



Logical Instrumentalism and Anti-exceptionalism about Logic

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Abstract

This paper critically examines logical instrumentalism as it has been put forth recently in the anti-exceptionalism about logic debate. I will argue that if one wishes to uphold the claim that logic is significantly similar to science, as the anti-exceptionalists have it, then logical instrumentalism cannot be what previous authors have taken it to be. The reason for this, I will argue, is that as the position currently stands, first, it reduces to a trivial claim about the instrumental value of logical systems, and second, by its denial that logic aims to account for extra-systemic phenomena it significantly differs from science, in contrast with the AEL agenda. I will conclude by proposing a different kind of logical instrumentalism that I take to have a broad appeal, but especially for anti-exceptionalists, for it is developed as analogous to—and thus much closer aligned with—scientific instrumentalism.

1 Introduction

Anti-exceptionalism about logic (AEL) is the thesis that logical theories are significantly similar to scientific theories, for example with respect to their epistemic status or methodology (Hjortland, 2017; Martin & Hjortland, 2022). Within the debate regarding this thesis (henceforth: the AEL debate), some authors have recently proposed various versions of what can be labelled *logical instrumentalism*, being the idea that logic should essentially be understood as a tool or instrument to achieve particular purposes (Arenhart, 2020; Dos Santos, 2021; Peregrin & Svoboda, 2021). The main aim of this paper is to critically examine current instrumentalist proposals in the AEL debate. I will argue that logical instrumentalism cannot be what previous authors in the AEL debate have taken it to be, first, due to challenges to logical instrumentalism more generally, and second, because of a significant dissimilarity with its counterpart in science, being scientific instrumentalism. I will then aim to show that the *lessons learned* from scientific instrumentalism can be fruitfully

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applied to improve the logical instrumentalist position, and I will provide the outline for such an improvement.

This paper runs as follows. In the Sect. 2, I will introduce AEL and clarify which version I will be working with in this paper. In the Sect. 3, I will introduce one kind of logical instrumentalism, and show that three recent instrumentalist proposals in the AEL debate are all of the kind presented earlier by Haack (1978). In Sect. 4, I will present challenges facing this kind of logical instrumentalism and show that the current instrumentalist proposals fail to meet these challenges. In Sect. 5, I will present scientific instrumentalism and show how this position has been faced with similar challenges as logical instrumentalism is facing, and how scientific instrumentalism has dealt with these challenges. In Sect. 6, I will provide an outline of a different kind of logical instrumentalism—for lack of a better term, I will label it *proper* logical instrumentalism—that is developed analogous to scientific instrumentalism.

2 Anti-Exceptionalism about Logic

Anti-exceptionalism about logic (AEL) is the thesis that logical theories are significantly similar to scientific theories, for example with respect to their epistemic status or methodology. Hjortland (2017) initially described the tenets of AEL as follows:

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. (p. 632).

There has been considerable debate over the question whether this is indeed the best way to understand AEL. Some have argued, for example, that this initial description of the basic tenets of AEL has proven to be problematic. For example, it has been argued that the suggestion that logic is *continuous* with science is too vague (Rossberg & Shapiro, 2021). Furthermore, exactly in what respects do the *methods* of logic can be likened to the methods of science (Martin, 2022)? And what do we mean by *science* here anyway? Martin and Hjortland (2022) aim to distinguish between various conceptions of AEL. First, they present the distinction between AEL as *continuity* and AEL as *tradition rejection*. AEL as continuity holds that logic is continuous with the empirical sciences and has its roots in the quote by Hjortland (2017) presented in the above. On the other hand, Martin and Hjortland offer a conception of AEL as tradition rejection. On this conception of anti-exceptionalism, “[l]ogic either fails to possess at least some of the properties traditionally assigned to it which were thought to make logic exceptional, or possesses them in an unexceptional fashion” (p. 5).

The aim of this paper is not primarily to contribute to a further clarification of AEL. Rather, I will assess a particular position put forth within the AEL debate, namely that of *logical instrumentalism*. The examples of instrumentalist proposals that I will present and discuss here all employ a conception of AEL as continuity with the (empirical) sciences. Peregrin and Svoboda (2021), for example, present

AEL—via Hjortland (2017)—as the idea that “logical methodology is much more continuous with the methodology of the sciences than logicians have traditionally tended to think” and write that they “are very much sympathetic with this approach to logic” (p. 8782)—although they also argue that anti-exceptionalists should not overlook features which *distinguish* logic from other sciences, hence the label *moderate* AEL to the position they put forth. Arenhart (2020) also adopts the conception of AEL as continuity when presenting, again, the proposal by Hjortland (2017) to consider, via what is labelled *gradualism*, theories of logic as continuous with theories in science (p. 3). Dos Santos (2021), lastly, takes as its starting point the view presented by Bueno and Colyvan (2004) that logic is in the same epistemic boat as other scientific theories (p. 12199).

In the remainder of this paper, I will critically examine three instrumentalist proposals and will come to argue that this kind of instrumentalism faces serious challenges, especially within a broadly anti-exceptionalist framework. In the following section, I will present one kind of logical instrumentalism and show that the proposals under scrutiny here are versions of that kind.

3 Logical Instrumentalism

A natural starting point for presenting logical instrumentalism is Haack (1978).¹ In mapping the pluralism-monism debate, Haack identifies “three broad kinds of response to the question of whether there is a uniquely correct logical system” (p. 221). According to *monism*, there is just one correct system of logic. According to *pluralism*, there is more than one correct system of logic. And lastly, according to *instrumentalism*, there is no ‘correct’ logic. Rather, the notion of correctness is inappropriate, according to the latter view. Her brief presentation, worth quoting in length, runs as follows:

The instrumentalist position results from a rejection of the idea of the ‘correctness’ of a logical system, an idea accepted by both monists and pluralists. On the instrumentalist view, there is no sense in speaking of a logical system’s being ‘correct’ or ‘incorrect’, though it might be conceded that it is appropriate to speak of one system’s being more fruitful, useful, convenient ... etc. than another (perhaps: for certain purposes). The rejection of the concept of correctness is apt to be based on a rejection of the extra-systematic ideas of logical truth and validity which that conception requires [...]. An instrumentalist will only allow the ‘internal’ question, whether a logical system is *sound*, whether, that is, all and only the theorems/syntactically valid arguments *of the system* are logical true/valid *in the system*. (p. 224).

It is from this rejection of the extra-systemic notion of logical truth or validity that the instrumentalist rejects the applicability of a notion of correctness for logical systems, according to Haack. As there is nothing that we can ‘measure’ the

¹ Note that Haack does not *endorse* logical instrumentalism, but merely *presents* it as an option in the context of the pluralism-monism debate.

correctness of a logical system against, we can say that logical systems are not truth-apt. We are left only with the logical truth or validity *within* a system. However, these logical systems could be *used* for specific purposes or goals, and some systems might be better suited to achieve these purposes or goals than others. But that would not be because it better represents an extra-systemic notion of logical truth or validity, for the instrumentalist rejects that those exist outside of a logical system.²

Following Haack's presentation, we can present logical instrumentalism as containing two core elements: the *logic-as-tool view* and *non-representationalism about logic*.

Logic-as-Tool View: logics are best understood as tools, a technology or instruments to achieve particular goals or purposes.

Non-Representationalism about Logic: logics do not represent any extra-systemic phenomenon.

As I will show, recent examples of logical instrumentalist proposals in the AEL debate adopt the same core-elements as the one presented by Haack. Versions of logical instrumentalism that do so are versions of instrumentalism that I will label *Haackian logical instrumentalism*. I will argue that Haackian logical instrumentalism faces particular challenges that make it that it conflicts with a broadly anti-exceptionalist agenda. First, I will present the three logical instrumentalist positions as put forth in the AEL debate.

The first example is due to Arenhart (2020). He puts forth his version of instrumentalism in response to the *background logic problem*, which is the issue of how to evaluate evidence for a logical theory without already pre-supposing some notion of validity, as the latter is considered to be precisely what is at stake in a logical theory. Arenhart takes this to be a major challenge for AEL and takes it that the position he puts forth offers a satisfactory treatment of the problem by rejecting the idea that natural language has a logic of its own that we use to evaluate evidence for a logical theory or system. This leads him to endorse a form of *logical nihilism*, but he quickly points out that "[l]ogical nihilism does not mean abandoning the very idea that a system of logic can be chosen for given purposes, and that one of them may be better suited to deal with the evidence than others" (p. 22).³ This is the logic-as-tool view. Arenhart then endorses non-representationalism when he writes that "we also abandon the idea that the aim of the activity of logicians is attempting to find out something that is already there 'in the wild', the idea that there is a notion of validity *simpliciter*" (p. 22). That leaves

² As a historical note, this conception of instrumentalism appears to be very much like the position put forth by Carnap (1937). For one, the well-known *Principle of Tolerance* can easily be interpreted in a goal-oriented fashion (see for example Warren (2020, p. 152) and Caret and Kouri Kissel (2021, p. 4790)), but, moreover, in the foreword of *The Logical Syntax of Language* Carnap explicitly rejects the notion of 'correctness' in the case of logic (1937, p. xv).

³ According to Kouri Kissel (2019), "[Haack's] use of the term [logical instrumentalism] picks out something closer to what would today be called a logical nihilism" (p. 154, fn. 1). For a recent discussion of logical instrumentalism as a kind of logical deflationism, see Shapiro (2022).

him with accepting only ‘instrumental applications’ of logical systems. Thus, this proposal, can be seen as a Haackian kind of logical instrumentalism.

Dos Santos (2021) criticizes anti-exceptionalist accounts of theory-choice in logic that he takes to rely on pre-theoretical logical intuitions for the assessment of candidate logical theories. Dos Santos takes these accounts to aim for an accurate representation of such intuitions, but he argues against the reliability of these intuitions, and he moves on to argue that logical theories are not representational, but rather ameliorative. That is, logical theories do not aim for an accurate representation of intuitions about logical consequence, but rather aim to improve upon such intuitions, and Dos Santos points out that on the ameliorative account, “there is no matter of fact about whether there are universally true logical laws” (p. 12,220). It is in this sense that Dos Santos endorses a form of non-representationalism about logic. On the ameliorative approach logical theorizing aims to “identify what purposes the concept in question is supposed to serve and, second, to improve on the available concept, or replace it by a new one, so that it can serve that purpose better” (p. 12,215). Furthermore, given that “logics are investigative tools used by specialists with specific purposes in mind” (p. 12,219), and that the choice of a logical theory, according to Dos Santos, “is always instrumental, to fulfill certain investigative purposes in specific contexts” (p. 12,219–20), he also adopts the logic-as-tool view. Combined with non-representationalism about logic, this makes this proposal another Haackian kind of logical instrumentalism.

A final example is due to Peregrin and Svoboda (2021), who aim to put forward and defend a view of the nature of logic they call *moderate anti-exceptionalism*. They take aim at the idea that the phenomenon logic aims to account for is that of *genuine validity*. They quote Hjortland (2019), who writes that:

[n]o one is disagreeing about, say, whether the law of double negation is classically valid. It is, and that is uncontroversial. The disagreement is about whether or not it is *genuinely* valid. (p. 252–253).

However, Peregrin and Svoboda argue against the idea that there actually is something like *genuine* validity, by arguing that the genuine logic can neither be an artificial language (for that would already presuppose a notion of validity) nor natural language (for that would make the issue of a genuine logic into empirical linguistics). They then move on to argue that “[i]f we give up on the idea of genuine logic we are, we will argue, left with logic as a human project—a project launched primarily to assure that our communication can be, whenever it is desirable, subject to public control” (p. 8784). On their picture:

logic, unlike the sciences, is not only (or not even primarily) a descriptive and explanatory enterprise. It is also (and perhaps primarily) a technology. It is a toolbox that aims to make something that we people do be more effective. (p. 8799).

Here we find again the two elements of logical instrumentalism: logic is not (primarily) descriptive, i.e., non-representational, but logic is primarily a tool or technology, i.e., the logic-as-tool view. This *moderate* AEL holds that logic is

not exceptional with respect to its subject matter in that the only world it has to do with is the natural world, but it does differ from (empirical) science in that *predictions* do not seem to be a reasonable goal in logic. Rather, the (primary) goal that Peregrin and Svoboda take logic to achieve is that of improving reliable communication. This aims to establish that the proposal put forth by Peregrin and Svoboda counts as a form of Haackian logical instrumentalism, and thus, as I will aim to show later, is susceptible to my critique of this position.

This concludes the presentation of logical instrumentalism and three of its versions put forth in the AEL debate. In the next section I will move on to critically assess this kind of logical instrumentalism more generally before I will focus on assessing the instrumentalist proposals presented in the above.

4 Challenges for Logical Instrumentalism

Logical instrumentalism as I have presented it in the above is not without its challenges. In this section I will examine the two core elements of logical instrumentalism on the Haackian picture more closely, and argue that in its current form the position reduces to a trivial claim about the instrumental value of logical systems and to a theory about the nature of logic with little to none explanatory value.

Recall that on the logic-as-tool view logics are to be understood as tools, a technology or instruments to achieve particular goals or purposes. Such a view has been put forth not only on the instrumentalist proposals in the AEL debate. For example, Dutilh Novaes (2012) considers formal languages such as those of logic and mathematics as cognitive, epistemic tools that have been developed, for the most part, as tools for more efficient computation and calculation. In the debate on logical pluralism Kouri Kissel (2019) puts forth a version of logical instrumentalism understood as the position that holds that “the norms of deductive reasoning should be evaluated based on one’s aims and goals in reasoning and the domain of investigation” (p. 154). As such, “[l]ogical instrumentalism could equally well be called goal-driven logical pluralism” (p. 154), given that there is a variety of goals to logic, and different goals require different tools—that is: different logics—to be fulfilled.

But what does it actually mean to say that logic is a tool? A first thing we need to be clear about is what we mean by ‘logic’ in this context: are we talking about logical *systems* or logical *theories*? Hjortland (2019) is careful to distinguish these two⁴:

A logical theory is not a proof system or a formal semantics with a consequence relation. Granted, formal systems typically contribute to logical theories. Our understanding of the property of validity is improved by formal counterparts such as model-theoretic consequence. But a logical theory should not be equated with the model theory. The model theory is not an account of logical properties in its own right—it is merely a formalism. For it to be part of a theory it requires an application, and it is the logical theory that states what the application is. (p. 252–253).

⁴ But see also Martin and Hjortland (2021, p. 289).

In other words, on the one hand we have a *theory* about logical properties that states, for example, whether validity is taken to be metalinguistic or non-metalinguistic—that is: whether validity is a property of language or of the (non-linguistic) world –, what exactly the *relata* for logical consequence are taken to be, and what the overall aim of logic is taken to be. On the other hand, we have the *formalism* that helps us to make better sense of these properties as they are conceived of within the theory that the formalism is a part of. Put differently: while a logical *system* is merely a formal apparatus or calculus, a logical theory on the other hand is a *theory* about the logical properties, such as validity. A logical system can contribute to a better understanding of a particular logical theory, but we should not conflate these two notions, for simply they are two different things.

There has been a growing interest in the literature on the philosophy of logic in this distinction between logical theories and logical systems. Recently, for example, Stei (2023) employs the distinction in the debate on logical pluralism. Stei takes logic to provide a *theory* of deductive validity, but notes that:

the mathematical framework [i.e., the *system*] may be very helpful when it comes to making theories precise, it does not seem to be indispensable when formulating such a theory. Logicians can propose theories of validity without relying on formal systems in the sense introduced above [*pure* formal systems] – many have actually done so. (p. 16)

Importantly, Stei takes the fundamental difference between theories and systems to be that:

[t]heories, quite generally, do not simply list laws. They also aim at providing explanations as to why these laws hold. More specifically, applied logics do not just list which arguments are valid. Being theories, they typically come with an underlying philosophical account of, say, what truth values there are and which of them are designated, or of which terms constitute the logical vocabulary. (p. 18)

Following up on the latter point of an underlying philosophical account, consider for example the case of intuitionism: Brouwer had a particular *theory* about logic and its properties that came with a particular underlying philosophical account, whereas Heyting developed a formal *system* that helped to elucidate that particular theory. Now, one can of course appreciate or even adopt the system for reasons other than its connection to—or: elucidation of—the particular theory. For example, an intuitionist like Dummett need not agree fully with Brouwer's theory about logic or its underlying philosophical account in order to use the system. I take it that this just shows, again, that theory and system—although connected – strictly speaking come apart.

In what follows I will aim to show how this distinction between logical theories and logical system plays an important role in understanding and evaluating (different versions of) logical instrumentalism, but before I move on, there are two points related to this distinction that I would like to make here in anticipation of considerations later in this paper. The first point is concerned with the metaphysical

commitments of this distinction, as one might wonder whether the distinction between logical theories and logical systems is committed to a broadly *realist* account of logic.⁵ For example, one might think that if logical theories aim to provide an account of some extra-systemic phenomenon, that would already entail that that particular phenomenon is *real*, in some sense. If that would be the case, then any emphasis on logical theories in this sense would already rule out anti-realist views on logic, or so the objection might go. However, this is not the case: the distinction between logical theories and logical systems does not carry any substantial metaphysical commitments, except for the claim that indeed logic aims to account for *some* extra-systemic phenomenon, but that claim alone is not tied to any particular metaphysical view. To borrow terminology from Stei (2023), the distinction between logical theories and logical systems is only *mildly metaphysical* in the sense that it does not involve extensive metaphysical commitments, but it does involve commitment to the existence of some extra-systemic phenomenon that logical theories aims to capture.⁶ To be fair, if *that* is a commitment one does not wish to bear—as might be the case for some of the instrumentalist proposals presented in the above⁷—then the distinction between theories and systems as presented in the above might indeed have no appeal, but in the remainder of this paper I will argue that, especially in the context of anti-exceptionalism, rejecting even such a *minimal* or *mildly* metaphysical commitment is unsatisfactory. One of the reasons for that, which leads me to the second and final point I'd like to make here about the distinction between theories and system, is that in science matters are no different with respect to such a distinction: a theory about some phenomenon—say: celestial bodies—is complemented with a mathematical model that can provide us, among other things, predictions regarding the phenomenon in play. Just as a model is complementary to the theory in science, so is the formalism complementary to the theory in logic.⁸

With this basic characterization of the distinction between logical theories and logical systems in play, let me show how this distinction is important in understanding and evaluating logical instrumentalism. Most importantly, those who we have seen articulate some version of the logic-as-tool view take it that logical *systems* have instrumental value. This is also how Haack (1978) presented it. Recall that on her instrumentalist picture:

there is no sense in speaking of a logical *system's* being 'correct' or 'incorrect', though it might be conceded that it is appropriate to speak of one *system's* being more fruitful, useful, convenient ... etc. than another (perhaps: for certain purposes). (p. 224, emphasis added).

⁵ I would like to thank an anonymous referee for pressing this point.

⁶ See Stei (2023, p. 46) for the use of the term 'mildly metaphysical' in a slightly different, yet related context.

⁷ See also Peregrin and Svoboda (2022) for an endorsement of the view that logic primarily serves as a tool (*logica serviens*), in contrast to the view that logic primarily aims at revealing the laws valid in a specific domain of reality (*logica dominans*).

⁸ Exactly how theories and model relate to each other is matter of dispute and diverging views on how (close) they are connected exist (see for example Frigg 2023). We need not further elaborate on this matter here, but only need to endorse the uncontroversial idea that they are essentially different.

The more recent instrumentalist proposals under scrutiny in this paper follow the same path as Haack on this. Arenhart (2020), for example, talks about *systems of logic* and *logical systems* throughout the paper, and there is no indication that something different is meant. Peregrin and Svoboda (2021) explicitly refer to logic as an apparatus built and used within the discipline that has the same name (p. 17), and in defense of such an understanding of logic they write that “[t]he long-lasting concentration on the formal issues has led to a point where a number of logicians identify logic with what we can call *the apparatus—or machinery— of logic*” (p. 18). Whether the latter is an empirical-sociological fact or not, as I’ve argued in the above, I believe that we need to resist this temptation of collapsing logical systems with logical theories, especially when considering logical instrumentalism: for the idea that the instrumental value of logical *systems* is undisputed, but not so for logical *theories*. I will elaborate on this further below, but first, for the sake of completeness, I would like to note that the case here is slightly different for Dos Santos (2021). On his picture logical theories *are* theories about something, more specifically theories about validity. It’s just that, according to Dos Santos, we were wrong in thinking pre-theoretical intuitions about validity are the phenomena that logicians (should) try to capture or describe. The alternative ameliorative picture he provides is one where logical theories do not *represent* logical intuitions, but aim to *improve* upon them. One might argue, however, that what Dos Santos merely shows is that if his argument succeeds logical theories do not represent *logical intuitions*, but this doesn’t exclude the possibility that those theories might represent something other than logical intuitions.⁹

Here is my first critique of the Haackian kind of logical instrumentalism: if the logic-as-tool view is to be understood as the idea that logical *systems* are to be understood as tools, a technology or instruments to achieve particular goals or purposes, then this reduces the logic-as-tool view to a trivial claim about the instrumental value of logical systems. For it is a trivial fact that different logical systems have been successfully applied to a variety of applications, such as in mathematics, computer science, linguistics, or electronic circuit design.¹⁰ For example, Cook (2010) considers what type of logical pluralism would be substantial and significant. One version of logical pluralism Cook considers, which very much resembles the goal-and application-oriented logic-as-tool view, is that of *Mathematical Application Pluralism (MAP)**, being the idea that “[t]he correct logic (relative to the goals of applied mathematics) is relative to the phenomenon that logic is meant to represent” (p. 494). But, Cook moves on to consider such a pluralism (and equivalent versions thereof) to be trivially true, given that “logics have been central to the study of a number of phenomena, [...] such as electronic circuit design, database management and internet security” (p. 494). A similar point has also been made by Priest (2006), who makes a distinction between *pure* and *applied* logics. A *pure* logic is nothing more than a “well-defined mathematical structure with a proof-theory,

⁹ Thanks to Matti Eklund for pointing this out.

¹⁰ One might however say that although this is *true*, the *triviality* of this is not so obvious, given that from a historical perspective it has not always been so obvious that logic *could* actually be applied on the many phenomena that logic is being applied on nowadays (see Cook 2010, Commandeur 2022).

model theory, etc.” (p. 195). An *applied* logic is simply a pure logic *applied*—or: interpreted—in some particular way, and then the logic “becomes a *theory* of how the domain in which it is interpreted behaves”.¹¹ Priest acknowledges that there are various things that we can do with logic and concludes that “it is clear and uncontroversial that different pure logics may be appropriate for each application” (p. 196). However, if the logical instrumentalist stops here, then it lacks an account of *why* these systems have been successful in their application. We can better see what the challenge for the instrumentalist here is when we consider the second key-feature of Haackian logical instrumentalism: non-representationalism about logic.

Recall that non-representationalism about logic is the view that logics do not represent any extra-systemic phenomenon. However, especially when combined with the logic-as-tool view that emphasizes the success of logical systems on a variety of applications, non-representationalism faces the challenge of accounting for precisely the success of particular logical systems. And without an *explanation* of the success of the logical system, logical systems might in some cases indeed turn out to be useful tools for particular applications, but since their success is—as Cook (2002) puts it—apparently only due to magic or happenstance, we are offered no significant or ‘philosophically illuminating’ insights. For example, it cannot account for the fact that arguments of a certain form consistently turn out to preserve truth.

This type of objection has earlier been put forth against an instrumentalist view on logic by the aforementioned Cook (2002). In a discussion on degree-theoretic semantics, Cook contrasts the logic-as-description view with a non-representational instrumentalist view of logic. He writes that on the logic as description view:

degree-theoretic semantics is an attempt to describe what is really going via-à-vis the truth conditions, meaning, etc. of the various assertions involved in Sorites-type arguments, or talk involving vague predicates in general (p. 234).

On the instrumentalist view of logic, however,

[the] entire machinery behind the account [being, degree-theoretic semantics] is a fiction, representing nothing actually occurring and giving us no real explanation of the behavior of the language being studied. Other than the language of the formalism roughly matching up with the natural language being investigated, no aspect of the formalization has any connection to anything really involved in the truth conditions of the discourse (p. 234).

On Cook’s presentation the fundamental difference between the logic as description on the one hand and the instrumentalist view on the other hand, is that on the former at least some aspects of the formalism or model correspond to the phenomenon in play, while on the latter “no aspect of the formalization has any connection to anything really involved in the truth conditions of the discourse” (p. 234, emphasis mine). This endorsement of non-representationalism makes it that the version of

¹¹ Although I take it that it might be better to say that applied logics are pure logics *enriched* with a (or: the relevant) logical theory understood in the sense presented in the above. But, also in this case we need to clearly distinguish between a system and a theory.

logical instrumentalism Cook has in mind is one of the Haackian kind presented in the above, and Cook moves on to criticize this view on logic, arguing that:

[the instrumentalist view] renders our formalizations philosophically unilluminating. [...] In short, a semantics that tells us what inferences to accept and reject but fails to provide any insights in why we ought to reason in this fashion might be helpful as a practical tool but is next to useless philosophically (p. 235).

Finally, Van Benthem (2008a) makes a similar point when he criticizes the view of logic “as an ‘arsenal of formal systems’ from which an applied logician can choose given any conceivable task at hand” (p. 70, fn. 7), for he takes such a view to lead to the problem of *system imprisonment*: a narrowed focus merely on technical problems *internal* to a particular formal system, without any *external* counterpart (see also Van Benthem, 1999). Logics are not *just* formal systems, the morale appears to be. We can’t simply collapse logical systems to logical theories, or vice versa. This is a point related to the critique of the logic-as-tool view presented in the above: the logical-as-tool view merely focusing on logical *systems* could lead to the problem of system imprisonment.

Furthermore, according to Martin and Hjortland (2022), any position that denies that logical theories are about anything thereby takes logic to be (metaphysically) *exceptional*, rather than *anti-exceptional*, as in that case “logic is clearly set apart from other disciplines in virtue of its lack of metaphysical content” (p. 15). They move on to write that it seems likely that metaphysical exceptionalist positions about logic “will have to result in a more thoroughgoing exceptionalism about logic, one that also involves claims about the exceptional nature of logic’s epistemology” (p. 15). As such, positions that deny that logical theories have metaphysical or extra-systemic content—as the Haackian logical instrumentalist does—appear to move *away* from the idea that logic is significantly similar as the (empirical) sciences, for clearly *scientific* theories are *about* something. For example, physical theories are not *merely* mathematical structures, but mathematical structures that have a certain connection with phenomena in the natural world. Moreover, Martin (2022) argues that precisely the idea that logics provide extra-systemic explanations is a crucial feature of the anti-exceptionalists program. In effect, such metaphysically exceptional positions, disregarding such extra-systemic phenomena, perhaps liken logic more to a prescriptive discipline such as ethics, rather than to the (empirical) sciences. Given that, as I have shown in the above, the three instrumentalist proposals I’m considering here endorse a view of AEL as continuity with the (empirical) sciences, this metaphysical exceptionalism would go against their AEL agenda.

All three instrumentalist proposals under scrutiny here endorse some form of non-representationalism about logic, and so I take it to be that all these proposals face the challenges I have presented in the above. Combined with the challenges to the logic-as-tool view presented earlier, this makes logical instrumentalism as it has currently been put forth an unsatisfactory position. Not in the least in the case of instrumentalist proposals put forth in the AEL debate, given that they rather seem to point out a significant *dissimilarity* with scientific theories, rather than a *similarity*.

One might thus present the overall argument I put forth here as follows, in what one could label the *Incompatibility Argument*¹²:

- P1. According to anti-exceptionalism about logic (as continuity), logic is continuous with science.
- P2. According to (Haackian) logical instrumentalism, logic is merely a useful tool that doesn't represent anything extra-systemic.
- P3. Scientific theories *do* represent (various) extra-systemic phenomena.
- C. Thus, (Haackian) logical instrumentalism entails that logic is *not* continuous with science.

There are, then, at least two general ways to go about from here. First of all, one might locate the problem with the particular conception of AEL endorsed by the authors presented in this paper. The result could be the suggestion to simply *reject* AEL as Continuity, as various authors have recently done in light of a variety challenges to this conception of AEL (see also Sect. 2). However reasonable that suggestion might be, it is not the route I'd like to take in this paper, for I'd like to locate the problem primarily at the conception of logical instrumentalism put forth by the authors presented. That is, as I will aim to show in the following section, I take it that there is a way out for the logical instrumentalist, namely by taking seriously particular *lessons learned* from its counterpart in (the philosophy of) science, being *scientific instrumentalism*. In doing so, I aim to provide an alternative kind of logical instrumentalism, and put forth a version of the position that is interesting and valuable as an independent position in the philosophy of logic, also *outside* of the AEL debate.

5 Lessons Learned from Scientific Instrumentalism

In the previous section I have presented some challenges for logical instrumentalism as it has been put forth recently, that led me to argue that the position so far reduces to a trivial claim about the instrumental value of logical systems or to a theory about the nature of logic with little to none explanatory value. As I have argued earlier, for the anti-exceptionalists who have put forth this kind of logical instrumentalism this is especially worrisome given that their proposals are intended to contribute to the idea that logical theories are significantly similar to scientific theories, while as it stands now their proposals seem to show that logical theories are significantly *dissimilar*. This is the *Incompatibility Argument*: current instrumentalist proposals put forth in the AEL debate are incompatible with the conception of AEL they endorse. Rather than rejecting the conception of AEL as Continuity, I will aim to articulate a different version of logical instrumentalism; one that avoids the problems facing logical instrumentalism that I have presented.

The aim of this section is two-fold. First, I aim to show that scientific instrumentalism had to deal with similar challenges as those facing logical instrumentalism presented in the above. The significant similarities in challenges facing logical

¹² Thanks to Benjamin Marschall for presenting the argument in this format to me.

instrumentalism and scientific instrumentalism warrants the application of the idea that lessons learned in the philosophy of science can (at least sometimes) be meaningfully applied to (issues in) the philosophy of logic. Second, I take this comparison to show, in more detail, that the kind of logical instrumentalism that has been put forth so far cannot be one that satisfies the AEL agenda because it significantly *differs* from its counterpart in science. To show this, I will in this section briefly present scientific instrumentalism and its *lessons learned* that I take to be relevant for logical instrumentalism.

As a start, we can contrast scientific instrumentalism with the opposing view, namely scientific realism. The main thesis of scientific realism is that our best scientific theories are accurate descriptions of (properties of) the natural world. At least it is the *aim* of scientific theories to be such a description. Three observations are noteworthy here. First, we can say that for the realist scientific theories are *truth-apt*. Second, according to the realist we are epistemically entitled to believe that the contents of our best scientific theories really exist in the natural world. Third, scientific progress for the realist primarily consists in coming up with more accurate descriptions of the natural world, where other goals of science such as predictive success *follow from* such accurate descriptions.

Scientific instrumentalism, on the other hand, is often described as a kind of *anti-realism*. It argues, contrary to scientific realism, that scientific theories are *not* (aimed at) accurate descriptions or representations of (properties of) the natural world. That is to say that scientific theories are *not* truth-apt—theories are not true or false, but merely useful or not (and perhaps *more* useful or *less* useful). Rather than accurate descriptions of (properties of) the natural world containing truths, scientific theories and laws are considered as functional devices that allow one to infer certain observation statements from other such statements. It is in this sense that on the instrumentalist picture scientific theories and laws are considered merely as ‘inference tickets’ from one observational statement to another. Further, according to the instrumentalist, we are *not* epistemically entitled to believe that the contents of our best scientific theories are real. Rather, the instrumentalist claims that scientific theories and their concepts and content are merely useful tools to predict or explain certain phenomena of the natural world, and we should at best be *agnostic* about the reality of at least some of the elements, such as *posited* elements, of a scientific theory. Progress for the instrumentalist consists not in more accurate representations, but rather more useful tools for the various purposes of science.

The major challenge for scientific instrumentalism is to account for *how*, on the instrumentalist picture, scientific theories are able to be successful in achieving the particular goals of those theories, such as making predictions or best explaining certain phenomena of the natural world. The scientific realist has a reply to this question readily available: our best scientific theories are successful precisely *because* they accurately represent or describe the (relevant properties of) the natural world. Put differently, one might say on the realist’s behalf that these theories are useful *because* they are (to some significant extent) true. If the instrumentalist denies precisely the truth-aptness of scientific theories, arguing that such theories do *not* (aim to) describe the natural world, then it appears to

be that only by magic or by happenstance our best scientific theories come to be useful. This leads Kyle Stanford (2016) to write that the scientific instrumentalist:

cannot regard the claims of science generally as merely instrumentally useful because she cannot make effective instrumental use of her best scientific theories without simply believing at least some of what they say about the world to be true (p. 323).

Scientific instrumentalists have tried to improve and refine the position in reply to this challenge. According to Musgrave (1985), these kinds of challenges for instrumentalism led “thoughtful antirealists such as Duhem [...] to spice his instrumentalism with a whiff of realism”, conceding that a scientific theory is *not* “a purely artificial system”, but rather “a natural classification [whose] principles express profound and real relations among things” (p. 1100). That need not directly turn the instrumentalist into a full-blown realist, for the instrumentalist could merely concede that it need not be the case that *nothing* of a scientific theory represent or describes the natural world: perhaps some parts do, and some parts don’t. A well-known distinction made here is between the *observable* and the *unobservable* elements of a theory. For example, while the instrumentalist could take on a *realist* stance towards the observable elements of a theory, it could take an *anti-realist*, or at least *agnostic* stance towards the unobservable elements (Van Fraassen, 1980). In that way, the instrumentalist can still maintain that scientific theories are not accurate descriptions of the natural world, as they include unobservable elements that do not directly correspond to anything in the natural world, and continue to hold that scientific theories are essentially tools to interact with or understand the natural world, given that the theory in its entirety—including both observable and unobservable elements—provides us a better understanding of the particular phenomena in the natural world that are trying to be accounted for.

The important point here is that, as Kyle Stanford (2016) writes, even as the scientific instrumentalist holds scientific theories are best understood as tools or instruments, rather than accurate descriptions of the natural world:

[t]his need not imply that such ideas, theories, and the like cannot also be truth-apt or even true, but simply that we misunderstand or overlook their most important characteristics – including the most important questions to ask about them if we instead think of them most fundamentally as candidate descriptions of the world that are simply true or false (p. 319).

By no means do I take this brief discussion of scientific instrumentalism to capture all the various intricacies that the debate in the philosophy of science has generated about this position and its related ideas. However, I do hope to have shown at least two things. First, that logical instrumentalism faces similar challenges as scientific instrumentalism has faced. Second, as a reply to the challenges facing the position, scientific instrumentalism need not resort to full-blown anti-realism, and that by no means does the scientific instrumentalist *deny* there to be particular phenomena ‘out there’ that our scientific theories aim to

‘capture’. Put differently, we have seen that scientific instrumentalism does *not* endorse a form of (complete) non-representationalism, in contrast to how logical instrumentalism has been put forth by the aforementioned anti-exceptionalists.

Let’s briefly summarize. We have seen that the challenges to the Haackian kind of logical instrumentalism, as I have presented earlier, are similar to those facing scientific instrumentalism. In short, both must deal with the challenge of its representational content: if logical- or scientific theories have no representational content at all, then there is the challenge of how those theories can be successful. In this paper I endorse the view that lessons learned in the philosophy of science can (at least sometimes) be meaningfully applied to the philosophy of logic. I take this to be such a case: we can provide a different kind of logical instrumentalism by considering and applying the lessons learned from scientific instrumentalism. In the following section I will aim to do exactly this by providing a first outline of such a different kind of logical instrumentalism.

6 An Outline of Proper Logical Instrumentalism

In this section I will put forth a first sketch of a different kind of logical instrumentalism. For lack of a better term, I will call this *proper* logical instrumentalism, to distinguish it from the *Haackian* logical instrumentalism we have seen so far. Proper logical instrumentalism is a position that I take to have a broad appeal, but especially for anti-exceptionalists, for it is developed as analogous to—and thus much closer aligned with—scientific instrumentalism. As such, proper logical instrumentalism has the promise of avoiding the challenges that I’ve taken to be problematic for previous instrumentalist proposals in the AEL debate.¹³

Roughly put, there are two main differences between previous instrumentalist proposals and proper logical instrumentalism. The first one is that proper logical instrumentalism holds that logical *theories* are to be considered instrumentally, and not (merely) logical *systems*. To be clear, that is not to say that the proper logical instrumentalist does *not* take logical systems to have instrumental value, for as we have seen in the above that logical systems have instrumental value is trivially true. Rather, the proper logical instrumentalist doesn’t stop there, but moves on to hold that logical *theories* are to be understood instrumentally. The motivation for the proper logical instrumentalist to do so is, partly, because of the analogous situation in scientific instrumentalism: it is not (just) a formalism that the scientific instrumentalist is instrumentalist about, but most of all the scientific *theory*. The second main difference is that proper logical instrumentalism does not endorse non-representationalism about logic. Instead, the proper logical instrumentalist aims to account for extra-systemic phenomena, just as the scientific instrumentalist does. As we have seen earlier in this paper, according to Martin (2022) the idea that logics

¹³ To be clear, someone who endorses the kind of (Haackian) instrumentalism that I have criticized in the above need not necessarily come endorse the kind of instrumentalism that I will advance here, for there might be independent reasons to hold, for example, that logic does not aim in any sense at extra-systemic phenomena. I do take my arguments to have appeal to anti-exceptionalists more generally.

provide extra-systemic explanations is a crucial feature of the anti-exceptionalists program, as he writes that “it is logics’ ability to provide extra-systemic explanation of validity which is the substance of the anti-exceptionalist’s claim that logics explain” (p. 4). This claim at least, in contrast to the trivial claim that logicians are engaged in providing *intra*-systemic explanations,¹⁴ is far from trivial, Martin emphasizes. And thus, this would make proper logical instrumentalism a more substantial position than the instrumentalist proposals put forth so far.

The main elements of proper logical instrumentalism presented in the above could be seen as the first attempt to articulate the core elements of a different kind of logical instrumentalism, more aligned with scientific instrumentalism and better equipped to meet (or: avoid) the challenges that face previous instrumentalist proposals of the Haackian kind. There might be different ways to flesh out such an alternative proper logical instrumentalism. In fact, some recently articulated positions might be taken as examples of some kind of proper logical instrumentalism. For example, Molick (2021) provides an anti-exceptional account of logical theories that is representational on the one hand, but also considers the particular epistemic and inferential aims of logical theories. On this picture, “the process of logical theory revision is understood as the struggle to produce adequate inferential and representational tools to model a relevant phenomenon” (p. 32). Another position that could be seen as an example of proper logical instrumentalism is *logical predictivism* (Martin & Hjortland, 2021). On that picture, there are extra-systemic phenomena that logical theories aim to explain, such as the validity of steps within informal mathematical proofs and in vernacular arguments, and the success of these explanations are (at least partially) judged by how successful the predictions, made based on these explanations, are. And indeed, I take it that logical predictivism could be seen as a version of proper logical instrumentalism. Thus, on the one hand the current study bolsters the idea that logical predictivism is indeed at least a more viable option for the anti-exceptionalist than the other positions discussed in this paper, but on the other hand, there might be different ways to flesh out proper logical instrumentalism. To see how, let me briefly present one other way the proper logical instrumentalism *could* go about there, that at least partly (but significantly) differs from logical predictivism.

Recall that the scientific instrumentalist can roughly distinguish between observable elements of a theory and unobservable elements. The unobservable elements of a theory together with the observable elements of a theory allows the theory in its entirety to account for particular (observable) extra-systemic phenomena. Could we apply such a distinction to the case of logical theories? A problem might arise when we take the observable-unobservable terminology too literal, for it is not obvious that logic deals with clearly *observable* data, at least not in the same way that empirical science does, such as with the movement of celestial bodies or bacteria. Although a case might be made for the claim that logic does deal with observable

¹⁴ Intra-systemic explanations can be understood as explanations of particular properties of a particular logical system, i.e., dealing with the ‘technical problems *internal* to a particular formal system’ as Van Benthem puts it in his description of *system imprisonment* (see Sect. 4).

data, I will not pursue such move here.¹⁵ Rather, I will turn towards a familiar view on logic, namely the logic-as-model view. First, recall that the scientific instrumentalist had to introduce “a whiff of realism” in order to account for the success of scientific theories, but a collapse into realism was avoided by insisting that not *all* elements of a scientific theory represent or describe (properties of) the natural world. Thus, according to the scientific instrumentalist, some elements of the scientific theory represent while others not. A similar distinction had been made in the logic-as-model view, put forth by Cook (2002) and Shapiro (1998, 2014). In short, on the logic-as-model view, logic is to provide us with “models of various discourses in order to investigate, explain, or understand them more easily” (Cook, 2002, p. 235). Cook moves on to note about the relation between models and their intended content:

At least some parts of any model are intended to be, in some sense, important, representing (in a perhaps simplified way) real aspects of the phenomenon being modelled. Other parts of the model, however, might not be intended to match up with anything real. In other words, although we require that some part of the model must match up with some aspects of the phenomenon, not all of them have to do so. [...] Call those aspects of the model that are intended to correspond to real aspects of the phenomenon being modelled *representors*, and those that are not intended to so correspond *artefacts* (p. 236).

It is precisely this distinction between *representors* and *artefacts* that I take the proper logical instrumentalist will endorse. Yet, Dos Santos (2021) explicitly states that his view *differs* from the logic-as-model view given that his own approach, in contrast to the logic-as-model approach, does *not* model a particular phenomenon (p. 12,219). Arenhart (2020) on the other hand explicitly *likens* his non-representational logical instrumentalism to the logic-as-model view (p. 23). However, this cannot be the case, as the current study shows, given that the logic-as-model view is—via the *representors*—*not* couched in non-representationalist terms, while Arenhart’s position is.¹⁶

A proper logical instrumentalist proposal could be to take the notion of validity as it occurs in logical theories to be such a theoretical element of a theory, or: artefact, that allows us to make sense of a variety of extra-systemic phenomena. For example, given that a significant set of arguments of a particular form are truth-preserving from premises to conclusion, how can we explain that fact? It is by setting up a logical theory, that introduces the notion of validity to account for that

¹⁵ But see for example Van Benthem (1983) as a proposal in this direction.

¹⁶ See Arenhart (2022) for a more in-depth and focused account of how the logic-as-model approach could be employed in an anti-exceptionalist position. There, Arenhart proposes to consider the models of logic as *epistemic* models, in line with the *models as epistemic tools* approach in (the philosophy of) science. On this account, ‘models are *constructed* to provide for *theoretical interpretations* of target phenomena, the latter being typically *co-constructed* with the model’ (p. 1219). Such an account appears to be compatible in many ways with the instrumentalism I’m endorsing in this section, for it doesn’t seem to deny that there are extra-systemic phenomena that logic aims to account for, but merely rejects the idea that what we find in the models that logic produces is something like an accurate representation of a notion of validity *simpliciter*.

fact. On this picture, what logicians do is setting up a theory, that introduces the technical notion of validity, that explains *why* particular inferences are truth-preserving. As such, they come along with a *model* for particular phenomena, namely particular truth-preserving inferences. There are, of course, other phenomena that logicians can—and do—model, and different logical systems can be taken to provide different models for different phenomena. Take substructural logics, for example. Substructural logics are logics that lack one or more structural rules, such as associativity, commutativity, contraction and weakening. Substructural logics can be considered as models of substructural phenomena. Girard (1987), for example, has developed the substructural linear logic as a model for processes with efficient resource use, and it lacks the structural rule of contraction, because sometimes, such as in database management, premises cannot be used more than once. Because of the particularities of such phenomena, there was the need for different logics, that resulted in the development of substructural logics. These substructural logics arguably provide a better model of substructural phenomena. Moreover, Van Benthem (2008b) presents the *logical dynamics* program, which takes it that logical systems should deal with a wide(r) variety of informational tasks, explicitly as the program that has set itself the task of “explaining *why* substructural phenomena occur” (p. 182), thereby aiming to offer us a deeper understanding of such phenomena.

There is at least one aspect in which the version of proper logical instrumentalism I have sketched here significantly differs from other current positions in the philosophy of logic. The suggestion to understand validity as the theoretical element of a logical theory, similar as to how unobservable elements occur in scientific theories, means that it is actually *not* the *phenomenon of validity* that logical theories primarily aim at, but rather the phenomena for which we need the notion of validity to account for. That is not at all the standard view, and this might be a challenge for this kind of proper logical instrumentalism. For, in contrast, the standard view is that it is exactly the notion of validity that logical theories and systems aim at. Martin and Hjortland (2021), for example, write that “logical theories aim to explain a certain phenomenon, validity” (p. 287), and that “logical theories are theories *of validity*” (p. 289). They move on to state that “[w]hile logical systems can be used to model many different phenomena, whether this be electrical gates or information states, logical theories so conceived are aimed at validity” (p. 289). In reply to this, however, we can observe that posited elements of a particular theory can become objects of investigation themselves.¹⁷ Examples of such a situation in physics can be seen in the case of dark matter, gluons and the Higgs-Boson particle, the latter of which ultimately came to be empirically verified. The case of validity might be similar.

In the above I have sketched one way the proper logical instrumentalist could go about, but different options are available here. More important here are the two core elements of proper logical instrumentalism: instrumentalism on the level of the *theory* and the abandonment of non-representationalism. All in all, I hope to have shown that something along the lines of what I’ve labelled proper logical instrumentalism is an encouraging line of enquiry, promising to offer us new perspectives

¹⁷ Thanks to Ben Martin for pointing this out.

on the nature of logic and logical theories, in analogy with science and scientific theories.

7 Conclusion

In this paper, I have first presented logical instrumentalism, identified three recent instrumentalist proposals put forth in the AEL debate and shown that all these three proposals are of the kind of instrumentalism first presented by Haack (1978). I have then offered a critical assessment of these proposals, arguing that logical instrumentalism as it has been currently put forth in the AEL debate threatens to reduce to a trivial claim about the instrumental value of logical systems when collapsing the distinction between logical *systems* and logical *theories*. Furthermore, by endorsing non-representationalism about logic they lack an explanation of the success of logical systems, are prone to the problem of system imprisonment, and are (metaphysically) exceptional rather than anti-exceptional. I then moved on to show how scientific instrumentalism has been able to meet similar challenges as those I have taken to threaten logical instrumentalism, by allowing some form of representationalism. Applying the *lessons learned* from scientific instrumentalism to logical instrumentalism would give us what I have labelled *proper* logical instrumentalism: an alternative version of logical instrumentalism developed as analogous to—and thus much closer aligned with—scientific instrumentalism. I argue that further developments on logical instrumentalism should be in line with the core elements of proper logical instrumentalism.

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