Part VI

LOGIC, EXISTENCE, AND ONTOLOGY

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Quantifiers, Being, and Canonical Notation

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1 Introduction

Aristotle was the founder of logic and ontology. The first discipline is concerned with the validity of arguments irrespective of their subject-matter. Its foundations were laid down in the *Prior Analytics*. Topic neutrality is achieved by abstracting the *form* of the arguments from their *content*, an operation which presupposes that we draw a distinction between the logical terms which make up the form ('every M is L,' 'some M is L,' 'A possibly belongs to no B' . . .) and the non-logical terms which belong to the content.

The second discipline, called 'first philosophy' by Aristotle (and 'ontologia' by Rudolphus Goclenius in the *Lexicum Philosophicum* (1613)) investigates being in its own right, that is the categorial aspects of entities in general, and the modes and aspects of being. It can be traced back to Aristotle's *Categories* and *Metaphysics*.

The third notion occurring in the title is central both to logic and to ontology. Indeed the question arises whether *existence* should be distinguished from *being*. For example, in *Principles of Mathematics* (1903), Russell claims that such a distinction is in fact presupposed by any denial of existence: "what does not exist must *be* something, or it would be meaningless to deny its existence" (Russell 1903: 450).

The interplay between logic and ontology has inspired major philosophical works of the twentieth century such as Russell's *Philosophy of Logical Atomism* (1918) and Wittgenstein's *Tractatus logico-philosophicus* (1921). Though both works now belong to the history of the subject, the issue they address, that is whether a logical language could be designed which would depict the main ontological structures of reality, remains a live issue.

With Quine's *Word and Object* (1960), a major shift of emphasis occurred. The mirror of the most important traits of reality is no longer to be sought in *language* as such, but in the *theories* about the world which scientists hold to be true, and only derivatively in the language needed to formulate them.

According to Quine, the ontological work incumbent on philosophers consists of the critical scrutiny of the realm of objects introduced into scientific theories by scientists. It is "the task of making explicit what had been tacit, and precise what had been vague; of exposing and resolving paradoxes, smoothing kinds, lopping off vestigial growths, clearing ontological slums" (Quine 1960: 274).

Logic plays a major role in the work of attaining precision and explicitness just described. The time has come to take stock of what has been achieved over the last 40 years by applying logic to ontology. Although my concern is thematic rather than historical, I shall devote much space to a detailed presentation and examination of Quine's views on the interplay between logic, existence, and ontology.

The motivation for my choice lies in the influential and challenging character of Quine's theses. I shall try to isolate what I consider to be of lasting value in his doctrines. I shall also describe and critically examine the arguments offered by opponents to Quine who claim that his logic is too restricted and his ontology too poor.

2 A Methodology for Ontology

For the philosopher who undertakes to clean up the conceptual framework built by the scientist and to purify it of unnecessary ontological excrescences, Ockham's razor, "*Entia non sunt multiplicanda praeter necessitatem*" is the main tool. To apply that precept, however, we have to answer the preliminary question: 'what are unnecessary entities?' One possible answer is: entities are unnecessary if we can abstain from countenancing them without sacrificing *scientific truth*.

That answer is controversial. One might argue that besides preserving the *set of truths* of a given science, we should also be concerned about preserving the *explanatory power* of our theories. One burning issue here is the question raised by the status of natural kinds and natural kind words. Kripke and Putnam have argued that natural kind words are rigid designators (Putnam 1975: 229–35). The very definition to the concept of rigid designator as "term which designates the same entities in our world and in all possible worlds" draws us willy-nilly into possible world semantics.

Quine has also contributed to the *methodology of ontology* by imposing a constraint encapsulated in the motto: "No entity without identity" (see Haack 1978: chapter 4). Such a requirement is fulfilled by *sets*: two sets are identical if and only if they have the same members. It is not fulfilled, however, by the entities of linguistic semantics such as concepts and propositions (for a defense of the latter see Orilia 1999).

The demand for clear *identification criteria* has far-reaching consequences in ontology. It has a bearing on another burning issue under discussion today: that of the status of possible objects. By Quine's standards, possible objects are not eligible as *entities*. They lack criteria of identification. Nobody, Quine complains, can decide whether "the possible fat man in that doorway" and "the possible bald man in that doorway" denote the same individual (Quine 1953, 1961: 4). (For another diagnosis of this puzzle, see Cocchiarella 1987: 126 f.).

Fifteen years after Quine first published "On What There Is," Kripke (1963) laid down a semantics which extends the standard definitions of satisfaction and truth to a first-order logic enriched with modal operators (see also Bayart 1958, 1959). The novelty of this approach lies in the model which contains a set of possible worlds together with an accessibility relation between worlds. The *domains* are allowed to vary from one world to another. An individual *a* which shows up in the domain D_1 of possible world W_1 may be absent from the domain D_2 of possible world W_2. That individual may also be present, but then the question of identifying *a* across possible worlds arises.

Quine argues that identifying individuals across possible worlds fundamentally differs from the familiar task of reidentifying an individual across successive moments of time. In the latter case, relevant criteria are available such as, if physical objects are concerned, continuity of displacement, continuity of deformation and continuity of chemical change. These criteria, however, cannot be extended across worlds "because you can change anything to anything by easy stages through some connecting series of possible worlds" (Quine 1981: 127).

Here again the problem is worth reconsidering in the light of recent developments. Several authors (Gupta 1980; Cocchiarella 1984) have provided evidence showing that the contrast between identification across moments of time and identification across possible worlds is not so sharp as Quine contends.

3 The Need for a Criterion of Ontological Commitment

The history of philosophy is replete with discussions about abstract objects. Plato held that *Forms*, such as Beauty, existed independently of the mind which conceived them and of the particular objects in which they were exemplified. For Aristotle, however, species differed from their instances but existed only in so far as they were instantiated by the latter.

In the Middle Ages, the distinction between concrete and abstract objects prompted a lasting discussion known as the *debate on universals*. A broad spectrum of positions were defended, ranging from realism to nominalism. According to the latter, universals are just words. The question has yet to be conclusively resolved. In the twentieth century, Church diagnosed the source of the trouble in these terms: "No discussion of an ontological question . . . can be regarded as intelligible unless it has a definite criterion of ontological commitment" (Church 1958: 1012).

Quine came to grips with the problem and provided a definite criterion: "[i]n general, *entities of a given sort are assumed by a theory if and only if some of them must be counted among the values of the variables in order that the statements affirmed in the theory be true*" (Quine 1953, 1961: 103).

Quine's criterion is informative. It serves to uncover *hidden* ontological commitments. Consider the following sentence due to Geach: "Some people admire only one another" in which the number of mutual admirers remains unspecified. Kaplan, has shown that Geach's sentence implicitly quantifies over classes. Its formulation in first order logic reads as follows (Quine 1982: 293):

$$\exists z(\exists x(x \in z).\&\forall x([x \in z \rightarrow \exists y(x \text{ admires } y)\&\forall y(x \text{ admires } y \rightarrow x \neq y\&y \in z)])).$$

When combined with his views about predicates, Quine's criterion of ontological commitment ceases to be neutral. In *Philosophy of Logic*, Quine writes "Predicates are not names, predicates are the other parties to predication" (Quine 1970: 27–8). This syntactic consideration leads to ban second order logic statements such as $\exists F \forall x\, Fx$ and forces us to rewrite them in first order logic as $\exists \alpha \forall x\, x \in \alpha$. This is not satisfying however. As Boolos observes, the first formula is valid but the second is not (Boolos 1975: 512).

Simons disentangled the two issues. He showed that we can quantify over variables belonging to the syntactical category of predicates without committing ourselves to say that predicates refer to properties. A restriction should be imposed upon Quine's criterion of ontological commitment. Not all quantification is committal: "nominal quantification commits one to things denotable because names denote, while other forms of quantification do not, since it is the office of names, and names alone, to denote, other categories of expression having other offices, the variables of these categories inheriting their offices from potential constants thereof" (Simons 1997: 268).

Cocchiarella criticizes Quine for assuming that being is a *genus.* Quine's criterion does justice to primary substances and complete (saturated) objects but fails to do justice to universals. Universals, Cocchiarella argues, have a *predicable nature* that constitutes their universality. That predicable nature consists of a *mode of being* different from the mode of being of saturated objects. Universals, unlike sets, are not generated by their instances.

According to Cocchiarella, we need *predicate variables* taking universals as their values if we want to represent not only saturated but also unsaturated entities in our formal ontology. If, following Quine, we take predicate variables as *schematic letters* which admit substitution but not quantification, we shall not be able to quantify over unsaturated entities such as natural properties and relations. Yet such a quantification is needed in the construction of a formal ontology for natural science (see Section 7).

To capture the ontological distinction between individuals and universals, we have to give predication precedence over membership and to recognize an ontological import to predicates as such (Cocchiarella 1997).

4 The Role of a Canonical Notation

According to Quine, ontologists should not address the *direct question* 'What objects are there?' Quine proposes a *detour* through existing scientific theories. Ontologists would start with a given theory and ask themselves what objects it is committed to. He coined the locution "semantic ascent" for referring to this shift of attention from the world to theories and their languages.

Positive knowledge about the world is not confined to specialized sciences only. Common sense knowledge expressed in everyday language is also knowledge. If we want to spot the ontological commitments of our knowledge as a whole, a preliminary task need to be performed. We have to *regiment* our language into a *canonical system of logical notation*.

Several sections of *Word and Object* show how constructions of ordinary language can be paraphrased into the artificial language of first-order logic. Some of these regimentation exercises are known to whoever has learned to translate arguments couched in natural language into the inferential schemes of standard first-order logic. For instance, 'Every man is mortal' is paraphrased into 'For every object x (if x is a man then x is mortal).' More drastic changes come next, such as the elimination of proper names and the elimination of definite descriptions. These are specifically Quinean doctrines.

Indirect discourse, however useful it may be for historians, has a major drawback. It violates "the substitutivity of identity: the putting of equals for equals" (Quine 1994b: 145). In the propositional attitude construction: 'Ralph believes that Cicero denounced Catiline,' the substitution of 'Tully' for 'Cicero' may fail to preserve truth. To prevent the unsafe substitution, Quine suggests a radical remedy: replacing indirect quotation by direct quotation.

Far from distorting our picture of the world, such regimentation would help us see the world aright. If we are 'limning the true and ultimate structure of reality,' Quine maintains, the canonical scheme that suits us is "the austere scheme that knows no quotation but direct quotation and no propositional attitudes but only the physical constitution and behavior of organisms" (Quine 1960: 221).

5 The Ontology of Mathematics

Quine's *New Foundations for Mathematical Logic* (1936) contains some technical innovations which are philosophically significant. The first one is the notion of stratification. A formula is called *stratified* if it is possible "to put numerals for the variables in such a way that 'ε' comes to occur only in contexts of the form '$n \in n+1$' " (Quine 1953, 1961: 91). Stratified formulas satisfy Russell's *type theory* (1908). Unstratified formulas would have to be declared meaningless by Russell's standards.

For Quine, on the contrary, unstratified formulas such as '$y \in y$' are meaningful, but they are not eligible as instances of F in the comprehension axiom $(\exists x)\,(\forall y)\,(y \in x \leftrightarrow F)$. Hence a formula can be meaningful *without carrying any ontological commitment*.

Russell's type theory has forbidding ontological consequences: the universal class V gives rise to an *infinite series* of quasi-universal classes. The null class also. The Boolean class algebra "no longer applies to classes in general, but is reproduced within each type" (Quine 1953, 1961: 92). The same is true of arithmetics. All that *ontological inflation* would be cut down in one stroke by adopting the stratification theory of *New Foundations.*

Stratification theory substitutes a *syntactic hierarchy* of formulas for the *ontological hierarchy* of types of entities. It switches from the multilayered universe of objects to a single universe of objects, with a general quantifier ranging over all the objects in the universe. As Vidal-Rosset puts it, the syntactic device of stratification "frees set theory from the realist assumption of types in the same way *free logic* purifies standard first-order logic of its ontological commitments." The claim that the existence of an infinite set is a *theorem*, rather than a *postulate*, is another achievement of *NF*. That startling thesis has been demonstrated later by Specker (1953) and Crabbé (1984).

Let us now move on to *set theory and its logic* and consider the theory of virtual classes. As a preparatory step, the reader should remember here that the grammar of first-order logic admits three basic constructions: (1) predication; (2) infixation or prefixation of connectives; and (3) quantification over individual variables. Predication unites a name with a predicate. Names refer to individuals. Predicates do not *refer* to classes or properties, they are *satisfied* by individuals.

Quine's statement already quoted "Predicates are not names; predicates are the other parties to predication" (Quine 1970: 27–8) might strike the reader as dogmatic.

It should not. A justification of this statement can be found later in the book. (We owe the point to Fernandez de Castro). Quine observes that quantifying over predicate variables leads to an unconstrained principle of comprehension. From the logical triviality $(\forall x)(Fx \leftrightarrow Fx)$ we can derive the unwanted conclusion $(\exists x)\,(Gx \leftrightarrow Fx)$ (Quine 1970: 68).

If we wish to *refer* to a class we need a class abstract, that is an expression like $\{x\colon Fx\}$ which can be rendered in natural language by 'the set of x that are F.' Whenever a class-abstract occurs only on the right of 'ε' we can treat the whole combination '$\varepsilon\{x\colon Fx\}$' as '$F$' and say that '$y\ \varepsilon\{x\colon Fx\}$' reduces to '$Fy$'. Conversely we may jointly introduce the membership symbol and the class abstract as *fragments of a predicate*. Most of what is said of classes with the help of the two-place predicate 'ε' can then be considered as *a mere manner of speaking* involving no reference to classes, that is no *ontological commitment to classes*.

Set theory and its logic offers a new definition of natural numbers which again enables the mathematician to reduce his ontological commitment without impoverishing science. Let us start with Frege's definition. Natural numbers are the common members of all classes z such that 0 is a member of z and all successors of members of z are members of z. Notice that the unavoidable quantification over classes makes the virtual theory of classes inapplicable here.

If the Fregean definition of natural numbers is to achieve its purpose, infinite classes are required. Quine, however, succeeded in showing that the need for *infinite classes* can be circumvented. We can define numbers in terms of their *predecessors*. This amounts to describing natural numbers as the members of all classes z which contain 0 if, besides containing their members, they also contain the predecessors of their members. For the new definition to work, "there are going to have to be larger and larger classes without end . . . but they can all be finite" (Quine 1963: 76). This meager basis should be enough for deriving the law of mathematical induction.

When put into an epistemological setting, Quine's ontology for mathematics shades into the structuralist position advocated in *Mathematics as a Science of Patterns* (Resnik 1997). Resnik's position is foreshadowed by Quine in the following statement: "what matters for any objects, concrete or abstract, is not what they are but what they contribute to our overall theory of the world as neutral nodes in its logical structure" (Quine 1995: 74–5).

The adoption of a structuralist ontology in which all that there is to an object is the role that it plays in theory is compatible with realism. As Hylton observes, "there is no issue concerning realism about objects which is separate from the issue of realism about the theory which mentions them: to repeat, ontology is derivative upon truth; hence, if we are realists about truth we are more or less automatically realists about objects too" (Hylton 2000: 298).

6 The Notion of Existence

Non-denoting singular terms such as 'Pegasus' have unwanted consequences for standard logic. From the logical truth '$(\forall x)(x = x)$' we obtain 'Pegasus = Pegasus' by the law of universal instantiation. Applying the rule of existential generalization next, we

derive the statement '$(\exists x)(x$ = Pegasus).' A factual falsity has been inferred from a logical truth. Clearly there is something amiss here.

Three solutions have been put forward. The most drastic one consists of first replacing proper names by definite descriptions ('Pegasus' becomes 'the unique object that pegasizes') which are eliminated by Russell's technique at a later stage. The trouble is that standard description theory, as opposed to *free description theory* (Lambert 1987), has unwanted consequences. It leads to paraphrasing a true sentence such as "Theory *T* is ontologically committed to the perpetual motion machine" into the false one "There is one and only one perpetual motion machine and theory *T* is committed to it" (Jacquette 1996: 56–69).

The second solution consists of modifying the laws of first-order logic in such a way that it becomes free of existence assumptions with respect to singular terms. Hintikka (1959) produced a *free logic* by submitting the application of the rule of existential generalization $f(a/x) \vdash (\exists x)fx$ to a condition: the truth of the premise $(\exists x)(x = a)$ which states that *a* exists.

The third solution consists of treating denotationless singular terms as denoting nonexistent objects and taking bound variables as ranging over objects which are either existent or nonexistent. On that account the use of a bound variable is noncommittal. The task of expressing existence devolves to a special predicate, the predicate 'exists' (see Section 10).

A variant of the third approach can be found in a version of first-order logic which operates with two pairs of quantifiers, viz (1) $\forall_a$ and $\exists_a$ which bind variables ranging over *existent* ('*actual*') *individuals* and (2) $\forall$ and $\exists$ which bind variables ranging over *possible individuals*. Distinct rules apply to possible and actual quantifiers. Whereas the law of universal instantiation $\forall x\phi \rightarrow \phi(\zeta/x)$ is logically true for the possible quantifiers without qualification, it holds for the actual quantifiers only on the proviso that an existential premise is supplied, premise which is false when the singular term is denotationless. For actual quantifiers the law of universal quantification reads as follows: $\exists_a y(\zeta = y) \rightarrow [ax\ \phi \rightarrow \phi(\zeta/x)]$ (Cocchiarella 1990: 245).

7 The Ontology of Natural Sciences

According to Cocchiarella, the ontology of physics requires objects which blur the sharp distinction drawn by Quine between objects located in time and objects located in possible worlds. A first motivation for countenancing objects which transcend the *realia–possibilia* dichotomy arises within the framework of the theory of special relativity. There can be objects, the theory says, that exist only in the past or future of our own local time, but which however "might exist in a causally connected local time at a moment which is simultaneous with our present" (Cocchiarella 1984: 351).

These things are real, even if not presently existing. Hence they are entitled to be called *realia* instead of *possibilia*. They qualify as values of our bound variables. Cocchiarella claims that a canonical notation reduced to standard first-order logic has not enough *expressive power*. We need to enrich the language with two *causal tense operators, viz.* 'P_c' for 'it causally was the case that' and 'F_c' for 'it causally will be the case that,' and to add the axioms and rules of quantified modal logic S_4.

Next, Cocchiarella spells out a semantics in which the *accessibility relation* between possible worlds appears in the guise of a *signal relation* linking together momentary states of the universe. Here again we see that a physicalistic interpretation can be grafted onto the suspect notions of the semantics of modal logic and that the gap between modality and time can be bridged.

Transuranic elements provide us with a second sort of entity which stand on the border between the *possible* and the *real*. When the formation of the earth was completed, "it contained the atoms of only ninety-two chemical elements, with uranium being the heaviest" (Cocchiarella 1986: 119). The question whether the universe outside of the earth contains atoms of transuranic elements is an open question. Whether these atoms exist or not, their elements as natural kinds are known so well that atoms of those elements have been produced in accelerators. We have, therefore, to reckon with transuranic substances that "as a matter of contingent fact, are and will never be realized in nature by any objects whatever, but which, as a matter of natural or causal possibility, could be realized" (Cocchiarella 1996: 45).

Aristotle held the view that universals such as the *ultima species* Man exist only in so far as there are concrete human beings that instantiate them (Moderate Realism). Transuranic substances which are not instantiated in concrete objects nevertheless belong to the *causal matrix* of the universe. 'Belonging to the causal matrix of the universe' has to be understood *analogically*. Just as some modes of being in Aristotle's system of categories must be understood 'analogically' (we owe this point to Cocchiarella).

To accommodate these transuranic substances, we need to relax Aristotle's Moderate Realism a little bit and replace 'instantiate' by '*can* instantiate.' To express this conceptual shift, we have to avail ourselves of the modal operator of *causal realizability*, *viz.* $\Diamond_c$. The fundamental thesis of modal natural realism is stated in this way:

$$(\forall \mathrm{F}) \Diamond_c (\exists_i x) \ldots (\exists_j x) \mathrm{F}(x_i \ldots x_j)$$

The colloquial rendering of the formula reads as follows: 'for all n-place predicates it is causally possible that there exists a n-tuple of concrete objects which exemplifies it.' Quine finds quantification over predicates objectionable. Predicates, he insists, are not referring expressions. However, we can recast Cocchiarella's formal representation of modal realism in a way which complies with Quine's requirement. It suffices to replace the predicate variable by an individual variable (ranging over sets) and to bestow the role of predicate to the *set-membership* predicate.

$$(\forall \mathrm{K}) \Diamond_c (\exists \langle x_i \ldots x_j \rangle) \langle x_i \ldots x_j \rangle \varepsilon \mathrm{K}$$

The predicate variable has been replaced by an individual variable K which takes natural kinds as values. The colloquial rendering is now: "for natural kinds K, it is causally possible that there exists a n-tuple of concrete individuals that is member of K." Admittedly Quine has misgivings about natural kinds which he takes to be *vestigial growths*. Yet natural kinds satisfy the requirement of *extensionality*. Kinds "can be seen as sets, determined by their members" (Quine 1969: 118). Hence my departure from Quine's standards is minimal.

The distinction between *natural kinds* and *conventional groupings*, just like the distinction between *lawlike statements* and *accidental generalizations*, however elusive it may be, is an essential ingredient of the standard account of *science*. As Peirce observes, prediction would be impossible and induction baseless if there were no genuine laws; and there would be no law if there were no real kinds (Haack 1992: 25).

8 Do Intensions Belong to the Furniture of the World?

I shall now consider a new argument put forward to support a much more dramatic revision in ontological theory than the latter two. In *Rethinking Identity and Metaphysics*, Hill challenges Quine's extensionalist ontology and writes: "Intensions are part of the ultimate furniture of the universe," and "in limning the true and ultimate structure of reality intensions must be given their due" (Hill 1997: 120). Even the description of the mechanisms at work in a successful transplantation of organs requires that we appeal to intensional notions.

Consider a man who donates a kidney to his twin brother. We can reconstruct the reasoning of the surgeon along the following lines: whenever transplantation occurs between twin brothers, the recipient's immune system 'thinks' the donor's kidney x to be sufficiently like diseased kidney y not to reject x as foreign. Hence "x can be substituted for y, though they are not the same" (Hill 1997: 120).

One might object, however, that the *physical exchange* of kidneys and the *logical substitution* of terms are altogether different things which should be kept separate. One might also question the claim that we are forced to make use of a non-mentalistic use of 'belief' in the description of the behavior of the immune system.

Alternative descriptions are available which do not rest upon the dubious notion of the 'body's belief.' Let us pay heed to the following dissymmetry: although the same causes always have the same effects, the same effects do not always have the same causes. If we bring it to bear on the issue, we can see the immune system's behavior as a case in which *different causes* produce the *same effects*.

In *Matter and Memory* (1929), Bergson considered two rival descriptive accounts of the same chemical process. The first one used psychological terms, the second one used physical terms. Bergson chose the second. Here are the scientific data: hydrochloric acid always acts in the same way upon carbonate of lime – whether in the form of marble or of chalk. We might therefore be tempted to say that the acid *perceives* in the various species (marble, chalk) the characteristic of a *genus*. Bergson took the other option and said that "similarity . . . acts objectively like a force." In a similar vein, I suggest that we should favour the description which does not make use of the notion of 'body' belief.'

9 How to Treat Intensional Contexts without Positing Intensions

Frege holds that when we embed a sentence such as 'Cicero denounced Catiline' into a construction like 'Ralph believes that . . . ,' a *shift of reference* occurs in the embedded sentence. The names now refer to whatever their customary sense was when they

occurred in the independent clause. This shift is meant to explain why substituting 'Tully' for 'Cicero' in a belief construction may fail to preserve truth.

Frege's appeal to semantic deviance prompted Davidson's comment: "If we could recover our pre-Fregean semantic innocence, I think it would seem to us plainly incredible that the words 'The earth moves,' uttered after the words 'Galileo said that,' mean anything different, or refer to anything else, than is their wont when they come in different environments" (Davidson 1968: 144).

Frege's account compels us to say that in the sentence 'Cicero denounced Catiline and Ralph believes that Cicero denounced Catiline,' the first occurrence of 'Cicero' (and 'of Catiline') does not have the same referent as the second one. The *arbitrarily created ambiguity* precludes the derivation of the statement '($\exists x$) (x denounced Catiline and Ralph believes that x denounced Catiline).'

Following Recanati's (2000) lead, I shall argue that most of the facts which Frege tries to account for in *semantic terms*, by positing intensional entities, can be dealt with in *pragmatic terms* by carefully distinguishing the perspective of the *ascriber* of propositional entities from that of the *ascribee*. Making appropriate use of the ascriber–ascribee contrast would require us to shift from what might be described as the *ascriber's* '*world*' to the *ascribee's* '*world*', but the *ontology* would remain that of the ascriber all along, that is the singular terms would refer to the same objects, whether we were talking about the actual world or about the ascribee's belief world.

First we should stress that the problems raised by propositional attitudes are much more complex than philosophers thought. As Recanati shows, three preliminary distinctions must be drawn if we want to do justice to the complexity of the data. First we should distinguish between (1a) *descriptive phrases* (such as 'The President') and *quantified phrases* (such as 'someone') on the one hand and (1b) *proper names* (such as 'Cicero') on the other. Definite descriptions and quantifiers induce *scope ambiguities*: 'Someone will be in danger' does not have the same truth-conditions as 'It will be the case that someone is in danger.' Names do not induce scope ambiguities: 'Cicero will be in danger' has the same truth-conditions as 'It will be the case that Cicero is in danger.'

Belief sentences with descriptive or quantified phrases, Recanati observes, are ambiguous in a way that exactly parallels the ambiguities found in temporal sentences with descriptive or quantified phrases. John believes that someone is a spy admits of two readings. If 'someone' takes wide scope, we obtain (2a) the *relational reading* of 'believes,' to use Quine's terminology. The sentence says: 'Someone is such that John believes of him that he is a spy.' If 'someone' takes the narrow scope, we obtain (2b) the *notional reading*. The sentence now reads: 'John believes that there are spies.'

When belief is relational, the ascriber and the ascribee refer to the same singular object. When belief is notional, on the contrary, quantification is internal to the ascribed content and not endorsed by the speaker. The ascriber makes no ontological commitment. Believing in that sense has neither a *converse* nor a *relatum.* Hence the exportation: 'John believes there are spies therefore there are people John believes to be spies' is invalid.

The distinction between *relational* and *notional* readings of the sentences containing propositional attitudes has been mistakenly conflated with a third one: the opposition between two varieties of relational reading: (3a) the *transparent* and (3b) the *opaque*

readings. In opaque readings, replacement of a singular term by a co-referential term may fail to preserve truth.

The failure of the substitutivity principle applied to 'Cicero' in the opaque reading of 'Ralph believes that Cicero denounced Catilina' can be imputed to the *double role* played by 'Cicero.' The name 'Cicero' denotes the same individual for both the ascriber and the ascribee, but the ascribee, as opposed to the ascriber, is ready to use the *name* 'Cicero,' but not necessarily the name '*Tully*' for Cicero. The opaque reading of the belief sentence can thus be paraphrased to read:

Ralph believes of Cicero thought of as 'Cicero', that he denounced Catiline

The co-referentiality of 'Cicero' and 'Tully' licenses the replacement of 'Cicero' by 'Tully' when these names are *used,* but not when they are *mentioned*. Hence we *cannot* obtain *via the substitutivity principle*:

Ralph believes of Tully thought of as 'Tully', that he denounced Catiline

which is the formal paraphrase of the opaque reading of 'Ralph believes that Tully denounced Catiline.'

Existential generalization, however, goes through. As 'believes' is relational we can infer '$(\exists x)$ (Ralph believes that x denounced Catiline)' from 'Ralph believes that Cicero denounced Catiline' whether 'believes' is transparent or opaque.

The *hybrid reasoning* however causes a problem. Consider the inference: 'Cicero denounced Catiline and Ralph believes that Cicero denounced Catiline therefore there is someone who denounced Catiline and who is believed by Ralph to have denounced Catiline.' In the premise, the first occurrence of 'Cicero' refers to Cicero whereas the second refers to Cicero *thought of as 'Cicero'*. Hence we cannot, on pain of equivocation, represent its conclusion by an existential quantifier binding two occurrences of the same variable x.

Hintikka's epistemic logic is equipped to cope with that problem. Hintikka imputes the failure of existential generalization in epistemic contexts to a failure of the *presupposition of uniqueness* if the singular term occurs inside the scope of the belief construction. He imputes it to a failure of both an *existence* and a *uniqueness* presupposition if the singular term occurs inside *and* outside the scope of the belief construction.

On Hintikka's account, an inference of the form 'bRc & B_a bRc therefore $(\exists x)$ (xRc & $B_a xRc$)' in which b occurs both inside and outside the belief operator 'B_a' is valid only if we supply an *auxiliary premise* of the form '$(\exists x)$ ($x = b$ & $B_a x = b$).' Admittedly we have been forced to enlarge our *logic*, but we still do this without bringing *intensions* into our *ontology*.

In the semantics for modal (*viz.* epistemic and doxastic) logic, what one quantifies over is "the totality of those functions that pick out *the same* individual from the domains of the different possible worlds" (Hintikka 1969: 137). The world lines which tie up individuals across possible worlds, however, are human artefacts which do not belong to the *furniture of the world*. Our departure from Quine's ontology is thus reduced to the minimum.

As far as Quine is concerned, he endorsed the purely extensionalistic treatment of *de re* propositional attitudes worked out in Burdick's paper (1982: 185–230; see Quine 1995: 98).

10 Fiction, Intentional Objects and Existence

However different the *ontology* of fiction may be from that of nonfictional prose, its *logic* proves to be the same. Binary relations have a converse both in the real world and in the world of fiction: "[r]eaders will automatically conclude that Gladstone shakes hands with Holmes when reading that Holmes shakes hands with Gladstone" (La Palme Reyes 1994: 312).

Even though 'Sherlock Holmes' denotes nothing in the real world, it refers to something in fiction and even *refers rigidly*, that is it designates the same individual in all the counterfactual situations defined relatively to the situations taken as being actual within the work of fiction. Similarly 'man' is a natural kind.

The quantified phrase 'every man,' however, has a different *domain* in fiction and in standard discourse. Should Conan Doyle ascribe immortality to one of his characters, he would not falsify the sentence: '$(\forall x)$ (x is a man $\rightarrow$ x is mortal).' The domain of fiction does not *intersect* with the domain of science, even if a name like 'Gladstone' may occur both in fiction and in history books. In the novels, 'Gladstone' designates a character.

Can we form the *union* of the two domains? Lauener gives a negative answer: "I do not believe that lumping all the individuals into one huge pool would make sense" (Lauener 1986: 285). Can we lump together *possible worlds*? Hintikka replies that we cannot: "The . . . trouble . . . with Meinong's jungle, is that it has not been zoned, plotted and divided into manageable lots better known as possible worlds" (Hintikka 1989: 40).

Admittedly, if our concern is *ontological*, if we only care about the 'furniture of the world,' then putting actual entities and fictional beings together would blur the distinction between reality and fiction and generate pure obscurantism. There is, however, another approach, as Hintikka observes in *Intentions of Intentionality* (1975). Our concern may be *transcendental*. We may be interested in bringing together all *thinkable* objects (which include existents, inexistents, and even impossible beings).

If we want to quantify over that unified domain, however, we need *neutral quantifiers*. Here we move beyond *free logic*, which remained content with *neutral singular terms*, and we enter into *Meinongian logic* invented by Routley (1966) in '*Some things do not exist*' and developed by several authors. See the recent contributions due to Jacquette (1996) and Pasńiczek (1998).

Far from being a gratuitous exercise, a logic of that kind is indispensable if we want to represent, for example the inference which starts with the assumption that there is a barber who shaves everybody in the village who does not shave himself and which ends with the conclusion that there is not such a barber.

We need a *Meinongian logic* to assess reasoning about inexistents just as we need a *paraconsistent logic* (or Batens's *adaptive dynamic logic*) to assess the reasoning of the scientist confronting an inconsistency. When Clausius discovered a contradiction between Carnot's theory and Joule's ideas, he did not apply the principle *ex falso sequitor quodli-*

bet, nor did he stop reasoning. He "implicitly used a logic that *localizes* the specific contradictions and *adapts* itself to these" (Meheus 1993: 385).

11 Lesniewski's Ontology

Consider the following syllogism:

All horses are animals
Bucephalus is a horse
Bucephalus is an animal.

It contains two types of predication: (1) *generic/generic predication* in the major premise and in the conclusion, (2) *individual/generic predication* in the minor premise. Representing that syllogism within the predicate calculus forces us to alter the purity of logic by introducing a semantic distinction between *singular names* ('Bucephalus') and *general names* ('horse', 'animal'). Such a distinction blurs the fact that singular names are logically and syntactically on a par with general names (Waragai 1999: 15). Next we are led to fuse general names with the copula in front of them and to attribute different meanings to the *copula* 'is,' depending on whether it occurs in a predication of the first or of the second sort.

This has prompted several authors (among them Lejewski 1954) to switch from *first-order predicate logic* to the deductive system that Lesniewski created in 1920, that is to '*ontology*.' The latter is based upon a *single copula* in terms of which the other meanings of 'is' can be defined. No distinction is made in the system between proper and general names. The task of expressing existence can be removed from the quantifier and the identity can be made ontologically noncommittal, as it is the case in Meinongian logic.

Lesniewski's ontology has been recently shown to be interpretable in monadic second-order predicate logic, which shows that its first-order part is *decidable* (Cocchiarella forthcoming).

Acknowledgments

I wish to acknowledge a deep debt to Eric Audureau, Nino Cocchiarella, Gabriella Crocco, Lieven Decock, Susan Haack, and Claire Hill.

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