Extensionalism in Context

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W. V. Quine
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Abstract

Quine's philosophy comprises a bewildering set of views whose integrating prin-
ciple is his "confirmed extensionalism". The paper offers a historical as well as an
intellectual reconstruction of extensionalism. Traditional extensionalism (Boole)
freed logic from Aristotelian essentialism that had inhibited the development of
logic. Quine's confirmed extensionalism is the acceptance, as a matter of course,
of the validity of Frege's criticism of [Boole's] extensionalism. His confirmed ex-
tensionalism is a generalized version of the philosophy of science known as con-
ventionalism. As such, it places the advancement of science outside the province
of science proper. It is, thus, at odds with Quine's repeated expressions of alli-
ance with the Popperian (hypothetico-deductive) model of science.

Keywords

extensionalism, conventionalism, essentialism, Boole, Duhem, Quine

> "I am neither an essentialist nor, so far as I know, an existentialist. But
> I am a confirmed extensionalist. Extensionalism is a policy I have
> clung to through thick, thin, and nearly seven decades of logicizing and
> philosophizing. . . . I was heeding it before knowing the word or hav-
> ing the concept clearly in mind."
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> Quine, Confessions (p. 498)

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"I doubt that I have ever fully understood anything that I could not explain in extensional language"

Quine, Confessions (p. 500)

1. The Quine Enigma

Willard Van Orman Quine is an acknowledged giant of twentieth-century philosophy. Yet it is scandalously difficult to explain why this is so. No other great philosopher has contributions to posterity so difficult to sum up, even for the initiate. An unprecedented number of papers have been written by distinguished peers in restatement of his output. And, as he frequently noted, they have usually got him wrong. My observation is made with great respect for his profound contribution to modern logic (most notably, his simplification of the *Principia Mathematica*) that is generally understood and admired. And it is made with frank envy at his notoriously witty and lucid prose. Despite, and sometimes because, of this, the conspicuously elusive character of his philosophical legacy is so puzzling: what is it?

Perhaps the heart of the difficulty to know what precisely Quine says is this: he is famous for his advocacy of a cluster of views whose integrating principle eludes his intended reader, often quite paradoxically. He is often recognized as an analytic philosopher, and yet he advocated holism, a theory of meaning that precludes the very possibility of philosophical analysis. He is often associated with a behavioristic theory of learning, yet he expounded the limits of language acquisition—and thereby of all learning—by means of his indeterminacy of translation thesis. This is the way he observed the limits of his behaviorism from a nonbehaviorist point of view. He was also an odd Platonist, striving for a nominalistic worldview, denying the existence of ideas (and thus also the meaningfulness of meanings), but grudgingly affirming the existence of classes in Plato's Heaven. And he was a naturalist in his own special sense, which meant, ultimately, endorsing whatever the dominant theories of natural science happen to assert. To confuse things a little more, despite his naturalism he expounded the underdetermination of scientific explanations thesis (ultimately a version of Hume's critique of induction; more specifically it is the observation that empirical theories always have viable alternatives with respect to the empirical observations that they explain). This, you will note, means that Quine observed the limits of his naturalism from a nonnaturalist point of view.

Considering these characteristic views, it may be stipulated that Quine's trademark philosophical move is expounding of a philosophy, (for example, behaviorism or naturalism) and then portraying its limits from a point of view

that is external to that philosophy. This may be true, and may provide at least a first clue to explaining the bafflement of his students; indeed, since Quine confesses in the motto above doubt that he had ever "fully understood" (whatever that means, exactly) anything that he could not explain in an extensional language, and since he expounded his philosophy in English, which is clearly nonextensional, a paradox may well be lurking here. But merely implying it will not do: we should also note that Quine is navigating the seas of his bewildering views with an unshakable sense of direction. His choice of philosophies is not arbitrary, and his criticisms of these philosophies are not capricious. What intellectual compass is he using, then? Is he suggesting to his intended reader a preplanned destination? If so, what is it?

Confessions of a Confirmed Extensionalist—a definitive collection of papers from Quine's last creative period as well as some terrific unpublished lecture notes from earlier years—offers an answer to our puzzle. Quine suggests there repeatedly that his philosophical development was, from its earliest years till its very end, an attempt to put into practice a single creed and to portray the limits of its successful implementation in various interrelated fields. This creed is extensionalism.

Let me put it in a nutshell: Quine advocated holism as a consequence of his extensionalist criticism of Carnap-style positivism (which involved, as a matter of course, the claim that there is a sharp distinction, within the empirical realm, between analytic and synthetic sentences). His holism, then, is an expression of his view that all nonextensional contexts are nebulous. Quine adopted behaviorism because he deemed it the natural creed of extensionalists. His indeterminacy of translation thesis is a discovery, as an extensionalist, of the limits of his own behaviorism. Quine purged the *Principia* of propositional functions (properties and the intension of relations) and of propositions, as well as of proper names, because as an extensionalist, he deemed them vague and undesirable, and he showed them redundant, at least for mathematics. His Platonism, then, is another discovery of the limits of his extensionalism, this time, within mathematics: it is a consequence of his contention regarding the minimal semantic-ontological limits within which such purging can be successfully achieved. His naturalism too is a mere aspect of his extensionalism, for, as we will see later on, the extensionalist adopts the conventionalist outlook by fiat, and this outlook regards the search for an external justification of scientific theories as a private and vague affair. And finally, Quine's underdetermination of empirical explanations thesis is the circumvention of the limits of his naturalism, from a nonempirical, extensional point of view.

Since the above paragraph is comprehensible only to the initiate, we must take things slowly from here on. The term "extensionalism" is highly technical, of course, and almost impossible to discuss without the presentation of some

terminology in disregard for common intuitions. That, clearly, is the major difficulty in explaining Quine's place in posterity to the lay reader. In this review, then, I offer to reconstruct the background to extensionalism, historical and intellectual. I hope to, thus, clarify the little discussed affinity between conventionalism (in the methodology of the empirical sciences), and extensionalism (the semantic heuristics that underlies it).

Let us ask, then, what extensionalism is, what it is good for and, of course, why, of all creeds, did Quine choose it as his philosophical compass?

2. Traditional Extensionalism

The extension of a term, it is well known, is the object or objects to which it refers (or which it designates). For example, the extension of "The morning star" is, famously, the planet Venus. Terms with identical extensions are called coextensive terms. For example, "The morning star" and "The evening star" are coextensive terms, since they designate the same planet: Venus. Our intuitive notion of meaning is extensional: it implies that the meaning of a term is its extension (and nothing more). The meaning of "The morning star" and of "The evening star" is, thus, one and the same: in both cases it is usually taken to be the planet Venus. Traditionally, then, coextensive terms were taken as synonyms in all contexts. This entailed that they were taken as interchangeable in all sentences, without thereby changing the meaning of these sentences and, consequently, without thereby changing the truth value of these sentences. Let us call this intuitive theory "traditional extensionalism." What is it good for? And who were its historical advocates?

The answer to our first question is straightforward and simple: once we achieve a fully extensional theory, one in which every expression is replaceable only by coextensive expressions, we have a formal language. In a formal language there is no place for intuitions (and thus no place for intuitive errors). This is why computers communicate only by means of formal languages: they have no intuitions. The search for an extensional theory is, thus, the search for a purely formal logical framework, one that would enable us to perform inferences while not needing to worry about being misled by our fallible human intuitions.

The answer to our second question is surprisingly difficult and requires a historical digression. Traditional logic was neither an extensional theory, nor was it founded on extensional notions of meaning. Indeed, the development of a purely extensional logic was obstructed by the influential Aristotelian contention that logic is the study of the taxonomy rules for essences. The notion of essence is elusive and ambiguous, and so clouds the criteria for deducing in a purely formal manner. Let us look at an example: consider the terms "a rational animal" and "a featherless biped." They are traditionally taken to be coextensive. But they are

not considered traditionally as synonyms. Aristotle's authority had decided this matter for generations of logicians who followed him: "Man is a rational animal" is the definition of the essence of Man, he maintained, but "Man is a featherless biped" is not, he contended. Therefore, the sentence "Man is by necessity a rational animal" is true, he argued, but the sentence "Man is by necessity a featherless biped" is not true. Although the terms "Man" and "Featherless biped" are coextensive, then, Aristotle clearly implied that they are not freely interchangeable in sentences without thereby changing their truth value.

Aristotle's authority, then, curbed the development of a purely formal, extensional logic, by subordinating it to what we nowadays regard as extra-logical preconception about what the world must be, and what knowledge of it should be. And yet neither he nor his followers could offer any complete set of rules for judging when to forbid and when to allow such basic deductive moves as the substitution of coextensive terms. Consequently, traditional logicians routinely cradled their deductions by extra-logical, intuitive knowledge: they were arguing within an intuitive epistemological context that blocked valid but undesirable consequences, such as valid but undesirable substitutions of coextensive terms. This intuitive extra-logical knowledge was historically called "judgment." (The term "judgment" is technical, and must not be confused with its everyday use.) The development of a formal extensional logic, then, was historically curbed by the ubiquitous use of judgments.

Here is a well-known example to the manner by which the use of extra-logical judgments obstructed the development of an extensional, formal logic. As a means to achieve his goal of limiting logic to the taxonomy of essences, Aristotle had famously intended to exclude names of fictitious entities from the province of his logic. Thus, in Aristotle the very use of a term implies the existence of its reference. (This implication is known today as "Aristotle's existential import.") How did Aristotle achieve this incredible feat? Is it at all achievable? How, for example, did Aristotle know that the conjunction of the terms "rational" and "animal" is not a name of a fictitious entity, as, say, "Goat-Stag" or "Rational-Wolf"? He used his judgment, of course; that is to say, in this case, he used his illustrious expertise as a biologist. In the context in which Aristotle was writing, then, there clearly are no rational wolves, and so "Rational-Wolf" is intuitively avoided. But this is certainly not true of the context in which animal ethologist Konrad Lorentz wrote. What are we to do? Aristotle was one of the greatest biologists in history, and yet his biology is, naturally, not error free. For example, famously, he regarded the conjunction of "Fish" and "Whale" as designating an existing entity, and this judgment held sway until whales where discovered to be the mammals that they are. In Aristotle, then, logic is subordinated to empirical judgments disguised as profound intuition about the essence of things. This is too limiting, of course: logic is the method by which we should search for a theory of the cosmos,

and so such a theory cannot be a presupposition to it. Think, for instance, of any sentence involving atoms: we do not know whether atoms exist, and before we can decide whether they do, we must discuss them, naturally, but if they do not exist we are not allowed to discuss them, in Aristotle, and then we are lost.

It is interesting to note, however, that Aristotle's circular attempt to eliminate fictitious entities from the province of logic was in other respects surprisingly farsighted. For admitting them into the province of logic is no easy feat. Consider unicorns, for example. Are they, or are they not identical with squared circles? Most of us would readily agree that unicorns are imaginary white animals whereas squared circles are not. Yet from the purely extensional point of view the terms ("Unicorns"; "Squared Circles") are clearly coextensive, they represent the same no-thing. The terms are coextensive, then, but not interchangeable without thereby changing some very basic intuitions that we have about the truth value of the sentences in which they appear. Aristotle, so it seems, intuitively grasped such dangers and so attempted to intuitively avoid them. The result, however, was that the traditional theory of deduction was conflated with an alleged intuitive grasp of the final scientific theory of the world.

To sum up this point, traditional Aristotelian logic was not extensional, and thus not formal. It demanded that logicians contemplate those deductions that spell out essential definitions, and that they be able to separate them sharply from all the rest. This demand has hindered the idea that logic should be a context-insensitive, formal theory of inference. Importantly, the three most basic notions of the modern logic of terms were simply avoided by traditional logicians, by means of implicit intuition. The three notions are the complement class (e.g., "Not a Wolf," or "The Sum of Things That Are Not Socrates"), the empty class (e.g., "Unicorns", or "Squared Circles"), and the universal class, or the universe of discourse (e.g., "Everything"). As a direct result of the essentialist outlook, then, logicians were prevented from formulating the most basic formal laws of the modern logic of terms (for example, that the universe of discourse is the disjunction of any term and its complement; or that the empty class is the conjunction of any term and its complement.) Such general extensional laws, the foundations of modern logic, have no place in the province of traditional logic.

It was Leibniz who first exposed the scandalous use of judgments in traditional logic. He discovered it as an immediate result of his magnificent innovative idea of proof. All proofs, said Leibniz, are successions of trivial replacements of synonyms, *salva veritate* (that is, with no effect on the truth value of the replaced sentence) that end in a formal identity statement (statements of the form "A = A"). This implied, as a prerequisite for successful proof, that judgments be explicitly acknowledged and reduced to trivial synonymy statements. Incredibly, Leibniz undertook that task: he attempted to reduce all true judgments to explicit identity statements within a rigorous

formal system of definitions. He hoped to be able to formulate (in advance, as part of a symbolically perfect language) all true cases of synonymy.

Leibniz, then, was the first to uncover, against his bidding, and yet in unprecedented clarity, the paradox of traditional logic: it purported to be the logic of scientific discovery, but to be also a formal system of essential relations, it had to presuppose that the project of natural science has already been completed successfully and incorporated into the logical system; it had to treat science as a set of analytic definitions, given in advance and true by virtue of dictionary alone. Traditional logicians, then, conflated the idea of a final theory of the universe and the logical laws for searching it, and Leibniz, by explicitly attempting to undo this conflation, uncovered its weakness.

The first advocate of "traditional extensionalism" within logic seems to have been George Boole (1847). Boole suggested a flat and unequivocal identification of terms with their extensions. He was thus the first logician to strive for a formal extensional language in the modern sense of that term: he sought a context-free, epistemically neutral language with inferences that require no extra-logical judgments as props. According to Boole, a class is any arbitrary collection of particular objects (whatever an object may be), and terms designate their extensions, and nothing more. He took it as a matter of course that logic is an extensional theory, that is, one in which coextensive terms are always interchangeable *salva veritate* regardless of context. As a direct result of this, Boole was the first to allow for an empty class in the province of logic, and all the terms that designate it. And he was the first to allow for the universe of discourse and the complement class, and all the terms that designate them.[1] Boolean logic, then, was the first extensional theory per se, a

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[1] De Morgan should be considered a codiscoverer of the complement class and the universal class. But De Morgan refused to acknowledge the empty class, and, as a result of this refusal, the logical usefulness of the notions of a universal class and of a complement class in his system is very limited. In De Morgan's system one cannot even name the universal class; one can only imply its existence, since admitting a name to it would make its complement designate the empty class, which De Morgan wished to avoid (see Bar-Am [2008], chap. 18). Even De Morgan's famous substitution laws are of limited use within his own original logic, since they only gain their striking usefulness once the empty class is admitted.

Strictly speaking, it should also be noted here that Boole did not complete the extensional revolution that he had aimed for: he did not achieve a clean and completely formal language that would stand up to our modern standards. He had a few uninterpretable signs in his system, and a mechanically cumbersome treatment of existential statements. Pierce and Jevons soon corrected this and Boolean Logic became the first formal logic, extensional as a matter of course.

theory of valid inferences, which could, in principle, be operated by a computing machine, one in which all coextensive terms were taken as synonyms, and so interchangeable with no loss of meaning, and no effect on truth value and validity.

In hindsight we may note that some medieval nominalists strived for an extensionalistic worldview, but their logic never reflected their semantic aspirations because to do so it had to acknowledge the existence of classes in general, and of arbitrary classes in particular. Nominalists grounded their theory of meaning in materialism, or in other forms of anti-Platonism, and so they did not even consider the (Platonic) existence of classes. And since they argued within an Aristotelian framework, the very idea of arbitrary collections of objects posed for them insurmountable epistemological difficulties, (as even Hume's theory of abstract concepts demonstrates). Boole's extensionalism, on the other hand, was the first nominalistic logic that acknowledged classes; it granted logicians an incredible freedom from all ontological commitments and all empirically based intuitions: the freedom to study the abstract laws of logic not worrying about unintentionally overshooting a target. Classical judgments, then, were not deemed as meaningless, of course, but rather as extra-logical and distinctly so. The same goes for the theory of intensions: as Quine would note later on, it is certainly not worthless, only extra-logical.

To appreciate the excitement that traditional extensionalism had brought to logic we must realize, then, that it completely transformed the aims and scope of classical logic. The replacement of essences (whatever these are) by classes, soon heralded a radical shift in the focus of logic, one which reached its most basic notions. The classic logical terminology had been superseded: judgments were replaced by propositions, the effort to separate essential definitions and accidental ones became obsolete; the search for essential definitions was replaced by a study of tautologies, the copula (traditionally the one and only metaphysical relation) was replaced by logical operations, and by a theory of relations; syllogisms (traditional inferences with only two essential definitions as premises, and one legitimate conclusion) were replaced by valid inferences (of whatever form, and with any number of premises); and finally, contextual-intuition-in-the-guise-of-logic was replaced by a new study, which was increasingly more formal, and so increasingly context-free.

3. Confirmed Extensionalism

Traditional extensionalism, to repeat, initiated a revolution in logic. This revolution stayed, although traditional extensionalism was soon refuted by Frege, in his epoch making 1892 paper "On Sense and Reference." Although Frege

did not mention Boole by name in this particular paper, his attack on the traditional theory of meaning as extension is clearly directed against the most basic tenet of Boolean logic:[2] its undaunted extensionalism. Frege pointed out that identity statements between coextensive terms are often synthetic, and some even express surprising empirical discoveries. This fact, to repeat, was already hinted in Aristotle's, somewhat nebulous, denial that coextensive terms (such as "rational" and "featherless biped") are synonymous. It is significant, then, that Frege reformulated the Aristotelian intuition (1) as a direct and explicit criticism of extensionalism, that Aristotle didn't pay much attention too, and (2) using no mention of the muddled notion of essence.

Frege's criticism is stunning, and although it is well known, it would be worthwhile to ponder it here briefly since I think it crucial for understanding Quine's philosophy. Synthetic identity statements, notes Frege, are impossible under the extensional theory of meaning. Indeed, if meaning is extension and extension alone, and if the two sides of an identity statement have the exact same extension, then, of necessity, all identity statements are tautologies of the form A = A. Such tautologies are a priori true, of course, but they have no empirical content. Empirical discoveries, on the other hand, should be formulated as the contingent, informative sentences that they are. (Even nonempirical synthetic a priori sentences should not be reducible to tautologies of course.) Frege's criticism is overwhelming, then, because it exposes the fact that traditional extensionalism warrants downright invalid inferences, and by its most basic tenet: by allowing the unlimited interchangeability of coextensive terms, it warrants the derivation of contingent sentences—for

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[2]Boolean extensionalism was advocated in Germany chiefly by Ernest Schröder and his collaborators. Schröder, notes Hans Sluga, regarded Frege as unwelcome competition and bluntly attempted to damage his budding academic career (Sluga 1987, 81-82). When Frege published his first work, the interesting *Begriffsschrift* (1879), Schröder wrote a viciously dismissive and clearly unfair review of it. This review, notes Sluga, was the foremost source for Frege's somewhat justified sense of intellectual isolation. Frege, however, did attempt an open counter-attack: he wrote two papers of comparison between Boole's system and his own, analyzing his system's advantages. Alas, he never succeeded in publishing them. They can be found today in his *Posthumous Writings* (1979). This is not to suggest that "On Sense and Reference" is a mere silent attack on Boolean logic, of course: it is much more than just that. Frege clearly needed to circumscribe the limits of extensionalism for his own future project, that of providing the logical framework for deducing (what he regarded as) the synthetic parts of mathematics (such as geometry, as he conceived it).

example, "the morning star is the evening star"—from tautologies—for example, "the morning star is the morning star."

Frege's conclusion was, famously, that a new theory of meaning is required. The meaning of expressions, he said, must be found not only in their extension, but also in the special manner by which they designate the objects that they designate: their "sense," (or intension). True synthetic identity sentences, then, are cases of coextensive terms having different senses, different intensions. Taking Frege's conclusion as sound, we must conclude that we can never account for the truth of synthetic identity statements without resorting to a nonextensional logic, a logic of sense, an intentional logic.

Famously, Frege did not intend this interesting conclusion to affect his own (immediate) logical project, the project of deducing arithmetic from a set of axioms that he regarded as constituting both the core of logic, and a set of tautologies. His (immediate) logical project, then, had no use for an intensional logic: it was extensional as a matter of course. (The only exception is Frege's odd revival of the term "judgment," albeit in a new and fairly harmless manner, which yielded Frege's eccentric view that logic handles sound inferences only, and not all valid ones.)

Frege, then, established modern logic by affecting a highly influential division of the traditional tasks of logic: on the one hand there was the task of studying extensional theories, purely analytic systems (such as arithmetic, as he believed it to be). On the other hand there was the realm of synthetic truths, the realm of empirical knowledge and discoveries, and the ideal of developing an intensional logic so as to enable the future study of valid deductions within that realm too. This second task he left for posterity. (Church and Kripke took it up).

Frege's theory of meaning has a host of problems which we need not attempt to explore here. Already Russell (1905) has shown that it inflates the number of problems that a logical theory is supposed to reduce and hopelessly increases their complexity, which it is likewise supposed to reduce. Furthermore, Russell's paradox, and more so his solution to it, exposed the first weaknesses in the notion that arithmetic is a purely analytic. Then came Gödel, who sealed matters by demonstrating that arithmetic cannot be derived in its entirety from any finite system of axioms. But Frege's criticism of traditional extensionalism is ubiquitously accepted as valid by all modern extensionalists and especially by Quine. How come?

Frege forced extensionalism to evolve by portraying its limits. The path from traditional extensionalism to Quine's confirmed extensionalism, then, goes through a standard and interesting reply to Frege's challenge, to which I come soon. Let me first say that I find it fascinating that before Quine had explored that path, it was already walked through and through by a philosopher

who was completely unaware of Frege's challenge and frankly uninterested in it: Pierre Duhem. Duhem's self-appointed task was not the study of arithmetic or of logic: it was to square his observation that the natural sciences advance with his conviction that they are perfect (and hence analytically true).

Let me explain Duhem's solution to this problem in a nutshell: when encountering any surprising empirical discovery, of the sort Frege's example makes use of, it is possible, he said, to declare that discovery an implicitly intended example of an analytically true definition. This practice may seem odd at first sight but knowledge of empirical facts regularly finds its way into dictionaries, of course, and, of course, by doing so in every case we may (in a consciously ad hoc manner) sustain the analytic character of our theories. This is what Duhem explicitly recommends.

To return to Frege's challenge (making extensionalism consistent in the face of empirical discoveries), having discovered that the morning star is the evening star, we could declare it analytic by stating that from now on, and until further notice, "the morning star" is interchangeable in all contexts with "the evening star." Then "the mornings star is the evening star" is reducible (by means of our dictionary alone) to a tautology of the form A = A; and so, to deduce it from "the morning star is the morning star" becomes as valid as deducing the latter from the former. The extensional character of our theory, and its consistency, are thereby restored.

Duhem's conventionalism is an expression of his idea that scientific theories are perfect and irrefutable by definition. It is only by interpreting them that they become empirical as well as fallible: our interpretations of them are fallible. When a new surprising fact is discovered, one that is not covered by a present interpretation of a theory, conventionalists claim that it should be regarded as implicitly covered by our theory by adjusting their interpretation of it.

Let me provide here a slightly more elaborate example so as to sharpen this observation: we have the theory that the density of a given quantity of air linearly depends on the pressure put on it, and then we notice that this is so only in the context of unchanging temperatures. We must then take care not to take "the density of air" as interchangeable, in all contexts, with "pressure," unless the temperature is fixed. We then change the theory to say: in the context of fixed temperatures, the theory stays put, for in that context "the density of air" is coextensive with "the pressure of air." By so adjusting the extension of our terms they are made coextensive again, and so interchangeable *salva veritate* again. In such a manner, having discovered a context in which the interchangeability of coextensive terms was limited, we get rid of it. It is as if we have empirically discovered a hitherto implicit presupposition to our theory,

and by including that presupposition henceforth explicitly, by readjusting the extension of our terms, we can regard our theory as a perfect: perfect and extensional.

Now, anticipating all possible hidden presuppositions to a theory amounts to explicit knowledge of all its consequences, all the cases to which that theory applies, and to explicit rejection, or explaining-away, of all its possible refutations. This is quite an excessive demand, as Leibniz reluctantly discovered when trying to construct his ideal language, in which all empirical knowledge is provable. To the extent that a theory is an attempt to study reality, we must admit that we are ignorant of it, of course. It is important to stress, then, that conventionalists elegantly achieve that which Leibniz was attempting to achieve by *suspending judgment* regarding the exact and full meaning of the terms of their theories, by declaring that interpretations are private matters, and that meanings reside outside the province of science. This situation will prevail, they are willing to admit, until the end of days. The meaningful constant methodological process of clarifying our theory's scope, then, does not vanish by the conventionalist strategy, nor is it meant to: it is simply declared to be a private affair and expelled to another discourse, a meta-discourse, an inherently nonscientific discourse. Within that meta-discourse, meanings (given interpretations of our theoretical terms, which allow us to find applications for our theories) are acknowledged as inevitable tools of thought. They yield fallible predictions without thereby rendering our theories fallible. This is no small price to pay, of course: by accepting it we suggest that every empirical interpretation of our theories is, properly speaking, outside the realm of pure science. It places the advancement of scientific thought outside the realm of pure science. Perhaps surprisingly, however, this is an almost exact transliteration of Quine's confession in the interesting book under review here. It is the gist of his confirmed extensionalism.

One difference between Duhem and Quine—and it is a significant one—is that Quine repeatedly stresses that meanings, and with them all empirical interpretations of our theories, are not merely a private matter, as Duhem emphasizes, they are also a hopelessly nebulous one. Meanings, he tells us, those intuitive judgments regarding the "real" scope of our theories, open the door for Frege's challenge to extensionalism: once they are admitted the consistency of our extensional theories is threatened, and only when they are successfully eliminated from the realm of science can extensional purity be restored. This is the core of Quine's confession: meanings are slippery creatures of the devil, threatening the consistency and purity of our extensional Garden of Eden, they poison the spotless deductive character of our extensional theories; we should extinguish their trace, then, for the sake of scientific cleanliness, for

the sake of deductive transparency: for as soon as they enter that Garden, Frege's criticism creeps in. To avoid it we are tempted to use our fallible judgment again, and with it, the purity of our logical point of view is lost.

Quine, then, adopted the conventionalist outlook as a whole. He did so according to his own testimony in the book reviewed here, at first while being unaware of Duhem's innovative work, and yet his extensionalism is a reiteration of Duhem's methodology, as he notes, with the difference that it is intended as an all embracing semantical heuristics, and not merely as a methodology, a point to which I shall return in the next section. Both of them tried to banish synthetic sentences from the realm of pure science. Duhem did so because he regarded it as a threat to the perfection of science. Quine did it because he regarded it as a threat to the clarity of our theories, a threat to their deductive transparency, and thus to their consistency. His philosophy, in his own words, is "an inclination to minimize the cleavage between mathematics and natural science."

Quine's justly most famous paper, "Two Dogmas of Empiricism" (Quine [1953] 1980, Ch. 2), is an attack on the very notion of an analytic judgment: analytic judgments, he noted, are those that are true by virtue of the meanings of their terms alone. Since assigning meanings to terms allows for Frege's criticism, they are shifty, and hence in the name of clarity should be banished from the realm of science when possible, and to the extent that meanings are banished then even analyticity is already banished, or rendered tautological. Quine never criticized the sharp distinction between the contingent and the tautological, or between the empirically meaningful and that which is not, only that between the synthetic and the analytic.[3] The extensionalist task, then, is to obliterate as far as this is possible all nonextensional notions, and to replace them, whenever possible, with the only clear and unequivocal logical concept that we have: substitution of coextensive wholes. That doing so, in every case in which it is possible, is desirable, is the confirmed extensionalist article of faith, it is his dogma. Quine formulates it thus: "I doubt that I have ever fully understood anything that I could not explain in extensional language." (p. 500)

"Two Dogmas," then, is the result of turning the extensionalist dogma (all nonextensional theories are vague and thus invite inconsistency) against

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[3]Since Quine's view in these matters has been often misunderstood, let me quote here his elucidation in his "Two Dogmas Revisited": "In so far as Mathematics gets applied in natural sciences, I see it as sharing empirical content . . . As for inapplicable parts of mathematics, say higher set theory, I sympathize with the empiricist in questioning their meaningfulness . . ." (pp. 394-95). Thus, pure mathematics is irrefutable in principle by virtue of its meaninglessness (see also p. 468).

the dogmas of Carnap-style positivism (analyticity and reductionism). The three dogmas comprise an inconsistent philosophical system, Quine showed.[4] The conclusions of this subtle argument are perhaps the most misunderstood part in Quine's philosophy. Allow me to stress, then, that when Quine argues for holism in the end of this classic paper he does not call into doubt that nonempirical extensional theories are perfect and irrefutable by definition; they are unthreatened by his holism, which only applies to empirical theories. True, extensional theories too can be replaced from time to time, admits Quine, by other extensional theories, in the light of explanatory convenience, but they stand independently of our interpretations of them and unharmed by the meanings that we ascribe to their terms (explanatory convenience is not the same as refutation, of course). Quine's holism, then, is simply his way of rephrasing his extensionalist dogma for his readers, it is his manner of explaining to us, in a nonextensional language, just how vague and ill-defined is the province that lies beyond the realm of purely extensional theories.

To sum up: Frege's criticism of traditional extensionalism is accepted as a matter of course by all modern extensionalists, and at least by Quine, who regards it as the starting point of his philosophy. In reply to it, he abandons undaunted extensionalism and with it extensionalism as a theory of meaning. He replaces it by programmatic extensionalism, by extensionalism as heuristic: the constant search for adjustments of theories in an effort to recover their extensionality (and hence consistency) in the face of surprising discoveries. Quine thus succeeds in retaining platonic serenity in the face of the turmoil of reality, and in particular in the face of scientific progress. He succeeds in retaining mathematical cleanliness in the midst of the muddy realm within which all creative thinking is preformed. As he puts it: he is neither an essentialist, nor an existentialist, he is a confirmed extensionalist, meaning he has "a predilection for extensional theories" (p. 498).

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[4]Quine provides an interesting record of his process of disillusionment with Carnap's positivism (pp. 391-94). He says that first he had been utterly convinced that Carnap accepted his extensionalist outlook "as a matter of course" (p. 504). He (Quine) defended Carnap's positivism at Harvard in 1934 in an "abjectly sequacious" manner. Carnap, however, continued to endorse the dogma of analyticity, disregarding Quine's argument that it is inconsistent with their extensionalism. Quine then wrote his "Truth by Convention" 1935 which was, he says, the first open admission of his misgivings regarding the possibility of working out a compromise between the two dogmas. What is perhaps most interesting, however, is that despite Quine's report that he had "frequent discussions" with Carnap on the matter, as he (Carnap) "was around Harvard all that summer [1936]" (p. 392), he reports to have "no record of his [Carnap's] reaction, not remembering the discussion." This is a significant lacuna in Quine's report: possibly here Quine the gentleman got the better of Quine the recorder of facts.

4. The Quine Enigma Explained

The greatest weakness of the confirmed extensionalist outlook is its deliberate disregard of any context and, in particular, that of possible novelty, particularly discovery: it makes impossible any talk about novelty, as novelty. Extensionalists have no problem discussing a context before the innovation and again after it; they are unable to account for the move. Here is a well-known example, one which Quine himself often devised with various minor variations: consider the Sumerians, who did not know that the morning star is the evening star. Just considering them already implies that "the morning star" and "the evening star" are coextensive terms. Describing this situation is highly problematic for extensionalists, then, for they must also uphold that the Sumerians did not know that the morning star is the morning star, which is absurd of course. The consistency of the extensional worldview is thus threatened whenever it is invited to discuss, within the same framework, a possibly surprising reality and some nontrivial expectation regarding it.[5]

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[5]A note to the expert: the history of the problem discussed here is somewhat puzzling. Consider its place in our narrative: it appears here as a criticism of the response of the confirmed extensionalist to Frege's challenge. Historically, however, and surprisingly, it was first explored by Russell before the appearance of confirmed extensionalism and as part of his deliberate attack on Frege's criticism of extensionalism: it is found in his abovementioned classic "On denoting." (Russell's famous example is that of King George who wished to know if Scott is the author of *Waverley* but, of course, did not wish to know whether Scott is Scott.) As Leonard Linsky already pointed out (Linsky 1967, 53), Russell erroneously maintained that his theory of descriptions handles such threats successfully. Historically, then, Russell had inadvertently stumbled on one of the greatest challenges to extensionalism as part of his attempt to defend it from Frege's attack.

Kripke suggested bypassing the problem by declaring that within any list of names for any object, one and only one shall be declared its true name its "rigid designator," thus rendering in effect all other names contingent and all identity statements in which they appear synthetic. Quine justly observed that allowing for such stipulations is the return of classic (Aristotelian) judgment into logic, in a modern guise: Kripke, he explained, suggested to rule out, ad hoc, that which threatens the consistency of logic by pretending to have a divine privileged access to an impossibly ideal list of "essential" names. Quine's own solution to this problem within the logic of the *Principia* was to offer a simple reduction mechanism, an improvement of Russell's theory of descriptions, that would get rid of proper names altogether by replacing them with artificial and yet unique (and logically usable) proper descriptions. This works for the *Principia*, not for the context of discovery, since for it, divine knowledge of future discoveries, and thus future proper descriptions, is needed.

This challenge is known as that of providing an extensional account for propositional attitudes. Without discussing what propositional attitudes are, let us note that the challenge can be easily reproduced by means of verbs such as "believed," "mistook," "hoped," and even "regretted" or "pretended." This resulted in the problem gaining a verbal-psychological mystique as the problem of intensionality or of intentionality. But the source of the problem is simply that all contexts which imply the possibility of novelty invite the discussion of the same sentence as possibly informative and possibly uninformative (trivially true or false) within the same referential framework. Extensionalists can easily redistribute truth values to sentences when faced with novelties, that is, with possible extensions of context, but they cannot consistently discuss the process of doing so within any framework, for it requires compromising their principle of extensionality.

To make things as tangible as possible, consider one computer program that takes "the morning star is the evening star" as undecidable, and a second one that is the same except that it takes this sentence as true. Merging these two programs is very easy. Yet to say that the sentence is both true and undecidable is inconsistent. The problem expressed by means of propositional attitudes, then, is simply that all cases of possible novelty (that is to say all cases!) are cases of resolving possible inconsistencies. Extensionalists, then, are incapable of discussing them.[6]

Quine, who was well aware of that problem, devised a number of ingenious measures to *imply progress* without discussing it, within the bounds of his extensionalist program. His best known defense against discussing possible extensions of contexts is the one he titled "semantic ascent." Briefly, the offer is to translate all problematic contexts of the kind described above to lists of ordered pairs of individuals and their attitudes toward sentences. Thus, instead of noting that the Sumerians did not know that the morning star is the evening star, we note that the Sumerians did not know that the sentence "The morning star is the evening star" is true. Since whatever appears between quotation marks is, strictly speaking, irreplaceable even by its synonyms without violation of the truth value of the ascription of the quoted sentence,

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[6]Here again it is worthwhile to stress the difference between Duhem and Quine: Duhem was indifferent to propositional attitudes and never considered them a serious challenge to his conventionalism because he was only interested in the structure of theories within natural science. Quine, on the other hand, advanced extensionalism as a general all-encompassing heuristic and thus regarded the challenge of successfully handling them as crucial.

Quine can now safely admit that the Sumerians also maintained that "The morning star is the morning star" is true, without violation of extensionality. Admittedly this solution does the trick. What it fails to do is to describe in an extensional system the Babylonian discovery of the identity of the two stars!

The price of Quine's technical wizardry then is that of regarding all possible novelties as cases of reprogramming.[7] The Sumerians, who did not know that the morning star is the evening star and the Babylonians, who discovered that they are one and the same, simply did not speak the same language. Here then lies the source of Quine's trademark philosophical move that I mentioned in the beginning of this article: whenever the context invites the discussion of possible novelty, possible extension of context, Quine endeavors to portray it as a subtle case of reprogramming.

But as the person who notes the novelty, as the programmer who executes the reprogramming, Quine is no extensionalist, he cannot be: discussing the reasons for the need to adjust a theory is dwelling in a nonextensional context. And so whenever Quine endeavored to portray the epistemic limits to any extensional context (the indeterminacy of translation for example) he inevitably yielded to nonextensional considerations in his attempt to find the new extensional representation of the situation.

Considering this disturbing epistemic limitation—the overstrained measures that extensionalists must devise so as to handle any possible novelty—Quine's open and repeated admission of alliance to the Popperian model of scientific progress is flabbergasting. Frankly, I do not know what to make of it. "The scientist" he says, "is well portrayed by Sir Karl Popper as painstakingly inventing a hypothesis and then doing his best to refute it by cunningly contrived experiments" (p. 332). And again: ". . . the deduction and checking of observation categoricals is the essence, surely, of the experimental method, the hypothetico-deductive method, the method, in Popper's words of conjecture and refutation" (p. 466). Indeed, Quine goes as far as to openly equate his naturalism and the Popperian method: "My naturalism," he says, "has evidently been boiling down to the claim that in our pursuit of truth about the world we cannot do better than our traditional scientific procedure, the hypothetico-deductive method." (*Ibid* p. 466)

Can the process of conjectures and refutations be admitted into the context of a consistent extensional language? I do not know. I did not find this pressing

[7]Here again Quine echoes Duhem's thesis of nontranslatability between two theories, yet with completely different interests, which explains the puzzle in the literature as to the possible identity of their views: they answer different questions.

question in the present book, which is clearly Quine's last and final word on the matter. I did not find discussion of this pressing question in any of Quine's writings. Quine students are thus destined to remain puzzled. Critical rationalism, I think, cannot go all the way with extensionalism exactly because it openly embraces the discussion of possible future success of various possible alternative solutions to any possible problem.

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Bio

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