WILLIAM OF OCKHAM: SUMMA LOGICAE

Introduction

OCKHAM's *Summa logicae* (*The Logic Handbook*), written *ca.* 1323, is a manifesto masquerading as a textbook.[1] Its aim, Ockham disingenuously declares in his Preface, is merely to help beginning students in theology avoid elementary difficulties in logic. His undeclared aim is far more ambitious. In the *Summa logicae* Ockham puts forward a new philosophical programme designed to supersede the views of his contemporaries and predecessors, views that come in for extensive and trenchant criticism in the course of its many pages. We call that programme and the movement it engendered "nominalism." Its guiding principle is the conviction that only concrete individuals exist, and hence that any other purported entities are no more than names (*nomina*)—traditionally expressed as the maxim not to multiply entities beyond necessity, a formulation known as "Ockham's Razor." This principle has a wide range of application, and it has deep theological and well as philosophical consequences. The *Summa logicae* lays out in systematic detail Ockham's account of logic and language, providing him with the necessary groundwork for applying his Razor.[2]

Ockham's goal in the *Summa logicae*, then, is to expound and promote his nominalist programme in the context of developing a rigorous account of logic and language. The *Summa logicae* follows the traditional division of logic: Part I is devoted to terms and is concerned with semantics; Part II is devoted to sentences, which are made up out of terms, and is concerned with truth; Part III is devoted to arguments, which are made up out of sentences, and is concerned with inference—a subject so extensive Ockham divides it into four sections, dealing respectively with the syllogism, demonstrative proof, 'topical' reasoning (broadly speaking), and fallacies. Most famous is Part I, in which Ockham wields his semantic theory as a razor

[1] The *Summa logicae* is not completely available in English yet: Part I is translated in Loux [1974] and Part II in Freddoso [1980], with excerpts from each in Spade [1995]; Part III has not yet been translated.

[2] Ockham's *Summa logicae* was recognized as a work of genius, and provoked immediate responses. Walter Burleigh, Ockham's older contemporary, replied with his *De puritate artis logicae*, and the pseudo-Campsall's *Logica valde utilis et realis contra Ockham* is a line-by-line critique of the *Summa logicae*.

against other philosophical views; Part II and Part III build on it and for the most part are directed at narrower logical aims. Accordingly, after giving some background against which to measure Ockham's achievements (§1), I'll concentrate on matters treated in Part I: the machinery of semantic theory (§2), including terms (§3) and their reference (§4), and its deployment against universals and most of the Aristotelian categories (§5). A brief look at Ockham's account of sentences and argumentation (§6) will round out the picture.

1. Background

The history of logic in the Middle Ages begins with its inheritance from antiquity—largely the work of a single man, Boethius (480-524/5), who translated Porphyry's *Isagoge* into Latin along with Aristotle's *Categories* and *Peri hermeneias*, and wrote commentaries on them. He wrote summary treatments of the categorical syllogism, the hypothetical syllogism, topics and topical inference, and logical division; he wrote a commentary on Cicero's work on topics as well. Thus from the beginning of the Middle Ages philosophers had a working knowledge of logical rules and practices. But the virtues of Boethius's work, attempting to encapsulate the whole of logic in a form readily assimilated without prior training, were also its defects: there was little explanation of why the rules and practices were what they were; no account of logical metatheory worth mentioning; an almost complete neglect of some areas of logic, such as modal and tense logic, proof theory, and fallacies. Succeeding generations therefore inherited a systematic discipline without an account of its foundations.

This they set about to provide, once the dust had settled on the collapse of the Western Roman Empire and civilization re-established itself in Western Europe. Progress was slow until early in the twelfth century, when the first great logician since antiquity, Peter Abelard (1079–1142), turned his attention to the project. In the course of his controversial life Abelard tried to create a new semantic foundation for logic, and wrote with a logician's insight on matters such as the nature of conditional inference, how the theory of topics is connected to the theory of valid argument, and much else. Above all, Abelard seems to have started an original tradition in logic; its achievements were represented in the systematic manuals of logic of the mid-thirteenth century written by Peter of Spain, William of Sherwood, and Lambert of Auxerre. These authors expounded an account of logic based on *supposition theory*, in which logical rules were shown to be derived from deeper principles in the philosophy of language (or sometimes the philosophy of logic itself).

This was the first phase of supposition theory: a complete account of logic that was neither derived from nor even, strictly speaking, inspired by antiquity, it was an original achievement hammered out over the course of centuries. However, for reasons we do not know, this native development of logic went into eclipse after the middle of the thirteenth century. There is little trace of it at the inception of High Scholasticism; it is not found in Aquinas, Bonaventure, Albert the Great, Duns Scotus, or others. They had shifted their attention to the effort to create a workable Christian Aristotelianism, and the main issues they confronted were theological rather than logical. So matters stood for several decades. Then came Ockham.

Ockham was born in the late 1280s, in the village of Ockham, so-called from Oak Hamlet, in Surrey, perhaps Woking today. His early years are lost to history. It is likely he was given to the Franciscan order at a young age and taken to its London house, known as Greyfriars, for his education. (We first glimpse Ockham in 1306 when he was ordained a subdeacon.) If he was on the regular schedule, Ockham would have begun studying theology around 1310. We do not know where he began his studies, but at the end of the decade, likely by 1317, he was a student at the University of Oxford, lecturing on Peter Lombard's theology textbook and writing his own commentary on it. Ockham did not complete his studies at Oxford. Instead, he returned to Greyfriars around 1321, where in the course of the next three years he wrote commentaries on Porphyry's *Isagoge* as well as on Aristotle's *Categories*, *Peri hermeneias*, *Sophistical Refutations*, and *Physics*. He also wrote a short treatise on predestination and foreknowledge, and conducted a series of 'quodlibetal' debates (open-question sessions). At the end of this period Ockham wrote the *Summa logicae*, presumably as a summary of how he thought logic, and by extension philosophy as a whole, ought to be done.

2. Mental Language and Signification

Ockham regards logic as a *scientia sermocinalis*, that is, as an organized body of knowledge concerned with meaningful language (I.2). But it is not empirical linguistics. Its proper subject, according to Ockham, is not conventional 'natural' languages such as English or French but rather what makes them possible in the first place: Mental Language. Ockham holds that thought is literally a language—a familiar thesis in contemporary philosophy. While there were authoritative precedents in the writings of Aristotle, Boethius, and Augustine, Ockham seems to have been the first to work out the details of the proposal.

Following Aristotle's lead, Ockham holds that there are three distinct

levels of language: *Written*, *Spoken*, and *Mental*, associated respectively with the activities of writing, speaking, and thinking. Each is a fully developed language in its own right, with vocabulary, syntax, and formation-rules. The three levels are hierarchically ordered, and the ordering is piecemeal rather than holistic: particular inscriptions are conventionally correlated with particular utterances (since the phonetic representation is up to us), which in turn are conventionally correlated with particular concepts (since we may say *red* or *rouge* to express a given concept). Ockham calls both instances of conventional correlation "subordination." Unlike the inscriptions and utterances that make up spoken and written languages, however, the concepts that are the basic vocabulary of Mental Language are non-conventionally correlated with things in the world. A concept, Ockham holds, is naturally linked to that of which it is the concept. This is a point about the nature of concepts: what it is to be the concept-of-φ is bound up with being φ, and not, for instance, ψ. Hence concepts are by definition related to the things of which they are the concepts.[3] Ockham explains this relation as a matter of similarity or likeness, maintaining that the concept of a rabbit (say) is naturally similar to rabbits, or at least more naturally similar overall to rabbits than to anything else.[4] The natural relation between concepts and their objects is the foundation of Ockham's semantics. He identifies it with the semantic property of (natural) "signification": roughly, meaning. Concepts naturally resemble their objects, and thereby signify those objects. The utterances subordinated to a given concept signify what the concept naturally signifies, and so too in turn do the inscriptions subordinated to them. Hence a spoken word does not signify the concept to which it is subordinated; instead, it signifies what the concept signifies, though conventionally and derivatively rather than naturally.

Ockham's account of signification is a technical version of a common intuition about language, roughly that words get their meanings from the ideas they are associated with, with the additional proviso that ideas are more fundamental. Hence in speaking we encode our thoughts in spoken or written form to communicate them externally, and the meaning of a word is what it brings to mind when it is heard.

[3] More exactly, the concept-of-φ is related to what it is to be φ, which is in turn intimately linked to something's being φ: in order for anything to be φ (whether there are any such things or not) there must be something that is what it is to be φ, which also accounts for how a concept is the concept it is rather than a concept of something else. Strictly speaking signification is not a relation at all.

[4] Ockham holds this account in the *Summa logicae* but there are reasons to think he abandons it in the end: see King [2005].

Mental Language therefore functions as the semantics for conventional spoken and written languages. It explains what it is for a written or spoken term to have a meaning, namely to be subordinated to a concept. Furthermore, it explains both sameness in meaning (synonymy) and difference in meaning (equivocation): terms of spoken or written languages are synonymous when subordinated to the same concept(s) in Mental Language;[5] again, a term in spoken or written language is equivocal if it is subordinated to distinct concepts at one and the same time.[6]

The vocabulary of Mental Language is made up of concepts, which play a dual role for Ockham. On the one hand, they have a psychological dimension. They are literally the elements of thought: *thinking of* φ just is *having a concept-of-*φ. As such, concepts are the primary building-blocks of thought itself. We acquire them from our interaction with the world, according to Ockham, and an adequate psychological theory should detail the process of concept-acquisition in light of the operation of other mental faculties, such as sense-perception. Thus Mental Language is at least a partial description of the way human minds actually function. Since the structure of conceptual thought was held to be the same for all thinking beings (God excepted as always), cognitive psychology can be a universal natural science; Ockham understands it to be the foundation for logic.

On the other hand, concepts have a semantic as well as a psychological dimension. As part of a language, concepts are normatively governed and have semantic features that can be considered independently of their psychological properties, and indeed so does Mental Language *qua* language. For instance, Mental Language will be universal to all thinking beings, in virtue of the universality of the structure of cognitive thought. Of course, it is universal only with respect to its structure, not its content, since two thinkers may have different (if not disjoint) stocks of concepts, depending on their past causal interaction with the world. To claim universality for the structure of Mental, then, is roughly to say that there is a set of conceptual abilities common to all thinkers, in virtue of which each is a thinker. (Any thinker can combine simple concepts into complex concepts, for exam-

[5] This point also explains how translation from one conventional language to another is possible, which is a matter of identifying the relevant utterances or inscriptions subordinated to the same expression of Mental Language.

[6] In contemporary terms, a semantics is a function from well-formed formulae to meanings, sufficiently well-behaved to individuate meanings. It may have further properties as well, such as compositionality, so that the meaning of an expression is a function of the meanings of the constituent parts of the expression. We'll see how Ockham handles such cases in §3.

ple.) Furthermore, the universal language of thought will be "expressively complete"—since thinking of φ just is to have a concept of φ, anything that can be thought is expressible, and in fact thereby expressed, in Mental Language; hence anything expressible at all must be expressible in Mental Language. By the same token, Mental Language cannot contain any ambiguity, since to do so would require that a concept-of-φ be naturally related to φ and also to some unrelated ψ, which is impossible, since the one does not involve the other. Ockham's psychological realism reinforces this conclusion. Since we think in Mental Language, an ambiguous term (concept) would mean that we could think something without determinately thinking it rather than thinking something else, which cannot happen. Hence Mental Language is universal, expressively adequate, and free of ambiguity.

Although Mental Language is a language, it does not have all the features conventional languages such as English or French have. In particular, Ockham holds that Mental Language includes only those syntactical (grammatical) features that are needed to make a semantic difference to an expression (I.3).[7] For example, pronouns are not required, since at least in principle they could be replaced by the nouns for which they stand (also disambiguating Mental sentences). Nor need there be distinct conjugations for verbs, declensions for nouns, or gender for nouns. However, nouns must have number and case; verbs must have number, mood, person, voice, and tense. These features make a difference to what is said: "Socrates will run" differs from "Socrates has run," for instance. Ockham leaves it open whether we should think of Mental Language as containing (*a*) verbs but not their participles, since "Socrates runs" can replace "Socrates is running" everywhere, or (*b*) one single verb, namely the copula, which can be combined with the participles of all other verbs for the converse reduction, putting "Socrates is running" in place of "Socrates runs" everywhere. Since (*a*) and (*b*) are semantically equivalent, we should think of Mental Language as having a deep structure that could be represented by either; the choice of one rather than the other is a matter of our (spoken or written) representation of Mental Language, not a fact about Mental Language itself.[8] In addition to nouns and verbs/participles, Ockham argues that conjunctions, prepositions, and adverbs are also included in Mental Language: "The cat

[7] Ockham offers as a test for inclusion in Mental Language whether the truth-value of a sentence can be altered by varying the syntactical feature in question (I.3).

[8] Ockham is particularly tempted to use (*b*) since it makes the statement of logical laws, such as equipollence and conversion, much easier. That is, again, not a deep fact about Mental Language but about our representation of it.

is on the mat" differs from "The cat is under the mat," for instance.[9]

The grammar, and hence the formation-rules, of Mental Language is therefore very like that of ordinary spoken and written languages, with this difference: the syntax of Mental Language is entirely driven by its semantics, and it contains all and only those features that could make a semantic difference.

3. Terms

Ockham distinguishes "categorematic" and "syncategorematic" terms, a distinction roughly parallel to the modern distinction between logical and non-logical particles. Unlike modern logicians who take the difference to be primitive and explicated by syntactic rules, Ockham distinguishes them semantically: a categorematic term has a "definite and determinate signification" as described in §2, whereas a syncategorematic term has no proper signification of its own but affects the semantic behaviour of any categorematic term with which it is combined (I.4). The categorematic term 'rabbit' signifies rabbits, and provides an unambiguous rule to determine whether some item is signified by 'rabbit' (namely whether it is a rabbit); its signification is therefore definite. Syncategorematic terms, in contrast, do not signify things but instead affect the semantic behaviour of terms that do. 'Every' does not signify anything, unlike 'rabbit' (what item in the world is an 'every'?), but it can be combined with 'rabbit'; 'every rabbit' distributively signifies all the rabbits there are. Since no item in the world, even a rabbit, is an 'every rabbit' (whatever that might be), 'every' clearly makes a semantic difference when combined with 'rabbit'. Hence 'every' is not a categorematic but a syncategorematic term.[10] So too for 'all', 'some', 'not', 'if', 'and', 'or', 'except', and the like, identified nowadays as logical constants.

[9] If Mental Language includes prepositions, then it arguably need not include noun-cases; since there must be scope-markers, the function of grammatical noun-cases could be replaced by explicit prepositions, *e. g.* "The book is Socrates's" (where 'Socrates's' is possessive genitive) could be eliminated in favour of "The book belongs to Socrates" (where 'belongs to' makes the possession-relation explicit).

[10] Technically 'every' affects the reference of the term 'rabbit' rather than its signification (we are still thinking only of rabbits in 'every rabbit'); hence the semantic property it affects is not its signification but its supposition (I.4): see §4. A term such as 'fake' alters the signification as well as the supposition of the term with which it is combined: 'fake rabbit' does not signify rabbits at all (and is not used to refer to them). It isn't clear, however, that 'fake' is purely syncategorematic, rather than being at least in part what Ockham calls a connotative term (like 'dead' in 'dead man'): see the discussion later in §3.

Syncategorematic terms are present in Mental Language, since they make a semantic difference to the expressions in which they occur.[11] Unlike ordinary concepts, they are not *of* something, for they have no significate. Instead, they *do* something when combined with ordinary concepts. In the case of conjunction, for example, the syncategorematic term 'and' forms a new expression out of two categorematic terms, so from 'Jerry' and 'Phil' we get the well-formed expression 'Jerry and Phil'; the psychological correlate is the combination of the concept-of-Jerry with the concept-of-Phil.[12] This expression is itself a term, since it can occur as the subject or predicate of a sentence (the root meaning of 'term' from *terminus*); as we would put it, Ockham takes conjunction to be a term-forming functor operating on (pairs of) simple terms.[13] Because all the parts of the new complex term already exist in Mental Language, the complex term is not something over and above these parts—nothing needs to be added to Mental Language to accommodate the new complex term; it can be produced from elements already present prior to their combination. Hence Mental Language will "contain" the new term in the sense that it will have its constituent parts conjunctively combined.

As with conjunction, so too with other syncategorematic terms. Mental Language thus contains primitive ("atomic") elements and complex expressions formed out of them by logical operations. Ockham holds further that this is *all* Mental Language contains, and hence that every expression in Mental Language is either primitive or a logical construction out of primitive expressions. Since mental life begins with the acquisition of concepts which are then combined, if Mental Language were to contain any complex expression not logically constructed from primitives it would have to involve a non-logical mental operator that compounds primitive expressions—but this operator would by definition be a syncategorematic term, since it affects the semantic properties of its constituents taken in combination, and hence it must belong to Mental Language.[14] Expressions in Mental Language

[11] Hence not every element of Mental Language has signification, strictly speaking.

[12] This brief sketch skates over several difficulties. Are syncategorematic terms in Mental Language concepts at all, or ways of thinking ordinary concepts? How do they have relevant logical properties, such as scope, ordering, and the like? Is the conjunction of the concept-of-φ with the concept-of-ψ the concept-of-$< \varphi + \psi >$? Ockham leaves these questions unresolved.

[13] Conjunction can also form (compound) sentences out of sentences. Ockham, like other mediæval logicians, regards sentential connectives and operators as having a rather different logical character: see the further discussion in §6.

[14] So described, Ockham's project looks very much like modern logic: a set of atomic

are therefore completely articulated with respect to their logical structure. The sequence of syncategorematic terms in an expression—the "frame" left behind after deleting the categorematic terms—is its logical form, which can be directly read off any expression. Accordingly, Mental Language is logically perspicuous, which makes it ideal as the foundation for logic.

However, Mental Language is not quite a "logically ideal" language of the sort in vogue at the beginning of the twentieth century.[15] Its semantics does not perfectly dovetail with the logical analysis of expressions. To see why not, we need to take a closer look at the signification of primitive and complex expressions.

Consider a complex expression, say 'white rabbit'. Ockham adopts a principle of semantic compositionality: the signification of an expression is a function of the signification of its parts. If 'rabbit' signifies rabbits and 'white' white things, then, there seem to be only two plausible candidates for the signification of 'white rabbit', namely the intersection of their significations (so that 'white rabbit' signifies white rabbits) or the union of them (so that it signifies rabbits and white things). The first candidate seems to match our practice. We use 'white rabbit' to talk about white rabbits, after all, and the juxtaposition of the terms might be thought to limit the signification of each to what it has in common with the other. Yet Ockham rejects the first candidate in favour of the second. On the one hand, while we do use 'white rabbit' to talk about white rabbits, that is a matter of how we use the (complex) expression to refer to things, not a matter of its signification; in short, this line of reasoning confuses meaning and reference.[16] On the other hand, the second candidate matches our intuitive understanding of signification. Hearing 'white rabbit' brings to mind (first) white things and (next) rabbits; hence it signifies white things and rabbits, the union of the signification of its component parts. So too in general: Ockham holds that the signification of a complex expression is the sum of the significations of its categorematic parts, the so-called "Additive Principle" (of semantic

expressions and a recursive definition of well-formed formulae by logical construction from atomic expressions. Ockham's treatment of the syntax is driven by his semantics, though, which is the opposite of our modern approach.

[15] Trentman [1970] argues that Mental Language is a logically ideal language for Ockham.

[16] For Ockham's theory of reference, see the discussion of supposition in §4. According to the first candidate, the complex expression 'John and Paul' would signify John and Paul, since the syncategorematic term 'and' has the effect of combining the signification of 'John' with that of 'Paul'. But syncategoremata were defined in terms of affecting the semantic properties of the terms with which they are combined, and so we cannot appeal to their effects in determining the signification on pain of circular reasoning.

compositionality).[17]

According to the Additive Principle, the signification of a complex expression is itself complex; the semantics follows the syntax well enough here. The difficulty lies instead in logically primitive expressions. For an ideal language all logically primitive expressions would also be semantically simple. This is not the case for Ockham. In addition to semantically simple primitive terms, Ockham also admits semantically complex primitive terms. He does so because he thinks there is another important distinction to draw among terms.

Signification as described above fits well the meaning of terms where there is some readily identifiable significate to which the term applies. Clear examples are proper names ('Socrates') and common names that are natural-kind terms ('weasel' or 'flower'). Such "absolute" terms, Ockham tells us, have no nominal definition (I.10), which is to say that there is no adequate way to describe what they signify; direct experience of their significates, or at least paradigmatic instances, is necessary to know what the term stands for. Hence some form of knowledge by acquaintance is called for in the case of absolute terms.[18]

There are other terms whose signification is more complex. A term like 'parent', for example, primarily signifies men and women—not all men and women, to be sure; only those men and women who have children. It is not possible to characterize what 'parent' signifies without mentioning children. Nevertheless, 'parent' does not signify children the way 'weasel' signifies weasels: 'parent' signifies men and women in virtue of their having children, and although it does call children to mind they are not what it primarily signifies; contrast 'parent' with 'family', which does signify children along with their parents. Ockham says that 'parent' primarily signifies men and women (those who have children) and secondarily signifies their children. In other words, 'parent' signifies men and women, and also connotes their children; Ockham calls such terms "connotative," as opposed to absolute terms like 'rabbit'. Unlike absolute terms, connotative terms do have nominal definitions. The nominal definition of 'parent' is 'man or woman who has at least one child'; this definition, though nominal, provides adequate "knowledge by description" of what a parent is (whether one has ever encountered a parent or not), in contrast to absolute terms, which lack such nominal definitions—no amount of description quite gets at what 'giraffe'

[17] See Spade [1975] and [1980].

[18] Absolute terms are thus similar to Kripke's rigid designators, involving necessary *a posteriori* criteria.

signifies, though some descriptions prepare us better for our first encounter than others.

Connotative terms greatly outnumber absolute terms. They include overtly relational terms, such as 'guitarist', 'double', 'wealthy', 'similar'; all geometrical terms, such as 'figure', 'circle', 'solid'; psychological terms, such as 'intellect' and 'will'; all terms in categories[19] other than Substance and Quality, and, especially worth noting, concrete terms in the category of Quality: 'white', for example, signifies (white) things and connotes whiteness, being nominally definable as 'thing having whiteness'.[20]

If all logically primitive expressions in Mental Language were absolute terms, connotative terms could be completely replaced by equivalent nominal definitions involving only absolute terms (in the end), and the semantics of Mental Language would match its logical structure. However, Ockham explicitly allows some connotative terms to be logically primitive in Mental Language.[21] Hence logical simplicity does not entirely match semantic simplicity. While logically perspicuous, Mental Language does not necessarily articulate the complex signification connotative terms may have—or, to the extent that it does, a simple connotative term can be present in Mental Language along with its complex nominal definition. Thus Mental Language may contain some redundancy, in the form of synonymous expressions, and so may not be semantically perspicuous.

Connotative terms are one of the weapons in Ockham's arsenal against what he regards as the bloated ontologies of his predecessors and contemporaries. Whereas absolute terms seem to require the existence of their significates, diagnosing a term as connotative rather than absolute gives Ockham a way to avoid the ontological commitments that it would carry if it were absolute. This is particularly important when it comes to the concrete and abstract forms of nouns, which, Ockham holds, have often misled philosophers, *e. g.* in mistakenly taking 'whiteness' to pick out an

[19] Aristotle held that there are ten categories of things: substance, quantity, quality, relation, action, passion, time, place, position, and state. Substances are primary self-subsisting beings; the other nine "accidental" categories classify features that substances may have. Thus Socrates (a substance) has a certain height and weight (quantities), is the son of Sophroniscus (relation), and so on. Language reflects the world, so Ockham classifies terms by the category they fall under: 'son' is a term in the category of relation, 'Socrates' a term in the category of substance, 'whiteness' in the category of quality. Ockham argues that, contrary to appearances, there are things in the world in only two of the traditional categories, namely particular substances and particular qualities.

[20] 'Whiteness', unlike 'white', is an absolute term naming a singular quality: see §5.

[21] See Panaccio [1990] and [1991], Tweedale [1992], and Spade [2002].

independent shareable entity, present simultaneously in many white things. But before we can turn to Ockham's programme of ontological reduction (§5), we first need to look at the other semantic notion fundamental to the *Summa logicae*.

4. Supposition

Signification is a property that terms, and by the Additive Principle complexes of terms, have in their own right; regardless of context they call their significates to mind whenever they occur. But we use terms for more than simply calling things to mind; we use them to talk about things, and indeed usually to talk about the things they signify. (Another way to put the point is to say that terms occur as subjects and predicates in sentences.) This is accomplished by a distinct semantic relation, called "supposition,"[22] which accounts for the referential use of categorematic terms.[23]

Supposition and signification thus differ in two ways for Ockham. First, terms retain their signification at all times, whereas they are only used referentially in sentences. Hence a term has supposition only in a sentential context. Second, terms can be used referentially in many ways; unlike signification, supposition takes a variety of forms, and it is the business of a theory of supposition to spell out what these varieties are. In practice that amounts to giving a taxonomy of kinds of supposition—a mediæval version of "the varieties of reference."

Ockham distinguishes three primary kinds of supposition (I.64): *material*, *simple*, and *personal*.[24] Consider the absolute term 'frog', which signifies frogs. We use it to refer to frogs when we say such things as "Waiter, there is a frog in my soup" or "Every frog is green." In these cases 'frog' has personal supposition, since it refers to what it signifies, namely frogs.

[22] The word 'supposition' is cognate to the Latin *supponere*, literally 'to put underneath' (*sub* + *ponere*), a matter of identifying the referent of a word—a usage apparently indebted to earlier grammarians' describing what a pronoun stands for. It has nothing to do with making an assumption or accepting an hypothesis. A better rendering would be 'reference' itself, but 'supposition' is now the entrenched translation.

[23] Ockham's account of supposition applies to terms in all three levels of language—spoken and written and mental—although sometimes obvious qualifications are glossed over. For instance, terms in Mental Language do not "call things to mind" but simply are the having of those things in mind. I will ignore such details and talk indifferently about language.

[24] Ockham's trichotomy is based on the observation that while we normally use a term to refer to what it signifies (personal supposition), in one way or another, we do not always do so (material and simple supposition), although in the latter cases we do refer to something interestingly related to what the term signifies.

Clearly there is much to say about whether in a given occurrence 'frog' refers to all frogs, or merely to some frogs, or perhaps to a certain frog; Ockham calls these the *modes* of personal supposition, to be investigated shortly.

We can also use 'frog' to refer to things other than frogs. I could use it to refer to pigs, or to the first person I see in the morning, or to red sails in the sunset. These idiosyncratic uses have no particular connection with 'frog' or with frogs, and are plausibly understood as changes in the signification of the term: in the first case it is a new word for pigs, no more sharing a meaning than 'bank' does as the side of a river and as a financial institution; in the second case it acts as a definite description; in the third it picks out a class of things for which there was no single word before. In none of these cases is there anything special about the choice of the term.

Ockham holds that two uses of 'frog' are interestingly related to what it ordinarily signifies, despite not referring to frogs. On the one hand, we say things like "Frog has four letters" and "Frog is a monosyllable." In these cases 'frog' has material supposition, since it refers to the particular inscription (element of written language) or the particular utterance (element of spoken language) *qua* subordinated to the concept-of-frog in Mental Language (I.67).[25] On the other hand, we say things like "Frog is a genus." According to Ockham, as we shall see in §5, genera are not real items in the world but only concepts; hence 'frog' here has simple supposition, since it refers to the concept-of-frog, not *qua* signifying frogs but *qua* intrinsically general in its signification. More exactly, 'frog' here refers to the particular concept (element of Mental Language) involved in its ordinary significative use, rather than to what it signifies (I.68).

Since there are only three elements involved in language—the embodied token subordinated to a concept, the concept itself, and what is conceived through the concept—Ockham's division of supposition into material, simple, and personal respectively is complete. Yet Ockham does *not* hold that when a term refers to embodied tokens it must have material supposition, or that when it refers to a concept it must have simple supposition, or that it must refer to things in the world if it has personal supposition. The term 'concept' personally supposits for concepts, for example; it does so by means of the concept-of-concept (just as 'pig' personally supposits for

[25] Ockham is unnecessarily restrictive here, since he recognizes only two subordinate levels of language. We could just as easily talk about the gestures that are the 'material' of sign language, or the raised patterns that make up Braille. The point is that a term has material supposition if it is used to refer not to what it signifies but to whatever encodes its signification in a given medium.

pigs via the concept-of-pig), which it picks out in particular, though not *qua* concept-of-concept, when it is in simple supposition, *e. g.* in "Concept is a universal." Likewise 'inscription' personally supposits for inscriptions, including the inscription 'inscription', whereas in material supposition it refers only to the inscription 'inscription' *qua* inscription (namely as ink on paper) rather than *qua* exemplifying the concept to which it is subordinated (the concept-of-inscription). Terms always have personal supposition when they stand for what they signify, taken significatively, and not otherwise (I.64).

Note that 'pig' is one and the same term no matter where it occurs, whether it has personal supposition ("Every pig is pink"), simple supposition ("Pig is a universal"), or material supposition ("Pig has three letters"). Ockham is therefore at odds with contemporary philosophy, which takes quotation to do much of the work of material supposition—to the point where the sentence would have to be written as "'Pig' has three letters." Modern quotation is a term-forming functor that produces a name of that to which it is applied: 'pig' refers to (the term) *pig*.[26] The former refers to a word (or perhaps a tokening of a word), the latter refers to pigs in the world. On the contemporary view, however, the new name produced by quotation is indivisible and has no special relation to the word of which it is a name; much the same effect could be obtained by letting 'A' stand for (the term) *pig*.[27] Ockham's account of material supposition has the virtue of explaining why the cases are not similar.

Material and simple supposition are cases in which the selfsame term is used referentially, though in nonstandard ways. Ockham recognizes their importance but devotes most of his energy to working through the modes of personal supposition (I.69–74), which catalogue the ways in which a term can be used to refer to what it signifies.

First, Ockham divides terms with personal supposition into "discrete" and "common" (I.70). Terms with discrete supposition are proper names, demonstrative phrases, and definite descriptions, each of which is seman-

[26] Strictly speaking this should be: ''Pig'' refers to 'pig'. Unlike material supposition, quotation can be indefinitely iterated. Contemporary philosophers of language take quotation to be a way of enshrining the distinction between *using* a word and merely *mentioning* it. For Ockham there is no distinction: each is a way of using the selfsame word referentially, though the ways of course differ.

[27] Whether a quoted name is indivisible is a matter of debate. The issue is surprisingly subtle, involving deep questions about quantifying into quotation-contexts, *oratio obliqua*, and substitutivity, questions that go to the heart of contemporary semantic theory. No consensus has been reached. See Normore [1997] for more discussion of Ockham's account of material supposition.

tically singular by its nature, signifying exactly one thing, at least on an occasion of its use—for example, 'Orson Welles', 'this fish', 'the present Queen of England'.[28] Hence each can be used to refer only to the very thing it signifies, and if used referentially at all must pick out that very thing. That is, the kind of reference in question for such cases is naming or denoting. Conversely, a term not semantically singular by nature will have common personal supposition. Ockham's distinction more or less matches the distinction between proper and common nouns (or noun-phrases); hereinafter he will be concerned with the referential uses of common nouns or noun-phrases.

Secondly, Ockham divides terms with common personal supposition into "determinate" and "confused" (I.71). He characterizes determinate supposition, and the remaining modes as well, in two ways: by the logical properties an expression has, and by the inferential relations of ascent and descent. Intuitively, a term has determinate supposition when it is used to refer to at least one of the things it signifies. (It may of course refer to more than one.) When Smith says "Some man has been on top of Mount Everest," for example, 'man' has determinate supposition.[29] With regard to an expression's properties, Ockham holds that a term has determinate supposition in subject-position if it is indefinite or in the scope of a particular quantifier not itself in the scope of another logical particle, as 'man' is in the scope of 'some' (but 'some man' is not in the scope of any other syncategorematic term). Furthermore, when a term has determinate supposition, two inferences are licensed: a 'descent' from the general term in the original

[28] Ockham does not try to spell out what such 'semantic singularity' consists in, offering instead grammatical criteria: proper names; demonstrative pronouns, perhaps in combination with common nouns; and the like. Only the last case properly fits Ockham's approach, where 'fish' in "This fish took twenty minutes to catch" has discrete supposition (taking 'this' as purely syncategorematic). Nothing of the sort is possible for proper names, which are necessarily singular; 'Socrates', for example, has no common referential use. Ockham and Burleigh disagreed about discrete supposition, Burleigh distinguishing proper names from demonstrative phrases as simple and complex forms of discrete supposition.

[29] This formulation conceals an ambiguity. If we ask Smith "Which man?" we may mean "Which man has been on top of Mount Everest?" or "Which man were you, Smith, referring to?" The former takes 'some man' in Smith's original statement attributively, accepting its truth and wondering which man or men make it so; the latter takes 'some men' referentially, so that Smith is talking about some man or men, and wonders whether they have indeed been on Everest. Each interpretation is possible; modern logicians prefer the attributive reading for the existential quantifier, whereas mediæval logicians, including Ockham, prefer the referential reading for the syncategorematic term 'some'.

sentence to individuals by a disjunction of sentences, and an 'ascent' from any individual to the original sentence. Thus "Some man has been on top of Mount Everest" licenses the inference "Hence Socrates has been on top of Mount Everest, or Plato has been on top of Mount Everest, or..." descending to singulars; equally, from any one of these disjuncts, such as "Arnold has been on top of Mount Everest," we may legitimately infer "Hence some man has been on top of Mount Everest," ascending to the general claim.[30] A common term that does not have determinate supposition has confused supposition.

Thirdly, Ockham divides terms with confused supposition into "merely confused" and "confused and distributive" (I.73). Again intuitively, a term has merely confused supposition when it is used to talk indifferently about several of the things it signifies, namely when it is used attributively: 'marsupial' in "Every kangaroo is a marsupial" refers to marsupials—in this sentence to whatever marsupials there are that are kangaroos, whichever they may be, indifferently, since none is singled out.[31] Ockham summarizes the situation by saying that sentences containing terms having merely confused supposition do not license inferences descending to singulars under the term via a disjunction of sentences, but they do license descent to a disjunctive predicate, and, like determinate supposition, they permit inferences to the original sentence from a given singular. Hence from "Every kangaroo is a marsupial" we cannot legitimately infer "Every kangaroo is this marsupial, or every kangaroo is that marsupial, or..." but we can infer "Every kangaroo is this marsupial or that marsupial or...": there is no given marsupial that every kangaroo is,[32] although any given kangaroo is some marsupial or other. The rules Ockham provides to describe the logical properties of expressions containing terms with merely confused supposition are a motley assortment: a term outside the scope of a universal sign has merely confused supposition if it is construed with a term falling within the scope of that sign (as 'marsupial' is construed with '(every) kangaroo' above); a term outside the scope of a quantifier but in subject-position has

[30] The inferential conditions for determinate supposition, then, roughly correspond to existential generalization and instantiation. Unfortunately, Ockham's account of ascent and descent does not work as a theory of truth-conditions for quantified sentences.

[31] Since merely confused supposition is attributive, working from the truth of the sentence to determine the extension of the predicate, it is in some ways closest to the modern use of existential quantification.

[32] In a world with only one kangaroo there is a single marsupial that every kangaroo is, namely the marsupial that is the lone kangaroo. True enough, but true due to the facts of the case rather than to its logic, which is all Ockham is concerned with here.

merely confused supposition, *e. g.* 'food' in "Every lawyer gives some food to this cat." (Note that this allows Ockham to handle multiple quantification with relative ease.)

A term having confused supposition but not merely confused supposition must have confused and distributive supposition (I.74).[33] Intuitively, a term has confused and distributive supposition when it is used to refer to every or all of the things it signifies. Hence 'pig' in "Every pig is pink" has confused and distributive supposition, since it is used to refer to every pig (whereas 'pink' has merely confused supposition). The semantic relations involved in distributive confused supposition are clear: reference is made to everything (presently existing) that the term signifies; it is "distributed" over each individual. Ockham's rules for confused and distributive supposition amount to this: a term in subject-position in the scope of a universal quantifier not itself in the scope of another logical particle has confused and distributive supposition, and likewise the predicate in universal negative sentences, as 'piano' in "No wind instrument is a piano." From a sentence with a term having confused and distributive supposition it is legitimate to descend to singulars via a conjunctive sentence, or to ascend from all the singulars. From "Every pig is pink" we can infer (descending under 'pig') "Porky is pink, and Petunia is pink, and Wilbur is pink, and. . . "

The theory of supposition bridges the gap between signification and truth, providing Ockham with a sophisticated and subtle account of the legitimate referential uses of terms when they are used, in sentences, to talk about things. In addition, it links logic to metaphysics, words to the world: truth depends on successful reference, and supposition theory catalogues the varieties of reference. In contemporary jargon, it is the vehicle of ontological commitment—the measure of what a thinker takes to exist, spelled out in the ineliminable references present in his or her account of the world. This cuts both ways, of course; Ockham can use his semantic theory to show that putative ontological commitments are in fact merely apparent, not genuine. Time for a razor.

5. Ontological Reduction

Ockham's charge is that his predecessors and contemporaries have been misled by grammar into thinking there must be certain sorts of entities: universals (common natures), and items in most of the traditional Aristotelian categories. In the case of the former they misunderstand philosophical ter-

[33] Ockham further divides confused and distributive supposition into "mobile" and "immobile," but this refinement is not necessary for our purposes here.

minology and the semantics of abstract names; in the case of the latter they mistake connotative for absolute terms.

The world contains distinct individuals. Trigger, Ed, and Silver are horses, each different from the others. They nevertheless belong to the same kind, since each is a horse; traditionally put, they share a common nature, one not shared with goats or geese, though all alike are animals and hence share a common animal nature distinct from the nature common to horses alone. The world is thus divided into genera and species reflecting these shared natures. Hence statements of the form "Horse is a species" will be as true as "Trigger is a horse" and, as we have seen in §4, 'horse' is the selfsame term in each sentence. This gives rise to two questions: (1) What do 'horse' and 'species' refer to in "Horse is a species"? (2) What does 'horse' refer to in "Trigger is a horse" and "Ed is a horse"? Many philosophers—too many for Ockham's taste—reasoned that in order to make a real difference in the world, 'horse' had to at least connote (if not refer to) some real shared feature that Trigger and Ed and Dobbin each have simultaneously, namely the common nature *horseness*. Thus metaphysically real differences are explained by metaphysically real constituents in things, constituents that can be named by abstract names. In addition to concrete singulars, then, the world also contains real abstract entities.

Ockham will have none of this line of reasoning, finding only bad semantics in it. He divides his response into two parts, the first offering his positive account of genera and species (I.14–17), the second his attack on abstract entities (I.5–9).

According to Ockham, "Horse is a species" is true but has no untoward ontological consequences. 'Horse' in this sentence does not have personal supposition, since it is not used to refer to horses the way it is in "Trigger is a horse"; instead, it has simple supposition. Recall from §4 that a term with simple supposition is used to refer to the concept involved in the term's ordinary significative use, rather than referring to what that concept signifies. Thus 'horse' in "Horse is a species" refers to the concept-of-horse, the very mental particular by which we think of horses; it picks out a word in the language of thought. The term 'species' must therefore personally supposit for the concept-of-horse, among other things, if "Horse is a species" is to be true. On this score it is like the term 'concept', which also personally supposits for concepts rather than nonmental objects. Now just as "Horse is a species" is true, so too is "Rabbit is a species," "Kangaroo is a species," and so on, but not "Trigger is a species." Hence 'species' must refer to items that are somehow general in their nature. Put another way, 'species' signifies general concepts, or technically the lowest-level general concepts

characterizing what a thing is: the concept-of-horse, the concept-of-rabbit, the concept-of-kangaroo, and so on, but neither the concept-of-Trigger nor the concept-of-animal (a generic rather than specific concept). And just as 'horse' signifies various horses through the concept-of-horse, so too 'species' signifies various species through the concept-of-species, that is, through the concept-of-<lowest-level general concept>.

To the question "What is a species?" Ockham therefore replies: a concept of concepts, what we technically call a "second-order concept" and Ockham technically called "a concept of second intention"—terminology aside, 'species,' and likewise 'genus' and 'differentia', classify kinds of concepts, not nonmental things or their real ingredients.[34] Each is itself ontologically singular, though semantically general. No non-individual entities need to be postulated to explain the truth of sentences such as "Horse is a species." His strategy, broadly speaking, is to resolve metaphysical questions by techniques of semantic ascent, so that claims about genera and species are reinterpreted as metalinguistic statements. "Horse is a species," stripped of Ockham's mentalese apparatus, is roughly equivalent to "The term 'horse' is a common noun." To ask what 'horse' picks out in the world beyond individual horses is to mistake this point, to confuse simple with personal supposition.

The objection might be raised to Ockham that even if he is correct about genera and species, there nevertheless must be some real feature in the world underlying the generality of the concepts we legitimately apply. Horses are not merely grouped together arbitrarily, after all; they constitute a natural kind no matter how our conceptual apparatus happens to work. What is more, we need to explain how general terms like 'horse' work, that is, how they signify all and only horses. We can satisfy both by postulating some real metaphysically common entity named by the abstract term 'horseness': each horse is a horse by horseness, which is possessed by horses and nothing else, and likewise the term 'horse' picks out horses because each has or exemplifies horseness.

Ockham's reply to this objection has three parts. First, Ockham offers a detailed psychological account of how concepts are acquired, and what it is for them to signify what they do. The bulk of his account, though, is not given in the *Summa logicae* but in his other writings.[35] Secondly, Ockham

[34] The term 'universal' is more general still, since "Genus is a universal" is true (and so for each of the five traditional universals); hence 'universal' must refer to concepts of concepts, and itself be a third-level concept, the concept-of-<concepts-of-concepts>. Ockham fumbles this point in *Summa logicae* I.14.

[35] See especially Ockham's Prologue to his *Ordinatio*.

argues that there are strong reasons not to postulate any such abstract entities, since theories involving them are inconsistent or at least highly implausible. This is the burden of *Summa logicae* I.15–17. The arguments he gives there are metaphysical, not particularly indebted to his semantics, and are found in much greater detail elsewhere.[36]

Thirdly, Ockham thinks this objection is confused about the semantics of abstract terms (I.5–9), mistakenly thinking that an abstract name must name an abstract object. He develops his reply by considering the general case of concrete names, such as 'horse' and 'white' and 'parent', as compared to their abstract counterparts 'horseness' and 'whiteness' and 'parenthood', in spoken or written languages.[37] Ockham argues that concrete and abstract names might be related in different ways.

On the one hand, a concrete name and its abstract counterpart might be completely synonymous (I.6), *i. e.* subordinated to the same concept or expression in Mental Language; in this case they each signify exactly the same thing in exactly the same way—the difference between them is wholly an artifact of written or spoken language. So it is for 'horse' and 'horseness', Ockham holds, and in general for absolute terms in the category of Substance.[38] 'Horseness' signifies exactly what 'horse' signifies, namely horses. It does not pick out some ingredient or feature in the horse, in virtue of which the horse is a horse, if for no other reason than that horseness is not some feature that a horse has, the way it has colour, but rather a description of what a horse is (I.7). After all, to think that 'horse' signifies a horse in virtue of its possession of some metaphysical property *horseness* is to treat it as a connotative rather than an abstract term, on a par with 'rich' (which signifies humans in virtue of their possession of wealth). Ockham's view has the surprising result that we can use the abstract term interchangeably with the concrete term, so we can talk about the horsenesses in the stable, or riding a horseness, and so on; we can even say "Horseness is a horse," of course (of course!). As long as we keep in mind that 'horse' and 'horseness' are synonymous, no difficulties, other than some deviant usage, should

[36] William of Ockham, *Ordinatio* 1 d. 2 qq. 4–8.

[37] In Latin, as in English, abstract nouns are typically formed by taking the concrete noun as the stem and adding a special suffix: in Latin *-itas* and in English *-ity* or *-ness* or *-hood*, so *equus* (horse) becomes *equinitas* (horseness), for example. But this is merely a grammatical feature that need not reflect any semantic difference in Mental Language, as Ockham notes (I.5).

[38] Ockham thinks that there are theological exceptions to this principle based on the possibility of hypostatically assuming a nature (I.7). We can ignore this complication in what follows.

trouble us. And as in the category of Substance, so too in many other categories, although the concrete and abstract names in those categories are connotative rather than absolute. For instance, 'parent' and 'parenthood' in the category of Relation are synonymous connotative terms: they each signify humans who have children, *i. e.* they primarily signify humans and connote their children. In these cases it is ontologically innocuous to allow the abstract name, since it is an exact synonym of the concrete name; 'horseness' no more fattens the ontology than 'horse' did in the first place.

On the other hand, a concrete name may fail to be synonymous with its abstract counterpart (I.5). This happens in the category of Quality, for instance; 'white' and 'whiteness' are not synonyms. The concrete name 'white' is connotative, signifying primarily something white and secondarily the whiteness through which it is white, whereas the abstract name 'whiteness' is absolute, signifying a real individual quality (the possession of which makes its possessor white). Yet even here there is no metaphysically common element. Each whiteness is an individual quality, one in itself and possessed by one substance at most. Two white things are each white, but each is made white by its individual whiteness, not shared with anything else. Hence even when the concrete and abstract names are not synonymous, just as when they are, the abstract name is not the name of an abstract entity but rather the name of an individual, albeit an individual from a category other than Substance. Abstract names, therefore, are no support for defenders of metaphysically common entities, for they only ever signify individuals. Realists about universals or common natures are simply misled by the shadow of grammar into thinking that there are such abstract entities.

Ockham's account of concrete and abstract names prompts the question: When are concrete names synonymous with their abstract counterparts, and when are they not? There seems to be no principled difference between the case of 'parent' and 'parenthood', which Ockham declares synonymous, and the case of 'white' and 'whiteness', which he declares non-synonymous. The answer won't affect Ockham's reply to the realist objection, since whether we treat the cases alike or differently we still are not countenancing any abstract entities. So why the difference? In particular, why not treat all the accidental categories uniformly, no matter which way that should be?

The answer is a blend of metaphysics and semantics: Ockham wants to reduce ontological commitments by countenancing as few basic *kinds* of things as possible, which meant paring down the number of the traditional nine 'accidental' Aristotelian categories; he does so by giving paraphrases

for sentences involving them. This project is the heart of Part I of the *Summa logicae*, occupying twenty-three chapters (I.40–62) and a staggering amount of detailed argumentation. In brief, Ockham's conclusions are these: (*i*) the only categories we need to countenance are Substance, Quality, and Relation; (*ii*) in each we recognize only individuals; (*iii*) the sole reason to countenance the category of Relation is for the sake of a few entities required for theological reasons having to do with the Trinity, the Incarnation, and the Eucharist, although natural reason would not recognize any need for these entities; (*iv*) only some, not all, entities in the category of Quality exist.

Ockham's strategy for categorical reduction is to show that purported absolute terms in a given category are really connotative terms not requiring any ontological commitments. Consider "Socrates is similar to Plato" in some qualitative respect or other. Ockham argues that we do not need to countenance the existence of an entity *similarity* in the category of Relation in order for this sentence to be true. Instead, all that is required is for Socrates and Plato each to have a quality of the same sort; the truth of the sentence follows immediately. The only entities that need to exist are Socrates, Plato, and their respective individual qualities. Hence 'similar' is a connotative term, primarily signifying substances and secondarily signifying their qualities; the sentence will be true if the qualities are of the same sort and false otherwise. Likewise, Ockham proposes that terms in the category of Quantity, such as 'body', are connotative rather than absolute; the nominal definition of 'body', for instance, is 'something having parts distant from one another in three dimensions', which signifies substances and connotes their parts, or at least connotes those parts spatially separated from one another.

There is no royal road to reductive ontology. Ockham argues in the *Summa logicae* for the elimination of each category (or sub-category) on a case-by-case basis, appealing to a wide range of considerations and styles of argumentation.[39] For instance, in attempting to determine which qualities are eliminable Ockham proposes the following technique: if some qualities can be predicated of something "successively but not simultaneously due only to local movement," they need not signify distinct things (I.55)—presumably because local movement can itself be explained away in terms

[39] One of his favoured styles of argumentation is by appeal to his Razor: If there is no reason to postulate entities of a given sort (since the work can be done by eliminative paraphrase), then such entities should not be postulated. Whether in the end Ockham genuinely eliminates entities or merely remains agnostic about them is a difficult question: see Spade [1998] and [1999b].

of the relative positions of parts of bodies, as described in the preceding paragraph. Yet just as often his arguments are independent of one another. Thus Ockham could be wrong that some qualities exist (he might just not have found the clever paraphrase) or that some entities are eliminable (perhaps relations cannot be paraphrased away as he suggests). Each case is its own battlefield, where most of the blood was spilt upon the publication of the *Summa logicae*.[40]

6. Sentences and Argumentation

Part II of the *Summa logicae* is devoted to sentences and their truth-conditions. Sentences are divided into simple and compound (*hypothetica*) sentences. Simple sentences are paradigmatically illustrated by the assertoric categorical sentence, consisting in a subject-term, a copula, and a predicate-term: "Every bat is bloodthirsty."[41] Compound sentences are either conjunctions or disjunctions of sentences. Ockham also allows 'consequence' as a type of compound sentence, which combines sentences by means of 'if' and 'then'/'therefore', but he defers treatment of them as being equivalent to inferences among sentences (II.31). That done, the truth-conditions for compound conjunctive or disjunctive sentences are straightforward, the former true if all the conjoined sentences are true (II.32), the latter if at least one is true (II.33). Most of Ockham's efforts are directed to understanding the categorical sentence in all its varieties.

Ockham holds that categorical sentences can be distinguished in four ways, namely by their quantity, quality, mode, and tense. (Contemporary logicians usually recognize only quantity and mode.) With respect to quantity, sentences are either universal, particular, singular, or indefinite, depending on syncategoremata such as 'every,' 'some', 'none'. With respect to quality, sentences are either affirmative or negative; Ockham recognizes two primitive and independent forms of the copula, one affirmative ('is') and the other negative ('is-not').[42] With respect to mode, sentences may be ei-

[40] For contemporary discussions of Ockham's reductive programme, see Adams [1987], Freddoso [1991], Tweedale [1992], and Klima [1999] in addition to the articles by Spade mentioned in the preceding note.

[41] Ockham also recognizes sentences that have a verb in place of the copula and predicate-term.

[42] Is Ockham's view defensible? The answer turns on the significance attached to the distinction between predicate-negation and sentence-negation, which cannot be clearly drawn in modern logic: there is no difference between belonging to the extension of the complement of a predicate and not belonging to the extension of the predicate. Ockham, however, insists on the difference

ther assertoric or modal, that is, they may explicitly involve possibility or necessity. Finally, with respect to tense, Ockham recognizes past, present, and future tenses as irreducibly different, although a sentence can be about times other than the present due to temporal words that are not part of the copula. Both modal and tensed sentences may involve "ampliation," that is, widening of the domain of discourse to include things that are possible, or future or past, and the like.

Truth-conditions for assertoric present-tense categorical sentences are straightforward. For instance, the particular negative sentence "Some vampires are-not friendly" is true just in case what 'friendly' personally supposits for, namely people who are friendly, does not include anything—note the negative copula—for which 'vampire' personally supposits. Universal affirmatives ("Every S is P") are true when everything their subjects supposit for their predicates also supposit for; particular affirmatives ("Some S is P") when their predicates supposit for at least one thing their subjects supposit for; universal negatives ("No S is P") when the predicate does not supposit for anything the subject supposits for.[43]

Ockham works through several cases in which this basic picture is complicated in some respect. For instance, adding the syncategorematic term 'only' to the singular affirmative sentence "Socrates is running," producing "Only Socrates is running," fundamentally alters its truth-conditions (II.17). Other complicating factors are reduplicative terms, such as 'insofar as' or '*qua*', or terms like 'except'. But he directs most of his efforts to exploring tensed and modal sentences.[44]

Consider the sentence "Something black will be blue." Ockham holds that it may be understood in two distinct ways. On each reading the predicate-term 'blue' personally supposits not for present blue things but, due to the tense of the copula, for future blue things; the subject-term 'something black', however, personally supposits for either (*a*) present black things, as it would ordinarily, or (*b*) future black things, which may include some present black things if they are also black in the future (but not otherwise), so that the supposition of the subject follows the temporal shift

[43] Ockham adopts the general mediæval view that affirmative sentences are false if their subjects are empty, whereas negative sentences are true if their subjects are empty. The former rule guarantees "existential import": a universal affirmative sentence entails a particular affirmative sentence, so that from "Every S is P" it is legitimate to infer "Some S is P." Logicians today represent the logical form of universal affirmatives conditionally, $(\forall x)(Sx \rightarrow Px)$, from which it is not possible to infer $(\exists x)(Sx \wedge Px)$.

[44] See Normore [1975] for an account of Ockham's modal and tense logic, and Karger [1976] for an account of Ockham's modal logic.

of the predicate. A similar distinction can be drawn for past-tense sentences. Likewise, modal sentences that have a modal copula such as 'can be' are also susceptible to this dual reading: the subject of "Someone ugly can-be a shoe salesman" may be taken as someone who is actually ugly, or as some non-actual ugly possible man; truth-conditions here, as with the tensed case, will systematically differ.[45]

Modal sentences, unlike tensed sentences, can also be formulated impersonally: "Socrates can run" is the same as "It is possible that Socrates run." Yet the former sentence looks as though it ascribes a power to Socrates, whereas the latter, when not read as a mere variant of the former, seems to characterize a state of affairs. Ockham calls modal sentences taken in this way *composite*, and he takes them to be about what sentences say: "It is possible that Socrates runs" attributes a property to what the sentence "Socrates runs" says (namely *that Socrates runs*), and is true or false depending on whether what it says has the modal quality attributed to it—here, whether "Socrates runs" is possible, that is, describes a possible situation. Thus the truth-conditions of composite modal sentences will track the modal qualities of other, simpler sentences; and there Ockham lets the matter rest, turning to the theory of argumentation.

Part III of the *Summa logicae* is devoted to inference in general, and is longer than Parts I and II combined. To some extent this is a reflection of the exponential complexity of Ockham's subject-matter. Since inferences are sequences of sentences that have or lack certain properties, Ockham has to take into account his analysis of the several kinds of sentences and how they can be legitimately combined to produce acceptable conclusions. Of the many topics Ockham addresses I shall mention only two that can give the flavor of his achievements as a logician: syllogistic and the theory of consequences.

By Ockham's day, the logic of the assertoric syllogism had been well worked out, and he accordingly presents it clearly and concisely. It is the springboard for Ockham's investigation of the modal syllogism. Unlike the assertoric syllogistic, modal syllogistic was neither well-understood nor systematic; Ockham helped make it both. He allows composite modal sentences as well as ordinary modal sentences to enter into syllogisms, and he further analyzes which syllogisms hold depending on whether a modal sentence is read as affecting the supposition of the subject-term or not. While this might seem to make the resulting theory unmanageable, Ockham offers

[45] Singular modal/tensed sentences do not have the dual reading, since their subject-terms must personally supposit for the unique thing to which they apply.

an elegant reduction of modal syllogistic. For ordinary modal sentences, Ockham proposes 'modalizing' the terms involved and then applying the ordinary assertoric syllogism. Thus Ockham transforms "Socrates can run" into "Socrates is a possible-runner," and the other premises likewise, until we are left with an assertoric syllogism (perhaps with some peculiar subjects and/or predicates). For syllogisms consisting in composite modal sentences, Ockham offers a series of reduction-rules that enable the assertoric syllogistic to generate valid moods of composite modal syllogistic. All that remains is the admittedly messy job of considering the mixed cases, which do not lend themselves to systematic treatment. But that should not blind us to Ockham's accomplishment in systematizing much of the rest of modal inference.

Modal inference is only one kind of inference. To the extent that Ockham has a general theory of inference, it is found in his treatment of consequences. The rules he offers spell out what is known as a 'natural deduction system'. The elements of this system are inferences—that is, consequences—which can be used to license arguments.[46] Hence the rules for consequences state legitimate inference-schemata. Consider, for example, the first rule Ockham gives for consequences (III-3.2): "There is a legitimate consequence from the superior distributed term to the inferior distributed term; for example, 'Every animal is running; hence every man is running.'" Ockham usually gives his rules in metalogical or schematic terms (often in both ways), referring to inferences that hold in virtue of the logical form of their constituent sentences. Consider three proposals that an inference or inferential scheme $A \vdash B$ is legitimate when:

(1) The truth of A guarantees the truth of B in virtue of the meanings of the terms in each
(2) The truth of A guarantees the truth of B in virtue of the forms of A and B
(3) There is no uniform substitution of nonlogical terminology that renders A true and B false

To the extent that the meanings of the terms in A and B determine the situations—the range of possibilities or models—we evaluate our sentences against, (1) may provide a semantic dimension to the modal account. Yet (1) will fail to capture formal validity to the extent that meaning is not a formal feature. If it is not, then inferences such as "Every animal is running; hence every man is running" are legitimate by (1) but are not formally valid: they do not hold in virtue of their form but only in virtue of some

[46] See King [2001] for an extended defence of these claims.

extrinsic feature, such as the meanings of their terms or the way the world is. (Thus even metaphysical necessity does not entail formal validity.) Logicians today usually adopt (2) or (3). Ockham, however, seems to endorse (1), thereby countenancing a wider scope for logic than formal inference; modern logicians take formal inference to be the whole of logic, whereas for Ockham it is only a part, though an important part. This may explain the wide variety of topics dealt with in Part III, which includes consequences, topics, sophisms, demonstrations, proof theory, paradoxes, obligations, and fallacies. Take the last case. Ockham's treatment of fallacies tries to give a systematic theory about the kinds of inferential failure. Such a project makes little sense on the modern understanding of logic as the study of formally valid inference, but it fits well Ockham's more generous notion about what may count as logic.

Conclusion

The *Summa logicae* was Ockham's last look at the issues covered here. In May 1324, shortly after its completion (perhaps even spurring him to complete it), Ockham left England for the Papal residence at Avignon to be examined on charges of "false and heretical teaching."[47] Apart from editing his London quodlibetal debates, and perhaps polishing parts of the *Summa logicae*, Ockham had little to occupy himself with in Avignon. Then in 1327 the Minister-General of the Franciscan order, Michele di Cesena, arrived in response to his own papal summons, and Ockham's life was irrevocably changed. The Franciscans had been in a long and increasingly bitter dispute with Pope John XXII over the Franciscan renunciation of property and the ideal of voluntary poverty. While conferring with the Pope, Michele asked Ockham to look into the poverty question with an eye to recent papal pronouncements on the subject. Ockham dutifully did so, and came to the conclusion that Pope John XXII had exceeded and contravened his own authority, becoming heretical in the process.

Matters deteriorated for the Franciscan delegation at Avignon, and, fearing for their safety, a small group of Franciscans, including Michele di Cesena and William of Ockham, fled Avignon during the night of 26 May 1328, travelling to join the Holy Roman Emperor, Louis of Bavaria, for political asylum. They were excommunicated for leaving Avignon without permission, but were welcomed by Louis, who was in the middle of his own

[47] The *Summa logicae* was not one of the works considered questionable by the investigating committee; only his theological work was taken under examination. We do not know who brought the charges against Ockham.

difficulties with John XXII. Ockham spent the rest of his life under German protection, much of it in Munich, writing on political matters—mostly on voluntary poverty, papal authority, and the relation of church and state. He died in Munich in 1347, perhaps of the Black Death.

Ockham is not known to have written anything else on logic, or generally on philosophy or theology apart from political matters, after his departure from England. Yet the movement begun by the publication of the *Summa logicae* carried on even in his absence. His work found its own defenders and enthusiasts, and it remained a much-studied work for centuries; between sixty and seventy manuscripts of it survive, remarkable for such a long, and often extremely dry, work. We are still tracing its repercussions in the history of logic and philosophy today.

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