Quine on Reference and Quantification

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Issues related to reference and quantification play a key role in Quine's thinking throughout his career. In his early work, he insists that quantification is restricted to first-order quantification, and quantification forms the basis for his much-discussed criterion of ontological commitment. He also endorses the elimination of names in favor of predicates and quantifiers. In his later work, he turns his attention to how our abilities to refer might have developed, and argues that reference is a derivative notion. These views are closely related to a number of Quinean theses, like the indeterminacy of translation and inscrutability of reference, ontological relativity, and naturalism. This essay will review Quine's main theses about the nature of reference and quantification, their origins, and their limitations. Where necessary, we will glance at Quine's wider views in metaphysics and epistemology. As we will see, Quine's early views on quantification and his later views on the nature and origin of reference cohere quite closely.

To get a general picture of Quine's views of both reference and quantification, it will be useful to start by considering a set of views very different from the ones Quine holds. Many philosophers of language and mind think of reference as one of the fundamental semantic relations, if not the fundamental semantic relation. The meaning of a sentence or other complex expression is determined, compositionally, by the referential properties of

its parts. Thus, meaning is built up from reference. Quantifiers are important, not only because of their ability to express certain kinds of generality, but because they mark an important difference in how referential properties are transferred up to thoughts or sentences. Some thoughts are singular, being about a particular object simpliciter (or perhaps directly). Some thoughts are general, being about whatever object or objects answer to some description. Quantifiers in our languages are devices for expressing general thoughts, while genuine referring expressions are devices for expressing singular thoughts.[1]

Quine's position is opposed to this picture in most significant respects. First and foremost, for Quine, reference is not a fundamental semantic relation. It is derivative. There is no substantial singular versus general thought distinction at work in Quine's views, and he does not see much importance for the role of proper names or other expressions that are often taken to be genuine devices of reference. Though everyone grants that quantifiers are useful devices for expressing generality, Quine is more concerned with their ability to express the specific notion of existence.

Quine's motivations and intended applications also depart from those of the picture just sketched. Quine's discussions of reference and quantification usually turn quickly to issues of ontology; and in particular, to what ontological commitments are implicit in our talk or theories, and how those commitments arise. His concern with how our ontologies

[1] Views like this are common across a great many philosophers, though obviously, I am presenting a cartoon form of a set of complex ideas. The role of reference in semantics I describe is clearly articulated by Higginbotham (1989). It can also be seen at work in many other philosophers of language. See Higginbotham (2006) for an overview and references. In the philosophy of mind, it can be seen at work in various representational theories of content. See Loewer (1997) for an overview and references. Just how to state the distinction between singular and general thought is itself a contentious issues, but see Jeshion (2010) for a review.

arise (he sometimes says 'our conceptual schemes') leads him to concerns about how our abilities to use referential and quantification devices could arise from what he sees as more basic aspects of semantics. Along with these concerns goes a set of limiting, or perhaps even skeptical views. I include among these Quine's well-known doctrines of the inscrutability of reference and indeterminacy of translation. Our attention here will be focused on his limiting theses about quantification in particular; where Quine is doubtful that quantificational apparatus, with its corresponding ontological implications, can or should be extended beyond the narrow range of first-order extensional quantification.

The discussion in this essay will proceed in seven sections. Sections 1 and 2 will focus on reference. Section 1 will review Quine's exploration of the place of reference in semantics, and how reference might emerge; while section 2 will discuss his attitude towards disquotational characterizations of reference. Sections 3 will introduce Quine's approach to quantifiers, and his notion of regimentation. Sections 4 and 5 will turn to Quine's limiting theses about quantification. Section 4 will review his insistence that quantification is first-order, and section 5 his rejection of quantification into modal contexts. Section 6 will examine the connections between Quine's view on quantification and ontological commitment. Finally, section 7 will consider how closely Quine's early views on quantification and his later views on reference coincide.

1. The Nature and Origin of Reference

Let us begin with Quine's views of the nature and origin of reference, and its place in semantics. Quine discusses these issues often throughout his career, in such central works as *Word and Object* (1960b) and *The Roots of Reference* (1974), and a number of later

works including *Pursuit of Truth* (1992) and *From Stimulus to Science* (1995), among many other places.[2]

The starting-point for this discussion is not reference *per se*, but Quine's distinctive combination of naturalism and behaviorism, the behaviorism especially visible when it comes to issues of meaning. For instance, in a much-noted passage (1992, 37-38), Quine says, "In psychology, one may or may not be a behaviorist, but in linguistics one has no choice…There is nothing in linguistic meaning beyond what is to be gleaned from overt behavior in observable circumstances." Similar remarks are repeated often. The general outlook is that to understand linguistic phenomena, especially, to understand meaning, we must look to situations that could count as stimulus conditions, and how they are paired with words and sentences. Add to that the sort of behaviorist story about learning that Quine typically assumes, and you have behaviorism about meaning. Quine often presents this as an instance of naturalism, simply following up the injunction to keep our thinking about meaning continuous with science.[3]

When we try to apply this general outlook, we need an 'entering wedge'. The key for Quine is the notion of an *observation sentence*. These are sentences like 'There's a rabbit' (or if you like, 'Gavagai'), which allow a pairing of observable repeatable occasions of stimulation with behaviors like utterance or assent and dissent. In effect, you can see if a speaker is willing to say or assent to 'There's a rabbit' in certain circumstances, and get a

[2] For extended discussion of some of the points of this section, see also Hylton (2004).
[3] A thorough discussion of Quine's behaviorism and related issues is beyond the scope of this paper. See, for instance, Gibson (2004). I do hasten to add that Quine's behaviorism about language has been challenged, and indeed is often challenged by linguists and psychologists, since Chomsky (1969). For some further discussion, see for instance George (1986) and remarks in Pietroski (2005). From the empirical side, one might start with Carey (2009) for a data-rich perspective very different from Quine's.

measure of its meaning—what Quine often calls its stimulus meaning. Quine takes observation sentences to be basic, in that they display the fundamental way language relates to the world. In typical Quinean fashion, he takes this also to show us how language could be acquired.[4] He writes (1995, 22-23), "They [observation sentences] are the child's entering wedge into cognitive language, for they are the expressions that can be conditioned to global stimuli without the aid of prior language."

Observation sentences and their stimulus meanings are the basic building blocks of language, to Quine. But, they do not involve reference. 'Gavagai' pairs an observable situation—a stimulus—with a behavior like assent. Understanding it does not presume referring to a rabbit, and predicating a property of that particular rabbit. He says clearly (1995, 25), "Even at this stage there is no denotation, no reference to bodies or other objects, to my way of reckoning." Reference and quantification both enter at a further stage. Quine describes the stage both psychologically, in terms of how children learn language, and conceptually, in terms of our theorizing about the world. Either way, there is a substantial leap from describing "repeatable features of the passing show" (1995, 26) to reference to particulars.

In a number of works (including *Word and Object*, *The Roots of Reference*, and later writings), Quine speculates about the psychological process that might lead a language learner to reference. The discussion is typically cast in terms of what grammatical devices the language learner would have to master to have mastered reference. Focusing on these, Quine isolates several important steps from observation sentences to reference.

[4] The precise characterization of observation sentences is somewhat more involved, and Quine's views on the right characterization changed over time. But this general gloss will suffice for our purposes. See Quine (1996) for some of his own reflections on these and related issues.

Interestingly, the main one is not simply the acquisition of singular terms. Given Quine's well-known strategy of avoiding such terms that we will discuss in section 7, this may not be surprising; but it is striking. One might have thought that mastery of singular terms of the common sort that pick out particulars would be a crucial step towards reference. Quine is skeptical of this. Thinking about the child language leaner, he notes that it would be hard to say why 'Mama' should be a singular term picking out an individual rather than an observation sentence picking out recurrences of Mama's presence. That would not involve genuine reference.

The first step towards genuine reference is the acquisition of what Quine calls 'general terms', i.e. *predicates*. Quine writes (1960b, 91), "It is with full-fledged general terms like 'apple' or 'rabbit' that peculiarities of reference emerge which call for distinctions not implicit in the mere stimulatory occasions of occasion sentences." 'Apple' applies to each apple, and mastering such a term requires understanding what makes an individual apple, as opposed to an event of the presence of 'appleness'. It requires, as Quine says (1974, 85), understanding a kind of "built-in individuation." This step requires the leaner to go beyond the stimulus meanings associated with observation sentences (1960b, 92), to an understanding of the roles of particulars. Thus, we have a significant step towards reference.

With that step, a range or possibilities opens. Quine (e.g. 1960b, 1974) explores the ways that general terms and demonstratives might interact to expand our referential horizons, including how we might come to refer to abstract objects. However, Quine still sees another important step on the way toward developing our full referential apparatus.

We still, with general terms, singular terms, and predication between them, do not yet really have the apparatus of quantifiers and variables.

This apparatus, Quine suggests, can be seen as emerging from the structure of relative clauses. Relative clauses show two features that Quine links. First, our languages allow us not only to mention objects, and predicate properties of them, but to do so in some complicated ways. Relative clauses give us a device that can separate off the thing of which we predicate from a complex property predicated of it. For instance, Quine (1974) asks us to consider a sentence like 'I bought Fido from a man that found him'. What does this say about Fido? It says that I bought him from a man that found him, or to produce a relative clause, 'that I bought from a man that found him'. Moreover, Quine proposes, such complex predicates introduce bound variables. The intuitive force of this can be seen by considering 'the dog which I bought', which seems to have the dog stand in the relation '*x* bought *y*'. A paraphrase seems to be 'the dog *x* such that I bought *x*'. Mastering this sort of construction, Quine suggests, is a major step towards the mastery of bound variables. Quine speculates that it is a significant leap, for it requires the language learner to reach beyond the evident subject-predicate structure that is most readily observed in relative clauses. Quine speculates (1974, 91) that we are lead to the more complex structure by encountering difficult examples, like Geach's donkey sentences, or Bach-Peters type sentences, which cannot be accounted for with simple subject-predicate structures.[5]

Mastery of relative clauses with the internal structure of bound variables opens the way for quantification in its familiar forms. For instance, it allows for 'categorical'

[5] More recently, the kind of analysis Quine proposes for relative clauses has become fairly common in linguistic theory (e.g. Heim and Kratzer 1998). Quine's discussion of predicates and mass terms in *Word and Object* has also been influential.

constructions from traditional logic, like 'Every dog which is playing on the beach is happy' (with form 'All *F*s are *G*s'). We thus finally get to the apparatus of quantifiers and variables.

According to the picture Quine outlines, reference emerges over a number of steps (1960b, 105-110). Already with predicates, Quine suggests one has "mastered the scheme of enduring and recurring physical objects" (1960b, 94). But our ontology does not stop there. Quine says (1974, 88), "Putting our ontological house in order is not a matter of making an already implicit ontology explicit by sorting and dusting up ordinary language. It is a matter of devising and imposing." As we develop more and more sophisticated referential apparatus, we can refer to more and more. Also, Quine speculates that our keeping track of specific objects might remain attenuated, until we reach the stage where we have variables to mark dependencies across complex sentences. Quantifiers and variables mark the late stages of development of reference, where it is finally fully developed. As Quine says (1974, 100), "Quantification is a welcome encapsulation of the referential apparatus."

As was noted above, Quine's view of the emergence of reference relies on broadly behaviorist premises that have been highly controversial. His story about the development of reference has also raised a number of questions. One is just what the status of his speculative developmental story is. Quine himself frequently describes the exercise as speculative, and says (1974, 92), "I am not bent even upon a factual account of the learning of English, welcome though it would be. My concern with the essential psychogenesis of reference would be fulfilled in fair measure with a plausible account of how one might proceed from infancy step by step to a logically regimented language of science, even bypassing English." Presumably, as Quine (1990b) himself notes, we might best conceive of

this exercise as somehow 'Kantian', asking about how our abilities to refer are possible (given a behaviorist starting point).[6] Some of the speculative psychology Quine engaged in has sparked the interest of genuine psychologists; however, in a number of cases, evidence suggests things may not in fact proceed the way Quine imagined. For instance, the psychologist Susan Carey (2009) discusses in depth a process much like the one we have been reviewing, and gives Quine full credit for pioneering ideas. But, she concludes (35), "My disagreement with Quine is straightforwardly empirical; in my view of conceptual development, he might be right. Rather, his picture of the infant just turns out to be false."[7]

It should be clear that the conclusions Quine reaches about reference are equally conclusions about ontology. The process we just reviewed, to Quine, does not merely describe how someone might come to be able to talk about things; it describes how they acquire a conceptual scheme that includes particulars at all. Just as reference is derivative, so is the ontology of things to which we refer.

Ontology always enters the picture for Quine along with achievements by agents. "The assuming of objects is a mental act" he writes (1981, 2). Especially in later writings, Quine talks about ontology in terms of reification, or taking something to be an object (e.g. 1995, 24). At the basic level, we have the same situation we saw when looking at reference: something like a 'passing scene' of stimulus, which does not already contain objects. We reify objects as our abilities with language develop, and then as our theories develop from those. Quine puts this very vividly (1981, 1), "Our talk of external things, our very notion of

[6] See also Parsons (1990a), Strawson (1986), and Stroud (1984).
[7] See also Bloom (2002), and, for instance, the survey papers in Gaskell (2007), notably the entry on word learning (Koenig and Woodward 2007). A glimpse of the rich research on the acquisition of relative clauses can be gleaned from discussion in Crain and Thornton (1998).

things, is just a conceptual apparatus that helps us to foresee and control the triggering of our sensory receptors in the light of previous triggering of our sensory receptors." Though we will not explore it here, this opens the door for Quine's much-discussed doctrine of ontological relativity.

2. Defining Reference

One of the main themes across a wide range of Quine's work is skepticism about meaning, in many of its aspects: analyticity, determinate synonym or translation, and intensional entities all are subject to scrutiny and fall short by Quine's lights. Given the derivative nature of reference, we might have expected it to fall prey to Quine's skepticism as well. In one way, it does not. It is, as we will see more in section 6, a concept with some blemishes, which quantification can often guide us past. But it remains respectable for Quine in a way that meaning does not.

The reason reference fares better than meaning is that there is a way of thinking about it according to which it is about as clear and simple a relation as we find in the philosophy of language. The name 'Obama' picks out Obama, and that is pretty much the whole story. Well, not the whole story, as the notion of picking out remains unanalyzed, but as explanations of semantic notions go, this one stands out as clear and accurate. Generalizing this observation yields a disquotation schema, as we find in work of Tarski:

'___' names ___ (and nothing else).

Quine endorses this schema (with suitable modifications in light of semantic paradoxes), both for utility and for clarity, often. In Quine (1961b, 134) he writes that it possess "a peculiar clarity." He does note that schemas like this (and related ones for truth) fail to

provide explicit definitions, but they are valuable nonetheless, as "they leave no ambiguity as to the extension, the range of applicability, of the verbs in question" (136). The schema above, in particular, fixes the extension of 'refers' for a given language. As he discusses at greater length in *Philosophy of Logic* (1986), schemas like this are also useful, as they allow, perhaps together with the rest of a theory of truth, for generalizations we would be unable to formulate otherwise.

If reference has such a simple and useful definition, why do we need the elaborate path marked out in *Word and Object* and *The Roots of Reference*, rather than the simple disquotation schema? Here we have an instance of what Quine sometimes calls 'immanent' versus 'transcendent' notions. (Quine 1986, see also Harman 1990.) An immanent notion is defined only for a particular language. The disquotational characterization of reference is thus immanent, as the instances of the schema are instances from some language (the paradoxes provide reason to think this sort of restriction is substantial). The explanation of reference via observation sentences and the path to reification is transcendent. Our immanent characterization of reference may be useful, and illustrates why reference is not vulnerable to Quinean complains about meaning and intensions. But it does not offer the kind of fundamental, transcendent characterization Quine is after in later work.[8]

The immanent characterization of reference also illustrates the way such phenomena as inscrutability of reference need not emerge in the 'home language'. As Quine (1981, 20) says, "Staying aboard our own language and not rocking the boat, we are

[8] This also shows that, in spite of celebrating the disquotation schema, Quine is arguably not a deflationist about reference. On the other hand, his discussion of truth in *Philosophy of Logic* (1986) is a starting point for many contemporary deflationists about truth, especially those identified with 'disquotationalism' (e.g. Field 1994).

borne smoothly along on it and all is well; 'rabbit' denotes rabbits, and there is no sense in asking 'Rabbits in what sense of "rabbit"?'." (See also Quine 1969b.)

We have already seen that in discussing reference itself, Quine quickly moves to quantification. As we will see more below, for most important questions, Quine prefers to work with quantifiers rather than referring expressions like proper names. To better understand why, we will have to better understand Quine's approaches quantifiers. To do that, we will first have to consider the important role for regimentation in Quine's thinking. It is to those tasks that we now turn.

3. Quantifiers, Logic, and Regimentation

In discussing quantifiers, Quine typically means what we mean in logic: quantifiers are the familiar '∀' and '∃' from logic, in their first-order extensional variants only! Now, it is a testament to Quine's influence in contemporary philosophy and logic that for many philosophers, this claim might sound unremarkable. It is remarkable, in at least two ways, both of which Quine is in fact keenly aware of. First, the formalisms of quantification and the quantificational constructions in natural language do not look exactly alike. When we employ '∀' or '∃', we are not simply employing the quantificational idioms of our home languages.[9] Second, when it comes to formal developments and applications to e.g. mathematics, the devices of standard first-order logic are one choice among many. Why then does standard first-order logic get a special place, and how do these devices, so central

[9] Developments in generalized quantifier theory show that natural language and the formalisms of quantification in logic can be fruitfully brought together (see Glanzberg 2006 for a review and references). Quine, to my knowledge, never commented on these developments. Though he considered branching quantifiers (1969a, 108-113), he never returned to the lively debate that emerged over whether these occur in natural language.

to Quine's thinking, fit with his concerns in *Word and Object* and *The Roots of Reference* about the situation of the child language learner or radical translator? We will here examine the first question. The second will be addressed later in section 7.

Quine sees first-order logic, and its quantificational component, as a hard-won achievement, not unique in its ability to do a particular job, but distinctive in doing the job well. What is the job? Quine often discusses this under the heading of *regimentation*: the exercise in which we recast our ordinary talk and our ordinary theories and claims in a more precise regimented language. We do this for purposes of clarity and precision in formulation. We may do it for other reasons as well. We might, for instance, want to more clearly display logical connections between parts of a theory, we might want to apply formal rules of deduction or other algorithmically specifiable procedures to parts of our theory, or we might want to measure the ontological commitments of our theory.

Regimentation into the forms of standard first-order logic is a successful way to approach these tasks. Quine writes in *Word and Object*, for instance:

> Simplification of theory is a central motivation likewise of the sweeping artificialities in notation of modern logic. Clearly it would be folly to burden a logical theory with quirks of usage that we can straighten. It is the part of strategy to keep theory simple where we can, and then, when we want to apply the theory to particular sentences of ordinary language, to transform those sentences into a "canonical form" adapted to the theory (1960b, 158).

The utility of the forms of standard logic shows itself in the achievements of Frege and Russell in the foundations of mathematics, and in many subsequent applications. We might think of Frege and Russell as having done some regimentation, as part of their projects.

The fact that we use logic in rigorous philosophical and mathematical theorizing shows that it is a useful tool for regimentation.

Quine's textbook *Methods of Logic* (1982), in the course of teaching various tools and results from first-order and propositional logic, gives a number of suggestions about how to properly carry out regimentation. Many of its exercises are regimentation exercises. Regimentation is something we can, and sometimes must, actually do, and Quine was interested in teaching us how to do it. Quantifiers, for Quine, are part of first-order logic, and so part of the apparatus of regimentation.

4. The Restriction to First-Order

Genuine quantification enters with regimentation. But regimentation into what formalism? We have seen that Quine would like to teach us to use the formalisms of standard first-order logic. Actually, Quine goes further. The formalisms of standard first-order logic are really the only choice for regimentation, as he sees it. This position involves several parts. Some are 'pragmatic'—first order logic works well. But some are more substantial; especially, Quine's rejection of second-order logic. We will review both aspects of Quine's position in this section.[10]

First, why does first-order logic make a good choice for a formal language in which to carry out regimentation? Quine is typically concerned with ontological commitments—with existence. First-order logic provides a single unequivocal notion of existence with its

[10] In describing the logic Quine insists upon as 'standard', I mean that it is to be formulated as it standardly is in logic textbooks, like Quine's own *Methods of Logic* (1982). We could also add that for Quine logic must be classical, i.e. not a relevance logic or a many-valued logic. These are among what Quine (1986) calls 'deviant logics'. Quine's assessment of such logics is in the well-known passage (1986, 81), "Here, evidently, is the deviant logician's predicament: when he tries to deny the doctrine he only changes the subject."

existential quantifier: 'exists' is mapped to '∃'. Anything which is not mapped to '∃' in regimentation is simply not recognized to mean 'exists'. To do otherwise would be to "ruining the good old word 'exist' " (1948, 3).

Another reason is that first-order logic has a complete proof procedure, while other formalisms, like those of second-order logic, do not (1969a, 1986). Since in regimentation we often wish to display or assess logical connections, a proof procedure is useful.

Quine recognizes that other formalisms than the standard ones of first-order logic that grace the pages of *Methods of Logic* could also be employed in regimentation. We could, for instance, start with combinatory logic, or the lambda calculus. Quine is well aware of these options (e.g. 1960a, 1961a, 1976). In response, he typically notes that standard quantification theory is just that; it is standard. It is thus "familiar" and "convenient" (1961a, 105). Thus, as a practical matter, we are invited by Quine to regiment using the formalisms of first-order logic.

This pragmatic attitude towards the formalisms of regimentation has limits, and at crucial points, Quine argues that one cannot make certain choices. First and foremost, Quine argues against second order-logic, and thereby rules out second-order formalisms as good media for regimentation. The problem with second-order logic, to Quine, is that it treats predicate positions as bindable. According to Quine, this embodies a confusion, which is best avoided by the discipline of first-order logic. Actually, it embodies three different confusions; or rather, there are three different ways one might think that predicate positions are bindable, and each is a confusion according to Quine.

The main confusion is confusing a predicate for a term which names something. One might, Quine imagines, think that a predicate functions as a name for something—a

universal, property, attribute, class, etc.—and so occupies a position essentially like those of singular terms. The latter are bindable, when occupied by variables. So, why not the former? And, we might suggest, we often see variables showing up in predicate positions, in familiar forms like '$Fx \vee Gx$'.

Quine frequently insists that predicates simply do not work this way. They do not name classes, or attributes, or other candidates to be the referents of predicates. The argument, in typical Quinean fashion, is rather condensed. For instance, he sometimes simply states that one cannot take predicates to be such names (e.g. 1948, 11). But, this claim comes after a somewhat more developed, if still rather telegraphic, argument earlier. Quine notes that we have clear evidence from Russell's theory of definite descriptions that expression can be meaningful and not be analyzed as referring expressions. Indeed, the quantifiers themselves are examples of meaningful expressions that are not referring expressions. So, Quine concludes, it is a mistake to assume that any meaningful expression must act like a name (cf. 1960b, 1961a).

Let us grant to Quine that it is a mistake to assume every position must be one for a referring expression. In "On what there is" (1948), Quine considers another way we might see predicate positions as indicating objects. Predicates are meaningful, and so, we might argue (as McX does), that there must be things which are their meanings, and these must be like properties or attributes in some ways. Quine labels this "an unusually penetrating speech" (11), but this note of sarcastic praise gives way to Quine simply asserting that he is happy to reject such meanings. (In later writings, he reminds of this often.)

Now, Quine's main concern in "On what there is" is with ontological commitment, not with the status of quantifiers *per se*. As we will see in section 6 below, Quine links the

two, and so, repudiating properties for Quine is repudiating there being any bound variables that range over them—repudiating second-order quantifiers. Nonetheless, it does seem that Quine's observation only goes so far. If we do not follow Quine in skepticism about intensional objects, we might wonder if we could not then set up devices of quantification over them. Now, we would have to recognize that these function somewhat differently than the familiar first-order extensional quantifiers, but we can make sense of them. Formally speaking, this has been accomplished, in different forms by Church (e.g. 1973, 1974) and Montague (1973).

Quine's final reason for treating quantification as first-order, discussed at length in "Logic and the reification of universals" (1961a), is that it embodies the confusion of schematic letters with variables. In many standard presentations of logic, including the one Quine himself develops in *Methods of Logic*, we find formulas like '$\forall x\ (Fx \vee \neg Fx)$', and we prove various facts about these. '*F*' in such a formula seems to express generality, and so, it might simply appear to be a variable. It need not be, Quine reminds us, if we treat it as schematic. To do so is to view the above not as a formula of the object language, but as a metalinguistic formula which displays the forms of certain object language formulas.[11]

Why should we prefer this route? In some places, Quine simply notes that there is no need to treat predicate positions as bindable to achieve the generality we need for the study of logic (e.g. 1961a, 108). Indeed, the years have been kind to the claim that we need some notion of schema in logic. Subsequent work has shown that this is so, even if we

[11] To be completely precise, we should be presenting schemas using the device of quasi-quotation Quine provides in *Mathematical Logic*. But for sake of simplicity of notation, we may skip this nicety, and rely on the reader's ability to understand schemas appropriately. Quine does the same thing in many places, including *Methods of Logic*.

break with Quine and adopt second-order logic. Second order statements like induction, and their schematic counterparts, are not always equivalent. But the question of whether the need for schemas shows we do not need second-order quantifiers is less clearly answered. Many interesting second-order theories rely on schemas, and in some cases, schematic forms of axioms can lead to stronger theories. Thus, the fact that we need schemas for certainly applications in logic seems to be independent of the claim that we have no need for second-order quantification.

Quine is also concerned by the technical difficulties in treating predicate positions as bindable, where the variables would range over classes. Paradox threatens if some care is not taken, as Quine is well aware (e.g. 1961a, 121). Quine over the years offered a number of proposals for how to treat classes in a consistent, sufficiently powerful, and non-*ad hoc* way. We will not pause to explore them here. (See Quine 1937, 1951.) Standard ZFC, of course, also offers a way to do so. Quine enjoins us to see any of these theories as theories of sets or classes, and not simply as logic in its pure form. We may well need such theories, and Quine is happy to grant that mathematic itself, and its applications to the natural sciences, may well call on us to admit sets or classes into our ontology. But this is not, to Quine, a matter of logic. We should not, as Quine says in *Philosophy of Logic* (1986, 66), allow set theory to sneak in wearing sheep's clothing. If we need set theory, we should adopt it explicitly, and not think it is merely as a byproduct of logic, or of being able to use subjects and predicates.

Over the years, Quine's opposition to second-order logic has met resistance. Boolos, for instance, challenges a number of Quine's arguments (e.g. 1975). An extended defense of the importance of second-order logic is given by Shapiro (1991). Boolos (1984, 1985)

went on to develop what is now known as the plural interpretation of second-order logic. This approach starts with a language including plural idioms, like 'there are some *F*s'. This can be regimented as a first-order language extended with plural constructions. Boolos shows that monadic second-order logic can be interpreted in such a plural language, without recourse to set theory. This, Boolos and others have concluded, shows it to be pure logic, and not, as Quine charges, set theory in sheep's clothing. This strategy can be extended to full second-order logic with the assumption of a pairing function, but that assumption has been thought by many to depart from the realm of pure logic. Boolos's ideas have been developed extensively (e.g. Burgess and Rosen 1997; McKay 2006; Rayo 2002; Rayo and Uzquiano 1999; Uzquiano 2003; Yi 2002). For critical discussion, see Linnebo (2003), Parsons (1990b), and Resnik (1988). The use of higher-order logics has become widespread in the semantics of natural language; but, for instance, Higginbotham (1998) continues to challenge the necessity of doing so.

5. Quantification into Opaque Contexts

We have now seen that for Quine, quantification is subject to some important restrictions. It is first-order. And of course, given Quine's skepticism about intensional entities, we can expect it to be first-order and ranging over extensional entities. No propositions, properties or other intensional entities will fall within the domains of quantifiers.

Quine's resistance to intensional quantification extends farther, to his well-known instance that quantification into modal contexts is unintelligible. Thus, forms familiar from modal logic like '$\forall x \Diamond Fx$' are not really available. It may not be surprising that Quine comes to such a conclusion, if we combine his skepticism about intensional entities with his

insistence that quantification always provides the standard of ontological commitment. But practitioners of modal logic have often seen quantifying into modal contexts a less ontologically heavy move than quantification over intensional entities. After all, we are simply starting with ordinary quantifiers over ordinary objects, and adding modal operators.

Nonetheless, Quine insists that no such quantifying in is to be allowed. The argument, presented in "Reference and modality" (1961c) and repeated often (e.g. 1953, 1960b, 1961d)[12] runs as follows. First, Quine observes that quantification into quotation contexts often produces results that are absurd. For instance, Quine asks us to consider '$\exists x$(‘x’ contains six letters). This is the result of quantifying into something like ' 'Cicero' contains six letters', which is no doubt true. But the result of quantifying in misses the mark. At best it is false: 'x' does not contain six letters, and at best the claim is that it does. But the situation is worse. If that is what the sentence says, then the quantifier is not really doing anything. We tried to make a simple existential generalization, and wound up with at best a false vacuous quantification. There is something amiss with quantification into quotation contexts, and Quine concludes that the results are generally meaningless. He writes (1961c, 150), "quantifiers outside a referentially opaque construction need have no bearing on variables inside it."[13]

What bearing does this have on quantifying into modal contexts? Quine notes often that quotation contexts are opaque contexts "par excellence" (1953, 159). But, by many ways of characterizing them, modal contexts are opaque as well. They fail to support

[12] "Reference and modality" draws on Quine's earlier (1943, 1947).
[13] For an extended discussion of quotation, see Cappelen and Lepore (2007).

substitutivity of co-referential terms (of course, non-rigid ones). And, Quine notes, we can raise similar puzzles for quantification into modal contexts as we saw with quotation contexts. For instance, we can start with the correct claim '$\Box(9 > 7)$', but quantifying in yields '$\exists x \Box(x > 7)$'. This, Quine claims, presents all the problems of quantification into quotation. What, he asks, is the thing which is necessarily greater than 7? If it is 9, it appears correct, but if it is the number of planets, it appears incorrect.[14] Quine concludes (1961c, 148), "In a word, to be necessarily greater than 7 is not a trait of a number, but depends on the manner of referring to the number."

In this and other discussions, Quine is quite explicit about viewing necessity as on par with, if not identical to, the notion of analyticity (which of course, Quine has some problems with). It is a notion of verbal necessity, where it is the meanings of the expressions that determines necessity. From this perspective on modality, Quine's complain is not surprising. What is it about the meaning of '*x*' that makes '*x* > 7' analytic? Presumably nothing. Like a quotation context, a verbal necessity relies on the specifics of presentation in some way, and quantification destroys that. As Quine puts it, our prior grasp of modality (as verbal) and quantification (as objectual) do not combine.

One possible response to this sort of problem, pursued in some ways by Church, is to make the variables in modal contexts range over suitable intensional objects. Quine is skeptical of this solution as well (1961c, 153). But the main line of resistance to Quine's skepticism has been to deny that the notion of necessity involved is a verbal one; rather, it is a genuinely *de re* modality. Developments in quantified modal logic (e.g. Hintikka 1961;

[14] The fact that the number of planets is currently counted to be 8 may make this point all the more vivid.

Kanger 1957; Kripke 1963, 1980; Marcus 1947, 1961) pursue just such a view.[15] The leading idea, of course, is that objects have properties necessarily or contingently, independently of how the objects are described.[16] We need not worry here about what in the nature of objects or properties allows that—the point for us is simply that such a modality is not verbal, and does not resemble analyticity. If we assume such an approach, then there is no fundamental barrier to granting that '$\exists x\Box(x > 7)$' is true, and is witnessed by 8, 9, 10,… .

Quine, of course, will have no truck with this sort of modality. The main objection is simply that he rejects any such *de re* notion of modality. His concern is with what he labels 'Aristotelian essentialism'. A *de re* modality will reveal some essential properties of an object, any time we have '$\Box Fa$' we can say that *a* has *F* essentially.

In "Reference and modality," Quine does raise some questions about whether approaches to quantifying in more closely tied to verbal necessity are viable. He notes that if one is to use linguistic form as a guide to modality, then one would have to find terms which "reveal the essences" of objects, and it is doubtful this will be natural, if at all possible. He also notes that there is a substantial tradition of taking necessity to be verbal, and many of the figures Quine is responding to did, such as Carnap and C. I. Lewis. But these points apply to systems where the modality is basically verbal, and not to thoroughly *de re* approaches. Against these, Quine's main objection is simply that he rejects the

[15] The currently received approach to quantified modal logic developed over time, and not all these works agree on the interpretation of quantification. For instance, some early ones rely on substitutional quantification.

[16] Sometimes the term '*de re* modality' is used simply for cases of quantification into modal contexts. The picture of modality at issue here, and the corresponding formal developments that go with it, involve more than that.

relevant notion of essence. He announces that it is "unreasonable by my lights" (1961c, 156), and in *Word and Object* (1960b, 200) he declares it "surely indefensible." That, as I read it, appears to be Quine's main argument.

One further comment is in order about Quine's aversion to what he labels 'Aristotelian essentialism'. In spite of Quine's label, it is doubtful that what has become the standard approach to quantified modal logic takes on the full weight of Aristotelian metaphysics (he holds the label subject to scholarly review in *Word and Object*). As Quine consistently notes, the sort of commitment involved is well-illustrated by the necessity of identity: '$\forall x \forall x(x=y \rightarrow \Box x=y)$'. This shows identity to be 'essential', but it is not clear whether it makes the metaphysical commitments of quantified modal logic as great as the talk of essence might make it seem (cf. Fine 1994, 1995).

In spite of Quine's doubts, quantified modal logic has flourished over the years, with impressive technical developments and interesting philosophical applications. It raises many questions, but it has been ably defended, and it is hard to insist in the current day on its indefensibility. Like any field of philosophy, it encounters a whole host of difficulties, many of which have been extensively researched. See Garson (1994) for a survey. For some retrospective on Quine's objections, see Marcus (1990) and Quine's reply (1990a), and Fine (1989). For a sympathetic review of how Quine's objections relate to specific developments in modal logic, see Burgess (1998).

Quine is generally sure that quantification into opaque contexts is incoherent. But, he also realizes that there are some constructions that seem to involve it which we cannot live without. In "Quantifiers and propositional attitudes" (1956), he considers quantification into attitude contexts like the famous 'Ralph believes that someone is a spy',

which has a quantifying-in reading. As Kaplan (1986) discusses in depth, Quine devotes a great deal of effort in that paper to rendering the plausibility of quantifying-in readings of attitude sentences consistent with his ban on quantification into opaque contexts.

We have now seen some of the main points about what Quine thinks quantification is, and is not. It is an important device of regimentation. Most importantly, in regimented languages, existence is expressed uniformly by the existential quantifier. But, regimentation is first-order, extensional regimentation. Going beyond those restrictions leads from useful regimentation to error or incoherence. Thus, as far as Quine is concerned, quantification is standard, first-order extensional quantification.

6. Ontological Commitment

Quine's discussion of the limits of quantification takes place against the backdrop of his wider views. His rejection of quantification into modal contexts and his skepticism towards intensions are linked. His discussion of second-order logic is linked to his views about ontological commitment. More generally, his understanding of regimentation and the role of quantifiers in it is closely tied to his thinking about ontology. To illustrate the link between quantification and ontology for Quine, we will briefly review his criterion of ontological commitment.

Quine is rightly famous for turning philosophical phrases, and perhaps none is as memorable "to be is to be the value of a variable" from "On what there is" (1948, 15). This slogan captures Quine's preferred measure of ontological commitment: ontological commitment is carried by the variables of a suitably regimented theory; and of course, we

know that a suitable regimentation is into a first-order language. Thus, what exists, according to a theory, is uniformly what the variables of its regimented form range over.

It is possible to take claims like this merely as suggestions for how to keep one's ontological books balanced. Chose a first-order language in which to regiment your theories, and count commitments accordingly. As such, it is not a claim about ontology itself; nothing about what does or does not exist follows from such a book-keeping system. In large measure, this is Quine's view. However, his position is somewhat stronger. Other options for how to measure ontological commitments embody mistakes, and the criterion Quine does endorse can help sustain the ontological "desert landscape" Quine prefers.

The classic argument in "On what there is" for the role of quantifiers and variables in measuring ontological commitment is driven by the contrast with a corresponding role for names. Consider a name like 'Pegasus', which seems perfectly meaningful, appearing in various Greek myths (or our English translations of them). Of course, we can correctly say that there is no such thing as Pegasus ('Pegasus is not', as Quine puts it). Quine imagines a philosopher McX, who assumes that because 'Pegasus' is meaningful, it must refer, and so, there is some object that is its referent. This is a puzzle, which Quine imagines our fairly crudely drawn McX tries to avoid by thinking of the referent of 'Pegasus' as an idea, or some other sort of intensional entity.

Quine finds this to be a fairly obvious mistake, and moves on to consider a Meinongian alternative, which he puts in the mouth of another fictitious philosopher named 'Wyman'.[17] Wyman proposes that the referent of a term like 'Pegasus' is an object

[17] Wyman is clearly Meinongian, but not a careful representation of Meinong. There is occasional speculation over who McX is; McTaggart is sometimes proposed as a possibility. For the record, on the website http://www.wvquine.org/, Douglas Quine reports, "I spoke

that lacks a property that ordinary (existing) objects have, like being 'actualized'. Pegasus, according to this view, is an unactualized possible object, which subsists but lacks existence. Quine is, again famously, unimpressed with Wyman's ontology, which offends his taste for "desert landscapes" and is to Quine a "slum" which is a "breeding ground for disorderly elements" (1948, 4). Ignoring the sarcasm that seems to go in place of argument here, Quine thereby alludes to a range of problems for Meinongian or non-actual objects. His solution to these sorts of problems is to avoid them altogether by a more careful analysis of ontological commitment, relying on variables rather than names.

The main inspiration for this alternative is Russell's theory of descriptions. This theory, among things, shows how we can make sense of an apparent singular term being meaningful without requiring it to have a referent. The outlines of this approach are extremely well-known. For Quine, the important point is that the work apparently done by a name like 'Pegasus' is taken up by quantifiers and bound variables, and some predicates. He writes of Russell's analysis (1948, 6), "the burden of objective reference … is now taken over by words of the kind that logicians call bound variables." Of course, the issue of mapping proper names to definite descriptions raises a number of well-known problems. Quine proposes to sidestep them (if necessary), by introducing canonical predicates to go with names. For 'Pegasus' we might introduce a predicate 'Pegasizes', which expresses the property of being Pegasus (8). With this, we can apply Russell's analysis of descriptions, and see the name as meaningful without any need to posit an object to which it refers.

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with Prof. Quine last night regarding your question [about McX and Wyman] which he found interesting. He says his intention was to create some fictional philosophers ("X" and "Y") to illustrate some of his concerns. There may also have been a "Z" man. These fictional philosophers were not designed to represent any particular philosophers although their viewpoints may happen reflect those of actual philosophers."

The moral of these proposals, to Quine, is first and foremost that we need not see any meaningful apparent referring expression as thereby inducing an ontological commitment. Where then do such commitments come from? Again following the proposal to employ Russellian methods, we can see them as coming from bound variables and the quantifiers that bind them. This is implicit in the appropriation of Russell's method, but becomes more explicit upon regimentation. Existence is expressed in a regimented language by '∃', and any specific claim of existence won't rely on a name, but on an existential claim '$\exists x \Phi x$'. What exists, according to this proposal, is just what values the variables are allowed to take in a given theory. We thus reach the conclusion that "to be is to be the value of a variable."

It is clear that Quine's criterion of ontological commitment and his views about quantification go hand-in-hand. Several of the arguments we saw in section 4 against second-order logic are parallel to the arguments against taking names as a guide to ontology, as Quine (1948) makes explicit. The fact that names and predicates appear meaningful is in neither case a reason for positing entities. Conversely, having fixed a standard for regimentation helps us to avoid 'spoiling the good old word exists'. More generally, Quine adopts the same stance towards quantifiers and regimentation and criteria of ontological commitment. There are choices to be made, but some are good and some are bad. Quantifiers appear (properly speaking) in regimented languages, and there are multiple options for how regimentation might proceed. To some degree, the choice is a practical one, driven by convenience. But there are some choices that embody mistakes, like second-order logic or quantification into modal contexts. Likewise, we may adopt different criteria of ontological commitment, but some criteria involve mistakes, like letting

your ontology be driven by proper names. Substantially the same issues bear on what makes both sorts of choices good, and so it is no surprise that Quine's preference for first-order logic and his preferred standard of ontological commitment coincide.[18]

Quine prefers first-order quantifiers, and he has a taste for desert landscapes. At one point in his career (Goodman and Quine 1947), he flirted with nominalism. But Quine's resistance to second-order logic is not thereby a nominalist position about universals or properties or attributes, or sets or classes. Quine sees no route from a sentence like 'The house is red' to properties like 'redness'; likewise we find no commitment to any universal or property or class in '*Fx*'. Such a route would, by Quine's lights, go through second-order quantifiers, which have been rejected. But this does not make Quine a nominalist, about classes or even properties. (He explicitly says so in the 1980 forward to the reprinting of *From a Logical Point of View*.) To decide the question of nominalism, you have to look at the full theories that might be involved. For Quine, some form of set or class theory will prove its worth, while intensional property theories will not. For instance, he says in "Existence and quantification" (1969, 97-98), "…we have essentially scientific reasons for excluding propositions, perhaps, or attributes, or unactualized bodies, from the range of our variables. Numbers and classes are favored by the power and facility which they contribute to theoretical physics…" Quine is ready to ridicule some ontologies as 'slums', and he prefers the desert, but the role of quantifiers and variables is to cleanly represent ontological commitments, not to decide them.

[18] It is worth noting that the way Quine sees such choices as good or bad makes a substantial dispute with Carnap. Many read "On what there is" as advancing an anti-Carnapian approach to ontology.

Quine's criterion of ontological commitment has been extraordinarily influential.[19] But not surprisingly, there have been opposing views, and many of them engage issues about the scope and nature of quantification. We have already seen one: approaches invoking plural quantification discussed in section 4. Advocates of plural quantification have often argued that it is *ontologically innocent*: plural quantification, they argue, carries no ontological commitments. As Boolos (1984) suggests, to say 'There are some cheerios in the bowl' does not seem to carry any commitment beyond that to the individual cheerios; and in particular, it does not seem to require a commitment to classes. This position changes the mechanics of applying Quine's criterion. If we regiment into a plural language, or a second-order language interpreted via plurals, then we no longer simply read ontological commitments off the variables. This can have several consequences. It opens the way to rejecting the commitment to classes or sets Quine accepts, since the work done by classes in Quine's preferred regimentation is now done by second-order or plural variables. Also, it allows us to see some quantifiers in regimentations as ontologically innocent. Quantification is no longer uniform, existential quantification no longer univocally expresses existence, and ontological commitments are marked by some but not all quantifiers. In a related vein, Hofweber (2005) argues that some occurrences of quantifiers, including seemingly existential ones, can be existentially non-committal. Recent years have also seen arguments against the quantificational nature of Quine's

[19] Classic discussions of Quine's criterion of ontological commitment include Alston (1958), Cartwright (1954), and Harman (1967).

criterion of ontological commitment. For instance, Azzouni (2004) argues in favor of a predicate-based approaches to ontological commitment.[20]

Quine never addressed these sorts of proposals directly, but he did consider one other sort of quantification that has been offered as ontologically innocent: substitutional quantification. Very roughly, a sentence of the form '$\Sigma x\ Fx$' with substitutional existential quantifier 'Σ' is true if there is some term '*t*' such that '*Ft*' is true. (See Kripke 1976 for extended discussion.) Substitutional quantification has seemed to some to offer a non-committal form of quantification—if terms do not carry ontological commitment, neither would substitutional quantifiers. But it has also seemed to some to involve a distinct notion of existence, perhaps 'lighter weight' than ordinary 'objectual' quantification. For instance, Parsons (1971, 66) suggests we might treat quantification over predicative classes substitutionally, and capture "the idea that classes are not "real" independently of the expression for them."

Quine's outlook on these issues, articulated in "Existence and quantification" and *Philosophy of Logic*, is mostly dismissive.[21] Now, Quine does not hold that substitutional quantification is unintelligible. Instead he points out that substitutional quantification can get strange results. If the universe is large (as it would be if, say, set theory is at issue), and we have only a countable number of names, then we will fail to accurately capture relevant

[20] Though it goes beyond the scope of this essay, it is well-known that Quine's approach to ontological commitment is part of his broader dispute with Carnap, as it makes no room for a distinction between internal and external questions about existence. With this in mind, it is worth noting that the growth of anti-Quinean approaches to ontological commitment has gone together with a growth of neo-Carnapian approaches to ontology. For a discussion of these issues, and the place of Quine's and Carnap's views in the current debate, see Eklund (forthcoming).

[21] Substitutional quantification is also briefly discussed in Quine (1947).

truths. If our substitution class is not ordinary terms, but some other parts of sentences (Quine mentions the left parenthesis), we will get odd existence claims. Quine concludes that substitutional quantification is not a competitor or alternative to ordinary objectual quantification when it comes to expressing existence. He says (1969a, 106), "To conclude that entities are being assumed that trivially, and that far out, is simply to drop ontological questions." To keep sight of ontological questions, he urges us, we should return to his preferred regimentation and see existence as solely the province of the standard objectual quantifier. It is doubtful this response would satisfy those like Parsons (who in facts examines this passage from Quine in depth), or others who seek to lightened or eliminated the ontological commitments of theories. But it does illustrate Quine's general outlook about both quantifiers and ontology. Standard first-order quantifiers avoid mistakes and should be preferred, and they avoid results in ontology Quine finds unpleasant.

The criterion of ontological commitment makes vivid how quantification works for Quine. Quantifiers and variables are primarily part of regimentation. In good regimentations, quantifiers are standard first-order: they are not second-order, they are not substitutional, and they do not cross into opaque contexts. The standard quantifier '∃' expresses existence, and so, questions of existence are to be resolved by regimenting a theory in the standard formalisms, and seeing what the existential quantifier ranges over. Since quantification is always standard first-order, that range is simply the range of values of variables, which is precisely what the theory is committed to.

7. Reference and Quantification

We have now seen a number of views Quine holds on reference and on quantification. To close, we should ask how those views relate. It is striking that since we left the topic of reference in section 2, we have consistently down-played the role of referring expressions in favor of quantification. That may make one wonder if Quine changed his mind about which of these concepts is important over the years?[22] Did quantification give way to reference as a central notion in Quine's later work? There are obviously some shifts in position over the many years of Quine's work we have been discussing, and some substantial shifts in emphasis. But even so, his earlier work focusing on quantification and his later work focusing on reference are substantially in accord.

To begin, let us remind ourselves how far Quine is willing to go in eliminating referring expressions. When it comes to names, he is happy to eliminate them altogether. We saw that in "On what there is," Quine almost casually proposes that names be eliminated in favor of predicates. This position is repeated in *Word and Object* (176-186), though there he highlights that treating names as predicates is to 'reparse' them as part of an exercise in regimentation. Doing so, of course, eliminates some ontological quandaries, as we saw in "On what there is." But the elimination of names, and related terms, is not the complete elimination of all singular terms. After all, the variables themselves are left, and they are not eliminable by any exercise Quine is willing to consider (except, perhaps, those of combinatory logic we mentioned in section 4). He concludes (1960b, 185), "Thus evidently nothing stands in the way of our making a clean sweep of singular terms altogether, with the sole exception of the variable."

[22] Hylton (2004) asks a related question about whether Quine's views on ontological relativity come into conflict with his earlier views on ontological commitment.

Why should we do that? Not to capture the ordinary ways we talk, as Quine (1960b) makes clear. Rather, to give the most useful regimentation of our theories, which avoids the ontological muddles names bring with them. Our regimented theories rely solely on the apparatus of standard first-order quantification theory, as Quine urged from early on. But we still make reference to objects, and our theories, regimented or not, should capture that. Quine's proposal is that they do so via the apparatus of quantifiers and variables, and appropriate predicates. Quine often talks about the values of variables; but variables taking values is an essential reference relation, and it tells us what we can refer to using our theories.

This conclusion is entirely in accord with the story about the emergence of reference from observation sentences and stimuli we reviewed in section 1. Recall, for Quine, reference does not emerge with the introduction of singular terms. Reference is first marked by the emergences of predicates, and further by a process that continues from predicates to the apparatus of relative clauses and pronouns, and finally, to regimentation with quantifiers and variables. Avoiding singular terms avoids nothing crucial to this process, and if anything, it puts our focus on the crucial elements first of predicates, and then quantifiers and variables.

Quine does not talk much about regimentation in *The Roots of Reference*, and it appears only occasionally in later writings (e.g. 1992). At least, the focus there is not on regimenting theories into first-order formalisms and assessing their ontological commitments with the aim of keeping them sparse and orderly. But, the themes of regimentation and ontology are still present. A passage from *The Roots of Reference* (1974, 89) makes this vivid:

> It is in deliberately ontological studies that the idea of objective reference gains full force and explicitness. The idea is alien to large parts of our ordinary language. Still it has its roots in ordinary language…It is in imposing this referential pattern all across the board that scientific theory departs from ordinary language (1974, 89).

We are looking at scientific theories that depart from ordinary language, which I take to be regimentations. An ontology comes from such a theory 'imposing a referential pattern'. Quine in later works describes this as "reification," but it also amounts to a theory carrying ontological commitments. As Quine likes to put the point (e.g. 1992, 25), "Substantial reification is theoretical." Thus in describing the introduction of reference, and the path to reification, Quine is revisiting the approach to ontology he started with "On what there is."

All we need to complete the parallel is the idea that the real force of reification—the real ontological commitments of a theory—is to be found in the domains of quantifiers. But, we have already seen that this is Quine's position. As we already mentioned in section 1, he holds that (1974, 100), "Quantification is a welcome encapsulation of the referential apparatus." Reification is a hard won achievement, and reference only emerges in stages, through a long complex process. As we saw in section 1, even at the point where reference emerges with predicates, it is still not fully formed. As we develop more sophisticated devices, it becomes more substantial. It becomes fully present only after the introduction of variables or pronouns. But this process does not stop with acquiring an adult language; it continues as we develop (regimented) theories. In these, we will have full-fledged quantifiers and variables. Our final 'conceptual scheme', with its ontology, emerges as those theories emerge. Reification is a process, whose culmination is the introduction of quantificational apparatus in a theory. That is the point where we can really assess

ontological commitment. In From *Stimulus to Science* Quine talks of "linking reification to the essential pronoun, or to its counterpart the variable of quantification" (1995, 32). On the next page (33), he concludes "to be is to be the value of a variable," just as he did in 1948.

We thus see that there is substantial continuity between Quine's early discussions of quantification and ontological commitment and his later discussions of reference and its origins. Throughout he insists that having an ontology, or a conceptual scheme, is a theoretical achievement. Throughout, he insists that reference is derivative. Ordinary referring expressions like names are of limited importance, and are to be avoided in regimentation. Throughout, what is important about reference is what variables refer to. Throughout, he insists on quantification being limited to first-order, extensional quantification not crossing into intensional contexts. Throughout he insists that ontological commitment is carried by the variables of theories regimented in such first-order languages. Though some themes, like behaviorism applied to meaning, are not present in early papers like "On what there is," Quine's core views about reference and quantification remain remarkably constant over many years.

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