The logic behind Quine's criterion of ontological commitment

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Funding information
Swedish Research Council, Grant/Award Number: 2017_06160_3

Abstract
This article first explains why Quine took first-order classical logic to be the only language in which we should formulate a theory or declarative statement to determine its ontological commitments. I then argue that Quineans cannot relax Quine's restriction to classical logic such that any nonclassical logic may be used to uncover a theory's ontological commitments. The reason is that this leads to radical ontological relativism according to which the ontological commitments of a theory are relative to a logic. This is not a Quinean picture of ontology, but a Carnapian one. Finally, I consider whether Quineans can go beyond Quine by allowing for classical and plural logic, but no other logics. I claim that this is not possible because plural logic is not transparent: it allows for ontologically nonequivalent theories to be formulated such that they come out as ontologically equivalent.

1 | INTRODUCTION

Meta-ontology is the study of ontology. The claim that existence is univocal is thus a meta-ontological claim. As is the claim that to determine what exists, we have to consult our best sciences. The meta-ontological framework that currently dominates the analytic tradition of philosophy is due to Quine. It is summarized by Varzi (2014a, p. 47) in three credos:

- \textit{Credo 1}: There is only one notion of existence, adequately captured by the existential quantifier.
- \textit{Credo 2}: Being and existence are the same.
- \textit{Credo 3}: We are ontologically committed to all and only those entities that must exist in order for the theories or statements we hold to be true to be true.
The last credo expresses Quine's criterion of ontological commitment. The idea is that a theory is ontologically committed to all and only those entities that, when the theory is formulated in first-order logic, need to be reckoned as the values of the bound variables in order for the theory to be true. Quine (1981) did not think this was a deep philosophical insight: "The solemnity of my terms ‘ontological commitment’ and ‘ontological criterion’ has led my readers to suppose that there is more afoot than meets the eye, despite my protests" (pp. 174–175). Arguably, Quine thought his criterion was merely a meta-linguistic remark about the referential apparatus of first-order logic. Still, Quine’s meta-ontological position is now a widely accepted framework for doing ontology. According to it, in order to know the ontological commitments of a theory, we have to formulate it in the language of first-order logic.

Not just any first-order logic though. Quine is explicit that a theory or statement has to be formulated in classical logic if we are to discover its ontological commitments. However, why exactly? What is so special about first-order classical logic that Quine thinks it deserves to be the canonical language for ontology? In Section 3, I address these exegetical questions.

There are self-proclaimed Quinean ontologists, such as Lewis (1991) and Sider (2013), who do not restrict themselves to classical logic. There are two ways in which one might go “beyond” Quine. One might go for an ecumenical approach by saying that various different (first-order) logics may be used in one’s ontological investigations. Alternatively, one might still insist that we need a single logic when doing ontology, but opt for a stronger logic than classical first-order logic. In particular, one might hold, just as Lewis and Sider do, that we should use plural logic rather than classical first-order singular logic. In Section 4, I argue that the ecumenical approach leads to ontological pluralism and I explain why this means we have to give up either Credo 1 or Credo 3. I also argue there that plural logic is, for a Quinean, nontransparent. By this, I mean that if we allow plural logic to be the canonical language for ontology, then ontologically nonequivalent theories may come out as equivalent.

I conclude that Quineans should stay close to Quine by only using classical logic when doing ontology.

2 | QUINE’S CRITERION OF ONTOLOGICAL COMMITMENT

Ontologists working in the analytic tradition often appeal to Quine’s criterion of ontological commitment when debating whether an assertion or theory implies the existence of a certain entity. Its most popular formulation is in slogan form—“To be is to be the value of a variable” (Quine, 1961a, p. 15). However, this formulation is susceptible to gross misunderstanding, especially if one is raised on a diet of model theory. In this section, I will thus make explicit what I take Quine’s criterion to be, using textual evidence from Quine’s oeuvre.

Instead of starting with a formulation of the criterion, it is useful to begin by looking at what purpose it serves according to Quine. First, the criterion does not aim to help us discover what it is that there is, but only what a theory says there is: “I look to variables and quantification for evidence as to what a theory says that there is, not for evidence as to what there is” (Quine, 1960, p. 225, fn.5) (See also Quine, 1969a, p. 92). Its polemic use is limited because one’s opponent could always refuse the first-order translations of her theory—although Quine takes this to mean that one’s opponent refuses to make herself clear:

Poemical use of the criterion is a different matter. Thus, consider the man who professes to repudiate universals but still uses without scruple any and all of the discursive apparatus which the most unrestrained of platonists might allow himself. He may, if we train our criterion of ontological commitment upon him, protest that the unwelcome commitments which we impute to him depend on unintended interpretations of his statements. Legallyistically his position is unassailable, as long as he is content to deprive us of a translation without which we cannot hope to understand what he is driving at (Quine, 1961b, p. 105).

(Note that Quine (1961b) sees little point in continuing an ontological debate with someone who refuses “to translate that discourse into the sort of language to which ‘there is’ belongs” [p. 105].) Quine’s criterion is particularly
useful for a theorist's own bookkeeping practices. A theorist may wish to avoid supposing the existence of certain (kinds of) entities, for whatever reason. To check whether she succeeded she checks whether her theory would be false if those unwanted entities would not exist:

For it can happen in the austerest circles that someone [sic] will try to rework a mathematical system in such a way as to avoid assuming certain sorts of objects. He may try to get by with the assumption of just numbers and not sets of numbers; or he may try to get by with classes to the exclusion of properties; or he may try, like Whitehead, to avoid points and make do with extended regions and sets of regions. Clearly, the system-maker in such cases is trying for something, and there is some distinction to be drawn between his getting it and not. (...) The question is when to maintain that a theory assumes a given object, or objects of a given sort—numbers, say, or sets of number, or properties, of [or] points. To show that a theory assumes a given object, or objects of a given class, we have to show that the theory would be false if that object did not exist, or if that class were empty; hence, that the theory requires that object, or members of that class, in order to be true (Quine, 1969a, p. 93).

So Quine’s ontological criterion is meant to uncover a theory’s ontological commitments. However, what exactly is Quine's criterion? One of Quine's oldest formulations of it appears in a paper first published in 1939: “We may be said to countenance such and such an entity if and only if we regard the range of our variables as including such an entity. To be is to be a value of a variable” (Quine, 1975b, p. 199). In his most-cited paper on ontology, first published in 1948, Quine formulates his criterion thus:

We can very easily involve ourselves in ontological commitments by saying, for example, that there is something (bound variable) which red houses and sunsets have in common; or that there is something which is a prime number larger than a million. However, this is, essentially, the only way we can involve ourselves in ontological commitments: by our use of bound variables. (...) To be assumed as an entity is, purely and simply, to be reckoned as the value of a variable. In terms of the categories of traditional grammar, this amounts roughly to saying that to be is to be in the range of reference of a pronoun. (...) [W]e are convicted of a particular ontological presupposition if, and only if, the alleged presuppositum has to be reckoned among the entities over which our variables range in order to render one of our affirmations true (Quine, 1961a, pp. 12–13).

And in one of his last monographs, Quine (1990) writes: “So I have insisted down the years that to be is to be the value of a variable. More precisely, what one takes there to be are what one admits as values of one’s bound variables” (p. 26).

The idea is that to uncover the ontological commitments of a theory, one should formulate it in the canonical language—that is, first-order classical logic—and check what values the variables need to take in order for the sentences to come out true. This thus means that the particular quantifier "∃" is stipulated to be read as “there exists.” Here is an example from Quine (1960) when he discusses ways of formulating the claim that the length of Manhattan is 11 miles in canonical notation: “If we were to push forward to minimum canonical notation (...) we would find our quantifiers calling for the number and the island unmistakably enough: (∃x) (∃y) (x is-11 and y is-Manhattan and x is-length-in-miles-of y)” (p. 226). So for the claim that the length of Manhattan is 11 miles to come out as true, not only should Manhattan indeed be 11 miles long, but there should exist an island called "Manhattan" and the number 11. However, there need not be an entity called "miles." Because, Quine says, in our canonical notation we discover that we have to existentially quantify over something called "Manhattan" and something called "11" but we do not need to existentially quantify over miles.
In this last example, there are two particular entities (the island Manhattan and the Number 11) that Quine's criterion takes us to be ontologically committed to. However, Quine's criterion often gives the verdict that a sentence is ontologically committed to some sort or kind of object, without forcing upon one an ontological commitment to a particular exemplar of that sort. For example, "\( \exists x \text{ is a dog} \) commits one to the existence of a dog but no one dog in particular (Quine, 1969a, p. 96).

## 3 | The Role of Classical Logic in Quine’s Criterion

The existential quantifier plays a central role in Quine's criterion of ontological commitment, for it is this device that helps make transparent what entities need to exist for a theory (or collection of statements) to be true. However, not all existential quantifiers are created equal. The existential quantifier used by, for example, intuitionistic logicians does not, according to Quine mean the same as the existential quantifier in classical logic:

[S]ome philosophical interest, ontological interest, attaches to deviations in quantification theory. They can affect what to count as there being. The intuitionist's deviant quantification (if "quantification" is still a good word for it) carries with it a deviant notion of existence (if "existence" is still a good word for it). When he recognizes there to be just such and such objects, we may not even agree that he recognizes there to be just those (much less that he would be right in so doing). It is only relative to some translation of his language into ours (not necessarily into our logic, but into our inclusive language) that we can venture to say what he really recognizes there to be (in our sense of "there to be") (Quine, 1986, p. 89).

So it is only through the existential quantifier of classical logic that Quine claims to be able to understand a theory's ontological commitments. (Note that intuitionistic logic is a strictly weaker logic than classical logic: anything provable in the first can also be proven in the second, but not vice versa.) Changing the logic thus changes the meaning of the quantifiers. This means that, in order for Quine's meta-ontology to be workable, we need to agree on a single logic with one existential quantifier and this existential quantifier can then be said to adequately capture existence—that is, Credo 1 above. Quine says we should be employing the existential quantifier of classical logic when formulating a statement in canonical notation in order to uncover its ontological commitments. That is to say, when Quine wants to know a statement's ontological commitments, he will formulate it in canonical notation with the classical existential quantifier, because that is how he understands existence. In this section, I will explain Quine's reasons for giving classical logic a unique place in his criterion of ontological commitment. However, first, it is worth noting that his insistence on classical logic as the (only) background logic for ontology has some counterintuitive consequences which Quine accepts wholeheartedly.

One such counterintuitive consequence concerns sets. Some sentences in English that do not seem to be ontologically committed to sets, do—according to Quine—invoke such a commitment. For example, when responding to Armstrong's (1981) claim that he does not take the problem of universals seriously, Quine claims that he does take the problem of universals seriously, Quine claims that he does take the problem seriously (bear in mind that Quine talks about so-called "Harvard universals"):

I see no way of meeting the needs of scientific theory let alone those of everyday discourse, without admitting universals irreducibly into our ontology. I have adduced elementary examples such as "Some zoological species are cross-fertile," which Armstrong even cites, and Frege's definition of ancestor; also David Kaplan's "Some critics admire nobody but one another," an ingenious example whose covert dependence on universals transpires only on reduction to canonical notation (Quine, 1981, p. 182).
It is not immediately obvious that these sentences commit one to functions or classes, but their commitment to such entities becomes apparent when we translate them into canonical notation. When we, for example, translate the Geach–Kaplan sentence ("Some critics admire only one another") into classical logic we need to quantify over sets or classes, that is, "Harvard universals".¹ (For a proof, see Boolos (1984, pp. 432ff)—Boolos attributes the proof to Kaplan.) By Quine's standards, this means that the sentence is ontologically committed to sets. Quine thus downplays any pretheoretical judgments that we might have about the ontological commitments of certain sentences. As Hylton (2007) rightly notes, "Quine would have no sympathy for the idea that [a sentence's] ontological commitments are to be judged by what strikes us as 'evident'. He thinks of ontology as an artificial matter, in which little weight is to be placed on pre-theoretic opinions" (p. 269).

The restriction to classical logic may seem arbitrary, especially in the face of certain extensions of classical logic. There are two reasons Quine restricts his criterion to first-order logic. One is the fact that it has a complete proof procedure, the other reason is that it has no ontological assumptions of its own (Hylton, 2007, pp. 265ff). Quine takes completeness to be the reason that classical logic is still logic, whereas extensions count as mathematics (Quine, 1986, p. 91). (The sharp boundary between classical logic and mathematics, in particular set theory, is something Quine draws only in some of his later works, such as Philosophy of Logic. Oftentimes Quine (2018, p. 1944) does consider ways of drawing a line but leaves "this terminological question undecided" (p. 112) or he says that "one might well limit the word 'logic' to the former (though I shall not)" (Quine, 1975a, p. 111.). Quine (1995) thinks classical logic is ontologically innocent for "it has no objects it can call its own; its variables admit all values indiscriminately" (p. 52). I will now explain why completeness matters so much to Quine, and why this underscores the ontological innocence of classical logic.

Quine is very much aware of the fact that sticking to classical logic means he restricts his criterion to first-order logic. One extension of classical logic that Quine (1969a, p. 109) discusses is the logic of branching quantifiers. (Here I first follow Quine's discussion in his "Existence and Quantification," but the issue is also discussed by Quine (1986), 89–91). I pick up the latter discussion when talking about the unity of classical logic.

Consider the following sentence:

1. Each thing bears \( P \) to something \( y \) and each thing bears \( Q \) to something \( w \) such that \( Rw \).

There are at least two ways of formulating this into canonical notation:

2. \( \forall x \exists y \ (Pxy \land \forall z \exists w (Qzw \land Rw)) \).
3. \( \forall z \exists w \ (Qzw \land \forall x \exists y (Pxy \land Rw)) \).

However, these are not equivalent statements because only in the first is the choice of \( y \) independent of that of \( z \), and only in the second is the choice of \( w \) independent of \( x \). Quine also gives the following example of an interpretation of \( P \), \( Q \), and \( R \) that suggests that the choice of \( y \) should be independent of that of \( z \) while, at the same time, the choice of \( w \) should be independent of \( x \):

4. Each thing is part of something \( y \) and each thing contains something \( w \) such that \( y \) is bigger than \( w \).

As Quine (1969a, p. 109) notes, it seems that "the notation of quantification is at fault in forcing a choice between (2) and (3) in a case like this." One way out is to quantify over functions:

5. \( \exists f \exists g \forall x \exists y \exists z \ (Pfx(x) \land Qgz(z) \land Rf(x)g(z)) \).

However, this means, of course, that we are ontologically committed to functions, that is, higher-order entities that did not seem to play a role in our original claim. Another option is to formalize three using branching quantifiers,
a technique first introduced by Henkin (1961). This means that the quantifier prefix of a sentence need not be linearly ordered, as is classically the case, but can be partially ordered. Then, three can be formalized thus:

\[
(\forall x \exists y (\forall z \exists w (Pxy \land Qzw \land Ryw))).
\]

(One should read the quantifier prefix such that the choice of \( y \) depends only on \( x \) and the choice of \( w \) depends only on \( z \).)

So it seems that we should not restrict ourselves to classical logic for it forces us to admit entities like functions into our domain of quantification, even though there are alternative means of quantification available that, for all we know, avoid a commitment to functions.

Since classical logic ontologically commits us to functions in certain cases, whereas branching quantifier logic seems to avoid such a commitment, different theories of quantification result in different answers to the question what entities a certain statement is ontologically committed to. Hence, we deserve an argument for the reason why we have to restrict ourselves to the resources of classical logic (i.e., without branching quantifiers) when investigating the ontological commitments of a statement or theory.

Quine’s argument is that classical logic has a certain unity that any extension of it lacks. This unity consists in the fact that classical logic has a complete proof procedure for both validity and inconsistency. And either procedure suffices, since a formula is valid if and only if its negation is inconsistent. However, when we use branching quantifiers then we cannot simultaneously have complete proof procedures for validity and inconsistency. This is where Quine draws a line:

It is at the limits of the classical logic of quantification, then, that I would continue to draw the line between logic and mathematics. Such, also, is the concept of quantification by which I would assess a theory’s ontological demands. In particular, thus, instead of viewing (6) as coordinate with (2) and (3), I would view (6) as a mathematical formula whose ontological content is fairly shown in (5) (Quine, 1986, p. 91—numerals changed).

Classical logic thus exhibits a certain unity which justifies giving it a special status among all logics: it is as powerful as any logic can be while still having a complete proof procedure that works both for validity and for inconsistency (Quine, 1969a, pp. 111–112). (Strictly speaking, first-order modal logics have a complete proof system and more expressive power than classical logic. However, Quine famously objected to such logics on other grounds (Quine, 1961c).)

There is also an ontological reason for Quine to draw the line between logic and mathematics as he does. This has to do with the fact that classical logic allows for various distinct, yet equivalent, definitions of logical truth. In classical logic, this notion can be defined model theoretically, substitutionally, or proof theoretically—the latter one is available precisely because classical logic has a complete proof procedure. Quine prefers the substitutional definition over the model theoretic one because the latter employs set theory: “The evident philosophical advantage of resting with this substitutional definition, and not broaching model theory, is that we save on ontology. Sentences suffice, sentences even of the object language instead of a universe of sets specifiable and unspecifiable” (Quine, 1986, p. 55). (Quine hastens to add that he does not think the substitutional definition of validity is completely free of set theory: “sentence” needs to be made precise either as a sequence or by identifying them, as Gödel did, with positive integers. In either case, “it renders the notions of validity and logical truth independent of all but a modest bit of set theory” (Quine, 1986, p. 56).)

Both the model theoretical and substitutional definition of logical truth employ the notion of truth or satisfaction. However, the completeness theorem—“If a schema is satisfied by every model, it can be proved” (Quine, 1986, p. 54)—gives us the means to define logical truth without having to talk about truth or satisfaction:

We can simply describe the moves that constitute one of those complete proof procedures, and then define a valid schema as a schema that can be proved by such moves. Then we can define a logical truth...
derivatively as before: as a sentence obtainable by substituting for the simple schemata in a valid schema. (...) Just how elementary is this manner of definition? It describes rules of proof and thus talks of strings of signs. On this score it is on a par with the definition that appeals to substitution of sentences; it operates, in effect at the level of elementary number theory. However, it keeps to that level, whereas the other definition invoked also the notion of truth. This is the great difference (Quine, 1986, pp. 57–58).

It is important to note that Quine (1986) tries to avoid model theory as much as possible because of its "ontological excesses of set theory" (p. 55). Quine's notion of ontological commitment should thus not be understood in model theoretical terms (pace Finn (2017)). That is to say, equating Quine's notion of ontological commitment to an entity e with the idea that e has to be an element in the universe is misleading, because the phrase "element in the universe" is a model theoretical one where "universe" means "a set of objects." Instead, the ontological commitments of a theory are the objects that the existentially quantified variables need to range over in order for the sentences to be true—this statement is free of model theoretical notions. One may, if so inclined, interpret this in model theoretical terms by taking the set of those objects and baptize it "the theory's universe." However, Quine's notion of ontological commitment is strictly independent of this model theoretical interpretation.

Although Quine's criterion of ontological commitment is thus independent of model theory, it is not at all independent of classical logic. The move from classical logic to another logic changes the meaning of "existence". The fact that the elements of the model "stay the same" in the (model theoretical) universe when one moves from classical logic to another logic is thus strictly irrelevant from Quine's perspective. It does not show that one has not invoked new ontological commitments. At most, it shows that the meaning of "ontological commitment" has changed.

Existential quantification in classical logic is thus the notion of quantification Quine uses for his criterion of ontological commitment. And the reason for using that concept is that classical logic has a complete proof procedure and thus a unity and strength not exhibited by any other logics. Other logics may be complete, but weaker than classical logic; or they may be stronger, but not be complete (again, ignoring modal logics).

4 | GOING BEYOND QUINE?

Quine's main argument for classical logic as the canonical language for ontology is that classical logic is the strongest (acceptable) logic that is still complete. However, Quine does consider the possibility of having to change the canonical language due to scientific progress (Quine, 1990, pp. 35–36). So it is worth asking: What if Quine is wrong about classical logic being the one and only logic we should use to discover a theory's ontological commitments? Quine's argument for choosing classical logic is based on it having a certain unity and a particular characteristic that some may consider strictly irrelevant for matters of ontology. To be a Quinean is to take existential quantification as ontologically committing, one might say, but without having to limit oneself to classical logic. Could we relax Quine's restriction such that logics other than classical logic may be used to uncover a theory's ontological commitments? I will first consider whether a Quinean could accept some form of logical pluralism for ontology. This, I argue, would lead to radical ontological relativism and a conception of ontology that is no longer Quinean. Then, I consider whether a Quinean could take plural logic to be the canonical language for uncovering a theory's ontological commitments. I provide reasons for taking this position to be problematic, even if plural logic is ontologically innocent.

4.1 | Logical pluralism

Logical pluralism, as I understand it here, is the view that many first-order logics may be used to regiment a theory and discover its ontological commitments. So, besides classical logic, one can use intuitionistic logic, branching quantifiers logic, plural logic, relevant logic, fuzzy logic, etc. To simplify matters, let us ignore logics that use substitutional
quantification, since those definitely go against Quine's criterion of ontological commitment. (For a comparison between Quine's criterion of ontological commitment with Barcan Marcus' (1972) competing substitutional criterion, see Janssen-Laure (2016).)

Consider again the following sentence “Each thing x is part of something y and each thing x contains something w such that y is bigger than w.” As said, when we regiment this sentence in classical logic (or any weaker logic), we have to quantify over functions—at least if we want a reading of the sentence such that the choice of y depends only on x and the choice of w depends only on the choice of z. Hence, given classical logic, the sentence is ontologically committed to functions. However, if we use branching quantifiers, then it seems we do not have to quantify over functions—at least not explicitly. Assume (for sake of the argument) that this shows that the formulation using branching quantifiers is not ontologically committed to functions. Then, the sentence we are considering is ontologically committed to functions relative to classical and any weaker logic, but it is not ontologically committed to functions relative to branching quantifier logic.

Consider another example, the Geach–Kaplan sentence "Some critics admire only one another." We know that regimenting this in classical logic results in quantification over sets. Thus, relative to classical logic, the Geach–Kaplan sentence is ontologically committed to sets. However, when we have plural logic at our disposal, the Geach–Kaplan sentence can be regimented such that we need not quantify over sets—at least not according to the standard interpretation of plural logic. Thus, relative to plural logic, the Geach–Kaplan sentence is not ontologically committed to sets.

The point is that the ontological commitments of a theory or sentence become relative to the logic one uses to regiment the theory or sentence. This can mean two different things. One option is that there are different notions of existence, captured by different logics. For example, the Geach–Kaplan sentence is ontologically committed to the classical existence of sets and critics, and it is ontologically committed to the plural-existence of critics. This means giving up Credo 1 and holding instead that there are different notions of existence, captured by different existential quantifiers. Another option is to say that it no longer makes sense to speak of a theory's ontological commitments tout court. Instead, we have to say that a theory is ontologically committed to certain entities relative to this or that logic. This means we give up Credo 3 because what needs to exist in order for the theory to be true will now depend on what logic you used to express the theory. Otherwise put: if we allow for multiple different logics in our ontological endeavors, then the link from the truth of a theory to entities existing in the world becomes relative to the logic one happens to use.

The problem is clear: by allowing more than one logic for uncovering a theory's ontological commitments, we either give up the idea that existence is univocal or the idea that ontological commitments are language independent. The first option is a version of ontological pluralism in which there are different modes of existence. This resembles a Heideggerian or a Meinongian meta-ontological framework. The second option is a version of ontological relativism which treats ontological commitments as relative to the language that is being used. This looks like a Carnapian framework: quite different from the ontological relativism that Quine came to defend later and for other reasons (Quine, 1969b). Neither option is Quinean.

4.2 | Plural logic

What about a more limited extension from Quine's position? In particular, can a Quinean hold that only plural logic should be used to discover a theory's ontological commitments? If so, she can extend the means of the ontologists to avoid certain ontological commitments, while avoiding the radical ontological relativism which treats ontological questions as dependent upon the language that is being used. For example, if plural logic is available to the Quinean as a suitable logic for ontology, the Geach–Kaplan sentence can be regimented without commitment to sets. And, as another example, a Quinean mereological nihilist may then use plural logic to paraphrase sentences that are allegedly about composite objects into sentences that quantify only over mereological atoms.
Many ontologists working in the Quinean tradition are indeed comfortable using plural logic in their ontological investigations. Plural paraphrases are commonly used to avoid ontological commitment to some unwanted entities. For example, in *Parts of Classes*, Lewis (1991) employs mereology and plural quantification as a framework to axiomatize set theory. Van Inwagen (1990) is less concerned with avoiding commitment to sets, but uses plural quantification to avoid ontological commitment to composite material objects. (Note that composite objects that are alive do exist according to van Inwagen, but for the purpose of this article we can ignore this vital difference.) And, as a final example, Sider (2013) recently started following van Inwagen’s lead, again by using plural quantification. These philosophers claim to be, at least to some degree, followers of Quine. Lewis can be seen adhering to a Quinean notion of ontology in his Lewis (1990), van Inwagen (1998) has made his adherence to Quinean meta-ontology explicit, and Sider (2013) writes “I often speak of existence, but as a good Quinean I intend this to be recast in terms of quantification” (p. 237, fn. 1). And it is not completely obvious that the later Quine would object to the use of plural logic in ontology, for when discussing Lewis’ *Parts of Classes*, Quine (1992) does not seem to think Lewis errs by using plural logic. So it is worth asking whether a Quinean can take plural logic instead of classical logic as the canonical language for ontology.

Ontologists who use plural logic and think they can do so as proper Quineans are influenced by Boolos (1984) who argued that plural quantification does not bring about any additional ontological commitments relative to the ontological commitments brought about by classical logic. Lewis (1991, pp. 62–71), for example, explicitly accepts Boolos’ arguments.2 In any case, the debate about the suitability of plural logic for ontological investigations focuses mainly on whether plural logic gives more expressive bang without additional ontological buck. This question—that is, whether plural logic is ontologically innocent3—is one I will not address because I cannot think of a good way to move forward in this debate within a thoroughly Quinean framework and without begging the question. To determine the ontological commitments of plural logic, a traditional Quinean will translate plural logic into first-order (singular) classical logic. If we do that, we have to introduce pluralities of some kind (sets, aggregates, fusions, whatever) in order to properly mirror the expressive power of plural logic. So the debate is then settled: plural logic is not ontologically innocent. However, this obviously begs the question to those self-proclaimed Quineans who object to restricting the language of ontology to classical logic. I do not see an obvious way forward in this debate—which is not to say that there is none—so I will ignore this issue.

Instead, I will simply assume that plural logic is ontologically innocent. However, this does not yet settle the question whether Quineans may use plural logic as the canonical language because ontological innocence is only one of three Quinean criteria for the language of ontology. The other two are expressive power and transparency. We want an expressively powerful language because a language that is too weak leads to cases where we cannot determine the ontological commitments of a certain statement simply due to the limitations of our language. As noted, Quine did not go for the most powerful language available but instead accepted that at a rather early stage one has to use additional machinery. (And, as we saw, he took the additional machinery to be set theory.) The term “transparency” I use here for the idea that a translation into the canonical language makes it evident what the ontological commitments of the translated statement or theory are. As an example of a failure of transparency, consider combinatorial logic. Quine (1961b, p. 104) thinks that we cannot (directly) determine the ontological commitments of a theory when expressed in combinatorial logic because combinatorial logic does not use variables or quantifiers.4 So, in order to know the ontological commitments of a theory expressed in combinatorial logic, we have to translate the theory into classical logic.

Another example of a failure of transparency came up in the first part of the paper: Quine thinks that branching quantifiers, although an increase in expressive power, blur the actual ontological commitments of certain sentences and theories—namely a commitment to functions. Something similar, I think, can be said about plural logic: it has more expressive power than classical logic, but it thereby allows one to blur the ontological commitments of your theory.

First, let us be a bit clearer on what plural logic is.5 We can think of plural logic as an extension of classical logic, which adds to classical logic the following: plural terms (constants $aa$, $bb$, ... and variables $xx$, $yy$ ...), a logical constant ($s$), plural quantifiers: $\exists xx$ and $\forall yy$ (“there are $xx$” and “for any $yy$”), plural/neutral predicates with distributive or
collective readings, and some axioms. Some plural logicians read “≤” as “is one of,” meaning that the first-argument place is singular, and the second is neutral (i.e., can take a singular or a plural term). I will follow Oliver & Smiley (2016, p. 108) in taking ≤ to be neutral in both argument places, hence reading it disjunctively as “is one of or are among the.” Nothing substantial hinges on this. For our purposes, the following three axioms should be noted:

- **Nonemptiness:**
  \[ \forall xx \exists y (y \leq xx) \]
  For any things, there is something that is one of them.

- **Plural comprehension axiom schema:**
  \[ \exists x \varphi(x) \rightarrow \exists xx \forall x (x \leq xx \leftrightarrow \varphi(x)) \]
  If something satisfies \( \varphi \), then there are some things which are all and only the things satisfying \( \varphi \).

- **Extensionality axiom:**
  \[ \forall xx \forall yy \forall vv (\forall v (v \leq vv \leftrightarrow v \leq yy) \rightarrow xx = yy) \]
  Contrapositively: If pluralities are distinct, then there is something which is only among one of them.

The expressive power of plural logic is much stronger than that of classical logic. It is the increase in expressive power that, ultimately, makes it unsuitable for the Quinean ontologists.

To see this, let us consider two competing theories: mereological nihilism and classical mereology. To keep things simple, we consider a very simple world in which, according to both the nihilist and the mereologist, there are only three atoms, that is, objects lacking proper parts. The nihilist holds that those three atoms are all there is to the world. Whatever else one might want to say should be said while quantifying only over those three atoms. Now, classical mereology states that for any objects there is a fusion of those objects. It also states that no two fusions have exactly the same proper parts, and that parthood is transitive. The mereologist is standardly taken to be committed to more objects than the nihilist: the latter thinks there are only three objects, whereas the former takes there to be seven objects: three atoms, and four distinct (proper) fusions composed of those atoms. If we formulate mereology using classical logic and we assert the existence of three atoms, then we do indeed have to quantify over seven distinct objects in order for all the axioms and theorems of mereology to come out as true. (A model is given in Figure 1.) Hence, applying Quine’s criterion of ontological commitment gives the result that classical mereology is ontologically committed to seven objects if we are already committed to the existence of three atoms. In general: if we are committed to atomic objects, classical mereology is committed to \( 2^n - 1 \) objects. Similarly, formulating nihilism in classical logic together with the claim that there are three atoms can be done such that we only need to quantify over three distinct objects. So far so good.

![Figure 1](image-url)  
A model of general extensional mereology
The nihilist is keen to use plural logic because she wants to be able to say things of the form “the atoms are arranged F-wise,” because this creates a general strategy to paraphrase-away quantification over composite objects to quantification over atoms. This is all perfectly fine since we are operating under the assumption that plural logic is innocent. We should thus grant that when the nihilist says “the atoms are arranged chair-wise” she is, strictly speaking, only committed to the existence of atoms. Having been granted this much, the nihilist seems to have a clear advantage in the debate. Whatever we say about the world that seems to be ontologically committing to composite objects, the nihilist can rephrase into a statement that is ontologically committed solely to atoms. In our simple example, the nihilist is thus committed to only three atoms, while the mereologist seems to be committed to seven objects. Hence, the nihilist has an ontologically simpler theory.

However, the mereologist has only used classical logic to express her theory and she might say that this leads to a misrepresentation of her position. In particular, since we may formulate our theories in the language of plural logic to uncover their ontological commitments, the mereologist should be given the chance to do so as well. Having learned a trick or two from her nihilist friend, our mereologist can easily come up with a formulation of her theory that is ontologically committed only to the same three atoms that the nihilist is committed to. In fact, she only needs to translate one primitive term, say “is part of,” of the classical formulation of her theory into the language of plural logic. The others follow more or less immediately:

- \( x \) is part of \( y \) \( \implies xx \leq yy \);
- \( x \) is a proper part of \( y \) \( =_{df} x \) is part of \( y \) and \( x \) is not identical with \( y \) \( \implies xx \leq yy \land xx \neq yy \);
- \( x \) overlaps \( y \) \( =_{df} \) something is part of \( x \) and \( y \) \( \implies \exists zz (zz \leq xx \land zz \leq yy) \);
- \( x \) is disjoint from \( y \) \( =_{df} x \) does not overlap \( y \) \( \implies \neg \exists zz (zz \leq xx \land zz \leq yy) \);
- \( z \) is the fusion of the things that satisfy \( \varphi =_{df} \) everything that satisfies \( \varphi \) is part of \( z \) and everything that is part of \( z \) overlaps with something that satisfies \( \varphi \) \( \implies zz \) is/are the fusion of the things \( xx \) that satisfy \( \varphi \) (i.e., \( Fu(zz, \varphi(xx)) =_{df} \forall xx(\varphi(xx) \rightarrow xx \leq zz) \land \forall yy(yy \leq zz \rightarrow \exists uu \exists ww(\varphi(uu) \land (ww \leq uu \land ww \leq yy))).

To be sure, this formulation of mereology is odd. For example, in the original formulation the dyadic predicate “is a fusion of” takes a singular term in its first argument place. In the translation to plural logic, however, the predicate is to be read awkwardly as “are a fusion of” and thus takes a plural term in its first argument place. However, there is really nothing about mereology itself that prohibits such awkwardness. To complete the formulation, we need to axiomatize mereology using the above vocabulary:

**Transitivity** \( \forall xx \forall yy \forall zz ((xx \leq yy \land yy \leq zz) \rightarrow xx \leq zz) \).

\( \text{If the } xx \text{ are among the } yy \text{ and the } yy \text{ are among the } zz, \text{ then the } xx \text{ are among the } zz. \)

**Universality** \( \exists xx \varphi(xx) \rightarrow \exists zz Fu(zz, \varphi(xx)) \).

\( \text{If there are some things that satisfy } \varphi, \text{ then there are some things that are fusing the things that satisfy } \varphi. \)

**Uniqueness** \( \forall xx \forall yy ( (Fu(xx, \varphi(zz)) \land Fu(yy, \varphi(zz))) \rightarrow xx = yy) \).

\( \text{If the } xx \text{ and the } yy \text{ are both fusing the things that satisfy } \varphi, \text{ then } xx = yy. \)

Given this axiomatization of mereology, it turns out that the mereologist is, in our three-atoms-world example, ontologically committed to only three entities. Because her theory, at least when formulated as suggested above, still comes out as true if there are only three atoms to quantify over. The situation is depicted in Figure 2. Remember that we are assuming that plural logic is innocent. This means that in Figure 2 a term such as “\( a_1 \& a_2 \)” is a plural term, denoting the two atoms \( a_1 \) and \( a_2 \). And, moreover, \( a_1 \) and \( a_2 \) each satisfy the predicate “a thing that is identical with \( a_1 \) or identical with \( a_2 \),” and \( a_1 \) and \( a_2 \) thus collectively satisfy the predicate “are fusing the things that are identical with \( a_1 \) or identical with \( a_2 \).”

All this merely illustrates something that is well known, namely that plural logic “is equi-interpretable with atomic extensional mereology” (Linnebo, 2017). However, what conclusion should we draw from it?
One conclusion to draw is that mereology is actually ontologically innocent and that we were wrong in thinking that the ontological commitments of the mereologist were greater than that of the nihilist. (Moves in this direction have been made: French (2016) argues for the innocence of mereology using flexible predicates and infinitary logic instead of plural predicates and plural logic. Cotnoir (2013) does not argue for the innocence of mereology, but does give a set-theoretical semantics in which a composite may be said to be identical with its parts such that composites are no additional ontological commitments.) However, this means that the debate between the nihilist and the mereologist is not substantial for there is no ontological difference between the two positions since both are committed to the same number of entities.

An alternative conclusion that one could draw is that this argument suggests that plural logic is too powerful a tool for ontology because it allows one to "hide" ones ontological commitments by paraphrasing them away in terms of plurals. If the mereologist and the nihilist agree that there are \( n \) simple entities, then the mereologist is committed to \( 2^n - 1 \) entities while the nihilist is committed to \( n \) entities. However, if both the mereologist and the nihilist use plural logic, then this difference does not become apparent. I think a Quinean should draw this second conclusion instead of the first.

The reason I think a Quinean should draw the second conclusion is that the debate between nihilists and mereologists has functioned as some sort of litmus test to determine whether one is a true Quinean ontologist. Lewis (1991, pp. 75–80), van Inwagen (1990, pp. 72–80), and Sider (2013, p. 238ff) all take this to be an example of a substantial ontological debate such that there is an ontological difference between the nihilist and the mereologist. (Although Sider (2013) thinks there is also an ideological difference between the two positions, and that this difference is more important.) Even Varzi (2014b, p. 25), who defends a version of conventionalism that comes close to the irrealism of Goodman, thinks that the mereologist and the nihilist cannot both be right about the structure of the world. However, as just shown, if we use plural logic as the language of ontology, then the nihilist and the mereologist can both be correct about the structure of the world for they can be committed to the exact same number of objects. Thus, a Quinean should say that plural logic is not transparent and hence unsuitable for determining the ontological commitments of a theory.

All this depends, of course, on my plural formulation being an accurate formulation of classical mereology. Before ending this section, I would like to respond to three possible reasons for thinking that my plural formulation is in some sense wrong.

### 4.2.1 Classical logic trumps plural logic

The first complaint against my argument is based on the idea that formulations in terms of classical (singular) logic are to be preferred over formulations that employ plural logic. We could, for example, have a principle that states

**FIGURE 2** A model with plural terms

![A model with plural terms](image-url)
that whenever there are adequate formulations of a theory available in both classical and plural logic, then we should take the formulation in terms of classical logic as giving the ontological commitments of the theory. Since there is an adequate formulation in classical logic of mereology, we should use that instead of the plural translation.

There are at least two problems with this response. First, a lot depends on what is meant by an “adequate formulation.” How do we determine whether a formulation is adequate? We cannot say that it is adequate if it delivers the right result with respect to the theory’s ontological commitments, because that supposes that we already know the ontological commitments of a theory. Moreover, anything that can be expressed in plural logic can also be expressed in classical logic augmented with set theory. For example, there is an adequate formulation of the Geach–Kaplan sentence in classical logic, although it employs set theory. So, in order to not fall back into Quine’s original position, one thus has to make sure that “adequate formulation” means something like “a formulation that does not use set theory”—but this seems hopelessly ad hoc.

Second, even if we have a principled way of making “adequate formulation” precise, it is not obvious that this will show that mereology falls in the group of theories that can be adequately formulated in classical logic. In particular, Lando (2017, pp. 149–161) argues that we should use plural logic as the background language for mereology in order to properly capture the intended notion of mereological fusion. (Note, however, that Lando does not formulate mereology such that, for example, “is part of” can take plural terms in either of its argument places.) If this is indeed the case, then my plural logic formulation of mereology merely illustrates how a more thorough use of plural logic allows for a more parsimonious formulation of mereology.

4.2.2 | Every nonlogical theory needs an nonlogical primitive term

Besides a theory’s ontology, there is its ideology, that is, the primitive terms one needs to express the theory. If “≤” is a logical predicate, as some defenders of plural logic hold (Oliver & Smiley, 2016, p. 337), then my plural logic formulation of mereology does not need a nonlogical primitive predicate. All it needs are the (logical) predicates “≤” and “=.” However, one might insist, if a theory is to be something more than pure logic, it must be in need of some extra-logical predicate. Since my plural logic formulation of mereology does not use nonlogical predicates, it is nothing more than pure logic. However, since mereology is supposed to be more than pure logic, I have therefore failed to adequately formulate mereology.

By way of response, I would like to note first that it is not obvious that every theory needs a non-logical primitive predicate. For example, it is not obvious that the nihilist needs one. And if the nihilist may do without, then so may the mereologist. Moreover, the need for a primitive term can be easily satisfied by simply taking, for example, “is part of” to be primitive although co-extensive with “is/are among the”. One needs additional principles which prohibit the use of redundant primitive terms (see below). Finally, a mereologist may simply accept that every nonlogical theory needs a non-logical primitive term, but conclude that mereology is thus not a nonlogical theory because mereology can be formulated using only logical primitives. The debate would then center around the claim that mereology is supposed to be more than pure logic. How do we determine whether mereology is supposed to be more than pure logic? If plural logic is pure logic, and we can formulate mereology using only notions from plural logic, it seems that mereology is pure logic. So, the burden of proof here seems to be on those who do think plural logic is pure logic, but want to deny the logicality of mereology.

4.2.3 | Not every formulation “carves at the joints”

There may be a way to combine the previous two objections into a master objection if one, like Sider (2011), thinks that the ideology of a theory is at least as important as its ontology. (Where the ideology of a theory consists of, at least, its undefined predicates.) This master objection states that mereology is meant to be a theory about the part–
whole relation and that, as such, it should take "is part of" or "overlaps with" as its main primitive term because such predicates, according to the mereologist, express a fundamental aspect of reality. Otherwise put: if we think of metaphysics as being in the business of finding joint-carving theories—where a joint-carving theory is one whose primitive predicates express the most natural or fundamental properties and relations of reality—then there is a difference between the standard formulation of mereology and the plural logic formulation of mereology because they carve at different joints. This shows that my plural logic formulation of mereology is, strictly speaking, a different theory from the classical formulation of mereology. Hence, or so the objection goes, I have not shown that there is a way of making mereology and nihilism indistinguishable with respect to their ontological commitments, I have merely shown that a theory that resembles mereology is ontologically indistinguishable from nihilism.

Assuming that the ideology of a theory matters at least as much as its ontology, this objection does not so much solve the original problem but rather puts the result in a different light. If joint-carving is a criterion for theory choice, then the question is whether plural logic is joint-carving. If it is not, then we should not use plural logic as the language in which to discover a theory's ontological commitments. This is exactly the conclusion that I think someone like Sider should draw. So suppose plural logic is joint-carving, then there is no longer a further question whether mereology or nihilism is more joint-carving, because plural logic is so powerful that the distinction between these two theories collapses. That is to say, one can say everything a mereologist or a nihilist may want to say, but using only the language of plural logic. Thus, I concede, if one thinks of metaphysics as being in the business of discovering and developing theories that carve nature at its joints, and one understands joint-carving in terms of the ideology of a theory, then the above shows not that plural logic is unsuitable for ontology, but rather that there is real debate to be had about the "joint-carvingness" of plural logic. However, if it turns out the plural logic is joint-carving, then the conclusion must be that the debate between the mereologist and the nihilist turns out to be shallow or merely verbal, because there is no difference between the two theories when expressed in (the joint-carving theory) plural logic. (I am ignoring the question whether a focus on joint-carving theories is a proper Quinean way of looking at ontology.)

5 | CONCLUSION

Different conclusions may be drawn, depending on one's meta-ontological preferences. A non-Quinean may see the above argument as further indirect evidence for her view that Quine's meta-ontological framework is mistaken. It is at most indirect evidence because if one sticks to classical logic, then Quine's meta-ontological position is a principled position. So a convinced Quinean may do just that. Nothing I have said makes sticking to classical logic an unstable or arbitrary position. However, self-proclaimed Quineans who do want to use the machinery of plural logic in their ontological investigations will have to do some work. They either need to show that there is something wrong with the way in which I made mereology come out as ontologically equivalent with nihilism, or argue that the resulting ontological equivalence between nihilism and mereology is not a problem for a Quinean ontologist.

ACKNOWLEDGMENTS

Many thanks to audiences at seminars in St Andrews, Lund, and Manchester where much of the material from this article has been presented. Special thanks to David Liggins, Fraser MacBride, Frederique Janssen-Lauret, Hein van den Berg, Jonas Raab, an anonymous reviewer for this journal, and an editor of this journal for discussion and valuable comments on previous drafts. Finally, thanks to the Swedish Research Council (Vetenskapsrådet) for funding our research (grant number 2017_06160_3).

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ENDNOTES

1 Although Quine uses the term “universals” in his response to Armstrong, it is clear that Quine does not mean by “universal” what Armstrong does. For neither Frege’s definition of ancestor nor the Geach–Kaplan sentence is ontologically committed to entities that are wholly present at multiple locations, that is, Armstrong’s immanent universals. (These sentences are free of this ontological commitment under Quine’s notion of ontological commitment, as well as under Armstrong’s truth-maker approach to ontology.) Moreover, Quine would probably have objected to any theory that includes Armstrongian universals because such entities seem to lack clear identity criteria.

2 The situation is a bit more complex with respect to van Inwagen. In Material Beings, van Inwagen uses plural quantification but says that the truth conditions for sentences that use plural quantification invoke sets (1990, p. 26). This suggests that van Inwagen does think that employing plural logic comes with additional ontological commitments, in particular to sets. I flag this as a warning: there may be Quineans out there who employ plural logic but think that in the official formulation of their theory should be in first-order singular classical logic with—if necessary—set theory.

3 In the camp defending plural (or second-order) logic as ontologically innocent, one finds Boolos (1984), Lewis (1991, pp. 62–71), McKay (2006), Shapiro (1991), and Simons (1997). Those who think it is not innocent include Hazen (1993), Linnebo (2003), Parsons (1990), Resnik (1988), and Rouilhan (2002).

4 We can, however, determine the ontological commitments of a theory expressed in combinatorial logic because we have a translation of combinatorial logic into classical logic: “Once we know the systematic method of translating back and forth between statements which use combinators and statements which use variables, however, there is no difficulty in devising an equivalent criterion of ontological commitment for combinatory discourse” (Quine, 1961b, p. 104).

5 See also Linnebo (2017) and Oliver and Smiley (2016).

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**How to cite this article:** Smid J. The logic behind Quine’s criterion of ontological commitment. *Eur J Philos.* 2020;1–16. [https://doi.org/10.1111/ejop.12534](https://doi.org/10.1111/ejop.12534)