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Why naturalists must give up deduction, or return to Hume

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Funding: University of KwaZulu-Natal postdoctoral funding

Potential competing interests: No potential competing interests to declare.

Abstract

This paper argues that there is a rational inconsistency in the naturalist project when rejecting analyticity and a priori knowledge but using deduction in philosophical enquiry. This is because deduction should be construed in the Humean sense – as demonstrative reasoning which allows necessary inference from conceptual truths in the premises to a conceptual truth in the conclusion. We look at a few different accounts of deduction, ones which might be able to assist the naturalist by offering an alternative reading of deduction, but in the end, reject all of them. Once it is accepted that the classical Humean account of deduction is correct, there is no plausible explanation for what it is naturalists do when they use deductive reasoning, given their other theoretical commitments. The naturalist is left with two options: accept that analyticity (logical truth) and a priori knowledge are possible and keep deduction as a legitimate method of enquiry, or forego both. (abstract 154 words)

Keywords: Deduction, Hume, necessity, a priori, naturalism, Devitt.

Introduction

Naturalists typically reject the existence of a priori knowledge. They also typically reject the possibility of purely logical truths, if construed as something like analytic truths. Yet they do not give up the use of deduction – there is much evidence of deductive argumentation in the work of philosophical naturalists. It therefore is easy to assume that they take deduction to be inference which does not involve a priori justification, nor does it yield purely analytic truths. Deduction, for naturalists, infers from and to empirically significant propositions, the inferential relationship is justified a posteriori, but has the modal character of necessity.

It might be interjected here that the above description is to reduce the naturalist position on these matters to the absurd. The naturalist, it might be said, holds much more sophisticated and nuanced views on matters of the a priori, analyticity and deduction. For instance, that even though there are epistemically different parts of a system of knowledge, empirical justification is the final arbiter of our knowledge of the world.

Given this naturalistic alternative, we have no need to turn to an a priori explanation of our knowledge of mathematics, logic, and the like. The original intuitions were really that this knowledge is not justified in some direct empirical way. Those intuitions are preserved. Yet we can still see the knowledge as empirical: it is justified empirically in an indirect holistic way. (Devitt, 2013, p. 186)

Our response is that the sophisticated arguments on offer from the naturalist camp do very little to save itself from the self-imposed dilemma about deduction. And it is a philosophically serious dilemma. Naturalists have tried to explain deduction by giving it a Darwinian explanation (Sterpetti, 2019) sometimes by using Quine's web of belief (Devitt, 2013), (Papineau, 2014). But to argue as Devitt does – that we need not concern ourselves with the direct epistemic nature of a proposition in mathematics and logic, because the overall justification will always be empirical – is a disingenuous sidestepping of the heart of the philosophical problem in question. There is not one current epistemologist who, to our knowledge, holds that propositions of differing epistemic nature populating science, philosophy and myriad other disciplines stand in a relationship with each other. This is taken as uncontroversial. Most current philosophers, even most current rationalists, are largely empiricists in this regard; by and large, they take empirical science to be the final arbiter of what the world is like. So, to this extent, everyone agrees with Devitt. But the difficulty with Devitt's articulation is that it neatly avoids the real philosophical problem. Philosophers are indeed very interested in which parts of enquiry are which, and how they engage each other in the formation of knowledge. So, if mathematics is a priori, but forms a part of natural science, the sceptics about naturalism want to know how these parts are distinct and what their distinct roles are in knowledge formation.

The problem to which naturalists have to respond if they offer us necessary entailments is whether necessities exist and if they do, how we justify our belief in them, if not a priori:

But why should we accept that necessities can only be known a priori? Prima facie, some necessities are known empirically; for example, that water is necessarily H₂O and that Hesperus is necessarily Phosphorus. Indeed, science seems to be discovering necessities all the time. (Devitt, 2013, p. 187)

Some take the a priori knowledge of mathematics and certain types of definitions to be final:

That mathematics is known a priori is uncontroversial. Furthermore, no one will oppose saying that explicit definitions of new predicates as shorthand for longer expressions are known a priori. (Johansson, 2018, p. 12)

We argue that if Devitt foregoes the a priori he must forego necessity. To retain both and allow their yoking (i.e. necessary a posteriori), is to permit metaphysical necessities. This is, surely, the rationalism of old? It is shown that, irrespective of what Kripke and Devitt say, unless the proposition that 'Hesperus is Phosphorus' is read as an analytic statement, it simply is not a logical contradiction that 'Hesperus is not Phosphorus'. If the statement is understood as empirically significant it immediately becomes impossible to demonstrate that 'Hesperus is not Phosphorus' is a contradictory statement. Consequently, the perceived necessity must be imported from a naming convention established within an accepted theoretical framework in science. As we shall see, the necessity cannot not reside in the empirical fact about identical objects.

Rejecting both a priori knowledge and necessity/analyticity, however, leaves the naturalist in a dilemma about deduction. Naturalists need deduction to be ampliative to cohere with their other theoretical commitments to synthetic truth, contingency and empirical/a posteriori knowledge. But can deduction be ampliative as the naturalist must surely hold it is? Or can it be non-ampliative (Hintikka, 1970) (Genot, 2018) and necessary, but empirically significant? Most importantly, if it is, 1. ampliative or, 2. non-ampliative but about matters of fact, what would Hume say? Hume, we think, would turn in his grave.

Matters of fact, which are the second objects of human reason, are not ascertained in the same manner: nor is our evidence of their truth, however great, of a like nature with the foregoing. The contrary of every matter of fact is still possible; because it can never imply a contradiction, and is conceived by the mind with the same facility and distinctness, as if ever so conformable to reality. That the sun will not rise tomorrow is no less intelligible a proposition, and implies no more contradiction than the affirmation, that it will rise. We should in vain, therefore, attempt to demonstrate its falsehood. Were it demonstratively false, it would imply a contradiction, and could never be distinctly conceived by the mind. (Stove, 1973, p. 151)

In Section 1 we discuss briefly why Humean deduction poses a challenge to the naturalist use of deduction given their other theoretic commitments. This discussion expresses the heart of the research problem. In Section 2 we look at alternative accounts of Humean deduction, such as the possibility of Hume allowing for deduction to be from non-necessary premises. Further, we describe Hintikka's analysis of deduction as non-ampliative but informative. Both alternative Hume and Hintikka's accounts are cast as possible solutions for the naturalist's dilemma. Section 3 sees a rebuttal of the options discussed in Section 2, with the conclusion being drawn that the only correct account of Humean deduction is not consistent with naturalistic use of deduction, because the latter is wrong-headed.

Section 1: Hume and the naturalist's dilemma

The naturalist's dilemma is the corollary of the freshman's challenge.

It seems to me that in addition to this scandal of induction there is an equally disquieting scandal of deduction. Its urgency can be brought home to each of us by any clever freshman who asks, upon being told that deductive reasoning is "tautological" or "analytical" and that logical truths have no "empirical content" and cannot be used to make "factual assertions": In what other sense, then, does deductive reasoning give us new information? Isn't it perfectly obvious that there is some such sense, for what point would there otherwise be to logic and mathematics? This question is apt to cause acute embarrassment, for no such sense has ever been defined in the literature. The only honest answer to our imaginary freshman's question is given by those few unregenerate logical positivists who are bold enough to deny the existence of any objective (non-psychological) sense in which deductive inference yields new information. (Hintikka, 1970, p. 135)

Hintikka's imaginary freshman's question is the corollary of naturalism's dilemma about deduction: Naturalism claims that there are no such things as analyticity or a priori knowledge. Yet, they use deduction in their philosophical enquiries – contemporary naturalised metaphysics is well-populated with deductive arguments. This phenomenon demands that naturalists give an account of deduction which is consistent with their other semantic and epistemological commitments. They either need to show that it is ampliative, or that it is non-ampliative but informative. This can be done by showing that deduction is possible between empirically significant, analytic premises and conclusion. Belshaw (1989) discusses such options. Or it can be done by showing that despite being analytic or conceptual such arguments still make contact with empirical reality (Genot, 2018) and (Hintikka, 1970).

We take the classic view of Humean to be that it is entailment which runs from 'relations of ideas' (or analytic or conceptual truths) in the premises to 'relations of ideas' in the conclusion. In addition, the entailment is justified a priori, and the entailment, of course, is logically necessary. Alternatives to the standard Humean account of deduction have come from both the empiricist and rationalist camps – there seems to be a motive on both sides to garner its argumentative prowess. One or two will be mentioned below. The outcome of the paper is a suggestion that it is best to stay true to Hume's (and, later, the logical positivists') account of deduction, and to accept that it is ill-suited to some types of philosophical enquiry.

There is an irony involved in the deference paid to Humean empiricism in current naturalised metaphysics, whilst simultaneously an important Humean principle is overlooked; the absolute distinction between synthetic and analytic and a posteriori and a priori. If one of the core mandates of naturalism is to reject the possibility of all a priori knowledge and, with it, purely logical truths, then it seems that Hume's fork – his distinction between 'relations of ideas' and 'matters of fact' (Barnard, 1996, p. 27) must also be rejected. This, one assumes, might be a sacrifice which naturalists are willing to

make. And indeed the dissolution of this distinction is often vigorously advocated [(Mill, 1969); (Devitt, 1998); (Papineau, 2014); (Quine, 1963) (Studtmann, 2010)].

Yet, despite the rejection of analytic truth and a priori knowledge, here is a deduction from Dennett's (2003)*Freedom Evolves*:

In some deterministic worlds there are avoiders avoiding harms

Therefore in some deterministic worlds some things are avoided

Whatever is avoided is avoidable or evitable

Therefore in some deterministic worlds not everything is inevitable

Therefore determinism does not imply inevitability

(Dennett, 2003, p. 56)

Whilst Hume scholars acknowledge the Humean distinction between 'relations of ideas' and 'matters of fact' they often do not agree on what exactly Hume takes 'demonstrative reasonings' to be about, or from. And it is this disagreement which opens up the debate about whether or not deductions can contain premises that state 'matters of fact'. In other words, they disagree about what Hume says about the content of demonstrative reasoning or demonstration.¹

What seems not to be contested is that Hume takes necessary entailment to be an essential trait of demonstrative reasoning and that this is significantly distinct from entailment in non-deductive reasoning. But, if there is disagreement about whether or not demonstrable reasonings, or demonstrations, can be from non-necessary or contingent premises then there must be disagreement about what exactly Hume means by 'relations of ideas', since he holds that 'demonstrative reasonings' are from 'relations of ideas'. What is the modal character of 'relations of ideas' and is the modality distinct from that of 'matters of fact'?

Naturalists must hold that they are contingent because all truths are.

Hume sets 'relations of ideas' apart from 'matters of fact'. There is, however, a 'standard reading' of Humean deduction which maintains that Hume thought there were different forms of deduction. Some deduction form empirically significant premises, or from 'matters of fact'. And some deduction is only between analytically true premises, or 'relations of ideas'. Naturalists could adopt the 'standard reading' about deduction – that deductive entailment from analytic premises is only one type of deduction. Belshaw (1989) argues against Stove's (1973) position in *Probability and Hume's Inductive Scepticism* that Hume's demonstrative reasoning is not the only type of deduction there is.

Stove's is a dissenting voice in all of this. He rejects the standard account, and urges instead that we interpret 'demonstrative' as referring to "a (valid) argument from necessarily true premisses" and thus indicates that he believes that Hume's demonstrative arguments form a subset of deductive arguments in general. He claims that only on this reading will Hume be able to argue, as he does repeatedly, that there can be no demonstrative arguments for contingent matters of fact. He wants to find good sense in Hume's account, but suggests that given the standard reading this will not be easy. For that there can be no deductive argument for any matter of fact, any contingent proposition, will strike us as thoroughly implausible. But, Stove insists, the standard reading of 'demonstrative' commits us to just this. (Belshaw, 1989, p. 145)

For Humean deduction, other than demonstrations, to be possible from non-necessary or contingent premises we must assume that the premises are not just relations of ideas but are articulated by propositions which are contingently true. So, if Belshaw is right, Hume allows for other deductions from empirically significant premises.

Assuming, for a bit, that a sort of empirically significant logical entailment is possible for Hume, what would be Hume's position on the justification of the entailment relationship? It seems decisive that Hume yolks necessity to a priority.

Now whatever is intelligible, and can be distinctively conceived, implies no contradiction, and can never be proved false by any demonstrative argument or abstract reasoning a priori. (EHU 4.18; SBN 35)

Hume's view on the a priori and its coupling with necessity is probably the best reason to assume that the classical account of Humean deduction is correct (Stove, 1973). Hume did not make any allowance for the possibility of necessity being known a posteriori. This is at the foundation of his reasoning about causality and his other metaphysics in general. So, irrespective of whether or not it is possible that there is ambiguity about Hume allowing for deduction from 'matters of fact', he did not allow for necessity without the a priori. This is all we need to accept the classical account of Humean deduction. This then strongly implies that Hume, like Carnap later, took it as impossible to have necessary proofs *from* or *about* contingent propositions. When Hume's semantic and epistemic distinctions were later adopted by the logical positivists of the Vienna Circle analogies are drawn between 'synthetic'/'matters of fact' and also between 'relations 'analytic'/'relations of ideas' (Belshaw, 1989, pp. 142, 143); (Frank, 1963).

Carnap divides all propositions having a meaning into three classes: (1) Propositions which are true in virtue of their form alone (tautological or analytical judgments). These propositions, according to Carnap, say nothing of

reality. Among these he counts the formulae of logic and mathematics. (2) Propositions containing logical contradictions; these are false in virtue of their very form. (3) The remaining propositions are judgments of experience and belong to empirical science and may be either true or false. Now propositions which do not belong to any of these classes are devoid of sense. [...] It is equally clear that Carnap's position is not very original. Long ago Hume divided the objects of human knowledge into relations between ideas and what he calls 'Facts of experience.' Hume also thought that mathematics deals not with an aspect of the real material world but with the ideal relations independent of reality. (Frank, 1963, p. 161)

For Carnap, analytic truths are definitions of one type or another and are logical formulations devoid of empirical content in that their truth is dependent entirely on intra-linguistic facts. Put another way, their meaning is intensional. The important point is that analytic sentences have to be provable, or demonstrable, but in a manner which does not require further empirical enquiry.

It was natural in this context to take provability as the essential trait of an analytic sentence. While self-evidence was to be discarded it seemed that an analytic sentence ought to be provable by means available to human minds [...] An analytic sentence is conceived of not merely as provable in a purely formal sense. It must be distinguished from theorems provable on the basis of synthetic laws by being true "in virtue of meaning". (Bohner, 1963, pp. 412, 413)

The difficulty is that naturalists, we know very well, do not want to be logical positivists. Quine broke with Carnap and the rest is history. We have been told and told again that naturalists have forsaken the analytic-synthetic distinction and the possibility of a priori knowledge. But not adopting the Humean-Carnapian distinctions above, leaves naturalism in a very difficult position for explaining what the difference is between deduction and induction and to give a plausible account of necessity and logical entailment – all things they want to be able to do.

Part 2: Must all deduction be Hume's deduction?

Henceforth, we take 'Hume's deduction' to refer to the classical account of deduction. Dennett is a self-professed naturalist (2003, p. 15). Yet, just in *Freedom Evolves* Dennett indicates many times, that Hume has the right ideas about a variety of issues (Dennett, 2003, pp. 243, 260 - 261). He also mentions and applauds Hume's recognition of the problem with inductive reasoning and probability (Dennett, 2003, pp. 33, 35). So, let us suppose that Dennett wants to follow Hume at least on some things – as indeed most naturalists do. Is Dennett a Humean empiricist about the distinction between

relations of ideas and relations of matters of fact, or is he a full-blown Quinean empiricist denying the distinction and the existence of a priori knowledge? If Dennett takes 'relations of ideas' and 'matters of fact' to be distinct, this distinction cannot be, like it is for Hume, based on the distinction between a priori and posteriori propositions, or necessary and contingent truths.

Empiricists with respect to knowledge think that all knowledge is ultimately empirical [...] As a result they must make one of two claims about a priori knowledge that in the end amount to the same thing: either (1) there is no a priori knowledge; or (2) what many have labeled "a priori knowledge" is in fact a posteriori. (Studtmann, 2010, pp. 48, 49)

If this is the case then 'relations of ideas' are not purely conceptual truths, with meaning determined intensionally, but more like statements of meaning where meaning is extensional and determined in the Quinean sense:

Interchangeability salva veritate is meaningless until relativised to a language whose extent is specified in relevant respects....Now a language of this type is extensional, in this sense: any two predicates which agree extensionally (that is, are true of the same objects) are interchangeable salva veritate. (Quine, 1963, p. 30)

Such empiricists will '...generally accept the concept of logical entailment from an empirically discoverable fact' (Studtmann, 2010, p. 27). Similarly, Mill says:

Why are mathematics by almost all philosophers, and (by some) even those branches of natural philosophy which, though the medium of mathematics, have been converted into deductive sciences, considered to be independent of the evidence of experience and observation and characterised as systems of Necessary Truth?

The answer I conceive to be, that this character of necessity ascribed to the truths of mathematics, and even (with some reservations to be hereafter made) the peculiar certainty attributed to them, is an illusion. (Mill, 1969, p. 18)

To the contrary, for the Carnapian type of empiricist, it is precisely because some truths have been justified by demonstrative processes that we are entitled to claim knowledge of them – *provided* we take their truth to be of the trivial

uninformative type.

Having thus shown that there is no inexplicable paradox involved in the view that the truths of logic and mathematics are all of them analytic, we may safely adopt it as the only satisfactory explanation of their a priori necessity. And in adopting it we vindicate the empiricist claim that there can be no a priori knowledge of reality. (Ayer, 1969, p. 42)

As Hahn puts it:

Logic does not by any means treat of the totality of things, it does not treat of objects at all but only of our way of speaking about objects: logic is generated by language. The certainty and universal validity, or better the irrefutability of a proposition of logic derives just from the fact that it says nothing about objects of any kind. (Miller, 1998, p. 95)

Hanson (1960) identifies metaphysical arguments as 'trans-type' (1960, p. 86). By this, he means that metaphysical arguments either have premises which are contingently true and then a conclusion which is necessarily true or the other way around. The reason he gives is that metaphysicians are intent on offering us information about the world, and therefore are in some way committed to not giving us purely conceptual truths. Trans-type arguments he rejects for a range of reasons. Hanson, however, allows for deductive argument of the following two types: 1. Deductive entailments between contingent premises and a contingent conclusion and 2. Deductive entailments between necessary premises and a necessary conclusion. Hanson says about these two types of deductions that they do not bear the ills of metaphysical trans-type arguments because they are 'semantical-unpackers'.

Again, the possibilities in entailment are just these: (1) the entailment can be from what is necessary to what is necessary, (2) the entailment can be from what is contingent to what is contingent. But neither (1) nor (2) constitutes an informative inference. They are just 'semantical-unpackers.' If the move from what is contingent to what is contingent is genuinely informative, then the move cannot constitute an entailment. It will be more like an inductive inference, or a causal inference, and hence be non-necessary. So they will not be entailment-bound. (Hanson, 1960, p. 87)

It seems correct to question the legitimacy of trans-type arguments – perhaps only for the epistemological problem presented by changing the type of modality across inferential lines. What is of greater interest is that he thinks logical

entailment between contingent premises and a contingent conclusion is possible. Hanson takes such deductions to not be informative (Hanson, 1960, pp. 87 - 88). If they were to be informative there could be no logical entailment (Hanson, 1960, p. 88). Hanson has offered the naturalist this: the possibility of contingently true premises and conclusion in arguments which are deductive. This is something. But he places a restriction on what is achieved in this way – certainly no new information. Would Dennett accept this as a description of his conclusion about determinism and free will – that no new information has been offered in the conclusion?

Hintikka (1970) starts his paper on 'Information, Deduction and the A Priori' with a nod to the logical positivist conviction that deduction is purely tautological, dealing in only linguistic or analytic truths. Let us rephrase Hintikka's (1970) freshman's question: 'Given that the non-ampliative nature of deduction presents as a seminal or defining feature of it, which also distinguishes it from induction and abduction, may naturalists legitimately use it within their particular brand of empiricism?' By the standard freshman's understanding of 'deduction', deductions should 1. Draw no further conclusions than is logically permitted by the premises (the inference should have a tautological relationship with the premise), and 2. Their premises should be understood as analytic or definitional truths, themselves. But both these features presuppose the possibility of a priori justification.

Hintikka (1970) goes on to offer an argument, contra the logical positivists (and in this case contra Hume), for why deduction is indeed informative. He introduces the idea of inference through the concepts of 'depth' and 'weight'. The weight of a 'unit' (either a singular statement/sentence or a group) is the contingencies associated with it. The more contingencies associated with a unit, presumably, the more inferred sentences from it, since every contingency can have an associated statement of it. Probability can deepen layer upon layer as inference becomes richer due to the weight of contingencies associated with the propositional content.

We start from the whole probability-mass of one unit, and start dividing it up. Every time we move one step downwards in the diagram, the weight (probability) of a given constituent $C(d)$ (of depth d , say) is somehow split up between its subordinate constituents of depth $d + 1$. (Hintikka, 1970, p. 138)

The depth of a unit, when part of deductive inference, is called its 'surface information'. But, surface information can be either conceptual or factual. Surface information would be information about 'mind-independent reality' (Hintikka, 1970, pp. 143 - 146).

What, however, is not required are new observations, experiments, or factual evidence of any other sort. All we have to do is to look deeper into our own language, to carry out further that purely conceptual analysis of the

different contingencies one may encounter in examining the world in which a constituent is true. (Hintikka, 1970, p. 143)

For conceptual information, Hintikka takes the investigation of contingencies to be a matter of conceptual analysis. Associated with all purely conceptual truths are empirical facts; facts about the world. He sees no reason why the enquirer cannot legitimately take the associated facts as information (Hintikka, 1970, pp. 141 - 145). Hintikka offers conceptual analysis as an epistemology of contingencies since he is committed to the idea that it is impossible to separate, in an a priori investigation or justification, that which is contributed by the 'real world' and that which is purely conceptual. Our conceptual frameworks are informed and inform our knowledge of the real and mind-independent world. We are back with Kant, of course. Even though Hintikka does not think "Kant's formulation is a particularly happy one" (Hintikka, 1970, p. 143) he does hold that "The deep fact here is that we are relying on the mediation of a certain conceptual system in order to 'reach reality'" (Hintikka, 1970, p. 143). Conceptual and real information are, thus, inseparable. There is nothing wrong, says Hintikka, with trying to get information about the world, unencumbered with conceptual schemes, but we should remember that to do so is impossible. We will always have to start from the conceptual scheme, the surface, and then discover what is deeper, what is the world.

There is nothing illegal or absurd in the enterprise as long as we remember that in general we have no method of doing so and that the concrete realities we face are to be approached in terms of surface information rather than in terms of depth information. (Hintikka, 1970, p. 145)

Let us grant him the self-proclaimed departure from Kant, but it hardly seems necessary since what he does is plainly an endorsement of the synthetic a priori. He offers an endorsement of the fact that it is possible to offer a priori, conceptual justifications, for factual statements about an empirical mind-independent reality. Hintikka has, in effect, given us an argument against the logical positivists which appeals to a defence of the synthetic a priori. Aside from the inseparability of our conceptual schemes and our knowledge of the world Hintikka also argues that information of the real world is possible by not being able to, empirically, rule out inconsistencies which are, respectively, supported deductively.

As long as we have not actually accomplished this, however, we must be prepared for the kinds of experiences [a constituent of depth d] says can take place – that is to say, prepared to meet certain kinds of individuals related to each other in certain ways.

This preparedness may even be a matter of practical precautions and of considerable urgency. If and when our

surface information increases and we come to know the inconsistency of [a constituent of depth d], we are relieved of the need of these preparations and precautions. We are relieved, in the most concrete sense imaginable, of uncertainty concerning the world our sentence s speaks of. (Hintikka, 1970, p. 142)

A key aspect of Hintikka's efforts to propose how logic can generate new information is that he is keen to give deduction a way of generating novel information. This is why deduction starts looking like the model theoretic part of science when reading Hintikka – it is novel information like models often are, but not conclusively/empirically justified. This project is further refined in work by Hintikka (1980s and 1990s). If successful, it can go some way towards immunising the naturalist's use of deduction against the freshman's question. Genot (2018) explains how Hintikka develops a model for the logical basis for empirical discovery. Hintikka proposes that hypothesis formation, in science, is not simply a psychological act incapable of prior logical justification (such as both Popper and Reichenbach do) but that hypotheses are, in fact, justified logically (Genot, 2018, pp. 2065 - 2067). Hypotheses, as used in science, are understood as being empirically significant, of course. This is what makes Hintikka's claim about the logical underpinning of empirical hypotheses potentially useful to naturalists. Hintikka builds a simple model using the metatheory of first-order logic to place constraints on a hypothetical Inquirer and to formulate the rules for their "interrogative model of inquiry" (Genot, 2018, pp. 2066 - 2067). The model offers "... a strategic viewpoint on logical reasoning, and a basis for a logic of discovery..." (Genot, 2018, p. 2067).²

In summary: Hintikka sets up a game, based on a logical model of inquiry (Genot, 2018). There are, in fact, a few models available, but we are only interested in the logical model of inquiry involving deduction. The game has two players, the Inquirer and Nature. The Inquirer is allowed to ask questions of Nature about what Nature is like (the state of Nature is hidden to the Inquirer). There are rules for what sorts of questions can be asked. And there are penalties or respectively lesser or greater "pay offs", for asking specific sorts of questions. The more open-ended or interrogative the question (*wh*-questions) the higher the price, whereas *whether*-questions, which require closed answers of a more definitional or relativised to the model types of questions do not bear the same costs. When using the Deductive Completeness Theorem, all Nature's answers add new premises (Genot, 2018, pp. 2070 - 2073). What theorists who are interested in the logic of discovery (new information) are after is to keep such a logic distinct from the logic of justification. There are a few options for the logic of discovery. One particularly stark example is algorithms. For instance, algorithms could have produced the Mendeleev Periodic Table and also a large range of yes-no questions for informative model creation (Genot, 2018, p. 2080). The point is that in the formation of the yes-no questions the answers to these questions are not explicitly available in Nature. Such questions would be formulated using "...background knowledge (working memory), while establishing complex chains of conclusiveness conditions involves additional recall of information stored in long-term memory, in particular through associations with the content of perception..." as the premises from which to infer the answers and therefore gain the discovery (Genot, 2018, pp. 2079 - 2081).

In principle, a successful account of logical enquiry yielding novel information is exactly what the naturalist needs to

develop a naturalistic account of deduction. Has Hintikka's analysis of logical enquiry given the naturalist a useable account of deduction as a necessary, non-tautological, information-generating enterprise? Our response, in the next section, answers 'no'.

Part 3: Innumerable missing premises and the impossibility of entailment

Dennett's argument for the compatibility between a deterministic universe and free will is presented as a deductive argument. It has the form of a deductive entailment. Whether or not he takes his premises to be either statements of fact or extensional statements of meaning, like Quine and Studtmann, it seems *prima facie* obvious that the aim is to have the conclusion follow validly, and also necessarily, from the premises. So, the modal character of the entailment relationship seems to be that of necessity. However, we know that Dennett is committed to his premises being contingent truths, up for a posteriori justification. He, therefore, wittingly or not, adopts the 'standard reading' (Belshaw, 1989) of Humean deduction; that there is more than one type – not only the classical Humean type which gives rise to the Freshman's challenge. Dennett's deduction presumably is an example of a logical inference from non-logical premises to a non-logical conclusion.

Can deductive entailment work between contingently true premises and conclusions?

No. This is why the classical reading of Hume on deduction is correct. We know that deductive entailment does not work deductively when the argument has even one missing premise, or when a premise is left implied, as opposed to explicitly stated. The premises needed for a necessary entailment must all be made explicit. It is for this reason that, for Hume, deductions are called 'demonstrations' – they are demonstrations of all the steps required to prove the entailment of the conclusion. Like a mathematical proof, if bits are left out, the demonstration fails and entailment is lost. The entailment is lost whether or not the conclusion happens to be a true statement or not. If it has not been demonstrated to be true, using all and only the explicitly stated premises, it is not a logical/deductive entailment. There can be no necessity.

But in the case of contingently true premises, there are an enumerable and unknowable amount of variables related to the truth or falsity of each premise. This is what contingency is. And these are the mounting variables which constitute Hintikka's (1970) 'depth' and 'weight' and why there is a "pay off" for rich questions when developing models for logics of inquiry (Genot, 2018). Crucially, these variables also bear on the legitimacy of inferring the conclusion because if there is a variable, unexpressed in the argument which bears on the truth of the premise, this will have an effect on whether or not the conclusion which is drawn, in fact should be drawn. But a contingent proposition, and therefore a premise expressed by such a proposition, is never conclusively true or false. So, one is nearly guaranteed of existing, but unknown variables associated with premises bearing on the truth or falsity of a premises. We are only omniscient relative to a stipulated finite system – a chosen and predetermined logical system.

Premise 1: Hesperus refers to the planet Venus

Premise 2: Phosphorus refers to the planet Venus

Conclusion: Hesperus and Phosphorus refer to the same planet

If some matter of fact, some contingent variable, shows that in fact Hesperus does not, after all, contrary to currently accepted scientific knowledge, refer to the planet Venus (but rather, after empirical revision, to a faraway galaxy which is made visible in a coincidentally similar way to Venus) then the entailment of the conclusion is confounded by this discovery. Empirical revision is never complete. This is Hume's point and is at the beating heart of the freshman's question.

Demonstrative proofs, if they are to retain the distinctive benefit of inferring with logical necessity and yet be about contingent matters of fact, require one of the following two, impossibly ideal, epistemic conditions: 1. The speaker should be epistemically omniscient. They should know every single relevant contingent matter of fact from the extra-linguistic world that has, or could have, a bearing on the inference of the truth of the conclusion. In Hintikka's lexicon, the full 'depth' and 'weight' of each premise must be made explicit. These should all form part of the premises. This is to ensure that the entailment has the modal character we want of it – that the matters of fact which are being premised *are the combined reason for* believing in the necessary obtainment of the concluded matter of fact, or 2. The argument should include the explicitly demonstrated premise stating that the course of nature is unchanging because we can assume that the conclusion has exactly the same set of truth conditions as the premises combined, for all eternity. We must be warranted in assuming that there are no unknown and surprising variables as truth conditions which might obtain for the new proposition. Only then is the conclusion not an inductive or abductive but necessary entailment.

Because it is impossible to meet the above-mentioned conditions Hume, the logical positivists and Kant to some degree characterised deduction as logical entailment only possible within a finite and stipulated system, such as a linguistic system. For deduction to be necessary, there can be no chance of nasty surprises. Any truths which deal with extra-linguistic reality are subject to such surprises.

What about a characterisation of deduction which takes into account the complexity of extra-linguistic information and carefully sets a model for how there can be necessary inference between contingent premises? There are three reasons why Hintikka's account won't help the naturalist:

1. Hintikka's (1970) account of deduction holds that it is possible to know matters of fact through conceptual analysis. So the necessity is preserved by making the entailment relationship conceptual, but then non-conceptual information is legitimately associated with the conceptual analysis. The epistemology of this very dubious association is, however, strikingly absent. This absence is a deal breaker because it is exactly how this would work that would import the epistemological advantage Hintikka is after. In Hintikka's 1980s and 1990s (Genot, 2018) account he sets out to show that we do not need deduction to be ampliative in order for it to be informative, by explaining in what way inquiry can happen without too high a cost to the prized tautological nature of deduction. In effect, he creates a game which allows the Inquirer to draw inferences from a predetermined set of facts which act as premises. So Hintikka allows for the creation of closed systems of knowledge, called tableaux. From within these tableaux, all the premises are taken. The more variables are selected the more weight and depth the inference gets and the more difficult it is to secure necessity. This has the advantage of being a closed system, so no nasty surprises, and therefore Humean necessity seems possible. However,

we are unconvinced that he has done anything other than design an elaborate game and model building apparatus which provide rules for elegantly regurgitating and reorganising things people already know and information systems already contain. This is not to generate novel information. Hintikka's deduction is not ampliative, but it is also not informative. It is not by any means certain that Dennett takes himself to have done something like this in his argument about free will and determinism. Although he might have to admit that, as unsatisfactory as it is, this is as good as it gets for the naturalist.

2. But even within a closed system (Genot, 2018), such as a game or model, it has not been explained how logical entailment is possible between a very large range of variables being dragged across inferential lines in a way which does not lose track of any of them, and has each and every variable, expressed as a premise, represented in the articulation of the final conclusion.

3. Hintikka's 1970s arguments have made deduction analogous to conceptual schemes. But not by any standard or non-standard view of deduction or the scientific method is such an analogy apt. A deductive argument, used in philosophy, does not have the same scientifically relevant features as a conceptual scheme used in science to support, direct and help understand empirical observation.

If Hintikka's account of the conceptual analysis of surface information yielding matters of fact, such as facts about a determinate universe, is the best artillery for legitimising deduction used in naturalised metaphysics, then this is not just a little ironic. It seems like the last thing an empiricist of any stripe should endorse.

But no deductive arguments are like this. Nor can they be. Our epistemic equipment cannot accommodate this requirement. Nor can the world. The best way to understand deduction, despite our desire to do otherwise, is to see deductions as dealing with definitions:

[...] never before had we been told so clearly that there is a large, essential element in all knowledge that is easily mistaken for the ordinary factual claim but that is actually a tool for the constitution of representational apparatus; that these apparently factual claims are "definitions in disguise"; and what they define is a linguistic framework.
(Coffa, 1991, p. 325)

The only way in which logical entailment is possible is when it is between necessarily true propositions, where a posteriori truth conditions, a myriad of known and unknown past and future variables, are not a player. For deduction to be non-ampliative it must have non-contingent premises and a non-contingent conclusion.

So, something that might appear to be a serious oversight, namely a failure to show much concern with deductive

arguments whose premises are contingent truths, is in the end a well-founded omission. For, on top of the rather dubious status of a posteriori knowledge to begin with, there lies a well-founded suspicion that such knowledge cannot be furthered by argument. This, I suggest, is Hume's insight. For while we can construct deductively valid arguments with contingent conclusions for as long as it pleases us, they will suffer under one of two handicaps. Either their premises will not be certain, as when we deductivise inductive arguments by means of some question-begging uniformity principle, or, if the premises are certain, the conclusion of the argument will tell us what we already knew. (Belshaw, 1989, pp. 158, 159)

Can the notion of the necessary a posteriori assist the naturalist? Devitt obviously thinks it does. But the usual response to the Kripkean concept still stands undefeated. The seeming necessary relationship between Hesperus and Phosphorus is due to a descriptive and definitional equivalence between the two. As we have shown already, while it remains possible that a new observational advantage, e.g. better observational equipment, to show the appearances to be, in fact, of two distinct planets, or a mirage, or one of a faraway galaxy and a planet we have a contingency, not a necessity. Put another way, whilst we can legitimately say “It *seems* as if the planets Hesperus and Phosphorus are the same planet” we should refrain from speaking about this as a necessity. It is a contingency while it is possible that the a posteriori observation was wrong. And it is possible. This is a position that the naturalist should be the first to adopt – no metaphysical necessities. Hume warned us many centuries ago of making this mistake. The perceived necessity is a definitional act – one adopted conventionally by a scientific community, as part of an established linguistic framework about planets. An appeal to the necessary a posteriori does not provide any support for the naturalist. In fact, it undermines some of their seminal tenets.

Devitt cannot imagine why the same holistic a posteriori nature of all scientific knowledge could not also characterise the more controversial cases such as mathematics and logic.

We all agree that there is an empirical way of knowing. Beyond that, the present aim needs only the claim that the empirical way is holistic. We have no reason to believe that a serious theory would show that, whereas empirical scientific laws are confirmed in the holistic empirical way, the laws of mathematics are not. (Devitt, 2013, p. 186)

Firstly, Devitt has not argued or demonstrated that the controversy about the a priori is resolved by placing all possibly a priori entities into a web where experience settles everything in the end. He has simply said we need not worry about what is and isn't a priori. But that is a psychological fact about himself – he isn't worried about it. We are. Secondly, we and others like us, also have no reason to believe that there *isn't* a serious theory which holds that we treat mathematics differently to other parts of science. In fact, many such theories have been proposed and they seem very serious indeed.

Devitt's imagination and chosen causes of concern are not philosophically compelling reasons. Deduction is not possible without analyticity, or purely logical truth. Nor is it possible when the justification of the entailment is a posteriori.

Conclusion:

We have argued that deductive reasoning, which is typically defined by a particular brand of entailment very unlike that of induction or abduction, cannot operate when from contingent or factual premises. The premises should be taken to be of the logically necessary and conceptual type. For this reason, it is inconsistent to reject logical necessity and purely conceptual truths, yet to brandish deductive reasoning.

Naturalised metaphysics, when in the form of Dennett's deduction about the nature of reality – and there are too many examples of this – disregards some very important principles which are supposed to make us better empiricists. To forego a priori and logical truth is one thing. And I have not directly argued against this here. But to forego these and then use deductions to forward matter of facts about the world is to do rationalist metaphysics of a most un-Humean sort.

Footnotes

¹ To be clear: Carnap – and beyond – would take a 'demonstrative reasoning' to be an a priori activity, an a priori justification, entirely based on definitional work, yielding analytic truths.

² There seems to be some confusion about whether Hintikka's model offers a 'model for the logic of inquiry' or whether it is "a model for logical inquiry". The first would be a meta-analysis of what inquiry consists of, formalised using logical principles. The second would be a case for how logic, such as deductive logic, could be used for inquiry. To me it seems as if the paper is about the latter (hence the reference to how Holmes uses deduction). My engagement with the paper assumes it is the latter.

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