

Logic is Not Science

Ulf Hlobil

Abstract I argue that logic is unlike science in its methodology, thus rejecting anti-exceptionalism about logic. Logic has a mathematical and a philosophical part. In its mathematical part, the methodology of logic is like that of mathematics, and no need to choose between theories arises in that part. In its philosophical part, the methodology of logic is like that of philosophy. Philosophy and mathematics are both unlike the empirical sciences in their methodology. So logic is unlike the empirical sciences in its methodology. I end by looking at disagreements about the liar paradox as an example.

1 Introduction

[L]ogic is, at root, a philosophical enterprise. Since at least the beginning of the twentieth century, however, logic has become a branch of mathematics as well as a branch of philosophy. (Shapiro, 2005, 651)

I agree with what Shapiro says here; and, in this chapter, I want to bring out some implications of this view for debates about the methodology of logic and theory choice in logic, namely by arguing for the following view: Logic is unlike the empirical sciences in its methodology. Logic has a mathematical part that is like mathematics in its methodology, and it has a philosophical part that is like philosophy in its methodology. In the mathematical part of logic, no need to choose between different logical theories arises. In the philosophical part of logic, there are disagreements between logical theories, so that the question of rational theory choice arises. However, the philosophical part of logic shares characteristic methodological features with philosophy. Since the methodologies of mathematics and philosophy are exceptional, it

Ulf Hlobil
Concordia University, e-mail: ulf.hlobil@concordia.ca

follows that the methodology of logic is exceptional. So, anti-exceptionalism about logic is false.

The chapter is organized as follows: In Section 2, I argue that anti-exceptionalism is unclear as it stands and should be clarified in such a way that it implies that the methodology of logic is unlike that of mathematics or philosophy. In Section 3, I argue that the mathematical part of logic is like mathematics in its methodology. In Section 4, I begin my argument that the philosophical part of logic is like philosophy. And I then support this claim further by looking at a disagreement about the liar paradox in Section 5. Section 6 concludes.

2 What is Anti-Exceptionalism?

I am writing in opposition to the current trend of anti-exceptionalism in the philosophy of logic. Recently many philosophers who otherwise share very few commitments have endorsed anti-exceptionalism about logic, and it is perhaps the currently most popular view about the nature and role of logic (Ferrari et al., 2023; Woods, 2023; Tajer, 2022; Martin and Hjortland, 2022; Carlson, 2022; Arenhart, 2022; Molick, 2021; Peregrin and Svoboda, 2021; Hjortland, 2019; Russell, 2019; Read, 2019; Finn, 2019; Costa and Arenhart, 2018; Wyatt and Payette, 2018; Williamson, 2017; Priest, 2014; Quine, 1964).¹ In this section, I first argue that the claims of anti-exceptionalism are not clear enough to be assessed as they stand. I then suggest that, at a minimum, anti-exceptionalists should hold that the methodology of logic is unlike that of mathematics and philosophy.

Hjortland (2017, 631) formulates anti-exceptionalism thus:

Logic isn't special. Its theories are continuous with science; its method continuous with scientific method. Logic isn't *a priori*, nor are its truths analytic truths. Logical theories are revisable, and if they are revised, they are revised on the same grounds as scientific theories.

According to this, anti-exceptionalists should hold that logic is not *a priori* and probably revisable in light of discoveries about nature. However, some philosophers who self-identify as anti-exceptionalists hold that logic might be *a priori* (Russell, 2019), and others are non-naturalists (McSweeney, 2021). Hjortland also suggests that exceptionalists hold that logical theory is unrevisable and analytic. However, while Kant (KrV, B viii) notoriously held that logic has made no progress since Aristotle, very few philosophers of logic or logicians agree (including exceptionalists). As Kneale and Kneale (1962, 355) say, Kant “was apparently unaware [...] that the doctrine which he regarded as the complete and perfect discovery of Aristotle was in fact a peculiarly confused version of the traditional mixture of Aristotelian and Stoic elements.” Similarly, the notion of analyticity is notoriously difficult to clarify

¹ Recent criticism is offered by Kripke (2023), Anderson (2023), Sagi (2021), Rossberg and Shapiro (2021), dos Santos (2021), Dicher (2020), and Woods (2019b; 2019a). My worries overlap with some of these other criticisms but are not identical to any of them.

(Quine, 1951), and hardly any philosopher or logician today (including exceptionalists) would put a lot of weight on this notion without sharpening it in specific ways (see Russell, 2008). So it seems that some of the ideas in Hjortland’s formulation are not universally accepted by anti-exceptionalists, and others are too unclear or controversial to function as core commitments of an exceptionalist opponent. Once we ignore these problematic parts, it seems that the core claims of anti-exceptionalism are that logical theories and methods are continuous with—or relevantly similar to those of—science, and that logical theories are revised (or chosen) on the same grounds as scientific theories.

Unfortunately, it is not obvious what “continuous” or “relevantly similar” and “science” mean in this claim (Rossberg and Shapiro, 2021). I will take these issues in turn and start with “continuous” or “relevantly similar.” Then I will turn to what anti-exceptionalists should mean by “science.”

2.1 “Similar” in What Way?

Sometimes the idea that logic is “continuous” or “relevantly similar” to science is taken to assert a similarity in the nature of the studied entities. More often, however, the respect of similarity is taken to concern epistemology and methodology (Martin and Hjortland, 2022).² Understood as a methodological thesis, anti-exceptionalism is taken to imply that theory choice in logic happens in a way that is similar to how theory choice happens in the sciences.³ Some think that this means that theory choice happens by abduction or inference to the best explanation (Priest, 2020, 2016). Others think that theories are chosen according to their power to make (confirmed) predictions (Martin and Hjortland, 2020). Yet others hold that theory choice in logic is like the choice of models in empirical sciences (Arenhart, 2022).

All of these views share the idea that logical theories are assessed in light of some data that the theory ought to relate to in an appropriate way, namely by explaining, or predicting, or modeling them. The term “datum” suggests that something is given to us (more or less) independently of our logical theorizing, so that we can compare and choose theories in light of what is given. Unfortunately, it is not easy to say what is “given” in such a way that we can compare and choose logical theories in light of it (Hlobil, 2020). Some think that what is given are intuitions about the goodness of arguments in natural language (Priest, 2016, 2020). Others think that what is given are very general facts about everything (Williamson, 2017). Yet others think that what is given are coherence norms governing discourse (Ripley, 2017a, 2015). And some think that what is given are social facts about how mathematicians assess each other’s proofs (Burgess, 1992). Moreover, as already intimated, while some think

² Since I am focusing on epistemic and methodological anti-exceptionalism about logic, I do not discuss the relation between logical anti-realism or instrumentalism and logical anti-exceptionalism in any detail here (see Tahko, 2021; Commandeur, 2024).

³ However, some philosophers who self-identify as anti-exceptionalists explicitly reject the continuity of methodology between the empirical sciences and logic (McSweeney, 2021).

that what is given is *a posteriori* (Hjortland, 2017, 631) others think that some of the given may be *a priori* (Russell, 2019). So what is given to us in our logical theorizing and how it is given to us are controversial issues. Indeed, one might suspect that the idea that there is a “given” in logic that plays a role comparable to that played by experimental results and observations in the empirical sciences is a myth, which we may call the “myth of the logically given.”⁴

Perhaps an opponent would want to dispel the myth of the logically given by pointing out that it is almost universally accepted that arguments that have the form of *modus ponens*, universal instantiation, Barbara and the like are logically valid, while arguments that have the form of affirming the consequent are not logically valid on account of this form. Can’t we use what we thus agree on as “the given” in logical theorizing? While it may be useful to have some agreement on the extension of logical validity, the problem is that there is no agreement on what it means for an argument to be logically valid.⁵ Does the validity of, say, *modus ponens* mean that it is necessarily truth preserving (if so, what does “necessarily” mean here)? Or that it codifies a good kind of reasoning? Or that any body of information that includes the premises also includes the conclusion? Or that it is incoherent to assert the premises and deny the conclusion? Or that mathematicians accept it as a step in a mathematical proof? Or something yet different? When logical theorizing gets hard, these differences start to matter. When we want to compare and choose between logical theories, we must usually consider cases that are not clear cut and uncontroversial and for which the question what it means for an argument to be logically valid makes a difference (Hlobil, 2020; Dicher, 2020). Once we face issues like the semantic paradoxes, for instance, we must give up something widely accepted; and which principles regarding validity it makes sense to give up may (and indeed often does) depend on what it means to accept it as valid in the first place. I will come back to this point below.

Partly in light of how difficult it is to articulate what “relevantly similar” means, some anti-exceptionalists have started to use “anti-exceptionalism” for any position that denies that logic is general, formal, foundational, *a priori*, analytic, and necessary (Martin and Hjortland, 2022). According to this understanding, anti-exceptionalists need not agree on anything except on a gerrymandered disjunction of claims, namely that logic is either not general or not formal or not foundational, etc. It seems to me that the disjuncts of this claim deserve to be discussed separately, so that the label “anti-exceptionalism” becomes unhelpful when it is understood in this way.

Instead of saying what it means to be “relevantly similar” to science, a more promising approach might be to say what it means *not* to be “relevantly similar” to science. Martin and Hjortland (2024) suggest that the two alternatives to an anti-exceptionalist (“science like”) methodology for logic are (a) that rational theory choice in logic happens by unmediated rational insights (logical rationalism) or (b)

⁴ Arenhart (2022) holds that the data are “co-constructed” with the target phenomenon that one aims to model by a logical theory. It is, hence, not clear to me whether Arenhart accepts the myth of the logically given.

⁵ Some prominent philosophical logicians deny that logical theories are theories of logical validity or consequence (Williamson, 2024). I ignore this extra problem for my opponent here.

that it happens by appreciating the analyticity of logical principles in virtue of grasping the meanings of logical expressions (semanticism). However, if these are the only genuine alternatives to an anti-exceptionalist methodology of any discipline, then any arguments that speak against rationalism and semanticism in general also speak for anti-exceptionalism in general, with respect to any discipline. Against rationalism, Martin and Hjortland (2024) say that it is unclear whether we have any capacity for rational insights and whether it can yield knowledge. And against semanticism, they point to general doubts about analyticity and links between understanding and assent. These arguments generalize to other fields, and in particular to philosophy and mathematics (which will become relevant below). So, if the arguments that Martin and Hjortland present are cogent, then their conclusion should not be anti-exceptionalism about logic in particular but rather anti-exceptionalism about philosophy, mathematics, and probably all disciplines.⁶ Therefore, Martin and Hjortland's arguments, if cogent, either support a global version of anti-exceptionalism or there is an alternative methodology besides rationalism, semanticism, and anti-exceptionalism.

Global anti-exceptionalism is an interesting claim only if there are plausible methodologies that some discipline might follow but none actually follows. Otherwise, global anti-exceptionalism degenerates into the uninteresting claim that all disciplines are alike in some unspecified and vague sense. Unfortunately, the versions of rationalism and semanticism that Martin and Hjortland sketch are not methodologies that are plausible alternatives to the alleged science-like method, which would give us a clear idea of what anti-exceptionalism is denying. So Martin and Hjortland should make sure that their anti-exceptionalism does not degenerate into global anti-exceptionalism. They owe us an account of what "science" is, such that there may plausibly be disciplines that are unlike science in their methodology. This brings us to the question what anti-exceptionalists should mean by "science."

⁶ Some philosophers hold that philosophy is or ought to be similar in its methodology to "science" (where this is usually taken to mean something like "natural science"). For example, Williamson (2013a) explicitly endorses exceptionalism about philosophy (and not just about logic). Williamson therefore owes us an account of what it would be to be exceptional. I think what he says on this point is not enough to make anti-exceptionalism interesting. While his *The Philosophy of Philosophy* (Williamson, 2007) includes detailed criticism of the linguistic turn and ordinary language philosophy, his positive proposal about the methodology of philosophy remain so thin as to amount to little more than the suggestion that we try to consider issues carefully and rationally in philosophy, which I do not think is an interesting claim about the methodology of philosophy.

Other philosophers also hold a more wide-ranging anti-exceptionalism. Ladyman and Ross (2007) hold that metaphysics should not go beyond unifying different parts of (natural) science. A little bit more liberal is Emery's (2023) view that metaphysics ought to be informed by science and that its method is continuous with the methods used in science. I set such views aside here because my target is anti-exceptionalism about logic, independently from more global kinds of anti-exceptionalism.

2.2 “Science” in What Sense?

Anti-exceptionalists owe us an account of what they mean by “science” or “the methodology of the sciences” that makes their claims worth considering. Since the quest for a demarcation criterion for science has failed, it is unclear whether the sciences share any particular methodology (Laudan, 1983). Moreover, Tajer (2022) has shown that we find diverse methodologies in logic. So instead of focusing on methodology, perhaps we can make progress on what anti-exceptionalism is by considering which disciplines should count as sciences.

There is a very broad understanding of “science” on which any discipline that offers theories of some subject matter is a science; and on this understanding science contrasts with the other four Aristotelian intellectual virtues: skill, prudence, rational insight, and wisdom. If “science” is accordingly taken to mean something like the Latin *scientia*, the German *Wissenschaft*, or the Greek *episteme*,⁷ then one of the most extensively discussed questions in the philosophy of logic over the past two millennia is whether logic is a science in this broad sense. This traditional disagreement centered on the question of whether logic is in the business of offering theories of some subject matter, or whether it is rather a skill or art, in the business of regulating or improving some activity (as it was universally agreed that logic cannot be part of prudence, rational insight, or wisdom). However, this is not the question that anti-exceptionalists have in mind. They do not want to contribute to this traditional debate. Rather, they seem to understand “sciences” as disciplines that share a particular method of rationally choosing theories. So how must theories be chosen in a discipline for the discipline to count as a science in this sense? We are thus led back to the issue of methodology.

Martin (2020) has suggested that the relevant anti-exceptionalist method consists of abduction or inference to the best explanation (though in other writing he claims that the method is that of selecting theories based on the predictions they make (Martin and Hjortland, 2020)). In particular, Martin looks at the work of Priest (2006) as a case study and argues that Priest’s methodology is abductivist because it relies on the following assumptions:

- (i) Good theories solve open puzzles in their field (for example, the semantic paradoxes in logic).
- (ii) Such solutions are better if they can be motivated on independent grounds.
- (iii) Independent motivations include the ability to solve other puzzles and account for important further commitments.
- (iv) Commitments that should be taken into account when assessing the quality of a solution include the (apparent) meaningfulness of sentences, the constitutive

⁷ As an aside, it is worth pointing out that most anglophone philosophers today use “science” in a way that is in sharp contrast with how the German speaking tradition of the Vienna circle, Popper, or Feyerabend used the term *Wissenschaft*, which is much closer to *scientia* and *episteme*. The concept used by anglophone philosophers seems to be a peculiar result of combining the Renaissance distinction between letters and sciences and the 19th century German distinction between *Geisteswissenschaft* and *Naturwissenschaft*. I doubt that the currently common English terminology is philosophically helpful; but I won’t engage the issue here.

properties of concepts, and the soundness of results and practices in established disciplines.

- (v) Such commitments can make a difference to whether one ought to accept the solution (and they are, in this sense, evidence for or against such solutions).

So should we perhaps understand “science” as any discipline whose methodology relies on these five assumptions? This suggestion degenerates into global anti-exceptionalism. The problem with this idea is that assumptions (i)–(v) are made in virtually all intellectual (theory seeking) human endeavors. If making assumptions (i)–(v) suffices to employ an anti-exceptionalist methodology, then the methodology of logic is almost certainly anti-exceptionalist—and so is pretty much every methodology for an intellectual discipline anyone ever thought about.

So far, we have not found any illuminating option for what anti-exceptionalists could mean by “science” or “science-like.” The problem is that the methodologies that anti-exceptionalists have specified are too broad and too vague to render their core claim interesting. I want to suggest that in order to be an interesting claim, anti-exceptionalists should exclude some disciplines from what they mean by “science,” so that their core claim implies that the methodology of logic is not like that of those disciplines. Moreover, the disciplines that are not like science should be such that someone might reasonably think that their methodology is similar to the methodology of logic. In this way, we would at least face a genuine and interesting choice between saying that the methodology of logic is more like that of the disciplines that count as “science” and saying that it is more like the methodology of the disciplines that don’t count as “science.” The question would be genuine because we would have concrete examples of disciplines with exceptional methodologies, and the question would be interesting because reasonable people could disagree on the question. Thus, I submit that the best way to formulate anti-exceptionalism is to specify some disciplines as having an exceptional methodology, where these disciplines should be such that a reasonable person could suggest that the methodology of logic is like that of these disciplines.

Two disciplines that can plausibly be taken to have an exceptional methodology and to be possibly similar to logic are mathematics and philosophy.⁸ And logic is

⁸ As an anonymous referee points out, philosophers like Ladyman and Ross (2007) might hold that insofar as philosophy (or at least metaphysics) has an exceptional methodology, this is a problem that must be overcome by changing the methodology of philosophy (or at least metaphysics). And one might hold that it is especially the *aprioricity* of philosophy’s method that is problematic. I reject anti-exceptionalism about philosophy. However, this isn’t relevant here because my thesis is that either one should accept global anti-exceptionalism, in which case debates about anti-exceptionalism about logic should be shaped by the correct global version of anti-exceptionalism and the arguments for it, or one should reject anti-exceptionalism about logic. My topic here is anti-exceptionalism that is specific to logic.

It may be worth mentioning in passing, however, that it seems to me that Ladyman and Ross (2007) run into a problem that is parallel to the problem that Martin and Hjortland are facing: there is no good philosophical account of what *the scientific method* is. Ladyman and Ross (2007, 28-38) end up appealing to peer-review processes and funding by established funding agencies to delineate what counts as science. While I recognize the authority of reason, as it is partially realized in science, I have little trust in peer-review processes and funding decisions; and I do not think that

often taken to overlap with both disciplines (as illustrated in the quote from Shapiro above), thus making it reasonable for someone to hypothesize that logic is similar to mathematics or to philosophy in its methodology. So I suggest that the best way to formulate a genuine and interesting question in the vicinity of anti-exceptionalism is as follows:

Question: Is the methodology of logic more like the methodology of mathematics and philosophy or more like the methodology of other disciplines, like the empirical sciences?

If anti-exceptionalists could establish that the correct answer to this question is that the methodology of logic is more like that of other disciplines than that of mathematics and philosophy, this would be an interesting and potentially illuminating result. Of course, we would still need to know in what way the methodology of logic is more similar to those other disciplines than to the methodology of mathematics and philosophy. Focusing as a first step, however, on the question above is still progress in the debate about anti-exceptionalism, or so it seems to me.

My thesis in this paper is that the methodology of logic is partially like that of mathematics and partially like that of philosophy. Since the methodologies of mathematics and philosophy are exceptional (as we assume in order to keep anti-exceptionalism interesting), it follows that the methodology of logic is exceptional. Hence, insofar as anti-exceptionalists deny that the methodology of logic is like that of mathematics or philosophy (as I just suggested they should), anti-exceptionalism is false. I will not try to rule out the possibility that logic has, besides a mathematical and a philosophical part, also a part that is similar to science in its methodology. Nor will I try to rule out that logic is like science in some respect. For all I say here, such a limited and modest version of anti-exceptionalism may be true; but it is not the kind of anti-exceptionalism that could justify sweeping claims like those in the quote from Hjortland above.

3 Mathematical Logic is Similar to Mathematics

In the previous section, I argued that anti-exceptionalism is best understood as implying that the methodology of logic is unlike that of mathematics or philosophy. In this section, I argue that one part of logic, namely mathematical logic, is similar to mathematics in its methodology. I cannot speak with authority about this part of logic,

many scientists share the faith of Ladyman and Ross on these issues. If the question at hand is what reason demands of us when we do logic (or metaphysics), rather than what referees and funding agencies demand, then anti-exceptionalism about logic (or metaphysics) must be established on the basis of an account of these demands of reason, rather than some hand-waving in the direction of the allegedly unquestionable rationality of (caricatures of) scientists. Whatever methodology science might use, its rational authority cannot come from the mere fact that it is accepted by referees and funding agencies. It must be possible to argue for the rationality of this methodology directly. So, we can cut out the middle man of appealing to science and ask directly what the arguments for some particular methodology in logic or metaphysics are.

as I am neither a mathematician nor a philosopher of mathematics. Accordingly, what I say in this section is meant as a reminder of some uncontroversial observations.

A lot of the work that is done today under the heading of “logic” belongs to mathematics. Most papers published in the *Journal of Mathematical Logic*, for instance, are contributions to mathematics. Even many papers in the more philosophically oriented *Journal of Symbolic Logic* have titles like “Elimination of Imaginaries in Ordered Abelian Groups with Bounded Regular Rank” (Vicaria, 2023). And such research can be classified under subject 03 of the *Mathematics Subject Classification* (MSC), which is “Mathematical logic and foundations.” It thus seems that one part of logic is a branch of—or similar to a branch of—mathematics. Publications in this part of logic seem to be assessed in a way that is similar to how contributions to other fields of mathematics are assessed. And the research reported in such publications seems similar to that in other fields of mathematics. It is thus reasonable to hypothesize that this part of logic is similar to mathematics in its methodology.

This hypothesis is supported by the following three observations: First, the most important methodology in mathematics and the mathematical part of logic seems to be the method of constructing theories—by laying down axioms, inference rules, definitions, and the like—and using mathematical proofs to establish results in and about these theories.

Second, if we set aside special issues like the search for new axioms in set theory, we don’t need to choose between theories in pure mathematics. Rather, we can understand non-equivalent, consistent theories as investigating different mathematical objects. We need not choose, for example, between theories of groups in which group operations are commutative and theories in which group operations are not always commutative. There are simply abelian groups and nonabelian groups, as well as theories of both kinds of group. The same holds for logical theories understood as theories of pure mathematics. From the perspective of pure mathematics, there is no pressure to choose between classical, intuitionistic, paraconsistent, connexive, or any other logic. We can view them as theories of different kind of consequence relations and pursue all of them simultaneously without seeing any tension between them. Even committed anti-exceptionalists like Priest accept that much.

As pure logics, no logic is a rival of any other. They are all perfectly good abstract theories.
(Priest, 2003, 458)

Priest goes on to add that logic has a canonical application, namely our “practices of inferring” (Priest, 2003, 458) or deductive “reasoning” (Priest, 2014, 215), and that different logics are not equally good as applied logics for this canonical application. Here it suffices to note the uncontroversial nature of my claim that in (pure) mathematics and the (pure) mathematical part of logic non-equivalent, consistent theories are not viewed as rival theories.

Third, in mathematics and in the mathematical part of logic, there are recognized central results, that are established by well-known proofs, which students in the fields have to learn and which serve as paradigms of what counts as progress and as important results in the field. In logic these results include Gödel’s completeness and incompleteness results, the undecidability of validity in classical first-order logic,

Gentzen's Cut-elimination theorem, the Post-completeness of classical propositional logic, and the like. A common way to approach a research question is to try to adjust techniques that are familiar from these paradigmatic results in such a way that they can be applied to the question at hand. This seems similar to how research is done in most fields of mathematics, and many of the paradigmatic results of logic have close connections to other fields of mathematics. Gödel's incompleteness results, for example, have far reaching implications for arithmetic and set theory, in a way that results of the empirical sciences do not seem to have implications for research in pure mathematics. Similarly, Hrushovski's proof of the Mordell-Lang Conjecture is an example of results from mathematical logic having implications for geometry (see Sagi, 2021).

I conclude that one part of logic, namely the mathematical part of logic, is similar in its methodology to mathematics. Since the methodology of mathematics (whatever it may be) should count as exceptional, as explained in the previous section, the methodology of the mathematical part of logic should count as exceptional. Indeed, it is easy to identify some respects in which this methodology is unlike that of the empirical sciences: (a) Non-equivalent, consistent theories are not seen as rival theories among which one must choose. (b) Results are established by mathematical proofs and not by experiments or other empirical studies. (c) The paradigmatic results in the mathematical parts of logic interact with mathematical research in the way in which mathematical results interact with mathematical research and not in the way in which results in the empirical sciences interact with mathematical research.

An opponent might object that the methodology of logic is unlike that of mathematics because in mathematics we must presuppose notions of implication and consistency to study and compare different mathematical theories, while logic investigates these notions of implication and consistency themselves. Moreover, we face the problem of theory choice with respect to the theory of implication and consistency that we use to study and compare mathematical theories. Thus, in logic non-equivalent theories of implication and consistency are rival theories, and their role in mathematics is not similar to the role of other mathematical theories. My response is twofold: First, it is common practice in logic to use classical logic (and set theory, etc.) in the metatheory to study and compare different logical theories. Thus, the situation in mathematics and in the mathematical part of logic seems to be the same. They both presuppose notions of implication and consistency in carrying out their investigations. Second, just as different notions of implication and consistency are sometimes advocated in mathematics, like in intuitionistic mathematics, so it is sometimes suggested that we should use some nonclassical logic in the metatheory in which we study and compare different logics. The reliance on a theory of implication and consistency in the metatheory in mathematics and the mathematical parts of logic may seem problematic from a philosophical perspective, but it is a part of how both of these fields are usually pursued today and, hence, no reason to deny that mathematical logic is like mathematics in its methodology.

My claim that mathematical logic is like mathematics in its methodology is not meant to be surprising. The claim is worth making, however, because it has recently been suggested that: "if we want to understand a field's research goals,

methodological procedures, and epistemology, we are best placed looking at the activities and decisions of its practitioners” (Martin, 2024, sec 1). If we look at the activities and decisions of practitioners of the mathematical part of logic, we find a very successful practice with relatively well established methodological standards but in which theory choice plays no prominent role. If we look, however, at other parts of logic, it may be far less clear that we find any successful and progressive practice with a shared methodology. The practice we find may be no more successful or progressive or methodologically unified than many sub-fields of philosophy. In that case, the hope that we can make progress in the philosophy of logic by “looking at the activities and decisions” of the practitioners of the non-mathematical parts of logic may be as reasonable as the hope that we can make progress in the philosophy of ethics⁹ by “looking at the activities and decisions” of philosophers who specialize in ethics. That is what I will suggest in the remainder of this paper.

4 Philosophical Logic is Similar to Philosophy

Besides a part that is a branch of (or similar to) mathematics, logic also has a part that is a branch of (or similar to) philosophy. This is the part of logic in which we find disagreements about questions like the following: Is classical or intuitionistic or relevance or connexive or some other logic the (or a) correct logic? Is there more than one correct logic? Is logic normative for thinking or reasoning? Do theories of logical consequence aim to represent something that is independent of our uses of concepts? How should we react to semantic and mathematical paradoxes? What is the best logic of conditionals? How do logic and probability theory hang together? How are logic and mathematics related? Is higher-order logic an acceptable and genuine part of logic? Etc. Such questions are answered by (some) logical theories; and these theories give rival answers, so that the question of how we ought to choose logical theories arises.

In this section, I will begin to argue that the philosophical part of logic is like philosophy in its methodology. This is a difficult project because the methodology of philosophy is unclear. Indeed, there does not seem to be any established methodology of philosophy. In light of this difficulty, I will assume that, whatever the methodology of philosophy is, it is characteristic of this methodology that philosophy has the following features. And I will argue that these features are shared by the philosophical part of logic.¹⁰

⁹ The philosophy of ethics—that is, philosophical reflection on what we do in ethics—seems to be a part of ethics itself, just as the philosophy of any other part of philosophy belongs to that part of philosophy itself. Philosophy is reflective and reflexive in this way. I think that the same is true of the philosophical part of logic: The philosophy of logic is part of the philosophical part of logic itself. Of course, one can study parts of philosophy “from the outside,” as a social or historical phenomenon. But to gain any philosophical understanding of a part of philosophy one must engage in that part of philosophy directly and not “from the outside.”

¹⁰ I agree with Tajer (2022) that we find different methodologies in the philosophical part of logic, as, for instance, the methodologies in debates about intuitionism, semantic paradoxes, and conditional

1. There are historical texts and traditions (of which some are older than, say, one hundred years) that are important for research in the field today, in such a way that current research engages (more or less consciously and explicitly) with historical texts and traditions (and not just textbook summaries of them).
2. Research projects in the field typically do not include any dedicated period (temporally distinct from periods in which hypotheses are formulated and periods in which data are analyzed) of rigorous and systematic data collection (like experiments, surveys, systematic observations, or quantitative analysis of corpora), after which previously formulated hypotheses are tested against the gathered data, such that there are antecedent and explicitly formulated standards for data quality and the methods for testing hypothesis in light of the data (such as established methods of inferential statistics, standards of experimental design like the randomization of control vs treatment groups, measures of the quality of measurements like Cronbach Alpha, and the like).
3. There are (or at least seem to be) perennial disagreements about foundational issues in the field, and there is no agreed upon methodology for (at least in principle) settling (or at least setting aside) these disagreements, so as to reach a widespread consensus.
4. The major milestones of progress in the field are not discoveries that are still viewed as correct (at least as approximations) but rather ways of reconceptualizing the whole field, so that the entire history of the field and research in it appear in a new light.

Philosophy has (or at least seems to have) these four features. Regarding the first, studying philosophy involves reading many centuries old books, and there are, for example, thriving research projects in ethics and metaphysics that understand themselves as neo-Aristotelian or Kantian or the like.

Regarding the second feature, probably every philosopher who has written an application for a major research grant knows that planning philosophical research is peculiar, compared to research in empirical fields. In philosophical projects, we typically do not find the usual division of research into a period of developing a theory, a period of designing empirical studies for testing the theory, periods in which data are gathered by conducting (some of) these studies, and periods in which the theory is assessed in light of the data. There are occasional exceptions (like projects in “experimental” philosophy) but those are rare.

Regarding the third feature, disagreements over realism regarding abstract objects, whether virtue can be taught, whether we can know anything and if so how, and the like are ongoing and have been part of philosophy for millennia. Although regularly some philosophers or schools of philosophy claim that they have found a method to settle such disagreements (as when Kant (KrV, B xviii) claims that his philosophy promises to metaphysics the “secure course of a science”), and sometimes this involves gathering data (as suggested by “experimental” philosophy),

logics are very different. However, I think the same is true of different debates in philosophy, and I suggest that the four features below are common to many debates in the philosophical part of logic and philosophy.

these suggestions always fail, at least in the sense that many philosophers remain unconvinced.

Finally, the texts that make up the canon of philosophy are usually not seen as records of philosophical discoveries that are generally accepted as correct (or good approximations). The groundbreaking texts of philosophy are rather suggestions for doing philosophy in a new way. In his *Meditations*, Descartes suggested taking human subjectivity as the starting point of first philosophy. In the *Critique of Pure Reason*, Kant suggested to pursue philosophy as an investigation into the conditions of the possibility of certain cognitions. And in the *Tractatus*, Wittgenstein suggested that philosophy is really concerned with the analysis of language. None of these suggestions are accepted by the majority of philosophers today. This contrasts, for example, with Galileo's discovery that the acceleration of falling bodies is independent of their mass, Kepler's laws of planetary motion, Newton's laws of motion, Maxwell's equations of electromagnetism, Einstein's general theory of relativity, and Heisenberg's matrix mechanics, which are contributions that are still accepted today as correct (or as good approximations)—although philosophers of science often claim that science is less cumulative than scientists think it is (Kuhn, 1996; Laudan, 1983).

In Kuhnian terminology,¹¹ we might say that philosophy is in a perennially pre-paradigmatic state or, perhaps, in a perennial crisis. A mature science, in which paradigms make periods of normal science possible, does not have the four features above. Regarding the first feature, Kuhn claims that scientific education makes no use of a "library of classics" (Kuhn, 1996, 167). Regarding the second, the scientific paradigms of normal science provide agreed upon methods that allow researchers to plan the systematic gathering of data and their systematic use in testing theories. Normal science does not have the third feature because, according to Kuhn, scientists turn to philosophical and foundational issues in their fields only during "periods of acknowledged crisis" (Kuhn, 1996, 88). And as for the fourth feature, scientists see the history of their field (wrongly, according to Kuhn) as a history of cumulative progress.

If the four features above are characteristic of the exceptional methodology of philosophy, we can now ask whether the philosophical part of logic has these four features. If anti-exceptionalism is correct and the methodology of logic is like the methodology of the mature sciences and unlike that of philosophy, the philosophical part of logic should not have these four features.

It may seem that the philosophical part of logic does not share these four features with philosophy because it may seem that there are paradigms in philosophical logic. It may seem, for instance, that an Aristotelian paradigm has dominated philosophical logic for centuries before a new paradigm was established by Frege, Russell, Hilbert,

¹¹ I use an admittedly old-fashioned Kuhnian framework here. This is in broad agreement with anti-exceptionalists's preferences (against the philosophy of science typical of logical empiricism or Popper). As far as I can see, not much hangs on this, and my points could be made in many other frameworks in the philosophy of science (like those suggested by Longino or Kitcher or Cartwright etc.).

Tarski, Gödel and others. Alternatively, one might think that there existed several paradigms in the philosophical part of logic in the twentieth century.

It is certainly true that the work of Frege, Russell, Hilbert, Tarski, Gödel, and similar figures are milestones of progress in logic. However, they are primarily milestones of progress in the mathematical part of logic. The axiomatic systems and analysis of mathematical notions of Frege and Russell, the proof theory of Hilbert, as well as Tarski's model theory, and Gödel's incompleteness results are universally recognized achievements. But these are primarily contributions to the mathematical part of logic. The philosophical ideas of these figures are not part of the accepted methodological background of philosophical logic today or during the twentieth century. Frege's distinction between sense and reference, Russell's logicism, Hilbert's formalism, Tarski's theory of truth, or Gödel's rationalism have always been as controversial as seems to be the fate of philosophical ideas quite generally.

Of course, there are important and long standing traditions in the philosophical part of logic. These are, however, no more paradigms as the important and long standing traditions in philosophy. As long as we take philosophy to be exceptional, the existence of such traditions does not speak against the exceptional nature of logic.

I claim that the philosophical part of logic has the four features that are characteristic of the methodology of philosophy. In particular, I maintain that:

- (A) Historical texts and traditions shape current research in the philosophical part of logic.
- (B) Research projects in the philosophical part of logic typically do not include dedicated and planned periods of systematic and rigorous gathering of data, which are then analyzed and used to test theories by established methods.
- (C) There are perennial disagreements without any agreed upon methodology for settling them in the philosophical part of logic.
- (D) The major milestones of progress in the philosophical part of logic are suggestions for reconceptualizing the whole field rather than (apparently) cumulative discoveries.

In contrast to what we saw Martin and Hjortland claim about anti-exceptionalism, that the methodology of the philosophical part of logic has these four features does not imply that logic is maximally general, or *a priori*, or formal, or fundamental, or analytic, or necessary. Nor does it imply realism or anti-realism about logic. As far as I can see, the view that I am advocating in this paper is neutral on all of these points.

Why should we believe that the philosophical part of logic has these four features? The piece of evidence that is most convincing to me personally is my own experience of doing research in the philosophical part of logic. Together with Robert Brandom (Hlobil and Brandom, 2024), I have coauthored a book in which we pulled together the research we pursued over several years—in collaboration with other members of the Research On Logical Expressivism (ROLE) group. (Ad A) This research was shaped by historical texts from Aristotle to Gentzen. (Ad B) Our research did not include any dedicated periods of gathering data, nor did we test any theories in light

of systematically acquired data by established methods. (Ad C) We address perennial questions about the nature of logic for which we do not know of any agreed upon method for settling them. (Ad D) Our aim was to offer a new way of looking at research in philosophical logic, and the parts where we added results to existing research in a cumulative fashion are the mathematical parts of our project.

To elaborate a little bit, we suggest a new logical theory, which can accommodate nonmonotonic and nontransitive material consequence relations; and we present this logical theory as our preferred and “to be chosen” theory. However, we do this against a very specific philosophical background that includes particular commitments about meaning, consequence, reason, the nature of logic, and discursive practices. Our research in philosophical logic cannot be separated from our related philosophical research, and our philosophical views on logic. Thus, insofar as I can speak with authority about my own research in philosophical logic, I have one clear data point that speaks for the claims (A)–(D) above.

I use my own research as an example here because my interest in anti-exceptionalism is driven by my interest in how I ought to conduct my own research in logic. If anti-exceptionalism does not apply to my work but only to the work of “real logicians” (as some anti-exceptionalists have suggested to me in conversation), this undermines most of my interest in it. And if anti-exceptionalism implies that I ought to change the way in which I conduct my research in logic by ignoring historical texts, by systematically gathering and analyzing data, by adopting a paradigm that allows me to ignore foundational questions, and by seeing the progress of logic as a series of cumulative discoveries, then this would change my research in ways that would make me lose all interest in it.

An opponent might object (a) that perhaps my research in philosophical logic is unusual or special or simply misguided. (b) Someone else might object that I am not a good judge of my own practice. (c) Yet another opponent might worry that anecdotal evidence about oneself should not carry any weight, otherwise my opponents could simply pit their own anti-exceptionalism friendly firsthand experience against mine, thus yielding a stalemate. In order to circumvent these worries and not focus on my own research in potentially problematic ways, in the next and final section, I want to sketch a disagreement in the philosophical part of logic and its historical roots. I will argue that this example supports my claims (A)–(D) above.

5 An Example: Disagreements About the Liar

In this section, I want to sketch three positions regarding the liar paradox that are currently defended in the philosophical part of logic. I will argue that the disagreement between these three positions supports my claims from the last section because: (Ad A) These positions are informed by historical texts and traditions. (Ad B) Research projects on these three positions do not include the systematic gathering of data that are then used to test theories by established methods. (Ad C) The disagreement between these positions is the latest manifestation of a very old disagreement for

whose resolution there are no agreed upon methods. (Ad D) What supports these different positions on the liar paradox are not accumulated discoveries but rather specific ways to view the nature and role of logic.

There are an enormous number of positions and subtleties in current debates about the liar paradox. Among these positions we find three that can be summarized (in a simplified way) as follows:

- Dialetheism:** The liar paradox should be solved by accepting the contradictory conclusions of the paradoxical arguments. We should revise classical logic by rejecting the principle that contradictions imply everything because such alleged implications do not correspond to good reasoning, whereas all the steps in the paradoxical arguments are good reasoning (Priest, 2006).
- Classicism:** The liar paradox should be solved by saying that there are exceptions to the T-schema: “ ϕ ” is true if and only if ϕ . We should keep all of classical logic because it underlies (or partly constitutes, or is indispensable for) our best theories of what reality is like (Williamson, 2017).
- Cut-Rejection:** The liar paradox should be solved by keeping all classical entailments but also accept all instances of the T-schema; we should rather reject the Cut-rule for meta-inferences. The Cut-rule can fail because it can happen that a collection of assertions and denials does not violate certain coherence norms on discourse that consequence relations aim to codify (i.e. the collection is “in-bounds”) but one can neither assert nor deny the liar sentence while keeping the collection of speech acts coherent (Ripley, 2015, 2013; Cobreros et al., 2013).

The advocates of these three positions do not merely disagree on what the correct solution to the liar paradox is; they also understand logic and (logical) consequence in different ways. It is common to distinguish (although sometimes in somewhat different ways) between, at least, an epistemic, a metaphysical, and a semantic understanding of logic (Hlobil, 2020; Shapiro, 2007, 2005). For my current purposes, I want to distinguish these conceptions of logic as follows:¹²

- *Epistemic conception of logic:* Logical theories provide means (or necessary parts of means) for assessing or guiding or improving acts or activities that aim at knowledge or understanding, such as reasoning, deducing, proving, explaining, extracting information from theories, maintaining consistency in one’s beliefs, giving definitions, making distinctions, and the like.
- *Metaphysical conception of logic:* Logical truths describe the most general features of reality or the most fundamental or general structure of reality.

¹² Notice that the distinction between these conceptions cuts across the distinction between model-theoretic and proof-theoretic conceptions of consequence. Many inferentialists have a semantic conception of logic and pursue it in a proof-theoretic way. And, for example, Priest has an epistemic conception of logic but often focuses on model theory.

- *Semantic conception of logic*: Logical theories give an account of the meanings of some (or all) expressions or the content of concepts, which typically includes (or consists in) an account of which arguments are good in virtue of the meanings of logical expressions.

As is usual with broad families of philosophical views with illustrious pedigree, the differences between these conceptions are not sharp, so that some versions of them may not be mutually exclusive, and they are not exhaustive. Moreover, different aspects of the work of important figures in the field may suggest that they adopted different conceptions of logic. There are aspects in Frege's work, for example, that can justify attributing to him each of the three conceptions of logic just listed. And one might even hypothesize that good philosophical accounts of logic should accommodate the insights of all three (and possibly more) conceptions of logic. The situation seems broadly similar to normative ethics, where we find consequentialist, deontological, and virtue ethical theories, or the situation in metaphysical debates about whether universals exist *ante rem*, *in rebus*, or *in mente*. In all of these cases, it seems to be part of the philosophical challenge posed by these fields to find illuminating ways to combine insights from different approaches. I suggest that we understand the three conceptions of logic just listed in a broadly similar way.

The three positions regarding the liar paradox above are defended against the background of different conceptions of logic. Priest (2006; 2014; 2020) defends Dialetheism with an epistemic understanding of consequence in the background.¹³ Williamson (2017; 2013b; 2024) defends Classicism with a metaphysical understanding of consequence in the background. And Ripley (2013; 2015) defends Cut-Rejection with a semantic understanding of consequence in the background.

In order to show that the disagreement between these three approaches to the liar paradox has the four features of philosophical methodology listed above, I now want to place each approach in a historical context, of which the advocates of the respective approach may be unaware and which they may not be willing to endorse explicitly but which is, I think, nevertheless informing these approaches. I will begin with the epistemic conception of logic and then turn to the metaphysical conception of logic, ending with the semantic conception. Of course, I cannot do justice to the history of these conceptions here. I am merely offering some pointers that support my claims about the methodology of the philosophical part of logic.

¹³ In private conversation, Priest insists that he means the same by "consequence" as does Williamson, and that they agree that logic is about what follows from what and why. I suspect that this is due to two factors. First, Priest and Williamson both think that consequence has metaphysical and epistemic importance. Priest lets his metaphysics be informed by his logic, and Williamson thinks that consequence plays an important role in scientific theorizing. Second, it can seem that one knows what one means by "follows from" and that philosophical disagreements about how to understand consequence are disagreements about the best philosophical theory of whatever it is that we mean by "follows from." Neither of these two points undermines my claims in this paper, and I can accept both.

5.1 The Epistemic Conception of Logic

The Aristotelian tradition conceives of logic as a tool, which one has to acquire before pursuing any special science (Aristotle, *Meta.* 1005b2). Logic does not have a proper subject matter, as Aristotle says that neither “rhetoric nor dialectic is the scientific study of any one separate subject: both are faculties for providing arguments” (Aristotle, *Rhet.* I, 1256a30).

Aquinas follows but also transforms this tradition when he says that logic is not only an art by which we can, in our acts of reason, “proceed in an orderly and easy manner and without error” but adds that this art is also a science namely the “science of reason” (Aquinas, *Expositio libri Posteriorum Analyticorum*, preface). Buridan disagrees with this view and says that logic is not a science in a narrow sense because knowledge of logic is not a “speculative disposition” (*habitus speculativus*) but a practical disposition (Buridan, *Quaestio Libri Porphyry*, 126, l. 155-6). For the knowledge of the logic we use (*logica utens*) consists in an ability—namely the ability to construct arguments—and not in holding a theoretical belief. The logic that we teach students (*logica docens*), however, is a theory and so a science of argumentation (Buridan, *Quaestio Libri Porphyry*, 127, l. 195-6).

Most philosophers of the early modern period, such as Descartes and Locke, accepted the idea that the purpose of logic is to help us to arrive at knowledge. However, they held that syllogistic logic does not work well for this purpose, and Bacon (*New Organon*, 35) concluded that “current logic [...] is not useful, it is positively harmful.” Kant also held an epistemic conception of logic. However, he did not think that logic can serve as a tool to arrive at new knowledge, he rather held that logic sets a minimal standard for the correctness of thoughts (a *canon*). Logic merely tells us when a cognition meets a necessary condition to be knowledge, namely that it is “in agreement with itself” (Kant, AA IX, 14).¹⁴

Priest’s conception of logic fits into this broad tradition because he holds that logic is concerned with regulating or assessing reasoning. Priest (2016, 40) holds that the subject investigated by logic is “constituted by the norms of correct reasoning.” These norms of our inferential practice constitute our *logica utens*, according to Priest (2014, 219). Logical theories are theories of these norms. These theories are the *logica docens* (Priest, 2014, 216).

[O]ne needs to distinguish between reasoning or, better, the structure of norms that govern valid/good reasoning, which is the object of study, and our logical theory, which tries to give a theoretical account of this phenomenon. (Priest, 2006, 207)

Priest, like Buridan, holds that the *logica docens* is similar to science. The point of this science is, however, the improvement or assessment of our activity of reasoning (Priest, 2014, 220). We should accept the logical theory that accurately captures the norms of good reasoning.

Against this background of an epistemic conception of logic, it makes sense to reject the principle that contradictions entail everything or the principle that logical

¹⁴ There are also social or dialogical versions of the epistemic conception of logic (Dutilh Novaes, 2016; Marion, 2009).

truths are entailed by everything. For, there are no good pieces of reasoning that lead from contradictions to arbitrary conclusions or from arbitrary premises to logical truths.

[L]ogic [...] is supposed to provide an account of correct reasoning. When seen in this light the full force of these absurdities [e.g. that arbitrary premises entail any logical truth, according to classical logic] can be appreciated. Anyone who actually reasoned from an arbitrary premise to, e.g., the infinity of prime numbers, would not last long in an undergraduate mathematics course. (Priest, 1979, 279)

If the subject investigated by logic are the norms governing deductive reasoning, then logical theories that posit a norm according to which one can reason from contradictions to arbitrary conclusions or from arbitrary premises to logical truths are clearly mistaken. The norms that actually govern deductive reasoning do not sanction reasoning like that. And Priest shows how we can use this insight to deal with the liar paradox.

5.2 The Metaphysical Conception of Logic

A second conception of logic sees logic as a part of, or closely related to, metaphysics. This tradition can be traced to neo-Platonism. Already Plotinus explicitly denies that logic is merely a tool for epistemic purposes, as the peripatetic tradition claimed.

For indeed dialectic should not be thought to be a tool of philosophy. For it is not concerned with bare theorems and rules, but it is concerned with real things and, in a way, has Beings as its material. (Plotinus, *Enneads* 1.3.5, 10-12)

Augustine continues this tradition in a Christian context and holds that the structure we find in logic reflects the divine order of reality. The validity of syllogisms is not a matter of convention or of what is conducive to our aims but is rather a matter of the “system of things.”

The validity of syllogisms is not something instituted by humans, but observed and recorded by them [...]. It is built into the permanent and divinely instituted system of things. (Augustine, 1995, 113)

In the ninth century, Eriugena agrees that logic is grounded in the nature of things rather than human thought or discourse. He holds that logic is concerned with the way in which reality is structured (into species and genera) and that this structure of reality “did not arise from human contrivances, but was first implanted in nature (*in natura rerum*)” (Eriugena, *Periphyseon*, 749 A).

After the middle ages, the metaphysical conception of logic surfaces again in German idealism. Hegel thinks that once we see the topic of logic clearly, which Hegel calls “thought”, we can realize that it is “subjective and objective at once” and that the categories are the “essences of being” (Hegel, 1986, 240).

Heidegger continues this line of thought and calls for a new and philosophical logic, saying that the term “tool” reveals a “superficial-technical conception of

logic” (Heidegger, 1978, 31-1). He draws on Leibniz to identify the principle of identity (which grounds the law of non-contradiction) and the law of sufficient reason (principle of ground) as the two basic general laws of thought. His perhaps central claim is that the principle of sufficient reason, as a metaphysical principle, is more basic than, and the ultimate foundation of, the principle of identity and, hence, of all of logic. He takes this to be a reversal of the traditional view that takes logic to be more fundamental than metaphysics.

Our claim is that the first principle of logic is the principle of ground. But this claim is not just the reversal of the traditional order, but it is spoken out of the radicalization of logic toward metaphysics. The principle of ground is not a rule and norm for asserting; it is rather the first principle of logic as metaphysics. (Heidegger, 1978, 282)

Heidegger claims that logic should be understood as metaphysics (at least in its foundations). He holds that logic as the study of thought in general must ultimately turn into a study of what is shared by everything that we think about, that is, a study of being or the most general structure of the world.¹⁵

In the current debate, Williamson is following (unintentionally) in the footsteps of Hegel and Heidegger when he writes: “For quantified modal logic [...], one of its many roles is to supply a central structural core to theories of modal metaphysics. [...] Those theories are not about our language or thought [...], except incidentally, since they are about everything whatsoever” (Williamson, 2013b, x). He thinks that the usual meta-linguistic understanding of logical consequence and logical truth is misleading (Williamson, 2017, 329). Logic is not about sentences or arguments or proofs. Rather, logical laws are truths about the world, truths that capture the most general features of reality.

[T]he law of excluded middle, $\forall P(P \vee \neg P)$, is just a very general structural law about the mostly non-linguistic world—a basic law of both logic and metaphysics, whatever Tarski would have said. [...] $\forall X\exists x(Xx \rightarrow \forall yXy)$ is another very general structural law about the mostly non-linguistic world— another law of both logic and metaphysics. (Williamson, 2024, sec 1)

According to this view, logical theories are not primarily theories of logical consequence but rather theories about “very general structural laws about [...] the world,” which are expressed by logically true sentences. While logical truth might be a special case of logical consequence from a proof-theoretic perspective, Williamson holds that “metaphysically, logical consequence is just a means to the end of logical truth” (Williamson, 2024, sec 1).

¹⁵ It might seem that the metaphysical conception of logic is tied to a realist understanding of logic (see Tahko, 2021). However, there is a sense in which Hegel and Heidegger do not have a realist conception of logic. For them logic is not independent of the structure of the understanding of knowing subjects. These views are compatible because they hold that the structure of the world and the structure of the understanding of knowing subjects are essentially related to each other. A kind of anti-realism about logic that seems to me to be genuinely incompatible with the metaphysical conception of logic is what Commandeur (2024) calls “Non-representationalism about Logic,” which is the claim that “logics do not represent any extra-systematic phenomenon” (where I think Commandeur means something like “entities or facts” by “phenomenon” and not necessarily something that appears to a subject).

The principles governing the truth predicate are not very general or fundamental, according to this view. After all, the truth predicate applies only to entities of a very special kind, such as sentences or propositions. Compared to principles featuring the truth predicate, the laws of first-order (or second-order) logic are much more general, as they apply to every object and relation. From this perspective, it makes sense to give up the T-schema as holding in full generality rather than to revise logic. The T-schema is an approximation of a local and special structural law, and the lesson of the liar paradox is that it is merely an approximation that fails in some special cases.

5.3 The Semantic Conception of Logic

The semantic conception of logic sees logic as concerned with a special kind of subject matter, namely (certain) contents or meanings. This conception of logic can be traced back (at least) to the Stoa.

In opposition to the peripatetic view that logic is not a part of philosophy but merely an instrument of philosophy, the Stoa saw logic as one of philosophy's three parts: physics, ethics, and logic (Hülser, 1987, fragments 20-26). According to the Stoa, logic has a proper subject matter, and this subject matter are things that "belong to speech." Boethius describes the Stoic position thus: "logic treats of propositions and syllogisms and things like that, for which there cannot stand in things that don't belong to speech [...]" (Hülser, 1987, fragment 32a). Logic is part of the study of conceptual acts, in particular the contents of such acts, which they called "sayables" (Barnes, 1999, 66). According to the Stoics, sayables are abstract entities that exist independently of us, and arguments are compounds of such sayables (Barnes et al., 1999, 121).

Bobzien (2021) has argued that Frege's account of thoughts is influenced by this Stoic view. For Frege, logic provides a language with which we can express the abstract objects that are thoughts. And Frege is explicitly taking up Leibniz's idea of a *characteristica universalis*, in his *Begriffsschrift*, when he says that he was "striving after a *lingua characterica* in the first instance for mathematics, not a calculus restricted to pure logic" (Frege, 1979, 12). In particular, Frege takes logic to provide the "logical cement that will bind [... the nonlogical concepts as] building stones firmly together" (Frege, 1979, 13). Thus, Frege sees logic as (among other things) providing a language that can be enriched with nonlogical concepts to express the contents of any science in a particularly rigorous and perspicuous way. And to do so, logic must include a theory of what concepts and contents are. Thus, logic includes a theory of meanings and contents, which Frege spells out in terms of sense, reference, functions, and objects.

Brandom (1994, 108-11) takes up and develops this aspect of Frege's conception of logic. Brandom holds that logic provides an account of the meanings of logical vocabulary, which are special because they allow us to make explicit what follows from what and what is incompatible with what.

Bilateralists like Ripley (2017a; 2015) and Restall (2005; 2008) take up and develop Brandom's ideas. They give accounts of the meaning of expressions in terms of the conditions under which sentences in which they occur can be asserted or denied without violating certain coherence norms on discourse: the conditions under which such assertions or denials are or aren't "out-of-bounds." In particular, they give accounts of the meaning of logical vocabulary in this format, as when they suggest that it is a (partial) account of the meaning of negation to say that asserting a negation is out-of-bounds just in case denying the negatum is out-of-bounds and denying a negation is out-of-bounds just in case asserting the negatum is out-of-bounds. According to this version of bilateralism, logical consequence is the relation that holds between two sets of sentences if and only if it is out of bounds to assert everything in the first set and deny everything in the second set, and this holds in virtue of the meaning of the logical vocabulary that occurs in these sentences.¹⁶ Bilateralists typically think that the relevant kind of incoherence is a matter of the norms that govern our discursive practices.

What it is for a bunch of premises to entail a bunch of conclusions is that if you assert the premises and deny the conclusions, then you're out of bounds. [...]. The role this is playing is as a constraint on what kinds of things people can get away with in the conversational positions that they adopt. For example, [...] reflexivity [of consequence] is the claim that asserting and denying the same thing is out of bounds. [...] Not that you can't do it; go ahead. But what you've done clashes in some way. It's to be ruled out by some coherence-based norms on assertion and denial. (Ripley, 2015, 28)

Given such a conception of logic, it makes sense to give up the Cut-rule in light of the liar paradox (although only Ripley and not Restall advocates doing so). For according to this view, the Cut-rule says that if a collection of assertions and denials is in-bounds, then, for any sentence, one can either add an assertion or add a denial of the sentence to the collection and it remains in-bounds.¹⁷ It seems plausible, however, that adding either an assertion or a denial of the liar sentence renders any collection of assertions and denials out-of-bounds, including collections of assertions and denials that are in-bounds. If that is correct, we have a counterexample to the Cut-rule. Hence, the idea goes, we should respond to the liar paradox by acknowledging that there are some sentences, such as the liar sentence, that one can neither assert nor deny without making one's collections of assertions and denials out-of-bounds, even if it was in-bounds before asserting or denying the liar sentence. The assumption, codified in the Cut-rule, that there are no such sentences simply turns out to be mistaken.

¹⁶ The kind of incoherence in question is the incoherence we can find even among mere suppositions (so Moorean-Paradox-style incoherence does not count) (see Ripley, 2017b).

¹⁷ If this isn't obvious to you, read the Cut-rule contrapositively: If $\Gamma \not\vdash \Delta$, then, for any A , either $\Gamma \not\vdash A$, Δ or $\Gamma, A \not\vdash \Delta$.

5.4 Lessons from the Case Study

What does this disagreement tell us about my theses (A)–(D) above? It seems to me that it lends support to all four theses, namely as follows.

(ad A) The three positions on the liar paradox are shaped by ways of thinking about logic and logical consequence that are rooted in particular historical traditions. I have offered a sketch of the ancient roots of the three conceptions of logic that underlie the three views on the liar paradox, namely the peripatetic, the neo-Platonist, and the Stoic tradition. And while some of the advocates of the three approaches (especially Williamson) to the liar paradox do not place themselves in the traditions that I identified, it seems to me that such connections to long standing traditions is illuminating and potentially productive for current research on the liar paradox. Going back to the original sources can be illuminating in disagreements about the liar paradox and conceptions of logic in a way in which reading original texts is only rarely illuminating in the empirical sciences.

(ad B) None of the advocates of the three approaches to the liar paradox has engaged in any systematic gathering of data that could be used to test their theories. They sometimes point to uncontroversial facts about certain arguments being good, or how apparently different paradoxes are really similar, or what someone could reasonably say, or what sentences are meaningful, and the like. Such appeals are very different, however, from appeal to data in the sciences, where it makes sense to ask scientists for their “raw data,” or to demand that they specify the way in which they will analyze their data before gathering the data (as this is increasingly institutionalized by requiring studies to be preregistered). Neither Priest, nor Williamson, nor Ripley use rigorous methods (like inferential statistics) for testing logical theories against systematically gathered data. And their research projects do not include assigned periods of data gathering, or hypothesis testing.

(ad C) The disagreement between the epistemic, metaphysical, and semantic conception of logic can be traced to antiquity, and there are no agreed upon methods for settling this disagreement. Insofar as these three conceptions of logic underlie the disagreement between the three approaches to the liar paradox, the latter disagreement is a reflection of a perennial disagreement regarding which we cannot reach a widespread consensus by applying agreed upon methods. There does not seem to be any “given” that could settle this disagreement.

(ad D) The three conceptions of logic that lie behind the three approaches to the liar paradox are not discoveries that are generally accepted as correct. They are rather suggestions for how to view the nature and role of logic, thus reconceptualizing the whole field of logic.

If there is a way to rationally choose between Classicism, Dialetheism, and Cut-rejection as logical theories regarding the liar paradox, it seems to me that this choice must be informed by an assessment of the three underlying conceptions of logic. Such an assessment, however, strikes me as a philosophical task that must be addressed by whatever methods philosophy can offer. The theory choice that we are facing with respect to the liar paradox seems to be the kind of theory choice that we face in philosophy. Perhaps philosophy cannot offer any agreed upon methods for

choosing theories in such cases, and perhaps this seems to some like a disappointing result. Pessimism about philosophy is, however, not a good reason to stick one's head in the anti-exceptionalist sand and to pretend that the philosophical part of logic is not like philosophy but rather like science. Nor is pessimism about philosophy a good reason to indulge in the myth of the logically given.

6 Conclusion

I have argued that logic is unlike science—and thus exceptional—in the sense that the methodology of logic is unlike that of the empirical sciences but rather partly like the methodology of mathematics and partly like the methodology of philosophy. In the mathematical part of logic, no need to choose between theories arises. And in the philosophical part of logic, the rational way to choose between theories is similar to the rational way to choose between philosophical theories (if such a way exists).

Perhaps some think it is insulting to claim that logic, in its philosophical part, is not a mature and developed science. That would be a mistake. Many of the activities that deserve our deepest respect and admiration are more like philosophy than like science. It can hardly be insulting, for example, to hold that logic may be similar to the fine arts, ethics, or history in important respects, for example, in being a manifestation of our ability to reflect on ourselves. I suggest that we do not let our view of logic be clouded by a misplaced worship of science and rather embrace its philosophical nature with open arms.

Acknowledgements I would like to thank Nabeel Hamid, Olivia Sultanesco, Katharina Nieswandt, Robert Brandom, Rea Golan, Shuhei Shimamura, Ryan Simonelli, Dax Hamouth, and Ori Schnider for very helpful comments and discussion.

References

- Andersen, F. J. (2023). Countering justification holism in the epistemology of logic: The argument from pre-theoretic universality. *Australasian Journal of Logic*, 20(3):375–396.
- Aquinas, T. (1949). *Commentary on the Posterior Analytics of Aristotle*. Magi Books, Albany, NY, USA.
- Arenhart, J. R. B. (2022). Logical anti-exceptionalism meets the "logic-as-models" approach. *Theoria*, 88(6):1211–1227.
- Aristotle (2014). *Complete Works of Aristotle: Volume 2 (revised Oxford translation, edited by J. Barnes)*. Princeton University Press.
- Augustine (1995). *De Doctrina Christiana*. Clarendon Press, Oxford.
- Bacon, F. (2000). *The New Organon*. Cambridge University Press, Cambridge.

- Barnes, J. (1999). Logic and language: Introduction. In Algra, K., Barnes, J., Mansfeld, J., and Schofield, M., editors, *The Cambridge History of Hellenistic Philosophy*, pages 65–76. Cambridge University Press, Cambridge.
- Barnes, J., Bobzien, S., and Mignucci, M. (1999). Logic. In Algra, K., Barnes, J., Mansfeld, J., and Schofield, M., editors, *The Cambridge History of Hellenistic Philosophy*, pages 77–176. Cambridge University Press.
- Bobzien, S. (2021). Frege plagiarized the stoics. In Leigh, F., editor, *Themes in Plato, Aristotle, and Hellenistic Philosophy, Keeling Lectures 2011-2018*, pages 149–206. University of Chicago Press.
- Brandom, R. B. (1994). *Making It Explicit: Reasoning, Representing, and Discursive Commitment*. Harvard University Press, Cambridge, Mass.
- Burgess, J. P. (1992). Proofs about proofs: A defense of classical logic. part i: The aims of classical logic. In Detlefsen, M., editor, *Proof, Logic, and Formalization*, pages 1–23. Routledge, London.
- Buridan, J. (1986). Jan Buridan, Kommentarz do Isagogi Porfiriusza. *Przegląd Tomistyczny*, 2:111–195.
- Carlson, M. (2022). Anti-exceptionalism and the justification of basic logical principles. *Synthese*, 200(3):1–19.
- Cobrerros, P., Egré, P., Ripley, D., and van Rooij, R. (2013). Reaching transparent truth. *Mind*, 122(488):841–866.
- Commandeur, L. (2024). Logical instrumentalism and anti-exceptionalism about logic. *Erkenntnis*, pages 1–21.
- Costa, N. D. and Arenhart, J. R. B. (2018). Full-blooded anti-exceptionalism about logic. *Australasian Journal of Logic*, 15(2):362–380.
- Dicher, B. (2020). Reflective equilibrium on the fringe. *Dialectica*, 74(2):247–270.
- dos Santos, C. F. (2021). Intuitions, theory choice and the ameliorative character of logical theories. *Synthese*, 199(5-6):12199–12223.
- Dutilh Novaes, C. (2016). Reductio ad absurdum from a dialogical perspective. *Philosophical Studies*, 173(10):2605–2628.
- Emery, N. (2023). *Naturalism Beyond the Limits of Science: How Scientific Methodology Can and Should Shape Philosophical Theorizing*. Oxford University Press, New York, US.
- Eriugena, J. S. (1987). *Periphyseon: The division of nature*. Dumbarton Oaks, Washington.
- Ferrari, F., Martin, B., and Sforza, M. P. F. (2023). Anti-exceptionalism about logic: An overview. *Synthese*, 201(2):1–9.
- Finn, S. (2019). The adoption problem and anti-exceptionalism about logic. *The Australasian Journal of Logic*, 16(7):231–249.
- Frege, G. (1979). *Posthumous Writings*. Basil Blackwell, Oxford.
- Hegel, G. W. F. (1986). *Werke in 20 Bänden. Band 19: Vorlesungen über die Geschichte der Philosophie II*. Suhrkamp, Frankfurt am Main.
- Heidegger, M. (1978). *Metaphysische Anfangsgründe der Logik im Ausgang von Leibniz*. Gesamtausgabe, Bd. 26: Abteilung 2, Vorlesungen 1923-1944. V. Klostermann, Frankfurt a.M.

- Hjortland, O. T. (2017). Anti-exceptionalism about logic. *Philosophical Studies*, 174(3):631–658.
- Hjortland, O. T. (2019). What counts as evidence for a logical theory? *Australasian Journal of Logic*, 16(7):250–282.
- Hlobil, U. (2020). Limits of abductivism about logic. *Philosophy and Phenomenological Research*, 103(2):320–340.
- Hlobil, U. and Brandom, R. B. (2024). *Reasons for Logic, Logic for Reasons: Pragmatics, Semantics, and Conceptual Roles*. Routledge.
- Hülser, K. (1987). *Die Fragmente zur Dialektik der Stoiker: Neue Sammlung der Texte mit deutscher Übersetzung und Kommentaren, Band I*. Frommann-Holzboog, Stuttgart.
- Kant, I. (1900 ff.). *Gesammelte Schriften*. Bände I–XXII hg. v. d. Königlich Preussische Akademie der Wissenschaften, Berlin 1900ff., Band XXIII hg. v. d. Deutschen Akademie der Wissenschaften, Berlin 1956, ab Band XXIV hg. v. d. Akademie der Wissenschaften zu Göttingen, Berlin 1966ff.
- Kant, I. (1966). *Kritik der reinen Vernunft*. Reclam, Stuttgart.
- Kneale, W. and Kneale, M. (1962). *The Development of Logic*. Clarendon Press, Oxford.
- Kripke, S. A. (2023). The question of logic. *Mind*.
- Kuhn, T. S. (1996). *The structure of scientific revolutions (3rd ed.)*. University of Chicago Press, Chicago, London.
- Ladyman, J. and Ross, D. (2007). *Every Thing Must Go: Metaphysics Naturalized*. Oxford University Press, New York.
- Laudan, L. (1983). The demise of the demarcation problem. In Cohen, R. S. and Laudan, L., editors, *Physics, Philosophy and Psychoanalysis: Essays in Honor of Adolf Grünbaum*, pages 111–127. D. Reidel.
- Marion, M. (2009). Why play logical games? In Majer, O., Pietarinen, A., and Tulenheimo, T., editors, *Games: Unifying Logic, Language, and Philosophy*, pages 3–26. Springer, Dordrecht.
- Martin, B. (2020). Identifying logical evidence. *Synthese*, 198(10):9069–9095.
- Martin, B. (2024). The practice-based approach. In Brendel, E., Carrara, M., Ferrari, F., Hjortland, O., Sagi, G., Sher, G., and Steinberger, F., editors, *The Oxford Handbook of the Philosophy of Logic*. Oxford University Press, Oxford.
- Martin, B. and Hjortland, O. (2020). Logical predictivism. *Journal of Philosophical Logic*, 50(2):285–318.
- Martin, B. and Hjortland, O. T. (2022). Anti-exceptionalism about logic as tradition rejection. *Synthese*, 200(2):1–33.
- Martin, B. and Hjortland, O. T. (2024). Evidence in logic. In Lasonen-Aarnio, M. and Littlejohn, C. M., editors, *Routledge Handbook of the Philosophy of Evidence*. Routledge.
- McSweeney, M. M. (2021). The cost of closure: Logical realism, anti-exceptionalism, and theoretical equivalence. *Synthese*, 199:12795–12817.
- Molick, S. (2021). Logical theory revision through data underdetermination: An anti-exceptionalist exercise. *Principia: An International Journal of Epistemology*, 25(1).

- Peregrin, J. and Svoboda, V. (2021). Moderate anti-exceptionalism and earthborn logic. *Synthese*, 199(3-4):8781–8806.
- Plotinus (2018). *The Enneads*. Cambridge University Press, Cambridge.
- Priest, G. (1979). Two dogmas of Quineanism. *Philosophical Quarterly*, 29(117):289–301.
- Priest, G. (2003). On alternative geometries, arithmetics, and logics; a tribute to Łukasiewicz. *Studia Logica*, 74(3):441–468.
- Priest, G. (2006). *In Contradiction: A Study of the Transconsistent*. Oxford University Press, Oxford.
- Priest, G. (2014). *Revising logic*, pages 211–223. Cambridge University Press, Cambridge.
- Priest, G. (2016). Logical disputes and the a priori. *Principios: Revista de filosofía*, 23(40):29–57.
- Priest, G. (2020). Logical abductivism and non-deductive inference. *Synthese*, 199(1-2):3207–3217.
- Quine, W. V. O. (1951). Two dogmas of empiricism. *Philosophical Review*, 60(1):20–43.
- Quine, W. V. O. (1964). Two dogmas of empiricism. Harvard University Press. TY - CONF.
- Read, S. (2019). Anti-exceptionalism about logic. *The Australasian Journal of Logic*, 16(7):298–318.
- Restall, G. (2005). Multiple conclusions. In Hájek, P., Valdés-Villanueva, L., and Westerstaahl, D., editors, *Logic, Methodology and Philosophy of Science: Proceedings of the Twelfth International Congress*, pages 189–205. KCL Publications, London.
- Restall, G. (2008). Assertion, denial, commitment, entitlement, and incompatibility (and some consequence). *Studies in Logic*, 1(1):26–36.
- Ripley, D. (2013). Paradoxes and failures of Cut. *Australasian Journal of Philosophy*, 91(1):139–164.
- Ripley, D. (2015). Anything goes. *Topoi*, 34(1):25–36.
- Ripley, D. (2017a). Bilateralism, coherence, warrant. In Moltmann, F. and Textor, M., editors, *Act-Based Conceptions of Propositional Content*, pages 307–324. Oxford University Press, Oxford.
- Ripley, D. (2017b). Uncut. unpublished manuscript.
- Rossberg, M. and Shapiro, S. (2021). Logic and science: Science and logic. *Synthese*, 199(3-4):6429–6454.
- Russell, G. (2008). *Truth in virtue of meaning: a defence of the analytic/synthetic distinction*. Oxford University Press, Oxford. TY - BOOK DB - WorldCat DP - <http://worldcat.org>.
- Russell, G. (2019). Deviance and vice: Strength as a theoretical virtue in the epistemology of logic. *Philosophy and Phenomenological Research*, 99(3):548–563.
- Sagi, G. (2021). Logic as a methodological discipline. *Synthese*, 199(3-4):9725–9749.

- Shapiro, S. (2005). Logical consequence, proof theory, and model theory. In Shapiro, S., editor, *Oxford Handbook of Philosophy of Mathematics and Logic*, pages 651–670. Oxford University Press.
- Shapiro, S. (2007). Necessity, meaning, and rationality: The notion of logical consequence. In Jacquette, D., editor, *A Companion to Philosophical Logic*, chapter 14, pages 225–240. Wiley & Sons, Oxford.
- Tahko, T. E. (2021). A survey of logical realism. *Synthese*, 198(5):4775–4790.
- Tajer, D. (2022). Anti-exceptionalism and methodological pluralism in logic. *Synthese*, 200(3):1–21.
- Vicaria, M. (2023). Elimination of imaginaries in ordered abelian groups with bounded regular rank. *The Journal of Symbolic Logic*, 88(4):1639–1654.
- Williamson, T. (2007). *The Philosophy of Philosophy*. Wiley-Blackwell, Malden, MA.
- Williamson, T. (2013a). Anti-exceptionalism about philosophy. *Croatian Journal of Philosophy*, 13(1):1–3.
- Williamson, T. (2013b). *Modal Logic as Metaphysics*. Oxford University Press, Oxford.
- Williamson, T. (2017). Semantic paradoxes and abductive methodology. In Armour-Garb, B., editor, *Reflections on the Liar*, pages 325–346. Oxford University Press, Oxford.
- Williamson, T. (2024). Is logic about validity? In Brendel, E., Carrara, M., Ferrari, F., Hjortland, O., Sagi, G., Sher, G., and Steinberger, F., editors, *The Oxford Handbook of the Philosophy of Logic*. Oxford University Press, Oxford.
- Woods, J. (2019a). Against reflective equilibrium for logical theorizing. *The Australasian Journal of Logic*, 16(7):319–341.
- Woods, J. (2019b). Logical partisanship. *Philosophical Studies*, 176(5):1203–1224.
- Woods, J. (2023). A sketchy logical conventionalism. *Aristotelian Society Supplementary Volume*, 97(1):29–46.
- Wyatt, N. and Payette, G. (2018). How do logics explain? *Australasian Journal of Philosophy*, 96(1):157–167.