at best, this objection would save the letter but not the spirit of the Casullo-Kipper principle and other similar principles. Presumably the philosophers who propose such principles have in mind sentences like (1)-(9) when they speak of 'atomic sentences', and accordingly they would think of the non-a-priori-knowability of the (non-)contingency of each of (4)-(9) as a counterexample to the principles they *thought* they were articulating. After all, according to the kind of semantic theory we have in mind hardly any natural language expression that we ordinarily call a 'sentence' is an atomic sentence, and it is not plausible that hypotheses like the Casullo-Kipper principle are meant to be vacuously or almost vacuously true as applied to natural languages. But, in any case, the objection would only work against putative counterexamples in natural languages. There is no hidden structure in formal languages, and formal languages with the syntax of first-order logic provide a plethora of counterexamples to the Casullo-Kipper principle.

Indeed, it bears emphasis that virtually any non-trivial first-order theory that deals with contingent subject matter will provide counterexamples. Virtually any such theory will have at least one two-place predicate '*R*' such that an atomic sentence '*R*(*a*, *b*)' is non-contingent but not a priori knowably non-contingent when '*a* = *b*' is true and is contingent but not a priori knowably contingent when '*a* = *b*' is false. Such a predicate might, for example, express the relation of being *at least as massive*, which relates or fails to relate distinct individuals contingently and relates each individual to itself necessarily. The Casullo-Kipper principle turns out to rule out the existence of any language that contains such a predicate and at least two singular terms that refer to concrete individuals. Since such languages clearly exist, the Casullo-Kipper principle stands refuted, and the prospects for an a priori epistemology of modality look as dim as ever.

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is entirely mainstream (see Kratzer 2003), but the view that *state* sentences like (4)-(9) have an analogous existentially quantified logical form is less so. Terence Parsons' observation that '[t]here is … evidence in favour of the underlying state approach for state sentences, but there is not as much of it, and it is not as easy to evaluate, as the underlying event approach for event sentences' (1990: 186) remains a fair assessment of the evidence 27 years later.

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