Anti-Exceptionalism about Logic (Part II): Methodological Anti-Exceptionalism about Logic

Ben Martin (University of Padova) & Ole Hjortland (University of Bergen)

Abstract. According to *anti-exceptionalism about logic* (AEL), logic is not as exceptional in terms of its subject matter and epistemology as has been conventionally thought. As such, AEL either outright rejects certain traditional properties of logic, such as its *formality*, *apriority*, or *necessity*, or rather proposes that while logic possesses these properties, it does so in a similar way to other research areas. In this second part of a two-part entry on AEL, we focus on contemporary proposals for *Methodological* AEL, the view that the mechanisms of theory-choice in logic are similar to those in the sciences. Firstly, we consider the various contemporary motivations for Methodological AEL and highlight how these motivations need not equally motivate *Evidential* AEL, the view that the *sources* of logical evidence are the same as the sources of evidence within the sciences. Secondly, we discuss the two most prominent versions of Methodological AEL in the literature, *logical abductivism* and *predictivism*, and end by briefly outlining some of the important challenges presently facing Methodological AEL.

Keywords: Anti-exceptionalism about Logic; Epistemology of Logic; Logical Evidence; Methodology of Logic; Practice-Based Approach; Logical Abductivism; Logical Predictivism.

§1 Epistemological AEL: A Recap

According to *anti-exceptionalism about logic* (AEL) logic is not as exceptional in terms of its subject matter and epistemology as has been commonly thought. As such, AEL either outright rejects certain traditional properties of logic, such as its *formality*, *analyticity*, *apriority*, or *necessity*, or rather proposes that while logic possesses these properties, it does so in a similar way to other research areas (Martin & Hjortland 2022).

Depending upon which cluster of these traditional properties have been rejected, two connected but *distinct* species of anti-exceptionalism have arisen: (i) *Metaphysical* AEL, according to which the laws of logic are about the world in the same way that those of the sciences are, though concerned with more "general" facts (Maddy 2007; Sher 2016; Williamson 2017); and, (ii) *Epistemological* AEL, according to which logical theories are justified by a similar means to theories within the sciences (Priest 2016; Williamson 2017). In this two-part introduction to the topic, we are concentrating most of our attention on *Epistemological* AEL, which has been the focus of much of the debate recently.

In the first part of the entry, we discussed how the epistemology of logic has traditionally been considered exceptional in virtue of being both *non-inferential* and *a priori*. This has led to the longstanding view that the justification of logical laws must either be a product of rational insight or epistemic analyticity. We then traced Epistemological AEL to its modern source, Quine's (1951) evidential holism, which was motivated not only by a rejection of rational insight and epistemological analyticity, but by an endorsement of naturalism and the Duhem-Quine thesis. Importantly, we showed that Epistemological AEL is constituted of two component parts: (i) *Methodological* AEL, according to which the mechanisms of theory-choice in logic are similar to those in the sciences, and (ii) *Evidential* AEL, according to which the *sources* of logical evidence are the same as the sources of evidence in the sciences. On the assumption that the mechanisms of theory-choice in the sciences require inferences to be made, and the sources of scientific evidence are empirical, while endorsing *Methodological* AEL requires rejecting logical justification's non-inferentiality, endorsing *Evidential* AEL requires rejecting the *apriority* of logical evidence. Further, we observed that while Quine endorses both *Methodological* and *Evidential* AEL as part of his evidential holism, one need not do so. Indeed, there are good reasons to think the majority of contemporary anti-exceptionalists do not accept Evidential AEL while endorsing Methodological AEL.

In this second part of the entry we focus on contemporary proposals for *Methodological* AEL, firstly by considering the various motivations for Methodological AEL in the literature and highlighting how these motivations need not

equally motivate Evidential AEL, and then secondly discussing the two most prominent accounts of Methodological AEL in the literature, *logical abductivism* and *predictivism*. We end by briefly discussing some of the important challenges presently facing Methodological AEL.

§2 Contemporary Motivations for Methodological AEL

In broad terms, there are two distinct motivations offered for Methodological AEL in the contemporary literature: a *normative* and *descriptive* variety. Both argue that on the basis of their proposed criteria for an adequate epistemology of logic, anti-exceptionalist accounts of theory-choice in logic are preferable to those that appeal directly to rational insight or epistemic analyticity. What is not often recognised in the literature, however, is that in virtue of the two motivations differing in their modal force, the claims that each motivates (at least, directly) also differ. While the *normative* justification for Methodological AEL, if successful, would establish that we *ought to* use a mechanism of theory-choice in logic similar to that used in the sciences, the *descriptive* justification by contrast only directly establishes that we *in fact do* use mechanisms of theory-choice in logic which are significantly more similar to those used in the sciences than traditionally thought. Importantly, neither motivation also commits the contemporary anti-exceptionalist to Evidential AEL.

The *normative* motivation for Methodological AEL can be traced back to at least Bertrand Russell (1949 [1917]), who proposed in his "On the Scientific Method in Philosophy" that we ought to "study the *methods* of science, and seek to apply these methods, with the necessary adaptations, to [philosophy's] own peculiar province," (1949: 98). However, a similar motivation has been used much more recently by Williamson (2017: 334–5), who proposes that "[t]he abductive methodology is the best science provides, and we should use it [to evaluate logical theories]." In both cases, the exact rationale for the proposal is somewhat elusive. Two possibilities stand out.

First, the proposal could be justified by a general commitment to *methodological naturalism*—that the methods of the natural sciences are the only viable route we possess to rationally justifying *any* theory. This rationale would draw the closest relationship between Quine's naturalistic motivations for his evidential holism and contemporary motivations for methodological AEL. A gesture towards this rationale can be found in Russell (1949), where a dilemma is drawn between philosophy either being informed by ethics and religion or the sciences. In this case, given that "ethical and religious motives in spite of the splendidly imaginative systems to which they have given rise, have been on the whole a hindrance to the progress of philosophy," they "ought now to be consciously thrust aside by those who wish to discover philosophical truth" (1949: 97–8). In its place, philosophy (and, thus, logic) ought to be "guided by scientific method" (1949: 98).

Second, the rationale could be due to the metaphysical view held by both Russell (1919: 169) and Williamson (2017) that logic *is about the world*, even if the most general facts about the world. Thus, given that the scientific method is the best means we have to investigate facts about the world, we ought to similarly use this method to justify our logical theories. Consequently, in this case, Methodological AEL is seen as a reasonable consequence of *Metaphysical* AEL.

Both rationales face challenges. Firstly, any appeal to *methodological naturalism* requires that there is one (and only one) method suitable to rationally investigate all domains of inquiry. Yet, even if we restrict our attention to the empirical sciences, and so leave to one side the very different methodological norms we find in the formal sciences, there is well-known significant methodological divergence found across the various fields of scientific enquiry (Ruphy 2016). Recognition of this fact is one of the underlying motivations behind the need to look in detail at the particular norms of individual sciences, such as in the case of explanatory norms (Woody 2003). Thus, *methodological naturalism* itself is dubious, given that it seems unrealistic that there is just *one* scientific method uniquely privileged in its ability to rationally inform all fields of inquiry.

This same concern also impacts the second possible rationale for the *normative* motivation. Given that there is not *one* scientific method, it cannot simply be "transferred across" to inform theory choices in logic. Further, different fields of scientific inquiry use different methodological norms for good reasons—*because they suit the subject of inquiry for that field* (Woody 2003). Save from general epistemic norms, such as proportioning one's theories to evidence and subjecting one's findings to the scrutiny of peers, which hold outside of the established sciences also, one needs to look in detail at the aims and subject matter of each field to establish what would constitute good methodological practice in those fields (Woody 2015). Given this, appealing to the success of the scientific method in abstract carries little weight beyond insisting that logic ought to use a method befitting its subject matter. We still lack details on what such a suitable method would be, and why. In addition, given that this second rationale for the *normative* motivation attempts to support Methodological AEL on the basis of Metaphysical AEL, it faces challenges from both rival metaphysical accounts of logic (such as logical conventionalism; cf. Warren 2020) and other advocates of Metaphysical AEL who are sceptical that the same methods of enquiry used in the sciences will be useful for logic given the generality and abstraction of these logical facts (Maddy 2007; Sher 2016).

Importantly, neither of these normative motivations for Methodological AEL commit the anti-exceptionalist to *Evidential* AEL. Firstly, even if one acknowledges that the scientific method of testing a hypothesized theory against a set of relevant data is the only rationally viable method of theory-choice we possess, it is of course open to the anti-exceptionalist to admit that what constitutes this *relevant data* is field specific. Indeed, they may point out that even a cursory consideration of the sciences highlights that across scientific fields various different *sources of evidence* are used, suitable for the field's subject matter. For instance, while the astronomical sciences and epidemiology rely heavily on computer-generated simulations, and descriptive linguistics relies upon the judgements of natural-language speakers, molecular biologists rely upon the outputs of spectrophotometers and phosphorimagers. Thus, it would not be a surprise if logic also required its own particular sources of evidence suitable for its subject matter (which could even be *a priori*). Further, if the methodological anti-exceptionalist were motivated by Metaphysical AEL, they could push this line of reply further. Given the *generality* of the nature of logic's subject matter, logic not only requires different types of evidence from the social and biological sciences, but that the *only* viable sources of evidence suitable to assess logical theories are *a priori* sources.[1] Both considerations highlight the possibility that while the *methods* of testing and evaluation within logic must fundamentally be the same as those in the sciences, given logic's subject matter the sources of evidence must be wholly different, and maybe even *a priori*.

In contrast, the *descriptive* motivation for Methodological AEL is not primarily interested in establishing that we *ought* to use a method of theory-choice in logic similar to that used in the sciences. Thus, there is no need to draw a connection between the subject matter of logic and sciences, or argue that the scientific method is the only successful game in town, to establish its conclusions. As a consequence, it may not necessarily face the associated concerns raised against the normative motivation. Instead, the descriptive motivation argues for Methodological AEL on the basis that the field of logic *in fact currently* uses a method of theory-choice similar in important regards to that used in the sciences. How close this proposed connection is, and the level of detail offered, depends very much on the methods used by advocates of the descriptive motivation.

[1] Indeed, this seems to be Russell's (1949) position on the matter. As he goes onto say, while "there are two different ways in which a philosophy may seek to base itself upon science", either by using similar methods or "emphasis[ing] the most general *results* of science, and seek[ing] to give even greater generality and united to these results," doing the latter would be a mistake—"it is not results, but *methods* that can be transferred with profit from the sphere of the special sciences to the sphere of philosophy" (1949: 98). Further, even more explicitly, "[a] philosophical proposition must be such as can be neither proved nor disproved by empirical evidence," only *a priori* evidence is suitable (1949: 111). Note, as is often the case in these contexts, by "philosophy" Russell means logic: "Philosophy, if what has been said is correct, becomes indistinguishable from logic as that word has now come to be used" (1949: 111–2). Russell is probably the clearest example we have of a pre-contemporary methodological anti-exceptionalist who rejects Evidential AEL.

Firstly, in an attempt to make sense of the fact that our logical theories *have been* rationally revised over time, Graham Priest (2014) has proposed that theory-choice in logic works similarly to rational theory choice in both the sciences and other fields of research: "Given any theory, in science, metaphysics, ethics, logic, or anything else, we choose the theory which best meets those criteria which determine a good theory" (2014: 217). Priest's argument can be interpreted either as an argument by analogy, or an inference to best explanation. Given that theories in both logic and other fields of research have been rationally revised, the methods for rational revision in the former are (likely to be) the same as those found in the latter fields. Given that the proposal is built upon a general claim about how rational theory choices function (across fields), however, it is perhaps not a surprise that when Priest (2016: 349) comes to provide a positive proposal for how theory-choice in logic operates, what is offered is only a potential model of how theory-choice *could* work, not how it does (Martin 2021b). Additionally, by relying solely upon an analogy with the methodologies of the sciences (which, as noted above, we have good reason to think possess their own methodological peculiarities), the resulting account of logic's methodology is prone to both deal in generalities which miss some of the important methodological features of the field, given its particular subject matter, and distort what happens in the field by overemphasizing similarities (Martin 2022).

In comparison, in Martin & Hjortland (2021) we find an attempt to justify methodological AEL on the basis of looking at the way that logic is actually practiced, using the so-called *practice-based approach*. According to the *practice-based approach*, the most reliable means we have to understanding the epistemology (and wider methodology) of a research field is by looking at how it is actually practiced by the experts within it. In this respect, the *practice-based approach* takes its lead from the success of similar methods in elucidating the methodological norms and epistemological standards used to justify both scientific theories and mathematical results. It is now widely appreciated within the philosophies of science and mathematics that in order to produce an adequate account of the methodology of both the empirical and mathematical sciences one needs to take into serious consideration the actual activities of their practitioners. Without these activities of the respective experts acting as a constraint upon our theories of scientific methodology, we are bound to produce over-idealised accounts of the fields, which neglected important features of their methodology (Carter 2019; Soler et al. 2014). In contrast, having embraced a *practice-based approach*, we now have a growing understanding of how explanatory models in the sciences function (Bokulich 2011; Braillard & Malatarre 2015), what constitutes scientific understanding (de Regt 2017), and the heuristics which underpin theorem-proving in mathematics (De Toffoli 2020). Similarly, according to the *practice-based approach* to the epistemology of logic, by building our account of logic's methodology up from the varied activities of its practitioners, we can reasonably hope to build a more detailed accurate picture of the field's epistemology and wider methodology. While obviously the truth of Methodological AEL is not entailed by the *practice-based approach*, it has been argued that if we look at how logicians actually go about justifying their theories, they adhere to several of the same mechanisms of theory choice which are prevalent in the sciences (Martin & Hjortland 2021).

In virtue of not attempting to justify Methodological AEL on the basis of the success of a privileged scientific method, or via an argument by analogy, the appeal to logical practice does not suffer from the same concerns as the previous justifications. It does, however, face its own considerable challenges. First, of course, it faces the challenge of competing interpretations of logical practice. The further we expand our consideration of the activities of logicians, we may well find that there are actually minimal similarities between the methodological norms of logic and those of the sciences. Second, one may be sceptical that looking at the activities of logicians provide us with much insight into logic's methodology, given that practitioners may have been engaged in epistemically inappropriate activities all along. In other words, without possessing reasons to the contrary, we have no assurance that how research in a field is *currently* practiced is a reliable guide to how it *ought* to be practiced. In order to meet these challenges, the onus is on the methodological anti-exceptionalist who uses the practice-based approach to both argue for the reliability of the method, and show how logicians' practice reveals significant similarities between the mechanisms of theory-choice in logic and the sciences.[2]

[2] For a detailed defence of the practice-based approach to the epistemology of logic, see Martin (2022 & forthcoming).

Importantly, again, neither of these descriptive motivations for Methodological AEL commit their advocates to Evidential AEL. Firstly, it is one matter to draw an analogy between the norms of theory-choice across other fields of research and logic, and another completely to conclude that the *sources of data* used across these fields are the same. After all, Priest himself cites the examples of history, ethics and the sciences as sharing the same norms of rational theory-choice, yet there's no need to think that each of these fields relies upon the same type of data to test their respective theories. Secondly, if one embraces the *practice-based approach*, then it is clearly an open possibility that logic shares with the (other) sciences important methodological features when it comes to theory choice, although the sources of data that logic uses are of a different type to the established sciences. Whether this is the case or not can only be determined by looking in detail at instances of theory choice and assessment in the field. As we shall now go onto see, both Priest (2016) and Martin & Hjortland (2021) think there's good reason to believe that the assessment of logical theories does (at least in part) rely upon *a priori* evidence.

§3 Anti-Exceptionalist Models of Theory-Choice in Logic

Combined, these varied motivations for methodological AEL have led to two general pictures of theory-choice in logic emerging, with Priest (2014; 2016) and Williamson (2017) both favouring an *abductivist* model of theory choice, and Martin & Hjortland (2021) proposing a *predictivist* account.[3]

§3.1 Logical Abductivism

According to *abductivism*, we come to be justified in believing a logical law or rule of inference not by either directly intuiting its truth, or understanding its constituent parts, but rather by being justified in believing a logical theory *L* containing the law or rule. Further, we come to be justified in believing a particular logical theory *L* because it better accommodates the relevant data, and possesses more relevant theoretical virtues, than other available theories.[4]

However, it is here that consensus among abductivists ends. First, while all agree that adequacy to *some* data is an important criterion for a successful logic, there is disagreement over what constitutes this relevant data. While for Priest (2014: 217) the relevant data for alethic logics are "those inferences that strike us as correct or incorrect", Williamson (2017: 334) also includes other "independently well-confirmed sentences, such as well-established principles of physics" as part of the data that logical theories must accommodate. Second, it's unclear to what extent abductivists agree over what constitute these further theoretical virtues which logics can possess. While each of Williamson (2017: 334), Priest (2014: 217) and Russell (2015: 800) mention the putative virtues of *strength*, *simplicity*, and *unifying power*, Williamson in addition mentions *elegance* and Priest *non-adhocness*. Further, given that none provide detailed descriptions of these virtues, it is difficult to know to what extent there is actual agreement

[3] Abductivism and predictivism are by no means the only accounts of theory-choice available for a methodological anti-exceptionalist about logic. Other options include evidential holism (as discussed in Part I of this entry), inductivism (as seemingly endorsed by J. S. Mill; cf. Godden 2017), and reflective equilibrium (Brun 2014; Peregrin & Svoboda 2017). We focus on abductivism and predictivism here because they are, at present, the most prevalent and detailed accounts in the contemporary literature. See Martin & Hjortland (2024) for further discussion of logical inductivism, and Woods (2019) and Martin (2024) for further discussion of reflective equilibrium in logic.

[4] As in Part I of this entry, in order to respect the norm within the literature, we use the term "abductivism" to refer to any account of theory-choice in logic which proposes logics are assessed on the basis of their ability to better accommodate some relevant data, and possess more relevant theoretical virtues, than competitors. As abductive accounts of a phenomenon should strictly speaking be *explanatory*, and it is not clear that all logical "abductivists" wish to take on the commitment that logics explain some phenomenon, this label is admittedly a little misleading. For further discussion of this point, see Erickson (2024).

over the positive qualities of a theory, or rather whether terms such as "simplicity" and "strength" simply serve as useful tags which hide significant disagreements among the parties.[5]

Contemporary abductivists' accounts of logical theory-choice differ from Quine's evidential holism in three important regards. First, unlike Quine, for whom observational data served as the final arbiter for all theories, including logics (Quine 1986: 100), even those such as Williamson (2017) who allow empirically well-confirmed theories to inform logic admit evidence beyond those from the empirical sciences. The role of logico-semantic paradoxes, for instance, play an important role within the epistemology for logic for Priest (2006), Russell (2015) and Williamson (1994). Second, there's no commitment on the part of the contemporary abductivist to see our logic as occupying the centre of a web of belief which is evaluated (and revised) as a whole. This has two consequences. Firstly, the abductivist need not treat all recalcitrant evidence of (non-logical) theories we endorse as a *potential* source of evidence against our logical theories. In other words, not all evidence needs to be relevant to our logical theories (unlike for the holist).[6] Secondly, the abductivist need not endorse a principle of minimal mutilation as Quine (1986: 100) did, only revising our logic in the most drastic of scenarios when no other adjustment to the web will suffice. The fact that Priest (2006) openly entertains a revision to the classical orthodoxy when classical solutions to the logico-semantic paradoxes are available is evidence enough that abductivists need not endorse the principle of minimal mutilation.[7]

Abductivism has come under criticism recently from Martin & Hjortland (2021) for failing to specify the mechanisms by which logics "accommodate" the relevant data, and not providing greater clarity on these further theoretical virtues that ought to be included in the evaluation of logics, including why these particular virtues are suitable to rationally inform our choice of the correct logic. In its place, they propose a predictivist model of theory-choice informed by logical practice which they claim details the mechanisms by which data informs logical theories, and specifies which further theoretical virtues justify logics and why.

§3.2 Logical Predictivism

Logical predictivism proposes that logical theories are justified, and ultimately chosen, on the basis of their predictive success, explanatory power, and compatibility with other well-evidenced commitments. In order to be able to provide fruitful explanations of the target phenomenon, and produce predictions to be tested against suitable data, logical theories are not conceived as simply sets of valid rules of inference or theorems, as is often the case. Instead, we should think of theories as a set of definitions, laws and representation rules that provide the underlying semantics and syntax of the theory, as well as specifying how the theory connects to the target phenomenon. It is then these definitions, laws and representational rules which *produce* a set of inference rules and theorems. For instance, here is a toy example of classical propositional logic under such an account:

Theory A

Definition 1: Let $\neg\phi$ be Boolean negation.

---

[5] In the case of one of these putative virtues, *strength*, it has actually been argued that once we attempt to provide some clarity over its content, we cannot help but admit it is not a theoretical virtue at all (Russell 2019). This gives some general basis, without reason to the contrary, to be sceptical regarding the status of these supposed theoretical virtues in logic (Martin & Hjortland 2021).

[6] An obvious exception here is Williamson (2000), for whom all knowledge constitutes possible evidence for our theories, and thus is likely to endorse this principle when it comes to logical theories too. However, this is an independent commitment which Williamson takes on, not required by abductivism itself.

[7] Interestingly, despite his continued endorsement of classical logic, Williamson (2017) himself denies that he endorses Quine's principle of minimal mutilation within his abductivist account of logic's epistemology; arguing instead that his own notion of *logical strength* is distinct from Quine's epistemic conservatism, while delivering the same outcome. See Beall (2019) for an argument to the effect that Williamson's *logical strength* criterion is Quine's principle of minimal mutilation in disguise.

Definition 2: Let $\phi \rightarrow \psi$ be Boolean material implication.
Representation Rule 1: $\ulcorner$not $\phi\urcorner = \ulcorner\neg\phi\urcorner$.
Representation Rule 2: $\ulcorner$if ϕ then $\psi\urcorner = \ulcorner\phi \rightarrow \psi\urcorner$.
Law 1: For every valuation, all sentences are either true or false, and not both.
Law 2: An argument is valid iff, for every valuation *v*, if every premise is true in *v*, the conclusion is true in *v*.

According to predictivism, theories are initially motivated by examples of arguments judged to be acceptable. As was often the case in early symbolic logic, these can take the form of informal mathematical proofs, judged to be acceptable by mathematicians, or rather natural-language arguments, judged to be acceptable by certain "reliable reasoners".[8]

In the particular case of informal proofs, having assumed that mathematicians' judgements about acceptable inferences are a reliable (though fallible) guide to which putative proofs are valid and which invalid, the logician then aims to provide an account of *why* certain proofs are valid and others invalid. To achieve this, she first forms a general hypothesis that inferences across multiple proofs may be (in)valid for the same reasons, because they share some *underlying form*. Secondly, she proposes a concrete hypothesis about the validity of an argument form that she thinks is exemplified by inferences within "acceptable" informal proofs. For instance, she may hypothesize that contraposition is valid:

Hypothesis 1

All arguments of the form

If not *B* then not *A*
If *A* then *B*

are valid.

Note, however, that this hypothesis does not by itself constitute an explanation of why the target proofs are valid. Rather, it is simply a generalisation that can subsequently be further confirmed or falsified. It is no more an explanation of the validity of contraposition than the generalisation "All swans are white" is an explanation of why swans are white. In order to *explain* why arguments of this form are valid (if they are), our logician must propose a theory (such as *Theory A*) that provides a set of postulates prescribing the behaviour of the argument's components and the consequence relation. The aim is for this theory to be able to explain why the given hypothesis is true (in this case, why contraposition is valid), by showing that the arguments' validity result from the theory's definitions and laws. Such an explanation would include detailing how the underlying form of these arguments ensured that when the premises are true, so is the conclusion, and that this subsequently ensured the arguments were valid.[9]

Importantly, while the proposed *Theory A* may provide one possible explanation of Hypothesis 1's truth, it is not the only possible theory that does so—it is not hard to find a theory that "fits" this initial data. Thus, further evidence needs to be found for *Theory A* that shows it to be preferable to competitors. One main route through which this is achieved is by making predictions on the basis of the theory's postulates, and subsequently testing these predictions. After all, the postulates of *Theory A* which (putatively) explain the truth of Hypothesis 1 do not only ensure contraposition is valid, but many other argument forms (including *modus ponens* and *tollens*). Further, these consequences of the theory can then be tested against whether mathematicians find inferences of these argument

[8] This brings up the interesting question of what warrant we have for thinking there are such reliable reasonsers, and how we go about identifying them. We come back to this topic in the following section.

[9] It is an interesting question how we should understand these (putative) explanations of validity within logic relative to paradigm explanations within the sciences. See Martin (2021a) and Payette & Wyatt (2019) for discussion.

forms within (putative) informal proofs acceptable or not, given that the logician assumes mathematicians' judgements over the (un)acceptability of putative proofs are a reliable guide to their (in)validity, respectively. Ultimately, if the logician finds that mathematicians' judgements fit her theory's predictions, then the theory is further supported. Inversely, if the judgements consistently contradict its predictions, then the theory faces problems which need to be somehow explained away (as in the empirical sciences).[10] The extent to which a given theory is evidenced is dependent upon its success *relative to competitors*—whether the theory is more predictively successful than alternative available theories.

Further, although the predictive success of a logic relative to the judgements of mathematicians and other "reliable reasoners" regarding acceptable inferences is the most *direct* form of evidence that theories of validity possess, they are not the only relevant theoretical criteria. For instance, one theory can be preferred to another which is relatively similar in terms of its predictive success due to its ability to explain more transparently with its semantics *why* the relevant domain of arguments are (in)valid. Again, modern logics do not merely provide us with a set of generalisations over valid argument schemas, but rather *explain* why arguments of this form are valid.[11]

§4 Live Challenges for Methodological AEL

The exact challenges facing methodological AEL depend upon which project—normative or descriptive—it is primarily engaged with. For those anti-exceptionalists engaged in the normative project, their burden is to demonstrate that an anti-exceptionalist model of logical theory-choice, such as abductivism or predictivism, is either more adequately suited to the subject matter of logic than exceptionalist accounts of theory choice, or that in virtue of *methodological naturalism*, we are rationally obliged to endorse one of these anti-exceptionalist models given its semblance to the scientific method. In comparison, for those engaged in the descriptive project, the onus is on them to demonstrate that a particular anti-exceptionalist model of theory choice makes better sense of actual logical practice than competing exceptionalist proposals.

This being said, regardless of whether the anti-exceptionalist is engaged in the normative or descriptive enterprise, both abductivism and predictivism face two notable challenges. Firstly, what is known as *background logic* (or, *centrality*) *problem* (Martin 2021b; Shapiro 2000; Wright 1986). Both abductivism and predictivism require that a logic be tested against some non-immediate data, whatever form this data takes. Yet, admitting that this data can play an evidential role requires that we make *inferences* in order to establish the (in)compatibility of the relevant data with the target logical theory. Yet, what guarantees we can reliably use these inferences in order to adequately test the logic? It can't be that the logic under examination itself sanctions the inferences, for this would simply beg the question in favour of the given logic. Similarly, we can't rely on inferences *not* sanctioned by the logic under examination, for if we were to rely upon these inferences to substantiate evidence for the logic, as soon as we were persuaded to accept the logic these prior justifications would be immediately undermined and evaporate. Consequently, any non-foundationalist epistemology of logic owes us a story of how we can rely upon inferences that mediate between the relevant data and target logical theory in order to reliably test the logic.[12]

Secondly, given that all current versions of abductivism and predictivism include judgements over the acceptability of particular arguments as an important source of data in order to test logics, this means that current methodological AEL models of theory-choice either presume that certain reasonsers' judgements over the (un)acceptability of particular inferences are *treated* as reliable data for logics by logicians (if their focus is primarily *descriptive*), or

[10] See Martin & Hjortland (2021) for a discussion of the options logicians have available to "explain away" apparently recalcitrant data.

[11] See Martin & Hjortland (2021) for discussion of other forms of *indirect* evidence for logics, including *post-hoc rejections*.

[12] See Martin & Hjortland (2024) for a discussion of some live solutions to the problem.

indeed that these judgements *are* reliable data to test logics (if their focus is primarily *normative*). This raises the important questions of *why* judgements over the (un)acceptability of an inference should be considered reliable data for theories of validity, and further how we go about identifying the *reliable reasoners* whose judgements provide such data, on the assumption that not all reasoners are. The current lack of an adequate answer to these questions has led some (dos Santos 2021) to call into question the role of such judgements in logic's epistemology.[13]

References

Beall, Jc. (2019). On Williamson's New Quinean Argument against Nonclassical Logic. *Australasian Journal of Logic*, 16, 202–30.

Bokulich, A. (2011). How Scientific Models Can Explain. *Synthese,* 180, 33–45.

Braillard, P. A. & Malaterre, C. (2015). Explanation in Biology: An introduction (pp. 1–28). In: *Explanation in Biology,* P. A. Braillard & C. Malaterre (eds.). Dordrecht: Springer.

Brun, G. (2014). Reconstructing Arguments: Formalization and reflective equilibrium. *History of Philosophy and Logical Analysis*, 17, 94–129.

Carter, J. (2019). Philosophy of Mathematical Practice: Motivations, themes and prospects. *Philosophia Mathematica* 27, 1–32.

De Regt, H. W. (2017). *Understanding Scientific Understanding*. Oxford: Oxford University Press.

De Toffoli, S. (2020). Reconciling Rigor and Intuition. *Erkenntnis,* 86, 1783–1802.

dos Santos, C. F. (2021). Intuitions, Theory Choice and the Ameliorative Character of Logical Theories. *Synthese*, 199, 12199–223.

Erickson, E. (2024). More Limits of Abductivism About Logic. *Studia Logica*. Online First: https://doi.org/10.1007/s11225-024-10130-4

Godden, D. (2017). Mill on Logic. In: *A Companion to Mill* (pp. 175–91)*,* C. Macleod & D. Miller, (eds.). Hoboken, NJ: John Wiley & Sons.

Maddy, P. (2007). *Second Philosophy: A Naturalistic Method*. Oxford: Oxford University Press.

Martin, B. (2021a). Anti-Exceptionalism about Logic and the Burden of Explanation. *Canadian Journal of Philosophy,* 51, 602-18.

Martin, B. (2021b). Identifying Logic Evidence. *Synthese*, 40, 9069–95.

[13] See Martin & Hjortland (2022) for a recent discussion of the challenge, which suggests that establishing the source of the reliability of these judgements will likely depend upon establishing what metaphysically grounds facts about validity.

Martin, B. (2022). The Philosophy of Logical Practice. *Metaphilosophy,* 53, 267-83.

Martin, B. (2024). Reflective Equilibrium in Logic. *Synthese,* 58. Online first: https://doi.org/10.1007/s11229-023-04480-0

Martin, B. (forthcoming). The Practice-Based Approach. In: *The Oxford Handbook of Philosophy of Logic*, E. Brendel, M. Carrara, F. Ferrari, O. Hjortland, G. Sagi, & G. Sher (eds.). Oxford: Oxford University Press.

Martin, B. & Hjortland, O. T. (2021). Logical Predictivism. *Journal of Philosophical Logic*, 50, 285–318.

Martin, B. & Hjortland, O. T. (2022). Anti-Exceptionalism as Tradition Rejection. *Synthese*. Online first: 10.1007/s11229-022-03653-7

Martin, B. & Hjortland, O. T. (2024). Evidence in Logic. In: *Routledge Handbook for Philosophy of Evidence* (pp. 467–82), M. Lasonen-Aarnio & C. Littlejohn (eds.). London: Routledge.

Payette, G. & Wyatt, N. (2019). How Do Logics Explain? *Australasian Journal of Philosophy*, 96, 157–67.

Peregrin, J. & Svoboda, V. (2017). *Reflective Equilibrium and the Principles of Logical Analysis: Understanding the Laws of Logic*. London: Routledge.

Priest, G. (2006). *In Contradiction: A Study of the Transconsistent* (2nd ed.). Oxford: Clarendon Press.

Priest, G. (2014). Revising Logic. In P. Rush (ed.), *The Metaphysics of Logic* (pp. 211–23). Cambridge: Cambridge University Press.

Priest, G. (2016). Logical Disputes and the a Priori. *Logique et Analyse*, 59, 347–66.

Quine, W. V. O. (1951). Two Dogmas of Empiricism. *Philosophical Review*, 60, 20–43.

Quine, W. V. O. (1986). *Philosophy of Logic* (2nd ed.). Cambridge, MA: Harvard University Press.

Ruphy, S. (2016). *Scientific Pluralism Reconsidered: A new approach to the (dis)unity of Science*. Pittsburgh, PA: University of Pittsburgh Press.

Russell, B. (1919). *Introduction to Mathematical Philosophy*. London: George Allen & Unwin.

Russell, B. (1949) [1917]. On Scientific Method in Philosophy. In *Mysticism and Logic and Other Essays* (8th ed., pp. 97–124). London: George Allen & Unwin.

Russell, G. (2015). The Justification of the Basic Laws of Logic. *Journal of Philosophical Logic*, 44, 793–803.

Russell, G. (2019). Deviance and Vice: Strength as a theoretical virtue in the epistemology of logic. *Philosophy and Phenomenological Research*, 99, 548–63.

Shapiro, S. (2000). The Status of Logic. In: C. Peacocke & P. A. Boghossian (eds.), *New Essays on the A Priori* (pp. 333–66). Oxford: Oxford University Press.

Sher, G. (2016). *Epistemic Friction: An Essay on Knowledge, Truth and Logic*. Oxford: Oxford University Press.

Soler L, *et al*. (2014). Introduction. In: *Science After the Practice Turn in the Philosophy, History, and Social Studies of Science* (pp. 1–43), L. Soler, S. Zwart, M. Lynch, and V. Israel-Jost (eds.). London: Routledge.

Warren, J. (2020). *Shadows of Syntax*. Oxford: Oxford University Press.

Williamson, T. (1994). *Vagueness*. London: Routledge.

Williamson, T. (2000). *Knowledge and Its Limits*. Oxford: Oxford University Press.

Williamson, T. (2007). *The Philosophy of Philosophy*. Oxford: Blackwell.

Williamson, T. (2017). Semantic Paradoxes and Abductive Methodology. In: B. Armour-Garb (ed.), *The Relevance of the Liar* (pp. 325–46). Oxford: Oxford University Press.

Woods, J. (2019). Against Reflective Equilibrium for Logical Theorizing. *Australasian Journal of Logic*, 16, 319–41.

Woody, A. I. (2003). On Explanatory Practice and Disciplinary Identity. *Annals of the New York Academy of Sciences*, 988, 22–9.

Woody, A. I. (2015). Re-orienting Discussions of Scientific Explanation: A Functional Perspective. *Studies in History and Philosophy of Science*, 52, 79–87.

Wright, C. (1986). Inventing Logical Necessity. In: J. Butterfield (ed.), *Language, Mind, and Logic* (pp. 187–209). Cambridge: Cambridge University Press.