The Irrelevance of the A Priori/Posteriori Distinction for the Epistemology of Logic

The a priori seems to be in fashion at the Vismarkt in Groningen

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Abstract

When justifying knowledge of logic, philosophers tend to start with the claim that logic is a priori or a posteriori. With the help of an example involving the incompatibility between quantum mechanics and classical logic, I will examine the views on the epistemology of logic of Paul Boghossian – who claims logic is a priori – and of Ole Thomassen Hjortland – who claims logic is a posteriori. I will argue that, when faced with the crucial epistemological problem of having to decide between two competing logical theories, Boghossian and Hjortland turn out to have no use for their considerations on the apriority of logic.

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Chapter 1: Introduction

It is the 1920s. Schrödinger, Heisenberg, Born and other physicists and mathematicians have just developed a new physical theory that is immensely successful in predicting the behaviour of (sub)atomic particles: quantum mechanics. We know and understand the relevant mathematics. The theory covers everything except gravity, which is mostly negligible in particle physics and for which we have another working theory (general relativity) anyway. There is however one big philosophical problem. We have no idea how to correctly interpret the theory. What is the world supposed to be like according to quantum mechanics?

Specifically, there seems to be a problem for our understanding of logic. The theory represents a quantum system as if it exists in multiple incompatible physical states at once.[1] Only when making a measurement does the system return to a single physical state we can make sense of. The then (and still) canonical logical theory – classical logic – can be adequately applied *after* the measurement of a quantum system but not before or during the measurement when we have no coherent picture of what is going on.

We should not jump to conclusions about the correctness of classical logic. The difficulty of interpreting quantum mechanics should set off some alarm bells. One philosopher, Hilary Putnam, argued in 1969 in a paper titled *Is Logic Empirical?* that the principle of distributivity of classical logic is incompatible with a reasonable interpretation of quantum mechanics.[2] We are still not sure what a reasonable interpretation of quantum mechanics is, but the incompatibility cannot be ignored. How can we fix it? Is it simply a matter of finding a proper interpretation? Is it at all possible for our experience of quantum mechanics to be evidence against our logical theory?

I do not know the answers and it is not the aim of this thesis to provide them. Perhaps it is not the principle of distributivity but the principle of bivalence that is incompatible with a reasonable interpretation of quantum mechanics, or perhaps the point is now considered obsolete in general. I will use it merely as a salient example of a context where the correctness of a logical theory seems to be at stake. For the purposes of this thesis I will assume that there is some principle X of classical logic that is in conflict with our experience of quantum mechanics.

Instead of providing answers to the questions about this incompatibility, I will scrutinize a line of thought that is generally used in consideration of these questions. It is often pointed out that logic is *a priori* – meaning that our logical beliefs are justified without reliance on experience – and that therefore quantum mechanics can have no bearings on the correctness of our logical theory. I will argue that this view does not provide sufficient justification of our belief in a logical theory. More generally, my claim is that the a priori/posteriori distinction is not helpful in the evaluation of logical theories and is therefore irrelevant for the epistemology of logic.

I will substantiate this claim as follows. In chapter 2, I will lay the groundwork by discussing some basic assumptions about the a priori/posteriori distinction and the goals of a logical theory. I will conclude the existence of an epistemology of logic, epitomized in one main question. Finally, I will explain what I take it to mean for a distinction to be helpful in answering this question. In chapter 3, I will examine the views on the epistemology of logic of Paul Boghossian – who claims logic is a priori – and of Ole Thomassen Hjortland – who claims logic is a posteriori. I will discuss how they would

[1] Peter J. Lewis, "Interpretations of Quantum Mechanics," in *Internet Encyclopedia of Philosophy*, ed. James Fieser and Bradley Dowden, https://www.iep.utm.edu/int-qm/ (June 16, 2018).
[2] Hilary Putnam, "Is Logic Empirical?" in *Boston Studies in the Philosophy of Science* (Volume 5), ed. Robert S. Cohen and Marx P. Wartofski (Dordrecht: D. Reidel, 1969), 216-241.

answer the main epistemological question and what their solution would be to the problem of quantum mechanics as illustrated in this introduction. In chapter 4, I will conclude that Boghossian and Hjortland are not capable of fully answering the main epistemological question, and that insofar they have a satisfactory answer at all, the a priori/posteriori distinction plays no role in providing it. I will end with closing thoughts that add some context to my thesis and suggest where we could find the answer to the main epistemological question.

Chapter 2: Groundwork

Section 2.1: The a priori/posteriori distinction

For a minimal characterization of the a priori/posteriori distinction, I turn towards Paul Boghossian and Christopher Peacocke.[3] According to them, the distinction relates to the justification of our beliefs. To call a belief knowledge, it must be justified. This is the *justification condition* of knowledge. Consider Paul, who comes to belief the proposition P by the flip of a coin.[4] Even if Paul turns out to be correct, we do not want to say that he *knows* P if this belief is based purely on a lucky guess. For Paul to know P, his belief in it must be properly justified.

This is where the a priori/posteriori distinction comes into play. The justification of *a priori* knowledge does *not* rely on experience while the justification of *a posteriori* knowledge *does*. Intuitively, our belief in a logical truth like '$(P \rightarrow Q) \vee (Q \rightarrow P)$' can be justified a priori and our belief in an empirical proposition like *'most dinosaurs went extinct 66 million years ago'* can be justified a posteriori. To see why, consider the role experience plays in these examples. It is the empirical study of fossils that justifies our belief in the extinction of dinosaurs. In the case of the logical truth however, it is not experience but the proof of the proposition that justifies our belief in it.

Of course, experience always plays *some* role. We were not born knowing all logical truths. We have had the experience of reading and understanding their proofs. Timothy Williamson makes the distinction between experience playing a merely *enabling* role as opposed to an *evidential* role like with the proposition about dinosaurs.[5] For a priori knowledge, experience only plays an enabling and not an evidential role.

One last important note about experience should be made. I take it to include both 'outer' experience involving perception by our senses and 'inner' experience involving reflection in our minds. What is relevant for the a priori/posteriori distinction is not whether the experience is 'outer' or 'inner' but whether it plays an evidential role or not. From now on, I will take this to be the key feature of the distinction.

Section 2.2: The goals of a logical theory

In chapter 1 I talked about quantum mechanics possibly having influence on the correctness of our established logical theory, which I took to signify classical logic. What classical logic is exactly and whether it actually fulfils this canonical role is not important. What is important is that there is such

[3] Paul Boghossian and Christopher Peacocke, "Introduction," in *New Essays on the A Priori*, ed. Paul Boghossian and Christopher Peacocke (Oxford: Oxford University Press, 2000), 1.
[4] Jonathan Jenkins Ichikawa and Matthias Steup, "The Analysis of Knowledge," in *The Stanford Encylopedia of Philosophy* (Fall 2017 Edition), ed. Edward N. Zalta, 1.3, https://plato.stanford.edu/archives/fall2017/entries/knowledge-analysis/.
[5] Timothy Williamson, "How Deep is the Distinction between A Priori and A Posteriori Knowledge?" in *The A Priori in Philosophy*, ed. Albert Casullo and Joshua C. Thurow (Oxford: Oxford University Press, 2013), 293.

a thing as an established logical theory and that it has proponents and opponents that may or may not use examples like quantum mechanics to defend their logical beliefs.

Even though the details of classical logic are not relevant, we can use a basic account of it to make some assumptions about the goals of a logical theory. This will at least demonstrate that classical logic meets these assumptions, which should make them more plausible.

Classical logic consists of a formal language: the building blocks to create sentences and a set of rules that govern the structure of these sentences.[6] Some of these building blocks, the logical constants, are used to create compound sentences. These constants correspond to words in natural languages. For example, the conjunction ∧ corresponds to the English 'and', and the material implication → corresponds to 'if… then'. What defines these constants is the topic of some debate. Whatever their definition, they play an important role in another component of classical logic: the deductive system.[7] This is a set of rules that describe logical relations between sentences in the formal language, which allows us to formally talk about arguments – collections of sentences with premises and a conclusion. The rules put constraints on the introduction and elimination of logical constants. Through such introductions and eliminations, we can move from the premises to the conclusion of an argument. If the deductive rules allow this move, the argument is *derivable*.[8] An example of a derivable argument is the following, with two premises (1) and (2) and a conclusion (4):

(1) P ∧ Q [premise 1]
(2) P → R [premise 2]
(3) P [1, ∧-elimination]
(4) R [2, 3, →-elimination]

It should now be clear that the logical constants have not been chosen arbitrarily. They have been chosen together with the deductive rules to capture the concept of *derivability*. This reasoned choice implies that logic is *about* something pre-theoretic. From now on, I will refer to this pre-theoretic notion as *consequence*.

The P, Q and R in the example above are variables. The idea is that the argument does not hold because it is about anything specific, but that it holds purely in virtue of its form.[9] That means that whatever we substitute for P, Q and R, as long as the premises are correct, so is the conclusion. To talk about correctness of premises, we must assign them meaning. This is done through *interpretations*, which tell us what domain the variables range over, among other things.[10] With the introduction of meaning comes another concept: *validity*.[11] If there is no possible interpretation of an argument in which its premises are correct but its conclusion incorrect, the argument is *valid*.

Like derivability, validity is also meant to capture the notion of consequence. The pre-theoretic domain where we would expect to encounter this notion is broad, but to develop a logical theory that is of any worth, we can require the domain to be sufficiently strong. The domain of science and philosophy comes to mind as a suitable candidate.

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[6] Stewart Shapiro and Teresa Kouri Kissel, "Classical Logic," in *The Stanford Encylopedia of Philosophy* (Spring 2018 Edition), ed. Edward N. Zalta, 2, https://plato.stanford.edu/archives/spr2018/entries/logic-classical/.
[7] Shapiro, "Classical Logic," 3.
[8] Shapiro, "Classical Logic," 3.
[9] John MacFarlane, "Logical Constants," in *The Stanford Encyclopedia of Philosophy* (Winter 2017 Edition), ed. Edward N. Zalta, 4, https://plato.stanford.edu/archives/win2017/entries/logical-constants/.
[10] Shapiro, "Classical Logic," 4.
[11] Shapiro, "Classical Logic," 4.

By adding meaning to a logical argument via interpretations, we apply it to some consequence-related domain to which this meaning refers. Because logical arguments hold purely in virtue of their form and we could substitute anything for the variables, this application should be possible for any consequence-related domain. This domain of application includes a phenomenon like quantum mechanics, assuming the right interpretation has been chosen. A logical theory should be widely applicable.

In summary, a logical theory has at least the following goals:

G1 To capture the pre-theoretic notion of consequence in a sufficiently strong domain.
G2 To be applicable to all consequence-related domains, including quantum mechanics.

Section 2.3: The epistemology of logic

The epistemology of logic is the study of knowledge of logic. This is only an intelligible endeavour if we know what logic is. Assumption G1 presupposes that there is something to theorize, to *discover*: consequence. Knowledge of logic then, is knowledge of consequence. A logical theory like classical logic gives an account of what we supposedly know about consequence. Without any presupposed goals no such account could be given.

As I have claimed in section 2.1, knowledge requires justification. Two different logical theories can give two incompatible accounts of what we know about consequence. One might include the principle X I mentioned in chapter 1 and the other might not. The justification of a logical theory must therefore explain what makes *this* account better than another at adequately capturing consequence.

Evidence is crucial in this explanation. Evidence for a logical theory makes it better and evidence against it makes it worse. From the goals of section 2.2 follows the range of possible evidence. It follows from G1 that anything in a sufficiently strong domain that could tell us something about consequence could be evidence for or against a logical theory. It follows from G2 that an incompatibility such as the one between quantum mechanics and classical logic could constitute evidence against classical logic.

Classical logic has been established as the best logical theory. Its principles were specifically chosen to capture consequence, so where is their evidence? How do we know if quantum mechanics really does constitute evidence against classical logic or if it is the interpretation we are mistaken about? As long as it has not been explained where the evidence *for* classical logic comes from or why quantum mechanics cannot be evidence *against* it, classical logic has not been properly justified.

In conclusion, I assume the main epistemological question to be this:

(MEQ) How can we establish which of two competing logical theories meets the goals better?

Section 2.4: Epistemological relevance

In consideration of the main epistemological question, there are two views I will discuss in the next two chapters: apriorism – the view that logic is a priori – and aposteriorism – the view that logic is a posteriori. A proponent of apriorism – an apriorist – will claim that evidence cannot consist of experience, and with that remove experience from playing a role in the evaluation of two logical theories. A proponent of aposteriorism – an aposteriorist – will claim that evidence *can* consist of experience.

Both the apriorist and aposteriorist must give an answer to MEQ that tells us why an established logical theory like classical logic may (not) rightly be considered the best logical theory. It is not

sufficient for the a priori/posteriori distinction to apply *after* the evaluation of logical theories. Logic can be said to be a posteriori if quantum mechanics ends up leading us to revise our established logical theory, but this is only epistemologically interesting if our experience of quantum mechanics plays a decisive role in the revision. Any arbitrary distinction could be coughed up in hindsight and it could always be claimed that one side of it applies to the established logical theory. If the a priori/posteriori distinction does not play a role in answering MEQ, I will consider it to be irrelevant for the epistemology of logic.[12]

How will I determine that the a priori/posteriori distinction plays a role in answering MEQ? First, I will show that both the apriorist and aposteriorist acknowledge the two goals of section 2.2, making MEQ relevant to them. Second, I will examine their different considerations of the role of experience, to see whether they help in the evaluation of logical theories. Finally, I will investigate whether the introduction of additional goals like universality – if needed for a decisive evaluation – involves the a priori/posteriori distinction.

Using the quantum mechanics example as guidance, I will specifically examine the views on the epistemology of logic of Paul Boghossian – an apriorist – and of Ole Thomassen Hjortland – an aposteriorist – using their papers *Knowledge of Logic* and *Anti-Exceptionalism about Logic*.[13] [14]

Chapter 3: Apriorism and Aposteriorism

Section 3.1: Boghossian – Knowledge of Logic

In *Knowledge of Logic*, Boghossian aims to provide a justification of the modus ponens, which he assumes to be the only underived deductive rule of classical logic. He believes that if a deductive rule can indeed be justified, it must be done either inferentially or non-inferentially.[15] The non-inferential option requires us to simply *see* that the modus ponens is correct by use of some rational, intuition-like faculty.[16] However, it is not clear what this faculty is supposed to be or how it leads us to correct knowledge. "'Intuition' seems like a name for the mystery we are addressing, rather than a solution to it," says Boghossian.[17]

We are left with the inferential option. Boghossian points out the difficulty of inferentially justifying any logical belief at all.[18] Inferential justification requires some notion of consequence. Given G1 and the fact that, being a job of philosophy, the justification of logical beliefs falls within the sufficiently strong pre-theoretic domain of logic, it follows that the justification will inevitably require the involvement of logic itself – either in a formal or informal sense. Because the modus ponens is the only underived deductive rule, the justification of any deductive rule must depend on it. Then how can we use such a rule to justify the modus ponens? Any inferential justification of the modus ponens will be what Boghossian calls *rule-circular*.[19]

At first sight, rule-circular justification does not appear to be cogent enough. However, if both the non-inferential and the rule-circular option are banned, and the inferential option is necessarily rule-

[12] This should make you wonder what the distinction is doing in papers titled *Knowledge of Logic*.
[13] Paul Boghossian, "Knowledge of Logic," in *New Essays on the A Priori*, ed. Paul Boghossian and Christopher Peacocke (Oxford: Oxford University Press, 2000), 229-254.
[14] Ole Thomassen Hjortland, "Anti-Exceptionalism about Logic," *Philosophical Studies* Vol. 174, No. 3 (2017): 631-658, https://doi.org/10.1007/s1109.
[15] Boghossian, "Knowledge of Logic," 230.
[16] Boghossian, "Knowledge of Logic," 231.
[17] Boghossian, "Knowledge of Logic," 231.
[18] Boghossian, "Knowledge of Logic," 229.
[19] Boghossian, "Knowledge of Logic," 231.

circular, there are no options left. Boghossian claims that this is as much a problem for aposteriorism as it is for apriorism.[20] He argues that an empirical justification of a logical belief must also make use of some core logical principles. Imagine we start with a particular physical theory T and logical theory L, and that we derive a claim P from T using L. Now suppose we have some experience that leads us to believe not-P. If logic is a posteriori we should consider modifying L – aside from considering to modify T. Presumably, there are multiple pairs of theory and logic to choose from. This assessment surely makes use of some logical principles.

In defence of rule-circular arguments, Boghossian distinguishes them from what he calls *grossly* circular arguments.[21] A grossly circular argument assumes what it is trying to prove and with that is able to prove anything. But although a rule-circular argument makes use of the deductive rule it is trying to prove (or of another rule dependent on it), it does not assume the rule as a premise. It is not clear that an argument relies on its used deductive rules in the same way it relies on its premises.[22] Boghossian notes that by assuming its conclusion to be true, a grossly circular argument is guaranteed to succeed. This is not the case for a rule-circular argument.[23]

Eventually, Boghossian concludes that rule-circular arguments must be allowed.[24] Still, they should be removed from the bad company of grossly-circular arguments. They require some constraint to prevent them justifying all sorts of absurd deductive rules. Boghossian finds this constraint in the concept of *meaning-constitution*.[25] He claims that the meaning of logical constants comes from their participation in some inferences and not in others. Of all the inferences involving 'if… then' there is a specific subset that is *meaning-constituting* for us. He proposes the following principle:

"(L) If M is a genuinely meaning-constituting rule for S, then S is entitled to infer according to M, independently of having supplied an explicit justification for M."[26]

If M is indeed meaning-constituting, it can now be used by S in a rule-circular argument to properly justify it.[27] To see how the requirement of meaning-constitution prevents S from justifying absurd deductive rules, consider the obviously incorrect rule R: *for any P, if P, then all snow is white*.[28] A rule-circular argument for R goes like this:

1. First assume any P;
2. Then infer *all snow is white* from this assumption and the use of R;
3. Finally – from the assumption P and *all snow is white* – conclude *if P, then all snow is white*.

Does this count as an adequate justification of R? Boghossian says that if we heed principle (L) it does not: "[I]t is obviously not part of the meaning of 'all' that '[a]ll snow is white' can be inferred from any proposition. Indeed, it is because we have an independent purchase on what '[a]ll snow is white' means that we know that R is not truth-preserving and, hence, that it would be embarrassing

[20] Boghossian, "Knowledge of Logic," 233.
[21] Boghossian, "Knowledge of Logic," 245.
[22] Boghossian, "Knowledge of Logic," 245.
[23] Boghossian, "Knowledge of Logic," 247.
[24] Boghossian, "Knowledge of Logic," 245.
[25] Boghossian, "Knowledge of Logic," 248.
[26] Boghossian, "Knowledge of Logic," 249. Note that Boghossian explicitly says it is required that M *is* meaning-constituting, not that S *knows* it is.
[27] Boghossian, "Knowledge of Logic," 250.
[28] Boghossian, "Knowledge of Logic," 248.

to endorse a theory that said otherwise."[29] R is not meaning-constituting and the above rule-circular argument for R does not count as an adequate justification.

This should give us some idea of how Boghossian might answer MEQ. Supposedly, only meaning-constituting inferences adequately capture consequence. Assuming an agreed upon selection of logical constants, the more rules a logical theory has that are meaning-constituting for these logical constants, the better it meets goal G1. The aim is to find the logical theory without any rules that are not meaning-constituting.

What about goal G2? Consider principle X, which I assumed to be incompatible with quantum mechanics. If principle X is meaning-constituting, it must be our interpretation of quantum mechanics that is incorrect. If principle X is not meaning-constituting, we should not have believed it anyway. To know whether to be justified in believing principle X, all we need to find out is whether it is meaning-constituting or not.

Evidence for or against a logical theory then, are inferences that are or are not meaning-constituting. The fact that rule R is not meaning-constituting is evidence against a theory that includes R. The fact that the modus ponens *is* meaning-constituting is evidence for a theory that includes the modus ponens. Indeed, this is in line with apriorism. It is not our experience of reflecting on the modus ponens that justifies our belief in it, but the fact that it is meaning-constituting. Experience only plays an enabling and not an evidential role.

Boghossian does not seem to think that the epistemology of logic is about the evaluation of different logical theories. If his own account of justification is correct then all that is left to do is find out which inferences are meaning-constituting. However, principle (L) requires that M *is* meaning-constituting for S, not that S *knows* it is.[30] Pending an explanation of what makes an inference meaning-constituting, it is not clear how Boghossian would solve the problem of two logicians claiming that two incompatible rules are both meaning-constituting.[31] It is doubtful that all proposed rules incompatible with the established logical theory will be refuted as easily as rule R.

Section 3.2: Hjortland – Anti-Exceptionalism about Logic

In *Anti-Exceptionalism about Logic*, Hjortland claims that logic is just like any other scientific field of study.[32] Like we have theories of gravity, we also have theories of logic – of consequence, by assumption G1. The method to discover facts about consequence is the same as the method to discover facts about gravity. We can turn out to be wrong about what we thought we knew about both gravity and consequence. Our logical theories are revisable in just the same way as our theories of gravity are. Because experience plays an evidential role in the discovery of facts about gravity, the study of gravity is a posteriori: so is logic.

According to Hjortland, theories such as those of gravity and logic are selected with the method of *abduction*, a form of reasoning that is roughly equivalent to *inference to the best explanation*.[33] The abductive method compares theories with respect to a few criteria, the most important of which is evidential fit: we say a theory T is better than a theory T* if and only if T would explain the evidence

[29] Boghossian, "Knowledge of Logic," 251.
[30] Boghossian, "Knowledge of Logic," 249-250.
[31] Boghossian, "Knowledge of Logic," 250. Boghossian admits an explanation of meaning-constitution still needs to be given.
[32] Hjortland, "Anti-Exceptionalism about Logic," 632.
[33] Hjortland, "Anti-Exceptionalism about Logic," 632.

better *if* T were correct than T* would explain the evidence *if* T* were correct.[34] Notice that we do not have to assume either of the theories *is* correct. A lot of scientific theories eventually turn out to be incorrect, but that should not stop us temporarily endorsing some of them.

Other criteria are virtues of a more aesthetic nature, like simplicity. Without going into detail, it should be clear that such additional criteria are required to select a theory in the case of underdetermination by evidence.[35] One theory might explain the evidence just as well as another, so we need more than just evidential fit to be able to keep evaluating theories.

There is one immediate problem that should be pointed out before I continue. It is not necessarily clear what evidential fit amounts to.[36] The obvious answer is that a theory must be consistent with the evidence, but consistency is itself a logical principle that is open to revision. This is the rule-circularity problem Boghossian talks about. It should now be clear that both Boghossian and Hjortland are left to develop their accounts of the epistemology of logic at the same starting position: after the lift of the ban on rule-circularity.[37] Hjortland is not worried about this. All logical principles should be open to revision, but they need not be open to revision *simultaneously*.[38]

Before he can start the abductive evaluation of logical theories, Hjortland claims he must answer two questions: what is a logical theory a theory of, and what constitutes evidence for a logical theory?[39] To make the development of a logical theory possible at all, an answer to the first question is required. Hjortland's answer is not too far off from the one I give in G1: I claim logic is about consequence, he claims it is about validity.[40]

The criterium of evidential fit requires an answer to the second question. According to Hjortland, the evidence can come from a number of sources: "from intuitions about validity or alethic modality, from mathematical theories and practice, from psychology of reasoning, from epistemic norms of rationality, and so on."[41] In section 2.2 I have suggested to restrict the domain of these sources to science and philosophy. As long as consequence (or validity, for Hjortland) is somehow involved in a source in this domain, our logical theory should fit the evidence that originates from this source. The a posteriori nature of his account of the epistemology of logic shows itself here. It is the experience of consequence itself that is evidential, not what it might enable us access to. Hjortland specifically

[34] Timothy Williamson, "Abductive Philosophy," *The Philosophical Forum* Vol. 47, No. 3-4 (Fall-Winter 2016): 266, https://doi.org/10.1111/phil.12122.
[35] Kyle Stanford, "Underdetermination of Scientific Theory," in *The Stanford Encylopedia of Philosophy* (Winter 2017 Edition), ed. Edward N. Zalta, https://plato.stanford.edu/archives/win2017/entries/scientific-underdetermination/.
[36] Hjortland, "Anti-Exceptionalism about Logic," 645.
[37] If apriorism is allowed another shot at rule-circular justification, so should aposteriorism. Neither Boghossian nor Hjortland seems to be able to explain what makes the one a better option than the other. Of course, I am now in danger of falling into an infinite regress. Asking Boghossian to defend their apriorism against aposteriorism – or vice versa – is equivalent to asking a MEQ-like question about the two accounts of the epistemology of logic. If these accounts require justification, then what about the justification of this justification? However, we can at least expect Boghossian and Hjortland to have reasons for assuming logic to be a priori or a posteriori. It does not seem fair that, after lifting the ban on rule-circularity, Boghossian never mentions aposteriorism as a possibility again.
[38] Hjortland, "Anti-Exceptionalism about Logic," 645.
[39] Hjortland, "Anti-Exceptionalism about Logic," 635.
[40] Hjortland, "Anti-Exceptionalism about Logic," 643.
[41] Hjortland, "Anti-Exceptionalism about Logic," 644.

mentions the observational data of quantum mechanics as possibly providing a reason to revise a logical theory.[42]

Note that nothing has been said about the weight of the abductive criteria. It does not necessarily need to be a problem that a theory of logic does *not* fit the observational data of quantum mechanics. Perhaps no theory that fits this data is possible at all, or perhaps only at the impermissible cost of other criteria.

One convincing piece of evidence for classical logic is its success in mathematics.[43] We should not gloss over this success, but according to Hjortland it should not be inflated beyond what it is either. Even if mathematics could not be done with any other logical theory than classical logic, this is because whatever notion of consequence classical logic is capturing is integral to mathematics, not classical logic itself.[44] Mathematics uses instances of classical principles but does not need to rely on them being applicable to the whole domain of science and philosophy. They could only hold restrictedly for mathematical discourse.

Now we arrive at the core of Hjortland's account of the epistemology of logic. Suppose that for principle X we have abductive reasons to endorse it – e.g. because of its success in mathematics – and other abductive reasons to reject it – e.g. because of the lack of evidential fit in quantum mechanics. Perhaps principle X could hold for some domains and not for others. We could develop multiple theories of logic – one for mathematics and one for quantum mechanics – or, alternatively, *one* theory with domain-specific restrictions for different principles. Hjortland calls these views *inter-* and *intra-theoretical pluralism*, respectively.[45] He is a proponent of the latter view.

Hjortland is very open to the different possibilities of the abductive method. He does not want to rule out beforehand that inter-theoretical pluralism or any other view is correct. Supposedly, some abductive criteria make his own view more plausible than another, but the weight of these criteria and even the criteria themselves can change. Hjortland therefore does not seem to have an unambiguous answer to MEQ. The goals mentioned in section 2.2 are not decisive enough. Whether or not a logical theory that includes principle X meets G2 depends on whether we consider the incompatible interpretation of quantum mechanics to be correct. An abductive criterium like simplicity provides a third goal, but not one that Hjortland is all too concerned about. Pluralism can hardly be called simple.

Hjortland's answer to MEQ depends on what he considers to be the (weight of) other abductive criteria. By leaving open the possibility of any encounter of consequence in a sufficiently strong domain being evidence for or against a logical theory, the answer of MEQ requires other goals besides G1 and G2. For now, we can assume that Hjortland would solve the incompatibility between principle X and quantum mechanics by restricting the principle to specific domains.

Chapter 4: Conclusions

Section 4.1: Shortcomings of the a priori/posteriori distinction

Hjortland specifically claims logic to be about validity. I have concluded that this conforms to my claim that logic is about consequence. So, Hjortland acknowledges G1. Hjortland's list of sources of evidential experience – and his explicit mention of quantum mechanics – implies his

[42] Hjortland, "Anti-Exceptionalism about Logic," 644.
[43] Hjortland, "Anti-Exceptionalism about Logic," 652.
[44] Hjortland, "Anti-Exceptionalism about Logic," 652.
[45] Hjortland, "Anti-Exceptionalism about Logic," 654.

acknowledgement of G2. Boghossian does not directly state what he considers logic to be about, but nevertheless acknowledges G1 by defending the modus ponens and claiming that some rules are, and other rules are not meaning-constituting – implying that meaning-constituting rules better capture whatever notion a logical theory is supposed to capture. Like Hjortland, Boghossian also acknowledges a possible incompatibility between quantum mechanics and a principle X.[46] I conclude that he acknowledges G2 as well.

Given these acknowledgements, I can suppose that Boghossian and Hjortland both consider MEQ to be a valid question. Their different answers to MEQ must rely on some underlying differences of opinion. One way in which they differ is their view on the apriority of logic. It follows from section 2.1 that this manifests itself in their consideration of experience. As an apriorist, Boghossian has no concept of evidential experience – it is the meaning-constitution that is evidential. As an aposteriorist, Hjortland considers experience (coming from a broad range of sources) itself as evidential. Do their answers to MEQ follow from this difference?

Boghossian considers experience of inferences to be merely enabling access to evidential meaning-constitution. In other words, experience enables us access to a sufficiently strong pre-theoretic domain of consequence. However, he gives no explanation of how we are supposed to figure out which inferences play this enabling role. For one, had we had relatively more experience of (sub)atomic particles, it is not clear that if a principle X that is considered incompatible with quantum mechanics would have been as obviously meaning-constituting as it might seem to us now. Consider such a meaning-constituting principle X. It is likely we would figure out its meaning-constitution through a lot of enabling experience of inferences. Now consider a world where most of our experience is quantum mechanical. Would we still have reached the conclusion that principle X is meaning-constituting? Never mind whether principle X actually *is* not meaning-constituting, would we not at least *think* it is not? Whenever we reach the conclusion that a principle is meaning-constituting, it seems very dependent on what we consider to be enabling experience. Boghossian says it is about principles *being* meaning-constituting, not about us *knowing* that they are. But then we could still be mistaken about what inferences enable us access to this meaning-constitution. In other words, Boghossian is in no position to claim his opponent's rules are not meaning-constituting – and is therefore in no position to answer MEQ – on the basis of his enabling experience of evidential meaning-constitution.

For Hjortland, all experience of a sufficiently strong domain of consequence is evidential. As I have remarked in section 3.2 however, this evidential experience alone cannot answer MEQ. There is evidence for and against logical theories. Whether quantum mechanics is evidence against principle X depends on whether the interpretation is correct. In the end, it is abduction that tells us how to weigh evidential experience. It is abduction that tells us quantum mechanics and principle X are incompatible in the first place, because the interpretation is abductively chosen. With only evidential experience to rely on, the only way Hjortland can make sense of MEQ is by embracing an extreme form of pluralism. Even his intra-theoretical pluralism still needs criteria to evaluate two logical theories that are incompatible in the same domain.

Experience of quantum mechanics can be considered to be evidential, merely enabling or neither. Boghossian and Hjortland fail to explain how we should find out which of these options is the case. Their differences come down to where they look for solid ground: Boghossian attaches more value to G1, hoping to find evidence in a pre-theoretic domain explained in terms of meaning-constitution, and Hjortland attaches more value to G2, hoping to find evidence in the application of logical

[46] Boghossian, "Knowledge of Logic," 233.

theories. In any case, both Boghossian's and Hjortland's considerations of experience do not help them provide answers to MEQ.

Section 4.2: The irrelevance of the distinction for the addition of goals

In section 3.2, I have suggested that the two goals are not sufficient for Hjortland to definitively evaluate logical theories and provide an answer to MEQ. Why does Boghossian seem to have less trouble with this? There must be some difference between them where the a priori/posteriori distinction could be of importance. This difference lies in their views on additional goals besides G1 and G2.

Boghossian cannot risk the possibility of having to resign to a form of pluralism. The implicit assumption seems to be that a logical theory should be universal. Suppose Boghossian's account of meaning-constitution is correct. A rule is meaning-constituting in all possible contexts. So, if two logics have different meaning-constituting rules, then these rules cannot contradict each other – or they would not be meaning-constituting. That means they must be compatible, making logic universal after all.

This is in clear contrast with Hjortland, who happily embraces pluralism. This contrast directly affects their answers to MEQ: Boghossian could not even consider a pluralistic logical theory to be adequate, let alone better than another.

I have suggested that adding goals could help the evaluation of logical theories. Let me assume Boghossian has added universality as a third goal on top of G1 and G2. Presumably, Hjortland has no problem with universality as an abductive criterium. After all, is it not a criterium of all scientific theories? For Boghossian, universality is a necessity. Hjortland need not agree with this but requires *some* additional goals at least. Because what does it mean for one theory to *better* meet these goals than another? Either some more goals are needed, or the goals themselves need some criteria – which could be translated to additional goals.

Assuming some third goal could and should be done by both. Hjortland has the right method for this – abduction – but does not make the necessary steps to let it help him evaluate incompatible logical theories. Boghossian's implicit assumption of universality as a third goal is fine in itself, but too restrictive if it is assumed that we could not be mistaken about what we think we know are the universal meaning-constituting rules – that would not merely be rule-circular, but grossly-circular.

If universality is chosen as a third goal, this should be done with reason. What does this have to do with the a priori/posteriori distinction? Why could it not be done separately from considering the apriority of logic, by Boghossian or by Hjortland? In the end, they both appeal to abductive notions – Hjortland more explicitly and more liberally than Boghossian. Insofar their views on MEQ differ, this difference does not rely on the a priori/posteriori distinction even after adding possible additional goals. The only goals that are related to experience are G1 and G2.

In can now conclude that the a priori/posteriori distinction plays no role in answering the main epistemological question and does not provide other ways of evaluating incompatible logical theories. The distinction is therefore irrelevant in providing a satisfactory account of the epistemology of logic.

Closing thoughts

Ever since I discovered the existence of other non-classical logics, I have wondered how it should be decided which logic is right. I can understand a conservative approach when it comes to revision of

logic, but in the face of the proposals of so many non-classical logics, classical logic surely requires some convincing justification. My main motivation for writing this thesis was my puzzlement over the frequent references to the a priori/posteriori distinction in the justifications of knowledge of logic. It never quite seemed to do the work it was expected to do – as I have hopefully adequately demonstrated. However, I do understand why philosophers would think logic is a priori. I have been deliberately vague about the notion of consequence, but there is something about it that suggests it could have no other structure than the one Boghossian defends: that of the modus ponens. Like there is only one wheel, there appears to be only one general way of drawing deductive conclusions: if P, and Q follows from P, then Q. Perhaps I am overlooking some detail, but this is at least why *I* could believe some part of logic to be a priori – in the sense that it is unchanging, universal, and unique.

This would certainly ease some of the troubles with circularity. Tinkering with logic is like reconstructing a ship while afloat on it. Hjortland points out that we could replace all parts of the ship as long as we do not do it simultaneously, but some reliable support would be nice. Stewart Shapiro calls this support the *weak extra-web logic* (referring to Quine's web of belief).[47] Hjortland cynically names it the *One True Logic* and claims it "will likely turn out to be exceedingly weak, maybe even empty."[48] I share most of his pessimism. Even if there is a One True Logic in some interesting sense, how would we know when we have discovered it? This is exactly the issue with Boghossian's meaning-constitution. Still, it seems the problem is not that we do not know what consequence is. We just do not know how to formalize it.

Although my sympathies lie more with Hjortland, I think he is too quick to claim logic is just like science. It is correct that – with the help of other abductive criteria – a new scientific theory is fitted to the evidence, some of which is observational. But this is not sufficient. Scientific theories must predict *new* observations too. This allows us to test a theory, and it is this testing that is most helpful in the evaluation of competing theories. I am not sure if the revision of logic works in quite the same way. Can a logical theory make any new predictions at all? The revision could depend on other abductive criteria, but we would need to agree on those first. I had always considered universality to be such a criterium, but unfortunately Hjortland seems to disagree: he does not at all seem apprehensive to endorse pluralism.

In any case, the solution probably lies somewhere between Hjortland and Boghossian. If there is one thing I have learnt, it is that their views are more similar than they would probably think. By demonstrating the irrelevance of the a priori/posteriori distinction for the epistemology of logic, I hope to have cleared up some of the fog that obscured these similarities.

[47] Stewart Shapiro, "The Status of Logic," in *New Essays on the A Priori*, ed. Paul Boghossian and Christopher Peacocke (Oxford: Oxford University Press, 2000), 339.
[48] Hjortland, "Anti-Exceptionalism about Logic," 655.

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