

of the sentence or other linguistic expression concerned; and this linguistic expression is

GRAMMAR

2

**Grammar by
recursion**

We lately noticed the law 'Every alternation of a sentence with its negation is true'; it is called the law of excluded middle. It is an excessively simple but in other respects typical law of logic. On the face of it, it talks about language: sentences. We saw why it is phrased in linguistic terms: its instances differ from one another in a manner other than simple variation of reference. The reason for the semantic ascent was not that the instances themselves, e.g. 'Tom is mortal or Tom is not mortal', are linguistic in subject matter, nor even that they are peculiarly beholden to language for their truth; one could still maintain that the trivial matter of Tom's being either mortal or not mortal is due no less to pervasive traits of nature than to the way we use our words. One could maintain this, at any rate, if one could make sense of the issue at all; but I shall urge in Chapter 7 that there is difficulty in so doing.

We shall now examine, by way of contrast, a really linguistic subject: one that not only, like logic, resorts to linguistic terms to express its generalities, but also is concerned with language still in the singular instances of its generalities. This subject is grammar. Significantly enough, the truth predicate, so widely used in logical generalities to offset the effects of semantic ascent and restore objective reference, has no place in grammatical generalities, at least as they are classically conceived. Grammar is linguistic on purpose.

I shall describe the business of grammar first along classically simple lines, postponing various qualifications. Let us picture the grammarian as confronted by a speaking community and provided

with a modest list of *phonemes*. These are short speech units, the analogues of letters. What is required of them is just that everything said in the community be representable as a string of these phonemes, with never the same string for significantly different utterances. To show that two particular acoustically distinguishable sounds are significantly different for a speaker, and so should be reckoned to two distinct phonemes, it is sufficient to find an utterance that commands the speaker's assent before the one sound is substituted for the other and commands his dissent afterward. Settling the phonemes of a language is thus a fairly straightforward empirical enterprise, and we suppose it already completed when the grammarian moves in.

The grammarian's question is, then, what strings of phonemes belong to the language? What strings, that is, ever get uttered or could get uttered in the community as normal speech? The grammarian's job is to demarcate, formally, the class of all such strings of phonemes. Formally? This means staying within a purely mathematical theory of finite strings of phonemes. More explicitly, it means saying nothing that could not be said by means of a technical vocabulary in which, besides the usual logical particles and any desired auxiliary apparatus from pure mathematics, there are only the names of the phonemes and a symbol signifying the concatenation of phonemes.

A mere listing of strings would already be formal, but it would not suffice, since the desired strings, though finite in length, are infinite in number. So the grammarian has recourse to recursion: he specifies a *lexicon*, or list of words, together with various grammatical *constructions*, or steps that lead to compound expressions from constituent ones. His job is to devise his lexicon and his constructions in such a way as to demarcate the desired class: the class of all the strings of phonemes that could be uttered in normal speech. The strings of phonemes obtainable from the lexicon by continued use of the construction should all be capable of occurring in normal speech; and, conversely, every string capable of occurring in normal speech should be obtainable from the lexicon by the constructions (or should at least be a fragment of a string which as a whole is obtainable from the lexicon by the constructions).

When we analyze a complex expression according to the constructions involved, we get something of the form of an inverted tree, like a genealogy. The complex expression is at the top. Below it, at the next level, are the "immediate constituents"—one or two or more—from which the complex expression was got by one applica-

tion of some one construction. Below each of these constituents are its immediate constituents; and so on down. Each branch of the tree terminates downward in a word.

Chomsky has argued that English grammar is not satisfactorily accommodated in such trees of constructions alone; we want also grammatical transformations. Some compounds are best analyzed by working back and forth between different trees of construction, and transformations provide for this lateral movement. Even on these liberalized terms, grammar remains true to its purpose of formal demarcation, since each transformation needed for a particular grammar can be specified formally. However, transformations can be passed over for our purposes. The need of them does not extend to the artificial notations that are fashioned for purposes of logic; and it is the grammar of such notations that will occupy us after the next few pages.

Categories As an aid to specifying the constructions, the lexicon is classified into grammatical *categories*. For we want to be able to specify a construction by saying what operation is to be performed upon any expression of such and such category; or perhaps what operation is to be performed upon any pair of expressions, one of this category and one of that. Since the compound expressions obtained by constructions are to be available as constituents under further constructions, we must also say what category each construction issues in.

Thus a construction is specified in this vein: take any expressions, belonging respectively to such and such categories, and combine them in such and such a distinctive way; the result will belong to such and such a category. Commonly the distinctive way of combining the constituents will be marked by the insertion of a distinctive particle; examples are 'or', 'plus', 'and', 'but'. Also there are constructions that operate on single constituents, rather than combining two or more; one such is negation, which consists in prefixing the constituent with the particle 'not'.

The constructions serve to add complex members to the categories, which had begun with word lists. A construction may even start a new category, which had no simple members; for instance, the class of sentences. The constructions, once specified, apply over and over, swelling the several categories *ad infinitum*.

The categories are what we used to call the parts of speech, though they need not preserve the traditional lines of cleavage. One of our categories might be that of singular terms. Another might be

that of copulas. Another might be that of intransitive verbs. Another might be that of adjectives. One of our constructions might be that of applying 'not' to a copula to get a complex copula. Another might be that of prefixing a copula to an adjective to get a complex intransitive verb: 'is mortal', 'is not mortal'. Another might be that of joining a singular term to an intransitive verb to get a sentence: 'Tom is mortal', 'Tom is not mortal'. Another might be that of joining two sentences by an 'or' to get a sentence: 'Tom is mortal or Tom is not mortal'. What grammar tells us thus indirectly through its lexicon, categories, and constructions is not that this last sentence is true, but just that it is English.

What classes to dignify by the name of category depends on what constructions we are going to specify, and what distinctions of category will be helpful in specifying those constructions. However, such being the use of categories, we can foresee that two members of a category will tend to be grammatically interchangeable. That is, if you put one member for another in a proper sentence of the language you may change the sentence from true to false, but you will not change it to ungrammatical gibberish. To use a Scholastic expression revived by Geach, the members of a category are interchangeable *salva congruitate*. This circumstance suggests a theoretical definition of grammatical category, applicable outright to languages generally: the category of an expression is the class of all the expressions that are interchangeable with it *salva congruitate*. This notion of category was propounded by Husserl.

Any sentence remains grammatical, it would seem, when 'drive' is put for 'lane'; but the opposite substitution reduces 'I shall drive' to nonsense. Substitutability *salva congruitate* is thus not symmetrical. Grammarians have disguised these asymmetries by inventing distinctions: they treat 'drive' as either of two words, a noun or a verb, according as it stands where 'lane' could stand or not. But no such distinction is available if we take a word steadfastly as a string of phonemes. The forthright answer is just that 'drive' is in one category and 'lane' in another, since their interchangeability *salva congruitate* is incomplete. So far so good.

The criterion responds poorly, however, to further pressure. Taking 'lane' steadfastly as a string of phonemes, what are we to say of the fortuitous occurrence of 'lane' in 'plane'? No other word is interchangeable with 'lane' *salva congruitate* when such fortuitous occurrences are counted in. The categories, so defined, threaten to end up with one word apiece. Can we repair the definition by limiting the interchanges to positions where (unlike 'lane' in 'plane') the

word figures as constituent of a grammatical construction? No, we are then caught in a circle; the notion of construction depends on that of category, and so cannot be used in defining it.

Immanence
and
transcendence

Theoretically there is no need of any definition of grammatical category, applicable to languages generally. To show why, it will be well at this point to contrast two sorts of linguistic notions: *immanent* ones, as I shall call them, and *transcendent* ones. A notion is immanent when defined for a particular language; transcendent when directed to languages generally.

For instance we would like it to make general sense, in advance of knowing some particular language, to ask whether a given string of phonemes belongs to that language. We would like to be able to state the grammarian's task, for *any* given language, as formal demarcation of the strings that belong to the language. This statement of his task calls for a *transcendent* notion of grammaticality, a transcendent notion of the relation of a string to a language to which it belongs. The transcendent notion does not itself pretend to formality; ideally it would be couched in behavioral terms, applicable in advance to any unspecified language. We have already seen a vague rendering of it: a string belongs to the language of a given community if it could be uttered in the community in normal speech. I shall return to this notion presently in a more critical vein.

An extreme example of the opposite, an *immanent* notion, is the notion of *der*-words in German grammar. This is a class of words which have the peculiarity of requiring so-called "weak inflection" of a following adjective. It would be silly to wonder regarding some other language, as yet unspecified, what its *der*-words are going to turn out to be. We specify the class of *der*-words in German formally, indeed by enumeration, as an intrinsically uninteresting aid to the major task of formally demarcating the total class of strings that belong to German. The notion of weak inflection is immanent too; we specify the weak inflections in German by enumeration, and, if we ever transfer the term 'weak inflection' to another language, we do so only by virtue of some felt family resemblance whereof no capital need be made. The relation between the two uses of the term would be little more than homonymy.

If, having started with some satisfactorily transcendent notion of grammaticality, we were to proceed to define the notion of a grammatical category simply by interchangeability *salva congruitate* in Husserl's way, then the notion of a grammatical category would likewise be transcendent. However, we saw reason to fear that cate-

gories so defined would prove too narrow to be useful. And anyway there is no need to force transcendence here. In doing the grammar of a particular language we formally demarcate the class of strings belonging to the language; and in order to implement a recursion for this purpose we formally specify certain helpful classes and certain constructions. If we call these classes grammatical categories, we are merely labeling the lot conveniently for the purpose of our grammatical enterprise in the particular language; and if we use the same phrase in connection with the grammar of another language, this is only a matter of family resemblance whereof no capital need be made. On this view there is no sense in wondering what the grammatical categories of some strange language might prove to be; the notion is immanent, like that of *der*-words.

The notion of a construction may be looked upon as immanent in the same way. So, for that matter, may the notion of a word, or, to speak more technically, a *morpheme*. The morpheme is sometimes carelessly defined as a shortest meaningful unit; and this definition would indeed make the notion of morpheme transcendent if it made sense at all. But by what criterion may strings of phonemes be counted meaningful, short of whole sentences or perhaps longer units? Or, if the morpheme is to be called meaningful on the ground of its merely contributing to the meaning of a sentence, why cannot the same be said of each mere phoneme? The notion of meaning is in too bad shape to afford a definition of morpheme. Nor is any definition needed, of a transcendent kind. Where to mark off the word divisions or morpheme divisions in a string of phonemes is just a question of the overall convenience and simplicity of the grammarian's recursive demarcation of the class of all strings belonging to the particular language. It is just a question what may more economically be listed initially as building blocks and what may more economically await construction as short compounds.

Lexicon, then, is similarly an immanent notion; for the lexicon simply comprises those words, or morphemes, that are assigned to categories. Some words are not so assigned but are treated rather as integral parts of the constructions themselves; thus 'not' and 'or', above. I shall recur to this point on page 28.

Grammarian's And what now of the notion of sentence: is it transcendent?
goal What, in general, does it mean to say of a string of phonemes
reexamined that it is a sentence for the language of a given community?
This may, on a generous interpretation, be taken to mean that
the string not merely belongs to the language (i.e., could be uttered

in the course of normal speech), but that it could be uttered between normal, unenforced silences. This notion of sentence is indeed transcendent. But it is not needed for the grammarian's task. As an aid to demarcating the class of grammatical strings, strings that could normally occur in the given language, the grammarian is apt to specify a so-called grammatical category consisting of the so-called sentences, but the specification will be formal and immanent; between the category so denominated for one language and the category so denominated for another language there need be nothing but a family resemblance, of which no capital is made. Typically the category so denominated will emerge in the next to last step of the formal grammar; and then, as a last step, the class of grammatical strings will be identified with the class of all fragments of strings of sentences. A transcendent notion, grammaticality, is in order just here at the top, to enable the grammarian to say what he is looking for.

Formality, for the transcendent notion of grammaticality, is not in point. But clarity and intelligibility are. What of our tentative formulation: "a string that could occur in normal speech"? It appeals to speech disposition, as distinct from actual behavior; but this I do not deplore. Talk of dispositions must be put up with, here as in any science. The behavior is evidence of the disposition; the disposition is a hypothetical internal condition that helps to cause the behavior. Such internal conditions may come increasingly to be understood as neurology progresses.

To speak of what "could occur in normal speech" is, nevertheless, objectionably vague. The vagueness is not to be laid to dispositional talk as such; it lies less in the 'could' than in the 'normal', or in their combination. The difficulty is highlighted by philosophers' examples of nonsense: Russell's "Quadruplicity drinks procrastination," Carnap's "This stone is thinking about Vienna." Some of us may view these sentences as false rather than meaningless, but even those who call them meaningless are apt to call them grammatical. Are they then to be said to be capable of occurring in normal speech? We begin to suspect that the notion of normality, in the relevant sense, leans on the notion of grammaticality instead of supporting it.

In fact, the grammarian exploits the vagueness of the transcendent notion of grammaticality, by trimming the notion to suit the convenience of his formal demarcation. He so fashions his recursion as to catch virtually everything that he actually hears in the community; and then the extras, such as Russell's and Carnap's examples,

find their way in only because it would complicate the recursion to exclude them.

So a statement of the grammarian's purpose, by means of a satisfactorily transcendent notion of grammaticality, is not forthcoming. The grammarian's purpose is defined in part, rather, by his progress in achieving it. Or, not to speak in riddles, his purpose is just this: to demarcate formally, in a reasonably simple and natural way, a class of strings of phonemes which will include practically all observed utterances and exclude as much as practicable of what will never be heard. He will not even accommodate *quite* all of the utterances that he does observe; considerations of simplicity of his formal demarcation will persuade him to discard a few utterances as inadvertent and erroneous. This modest statement of the grammarian's vague objective is about the best I can do in a transcendent way; and it appeals to no transcendent notions more notable than the notion of an observed utterance.

Logical
grammar

Seeking no further for a theoretical definition of the grammarian's task, we turn now to a closer consideration of grammatical analysis in a more limited context: in application to notations of symbolic logic. Thanks to their artificiality, these notations admit of a gratifyingly simple grammar. Lexicon and constructions suffice, unaided by transformations. Grammatical categories, moreover, can be demarcated strictly on the basis of interchangeability *salva congruitate*; there is no longer the complication of ambiguities, nor of fortuitous occurrences like that of 'lane' in 'plane'.

The artificial form of notation that figures most prominently in modern logical theory has a grammar based on the following categories. There is a category of one-place predicates, or intransitive verbs; a category also of two-place predicates, or transitive verbs; a category also perhaps of three-place predicates, and so on. Besides these predicate categories, there is an infinite category of variables 'x', 'y', 'z', 'x"', 'y"', 'z"', 'x'''', etc. The accent that is applied to 'x' to form 'x"', and to 'x"' to form 'x'''', indicates no relation but serves merely to augment the supply of variables.

The lexicon of a language is a finite set, for the grammarian presents it as a list. We may imagine the predicates thus presented. As for the infinite category of variables, we must view it as generated from a finite lexicon by iteration of a construction. The variables in the lexicon are just the letters 'x', 'y', and 'z', and the construction is *accentuation*, the application of one accent at a time. Thus, the variable 'x"' is grammatically composite.

The rest of the grammar consists of further grammatical constructions. One of these is *predication* of a one-place predicate. It consists in joining such a predicate, perhaps the verb 'walks', and a variable to form a sentence: 'x walks'. The result is an *atomic* sentence, in the sense of containing no subordinate sentence. Also it is an *open* sentence, because of the variable. It is true *for* certain values of the variable, namely, those that walk, and false for other values, but of itself it is neither true nor false; such is the way of an open sentence.

A further construction is the predication of a two-place predicate. It consists in joining such a predicate, say the transitive verb 'loves', and two variables, to form—again—an atomic open sentence: 'x loves y'. There is also perhaps the predication of a three-place predicate, and so on. All these predication constructions join predicates with one or more variables to produce members of a new category, that of sentences. It is a category of compound expressions only; for the sentence, even when atomic, is compounded of a predicate and one or more variables.

The remaining constructions are constructions of sentences from sentences. One such construction is *negation*, which consists in prefixing the symbol '~' or 'not' to a sentence to form a sentence. One is *conjunction*, in the logical sense of the word. It consists in joining two sentences by the particle 'and', or in symbolic notation a dot, to produce a complex sentence.

Finally, there is a third construction on sentences, namely *existential quantification*. It applies to an open sentence and a variable to produce a sentence. The variable, say the letter 'x', is put into a so-called quantifier in the manner ' $\exists x$ ', and this quantifier is prefixed to the open sentence in the manner ' $\exists x(x \text{ walks})$ '. The resulting sentence says there is something that walks.

Such, in its entirety, is the logical grammar that I wanted to present. It lacks only the list of predicates. This list could include the one-place predicates 'walks', 'is white', the two-place predicates 'loves', '<', 'is heavier than', 'is divisible by', and so on. The logician has no interest in completing the lexicon, for it is indifferent to the structure of the language.

Redundant
devices

I would seem to have omitted not only the lexicon of predicates but also some constructions which are logical in character. One such is *alternation*, a construction that joins two sentences by the particle 'or' to form a complex sentence. This construction is useful in practice, but superfluous in theory. Every logic student

knows how to paraphrase it, using only negation and conjunction. Imagining any constituent sentence in the position of the letters '*p*' and '*q*', we can paraphrase '*p* or *q*' as ' $\sim(\sim p \cdot \sim q)$ '.

Another important construction that is logical in character is the *conditional*. This construction produces a compound sentence from two constituent sentences by applying the particle 'if': 'if *p*, *q*'. The sense of this familiar construction is not always clear. 'If Flora were fairer than Amy, Flora would be fair indeed'; 'If Flora were fairer than Amy, Amy would be plain indeed'. Commonly the force of a conditional is indeterminate except by reference to the purposes of some broader context. The conditional also has its clear and self-contained uses, but the services rendered by these uses can be rendered as well by negation, conjunction, and existential quantification. For example, 'If an animal has a heart, it has kidneys' is adequately paraphrased thus:

$$\sim \exists x (x \text{ is an animal} \cdot x \text{ has a heart} \cdot \sim(x \text{ has kidneys}))$$

Often the purpose of a conditional, 'if *p*, *q*', can be served simply by negation and conjunction: $\sim(p \cdot \sim q)$, the so-called *material conditional*.

Along with the conditional there is the *biconditional*, formed by means of the polysyllabic particle 'if and only if'. It adds no problem, for it can be expressed by means of conjunction and the conditional: 'if *p*, *q* . if *q*, *p*'. In particular thus the *material biconditional* becomes ' $\sim(p \cdot \sim q) \cdot \sim(q \cdot \sim p)$ ', for which I shall use the customary abbreviation ' $p \leftrightarrow q$ '.

The truth values of negations, conjunctions, alternations, and material conditionals and biconditionals are determined, obviously, by the truth values of the constituent sentences. Accordingly these constructions, and others sharing this trait, are called *truth functions*. It is well known and easily shown that all truth functions can be paraphrased into terms of negation and conjunction.

Note carefully the role of the schematic letters '*p*' and '*q*' in the above explanations. They do not belong to the *object language*—the language that I have been explaining with their help. They serve diagrammatically to mark positions where sentences of the object language are to be imagined. Similarly, the schematic notation '*Fx*' may conveniently be used diagrammatically to mark the position of a sentence when we want to direct attention to the presence therein of the variable '*x*' as a *free* or unquantified variable. Thus we depict the form of existential quantification schematically as ' $\exists x Fx$ '. The

schematic letter '*F*', like '*p*' and '*q*', is foreign to the object language.

I explained why alternation, the conditional, and the biconditional are omitted from our list of constructions. A similar remark applies to *universal quantification*: $\forall x Fx$. The open sentence in the position of '*Fx*' is satisfied by every object *x*; such is the force of ' $\forall x Fx$ '. Universal quantification is prominent in logical practice but superfluous in theory, since ' $\forall x Fx$ ' obviously amounts to ' $\sim \exists x \sim Fx$ '.

Another frill that I have dispensed with is the admission of distinct categories of variables, to range over distinct sorts of objects. This again is a mere convenience, and is strictly redundant. Instead of admitting a new style of variables '*α*', '*β*', etc., to range over some new sort *K* of objects, we can just let the old variables range over the old and new objects indiscriminately and then adopt a predicate '*K*' to mark off the new objects when desired. Then instead of the special style of quantification ' $\exists \alpha F\alpha$ ' we can write in the old style ' $\exists x (Kx \cdot Fx)$ '.

Names and functors

Chief among the omitted frills is the *name*. This again is a mere convenience and strictly redundant, for the following reason. Think of '*a*' as a name, and think of '*Fa*' as any sentence containing it. But clearly '*Fa*' is equivalent to ' $\exists x (a = x \cdot Fx)$ '. We see from this consideration that '*a*' needs never occur except in the context '*a* ='. But we can as well render '*a* =' always as a simple predicate '*A*', thus abandoning the name '*a*'. '*Fa*' gives way thus to ' $\exists x (Ax \cdot Fx)$ ', where the predicate '*A*' is true solely of the object *a*.

It may be objected that this paraphrase deprives us of an assurance of uniqueness that the name has afforded. It is understood that the name applies to only one object, whereas the predicate '*A*' supposes no such condition. However, we lose nothing by this, since we can always stipulate by further sentences, when we wish, that '*A*' is true of one and only one thing:

$$\exists x Ax, \quad \sim \exists x \exists y (Ax \cdot Ay \cdot \sim(x=y))$$

(The identity sign '=' here would either count as one of the simple predicates of the language or be paraphrased in terms of them.)

The notation without names talks still of *a* and other objects, for they are the values of the quantified variables. An object can also be specified uniquely, still, by presenting some open sentence (in one variable) which that object uniquely satisfies. '*Ax*' is such a sentence for the object *a*. And the names can even be restored at pleasure, as a convenient redundancy, by a convention of abbreviation. This con-

vention would be simply the converse of the procedure by which we just now eliminated names. Each predication, let us say 'Fa', containing the name 'a', would be explained as an abbreviation of the quantification ' $\exists x (Ax \cdot Fx)$ '. In effect this is somewhat the idea behind Russell's theory of singular descriptions.

In the redundant system that retains names, there are two categories of singular terms: the variables and the names. The categories count as two because names cannot stand in quantifiers. The asymmetry illustrated by 'drive' and 'lane' above recurs thus in this artificial setting: you can put a variable for a name *salva congruitate* but not always vice versa.

Names are convenient, as are universal quantifiers and the excess truth-function signs. In practice we use them all, and more: there are also the *functors*. A one-place functor, e.g. 'square of' or 'father of', attaches to a singular term to yield a singular term. A two-place functor, e.g. '+', joins two singular terms to yield a singular term. Correspondingly for three and more places. The functors, again, are just convenient redundancy; they can all be dropped in favor of appropriate predicates, by an extension of the method by which we dropped names.

Functors generate complex singular terms. These and names belong in a single category—the category of singular terms other than variables. The complex singular terms may contain variables; but what sets the variable itself apart from all these other singular terms is its occurrence in quantifiers.

Artificial languages of the forms we have been considering may, following Tarski, be called *standard*. This term is used for those that admit names, complex singular terms, functors, and the lesser devices lately noted, as well as for those that do not. These last, the standard languages of the simple and austere sort, differ from one another only in their vocabulary of predicates. They share the variables, predication, negation, conjunction, and existential quantification.

Lexicon,
particle,
and name

The grammatical pattern of category and construction brings out a distinction, customary in linguistics, between two kinds of vocabulary: the lexicon and the particles. It is not a new distinction. It has long governed Japanese orthography, which uses a special Japanese syllabary for the particles (and another for European loan words) but preserves Chinese characters for the lexicon.

The distinction is this: the words classed in the categories comprise the lexicon, whereas the words or signs that are not thus classi-

fied but are handled only as parts of specific constructions are the particles. In our logical notation, thus, one particle is the sign '~' whose prefixure constitutes the negation construction; another is the dot, whose interposition constitutes the conjunction construction; another is the accent, whose application constitutes the variable-generating construction; another is the sign '∃' of the quantification construction; and others are the parentheses, used in the quantification construction and sometimes also, for grouping, in negation and conjunction.

The distinction between lexicon and particles is yet more venerable in the West than in the East. It is identifiable with the Scholastic distinction between *categorematic* and *syncategorematic* words. This, even in its terminology, goes back to antiquity.¹ There is a connection with categorical propositions in the logic of the syllogism; the terms in a categorical proposition are *categorematic*.

The terminology seems curiously pat now, given the modern notion of grammatical category; for the *categorematic* expressions are the members of categories. But the theory of grammatical categories, lexicon, and constructions does not hark back thus. The definition of '*categorematic*' was apt to be something lame like 'significant in itself'. Still our notion of lexicon, or of what goes into the grammatical categories, seems to capture the feeling.

Being in the lexicon does not, of course, mean being a name. If an occasional Scholastic or modern philosopher seems to identify the distinction between *categorematic* and *syncategorematic* with the distinction between names and other words, it is easy to see why he might: he has already taken the previous step of construing predicates as names of attributes. The terminology can in this way change, so that a philosopher who wants to deny that predicates are names finally does so by calling them *syncategorematic*.

The old terms '*categorematic*' and '*syncategorematic*' are a curiosity that I shall put aside. But I must reiterate the antecedent point, which squarely concerns our present business: being in the lexicon does not mean being a name. Taking predicates as lexical does not mean taking predicates as names and accordingly positing attributes for the predicates to be names of. What distinguishes a name is that it can stand coherently in the place of a variable, in predication, and will yield true results when used to instantiate true universal quantifications. Predicates are not names; predicates are the

¹ See Norman Kretzmann, "Syncategorematic," *The Encyclopedia of Philosophy* (New York: Macmillan, 1967), VII, 373.

other parties to predication. Predicates and singular terms are what predication joins.

I deny that predicates are names without having to deny that there are such things as attributes. That is a separate question. We can admit attributes by reckoning them to the universe of objects which are the values of our variables of quantification. We can name them, too, if we allow names in our language; but these names will not be predicates. They will be singular terms, substitutable for variables; abstract singular terms like 'whiteness' or 'walking', not predicates like 'is white' or 'walks'.

There are those who use so-called predicate variables in predicate position and in quantifiers, writing things like ' $\exists F Fx$ '. The values of these variables are attributes; the constants substitutable for the variables are, we are told, predicates; so that predicates double as names of attributes. My complaint is that questions of existence and reference are slurred over through failure to mark distinctions. Predicates are wanted in all sentences regardless of whether there are attributes to refer to, and the dummy predicate 'F' is wanted generally for expository purposes without thought of its being a quantifiable variable taking attributes as values. If we are also going to quantify over attributes and refer to them, then clarity is served by using recognizable variables and distinctive names for the purpose and not mixing these up with the predicates.

Criterion of
lexicon

The distinction between lexicon and particles is not, I have twice said, a distinction between names and other words. Let us now go back and examine it more closely for what it is. How do we settle what words to sort into categories, and hence consign to the lexicon, and what words to absorb as particles into the constructions? Consider the negative sentence ' $\sim(x \text{ walks})$ ', as of our logical grammar. I have reckoned 'x' and 'walks' to the lexicon, while calling ' \sim ' a mere particle incidental to the negation construction. The whole sentence is constructed by negation from the constituent sentence 'x walks', which is constructed by predication from the lexical words 'x' and 'walks'. Why not, instead, treat 'walks' as a particle on a par with ' \sim '? This would mean skipping any general predication construction and recognizing instead a walking construction, along with the negation construction. On this view, 'x walks' is got from the single lexical word 'x' by the walking construction and ' $\sim(x \text{ walks})$ ' is then got from 'x walks' by the negation construction. Why not? Or, taking the other turning, why not treat ' \sim ' as lexical along with 'x' and 'walks'? This would mean recognizing a construction

which, applied to the lexical word ' \sim ' and a sentence 'x walks', yields a sentence ' $\sim(x \text{ walks})$ '. Or we could recognize a three-place construction leading directly from three lexical words ' \sim ', 'x', and 'walks' to ' $\sim(x \text{ walks})$ '.

The choice among these alternatives of grammatical theory turns upon considerations of the following kind. By iteration of constructions, complex expressions accrete *ad infinitum*; and we must have infinitely expansible categories to receive them. Now a reason for reckoning a word to the lexicon is that it gets into one of these big categories through being interchangeable *salva congruitate* with the other expressions in the category.

What, then, about the words that do not get into big categories? Each such word is in a class fairly nearly by itself; few words are interchangeable with it *salva congruitate*. Instead of listing a construction applicable to such a word and to few if any others, we simply count the word an integral part of the construction itself. Such is the status of particles.

Thus take first the three variables 'x', 'y', 'z'. They are in the lexicon because the variables make up a category, being infinite in number. If we could make do with the three variables 'x', 'y', 'z' to the exclusion of their unending accented suite, then we would drop variables as a category and demote variables from the status of lexicon to the status of particles. Instead of the construction which was the predication of a one-place predicate, we would thereupon recognize three constructions: attachment of 'x', of 'y', and of 'z'. Instead of the construction which was the predication of a two-place predicate, we would recognize nine constructions: attachment of 'xx', of 'xy', . . . , and of 'zz'. Instead of existential quantification we would recognize three constructions: prefixure of ' $\exists x$ ', of ' $\exists y$ ', and of ' $\exists z$ '.

I have not said which particular predicates are to be present in the language—whether 'walks', 'is red', 'is heavier than', 'is divisible by', etc.; for the point is indifferent to the logical structure of the language. This studied indefiniteness, indeed, and not infinitude, is the main reason for counting predicates as lexical rather than as particles. For note that I have not been recognizing any predicate-yielding constructions. The list of predicates is meant to be finite and fixed, but merely different for each particular language of the contemplated kind. For each such language, with its predicates listed, we could demote predicates to the status of particles and recognize a distinct construction corresponding to each—as we lately contemplated for 'walks'.

The indefiniteness of the supply of predicates is not the only reason for counting the predicates as lexical. One may wish also to leave the way open for some predicate-yielding construction that would generate an infinitude of complex predicates.

It is worth remarking that if one chooses to admit predicate-yielding constructions and exploits them to the full, he can even make some such constructions do the work of the quantifiers and variables themselves. There are a half-dozen such constructions which, in combination, would enable us to drop variables and quantifiers altogether. One of the constructions is the negating of a predicate; one is the active-passive transformation that turns the two-place predicate 'loves' into 'is loved by'; and there are four others.¹ But this is a drastic alternative to standard logical grammar.

**Time,
events,
adverbs** Our standard logical grammar is conspicuously untouched by the complications of *tense* which so dominate European languages. Logical grammar, like modern physics, is best served by treating time as a dimension coordinate with the spatial dimensions; treating date, in other words, as just another determinable on a par with position. Verbs can then be taken as tenseless. Temporal predicates, such as the two-place predicate 'is earlier than', belong in the lexicon on a par merely with predicates of position or color or anything else. Any temporal details that we may want to include in a sentence, in the absence of tensed verbs, we may add explicitly in the same way that we might add details of position or color.

A body is thus visualized eternally as a four-dimensional whole, extending up and down, north and south, east and west, hence and ago. A shrinking body is seen as tapered toward the hence; a growing body is tapered toward the ago.

We might think of a *physical object*, more generally and generously, as simply the whole four-dimensional material content, however sporadic and heterogeneous, of some portion of space-time. Then if such a physical object happens to be fairly firm and coherent internally, but coheres only rather slightly and irregularly with its spatio-temporal surroundings, we are apt to call it a body. Other physical objects may be spoken of more naturally as processes, happenings, events. Still others invite no distinctive epithet.

This four-dimensional view of things is an aid to relativity physics; also it is a simplification of grammar, by resolution of tense; but either of these characterizations understates its importance for logic.

¹ See my *Methods of Logic*, 4th ed. (Cambridge: Harvard, 1982), § 45.

Think how awkward it is, without some such view, to make sense of applying a predicate to something that no longer exists; or to make sense of quantifying over objects that never coexisted at any one time, and assembling such objects into sets.

I have stressed how much our austere little standard grammar potentially encompasses. Its lack of tense, its lack even of names and all complex singular terms, detract none from its adequacy. Still I cannot claim that it is adequate to all purposes of cognitive discourse: that everything can be said in a language comprising just these constructions and variables and a finite lexicon of predicates.

There is for instance the question, raised by Davidson, of adverbs. If all predicates are to be simple, there can be no provision for adverbial modification of predicates to form new predicates. We might therefore be moved to liberalize our grammar by recognizing some supplementary predicate-yielding constructions, capable of generating complex predicates in infinite supply. Any fixed and finite lot of adverbs could be accommodated in this way, each as a particle marking a separate predicate-yielding construction. But more is wanted: adverbs themselves—adverbial phrases—are evidently wanted in unending supply and without limit of complexity. For this purpose, grammatical categories of adverbs are required; also constructions for adjoining adverbs to predicates. Such a development would be, it seems, a genuine and not just stylistic extension of our standard logical grammar.

Or can we hope still to achieve all these adverbial ends by other means? Perhaps if we were just to add to the lexicon some cunningly construed new predicates, and add to the range of values of the quantified variables some peculiarly helpful new domain of objects, we would achieve all those adverbial ends without bursting the bonds of our standard grammar. Davidson, exploring this possibility, sees *events* as the helpful new domain of objects. He might analyze 'x walks rapidly (sometime or other)' somewhat as '∃y (y is a walking of x . y is rapid)'. The troublesome adverb 'rapidly' has given way here to an innocuous predicate, 'is rapid'. The one-place predicate 'walks', or better the two-place predicate of walking at a time, has given way to a different two-place predicate, relating the walking event to the walker. The relevant values of 'y' are events.

But it is not yet clear whether we can make do here with events in the weak and innocent sense noted early in this section, under the head of physical objects. So construed, no two events have the same spatio-temporal boundaries. If events in some other sense are required, we shall have to face the problem of how to individuate

them. It was inadequacy of individuation, after all, that turned us against propositions in Chapter 1.

Attitudes and modality However this interesting venture may turn out, there are other challenges to the adequacy of our standard grammar. We must reckon somehow with the stubborn idioms of *propositional attitude*—‘thinks that’, ‘believes that’, ‘wishes that’, ‘strives that’, and the rest. These cause sentences to be constituents of constructions other than truth functions and quantification.

There are several ways of organizing these matters. One way is to recognize a construction that builds a name from a sentence by prefixing the particle ‘that’. This means restoring names as a grammatical category. Also it raises the question what sort of things ‘that’-clauses name: perhaps propositions, so dimly viewed in Chapter 1? Also it raises the question of having to subdivide the category of two-place predicates, since some of them (‘thinks’, ‘believes’, ‘wishes’, ‘strives’) can apply to a ‘that’-clause while others (‘eats’, ‘>’) cannot. This, however, is easily settled by just regarding sentences of the form ‘x eats that *p*’ and ‘x > that *p*’ as trivially false rather than meaningless. One sees in this latter expedient, by the way, an illustration of what was remarked upon earlier in this chapter in connection with ‘Quadruplicity drinks procrastination’ and ‘This stone is thinking about Vienna’; an illustration, namely, of how grammatical simplicity can be gained by taking grammaticality broadly. By counting ‘x eats that *p*’ grammatical we make do with one category of two-place predicates in place of two.

Such, then, is one way of arranging the grammar of propositional attitudes: by recognizing a construction that builds a singular term from a sentence by prefixing the particle ‘that’. Now an obvious second way is to recognize, instead, a construction that builds a one-place predicate from a two-place predicate and a sentence by interposing the particle ‘that’. This way has the advantage of not involving names of propositions. It does not dispense with propositions themselves, however, or whatever the objects of propositional attitudes might be presumed to be; for, in taking ‘believes’ and the rest as two-place predicates it still admits ‘x believes *y*’ and the like.

A third way is to treat ‘believes that’ and the rest as comprising a new lexical category, the *attitudinatives*, and then to recognize a construction that builds a one-place predicate such as ‘believes that Darwin erred’ by concatenating an attitudinative ‘believes that’ and a sentence ‘Darwin erred’. On this analysis ‘thinks’, ‘believes’, etc.,

are not cast with ‘eats’ and ‘>’; they are not predicates at all. On this analysis, objects of propositional attitudes are no longer called for. But there is a price: one can no longer say ‘x believes *y*’, and the like, with quantifiable ‘*y*’. One can no longer say that there is something that *x* believes.

Besides the idioms of propositional attitude there are those of *modality*: ‘necessarily’, ‘possibly’. These again cause sentences to be constituents of constructions other than truth functions and quantification. To accommodate them we could recognize a necessity construction that forms a sentence from a sentence by prefixing the particle ‘necessarily’. As for ‘possibly’, it can be seen simply as a concatenation of three particles marking three successive one-place constructions: ‘not necessarily not’.

The idioms both of propositional attitude and of modality are notoriously unclear from a logical and philosophical point of view. Their want of clarity was remarked on in Chapter 1, but it is yet more abject than there indicated. Troubles can arise, in such contexts, from putting one side of a true statement of identity for the other. The sentence:

Tom thinks that Tully wrote the *Ars Magna*

may be true, and yet become false when ‘Cicero’ is put for ‘Tully’, even though Cicero = Tully. Questions consequently arise regarding the coherence of using a neutral variable of quantification in such a position:

Tom believes that *x* wrote the *Ars Magna*.

If this open sentence is going to have to be true or false of a man *x* depending on which of his names we refer to him by, we may question whether as an open and quantifiable sentence it makes sense at all.

This difficulty over the interpretation of open sentences and their quantifications affects modal contexts as well as the idioms of propositional attitude. On the other hand, all these idioms reduce to a pretty hollow mockery if we never quantify into them. Efforts to save the situation prove to involve us either in considerations of essence and accident and kindred dim distinctions, or else in elaborate further grammatical apparatus which I forbear to enlarge upon here.

We should be within our rights in holding that no formulation of any part of science is definitive so long as it remains couched in

idioms of propositional attitude or modality. But to claim this is more modest than to claim that our standard logical grammar is enough grammar for science. Such good uses as the modalities are ever put to can probably be served in ways that are clearer and already known; but the idioms of propositional attitude have uses in which they are not easily supplanted. Let us by all means strive for clearer devices adequate to those purposes; but meanwhile we have no assurance that the new devices, once found, will fit the elegant grammar that we are calling standard.

TR