Indian Philosophical Quarterly, Vol. XI, No. 2, April 1984

LOGICAL FORM AND NATURAL SYNTAX

Sicut se habet stultus ad sapientem,
sic se habet grammaticus ignorans
logicam ad pertum in logica

Alexander of Villedieu

1. Quine's *algebra* of predicate functors [see (26), (27), and (28)] admits only predicates and functors. The full-blown first order predicate *calculus* admits functors, predicates, and individual variables (from now on simply " variables "), and sentential variables (which could be viewed as null-lace predicates). Predicates are general terms. They are not names. In particular, they are neither names of abstract universals nor names of classes. Individual variables are singular terms corresponding to the personal pronouns of ordinary discourse. Other, more familiar singular terms, such as proper names and descriptions, have been eliminated in favour of the predicates, variables and functors of the calculus.

The calculus, then admits functors and terms. And the terms are divided into those which are general (predicates) and those which are singular (variables). Only general terms are predicated and only variables refer. Predicates are unfit for referring, while variables are unfit for predicating. To guarantee this division of labour the canonical notation of the calculus uses letters of two different fonts. " Basic combinations ", sentences of the syntactically most simple kind, consist of just one referring term and just one predicate—a singular term and a general term.

The algebra, unlike the calculus, recognizes only one kind of term—the predicate. Variables have been explained away. But the criterion for ontic commitment remains. [See (27), p. 23]. When terms are divided into two or more kinds there is a need for two or more labels. Thus the calculus must use something like " predicate " and " variable ". When terms are not so divided there is no need whatsoever for such labels. "Term" will do. Quine's " predicate " (in his algebra) could easily be replaced by " term ". That the label " predicate " has survived into the algebra is due in large part to the notion that all the terms of the algebra are general, and all general terms are predicates.

The important point to grasp now is that the algebra is a *term logic.* Aristotle's old syllogistic was a term logic. The universal calculus sought by Leibnitz was a term logic. Boole's algebra was a term logic. Quine has shown, in effect, how to translate the first order predicate calculus into a term logic. Unlike his terminist predecessors, who sought a logic suited to the practical ends of logical reckoning (e.g. deciding validity, drawing conclusions, proving), Quine's interest is merely theoretical. His claim is that the algebra casts light on the variable of the calculus [see (27), p. 24].

The role that any term happens to play in a given sentence is displayed quite readily in the calculus : upper case font—predicating, lower case font—referring. What of the terms (predicates) of the algebra ? Consider the relatively simple sentence ' Some actors are buffoons '. Its translation into the notation of the calculus is :

(1) $(\exists x)(Ax \cdot Bx)$

To see how (1) can be rewritten in the predicate functor algebra we make use of two devices. The *cropping* functor (ꟻ) applies to an *n*-place predicate and results in an *n*-1-place predicate. It carries the existential force of the existential quantifier. Thus :

(2) $(\exists x)Mx$

is transformed by replacing the 1-place ' Mx ' with the 0-place ' M ' and letting the cropping functor occupy the place of the quantifier. The result is

(3) ꟻM

The second device is the Boolean intersection functor ($\cap$). It reduces a conjunction of two *n*-place predicates, each followed by *n* variables, to a single complex *n*-place predicate followed by *n* variables. Thus

(20), (21), (22), (23)]. The modernist grammarian gleans his grammatical insights from the calculus divised by the modernist logician.

The calculus, unlike the syllogistic, is not a logic of terms. It takes sentences to be either " atomic " or a function of atomic sentences. Atomic sentences consist of a single predicate and one or more referring phrases, names. Other sentences are built-up of atoms by the application of higher predicates, which apply to sentences (sentential functors). Consider the sentence ' Socrates is mortal '. The traditionalist takes this as a combination of a subject/noun phrase and a predicate/verb phrase. The predicate is syntactically complex, consisting of a term (' mortal ') and a copula, or qualifier (' is '). Surprisingly (for those of us trained in modernist terms), the subject was likewise taken to be syntactically complex, consisting of a term (' Socrates ') and a quantifier. In the case of terms with individual referents (e.g. proper names) the quantifier was supressed in the natural language sentence but logically understood (see part 3, below). In sharp contrast to this view, the modern logician takes such a sentence to be logically atomic, consisting of a syntactically simple predicate and a syntactically simple name. ' Socrates taught Plato ' would, on the modern view, be an atomic sentence with the predicate ' taught ' and the two names ' Socrates ' and ' Plato '. A sentence like ' Every man is mortal ' was taken by the traditionalist to be syntactically similar to ' Socrates is mortal '. Each was seen as consisting of a syntactically complex subject (a term plus a quantifier) and a syntactically complex predicate (a term plus a qualifier). For the modernist, however, while ' Socrates is mortal ' is taken to be atomic (consisting of a syntactically simple subject and a syntactically simple predicate), ' Every man is mortal ' is taken as non-atomic. It is reparsed roughly as : ' Everything is such that if it is a man then it is mortal '. In the usual notation of the calculus :

$$(8)\ (\forall x)(Mx \supset Tx).$$

The two subsentences ' it is a man ' and ' it is mortal ' are logically atomic. Each consists of a predicate and a common singular referring phrase (in this case the singular pronoun ' it '). The conditional functor (' if. . . . then ') is applied to these two atoms to get ' if it is a man then it is mortal '. Finally the universal quantifier (' Everything is such that ') is applied to the conditional sentence to get ' Everything is such that if it is a man then it is mortal '. The quantifier is a function on an entire sentence which " binds " together the variables/pronouns of that sentence. (8) is taken to be the logical form of ' Every man is mortal ', and, by some, to be the hidden grammatical form as well. Like other contemporary linguists, the generative semanticist offers phrase structure analyses of natural language sentences as a way of revealing their hidden forms. The syntax of modern logic is directly reflected in the structural analyses produced by these linguists.

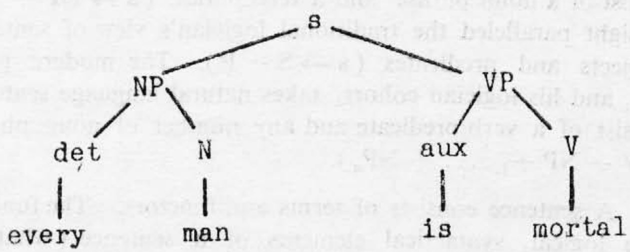
In (4) McCawley has argued that a Polish rather than Italian system of logical symbolization provides the best deep structure analyses for natural language sentences. The Polish system differs from the Italian by treating all sentence functors as predicates taking the constituent sentences as subjects/arguments. For example, ' If p then q ' is normally symbolized by ' $p \supset q$ ', with the " horseshoe " as the mark of conditionalization. It is placed between the two subsentences and is said to " connect " them. The Polish version is ' Cpq '. Here the conditionalization sign, ' C ', is placed before the two subsentences in the same way that a relational predicate is placed before its relata in the predicate calculus. Quantifiers are as well treated as verbs or predicates applying to the sentences within their range. For example, ' Every man is mortal ' would have the logical form

$$(9) \ (\forall x) \ C_{MxTx}$$

A comparison of the structural analyses offered by the traditionalists, like Chomsky, and the modernists, like McCawley, reveals the great differences between the two. The traditionalist would analyze ' Every man is mortal ' in accord with " rewrite " rules such as the following :

(i.c) s $\rightarrow$ NP + VP
(ii.c) NP $\rightarrow$ det + N
(iii.c) VP $\rightarrow$ aux + V
(iv.c) det $\rightarrow$ *every*
(v.c) N $\rightarrow$ *man*
(vi.c) aux $\rightarrow$ *is*
(vii.c) V $\rightarrow$ *mortal*

This can be displayed on the following phrase structure diagram.



The modernist rewrite rules would be :

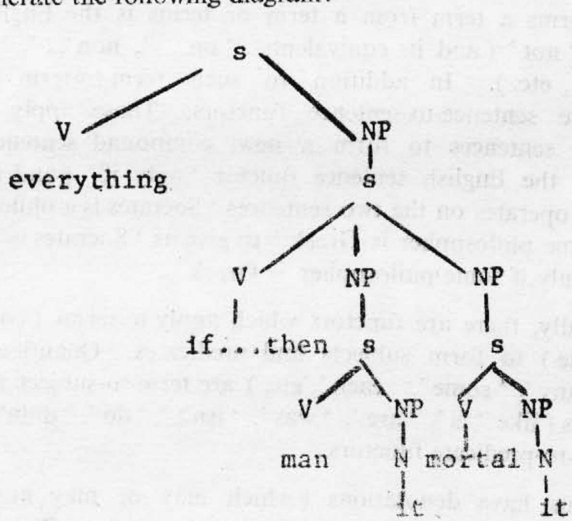
(i.m) $s \rightarrow V + NP_1 + \ldots + NP_n$

(ii.m) $NP \rightarrow s$, N

(iii.m) V $\rightarrow$ *everything, if . . . then, man, mortal*

(iv.m) N $\rightarrow$ *it*

These generate the following diagram:



The resulting analysis is easily transcribed, then into the Polish notation.

(10) everything if . . . then man it mortal it
(∀x) C M x T x

The traditional grammarian took natural language sentences to consist of a noun phrase and a verb phrase ($s \rightarrow NP + VP$). His insight paralleled the traditional logician's view of sentences as subjects and predicates ($s \rightarrow S + P$). The modern grammarian, and his logician cohort, takes natural language sentences to consist of a verb/predicate and any number of noun phrases ($s \rightarrow V + NP +_1 \ldots + NP_n$).

3. A sentence consists of terms and functors. The functors are the logical, syntactical elements of a sentence (what the scholastics called " syncategoremata "). The terms are the non-logical, material elements of a sentence (what the scholastics called " categoremata "). Some functors apply to one or more terms to form new terms. Thus, for example, the English term functor ' and ' operates on ' short ' and ' fat ' to give us ' short and fat '. The latter is a compound term formed from the two simple terms by the term functor ' and '. Another functor which forms a term from a term or terms is the English term negator ' not ' (and its equivalents : ' un .. ', non .. ', ' dis .. ', ' .. less ', etc.). In addition to such term-to-term functors there are sentence-to-sentence functors. These apply to one or more sentences to form a new, compound sentence. For example, the English sentence functor ' only if ' (and its equivalents) operates on the two sentences ' Socrates is a philosopher ' and ' Some philosopher is Greek ' to give us ' Socrates is a philosophei only if some pnilosopher is Greek '.

Finally, there are functors which apply to terms (compound or simple) to form subjects and predicates. Quantifiers (like ' all ', ' any ', ' some ', ' each ', etc.) are term-to-subject functors. Qualifiers (like ' is ', ' are ', ' was ', ' isn't ', ' do ', ' didn't ', etc.) are term-to-predicate functors.

Terms have denotations (which may or may not exist). Functors do not (not even nonexistent ones). ' Philosopher ' denotes Socrates, Plato, Aristotle, Descartes, Hume, etc. 'White' denotes clouds, uncolored paper, the shells of hen eggs, etc. ' Philosopher ' and ' white ' each denote several individuals. Some other terms denote just one individual. ' Socrates ' denotes just Socrates, ' 2 ' denotes just the number two, and ' the sun ' denotes just the sun. A quantified term, or subject, does not denote. It refers. Universally quantified terms (e.g. 'every man', 'all philosophers') refer to the entire denotation of their constituent terms. So 'all philosophers' refers to the entire denotation of 'philosopher' (viz. Socrates, Plato, Aristotle, Descartes, Hume, etc.). Particularly quantified terms (e.g. 'some philosopher', 'a man') refer to an undetermined part (perhaps all) of the denotation of their constituent terms. So 'some philosopher' refers to some part of the denotation of 'philosopher'. Now a singular term like 'Socrates' denotes just one individual (Socrates). 'Every Socrates' must refer to the entire denotation of 'Socrates', which, since Socrates constitutes the entire denotation of 'Socrates', just is Socrates. And 'some Socrates' must refer to a part of the denotation of 'Socrates', which, since Socrates is the *only* part of the denotation of 'Socrates', just is, again, Socrates. Thus, 'every Socrates' and 'some Socrates' both have the same referent—Socrates. And this is true in general for singular terms. That explains why singular terms appear unquantified in natural language sentences. It is not that they have no quantifier, but that the quantifier makes no difference. Let us use '*' for the logical quantifier whenever either a universal or a particular quantifier will do. Then, for example, 'Socrates is wise' is the natural anguage shorthand for '*Socrates is wise'.

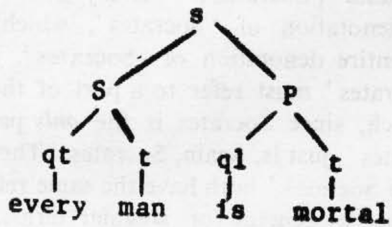
Every sentence is a categorical—a sentence consisting of exactly one subject and one predicate ($s \rightarrow S + P$). Every Subject is a quantified term ($S \rightarrow qt + t$), and every Predicate is a qualified term ($P \rightarrow ql + t$). Natural language sentences may often appear to omit quantifiers and qualifiers. We have just seen that this is always so for quantified singular terms. Sometimes the quantifier is suppressed when the context makes it obvious. For example, we usually say 'Horses are mammals', where the universal quantifier is clearly to be understood. Or again, we say 'Americans have landed on the moon', where the particular quantifier is obviously understood. As well, we often omit explicit qualification, as in 'Mexicans speak Spanish', where 'do' is understood (compare this with 'Brazilians don't speak Spanish').

Thus far, we have, in effect, formulated three rewrite rules for the formal analyses of natural language sentences.

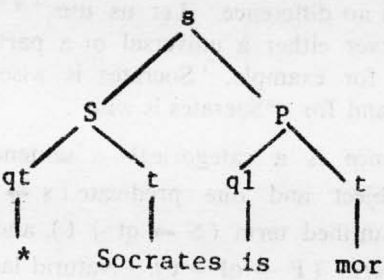
$$\text{(i) } s \rightarrow S + P \qquad \text{(ii) } S \rightarrow qt + t \qquad \text{(iii) } P \rightarrow ql + t$$

Each of these embodies an insight offered by traditional logic. Indeed, modern critics of traditional term logic trace most of its shortcomings to (i). These rules can be used to analyze a large number of natural sentences. Here are some simple examples of phrase structure analysis generated by these rules.

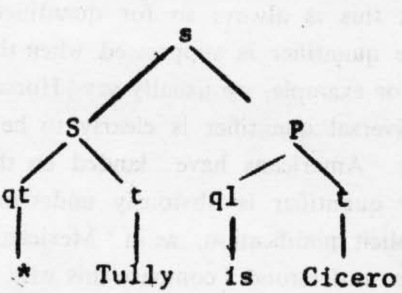
(*a*)



(*b*)



(*c*)



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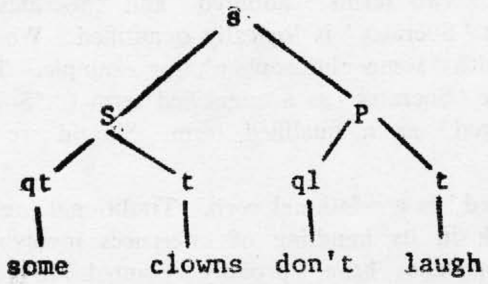
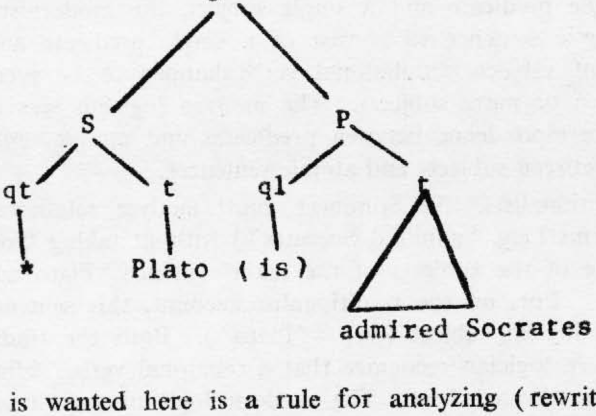


Notice that in (*c*) the predicate term is singular. Where modern logicians feel constrained to take all singulars as subjects/names and all subjects as singulars, and all general terms as predicates and all predicates as general terms, the traditional logician feels no such constraints, and surely none are forthcoming from natuıal language. Natural languages freely use singulars and general terms alike in both subject and predicate positions. [For more on the traditional account of singulars see (10), (24), (30), (32), and (40).]

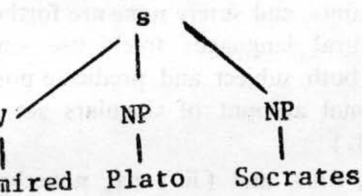
Rules (i), (ii), and (iii) are, nonetheless, insufficient for generating all natural language sentences. Consider a sentence like 'Plato admired Socrates'. Using our three rules we can generate the following structural tree.

(*e*)



What is wanted here is a rule for analyzing (rewriting) the complex predicate term 'admired Socrates'. The term appears to consist of two terms, 'admired' and 'Socrates'. Now, it is clear that 'Socrates' is logically quantified. We could easily replace it with 'some philosopher', for example. This suggests that we take 'Socrates' as a quantified term ('*Socrates') and take 'admired' as a qualified term. Should we follow this suggestion ?

'Admired' is a relational verb. Traditional logic was notoriously weak in its handling of inferences involving relations. Modern logicians have proudly pointed to their rule : $s \rightarrow V + NP_1 + \ldots + NP_n$ as the source of their facility with relationals. 'Plato admired Socrates' is taken to consist of the verb/predicate 'admired' and the two noun phrases 'Plato' and 'Socrates'. The usual notation ('Aps') is reflected in its structural analysis.



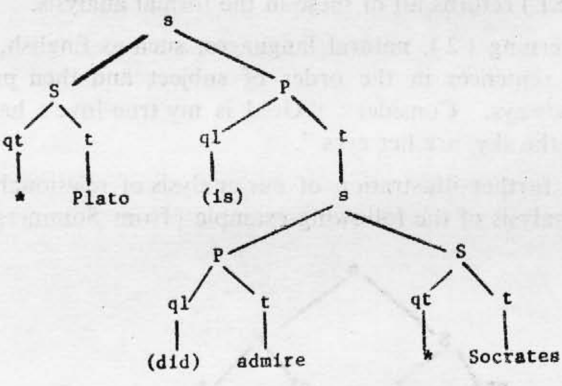
According to this modern analysis 'admired' is a two-place predicate predicated of the ordered pair of subjects < Plato, Socrates >. While traditional logicians took each sentence to consist of a single predicate and a single subject, the modernist takes each atomic sentence to consist of a single predicate and any number of subjects. Relational verbs happen to be predicates taking two or more subjects. The modern logician sees a one-to-one correspondence between predicates and atomic sentences, but not between subjects and atomic sentences.

Traditionalists, like Sommers, must analyze relational predicate terms (e.g. 'admired Socrates') without taking 'Socrates' to be one of the subjects of the main sentence 'Plato admired Socrates'. For, on the traditionalist account, this sentence has only one logical subject (viz. '*Plato'). Both the traditional and modern logician recognize that a relational verb, 'admired', is being predicated here. The modern logician sees it as predicated of two subjects. The traditional logician must take it to be predicated of a single subject. So what *is* the subject of 'admired' here ? It cannot be '*Plato', since what is said of Plato is not that he admired, but that he admired Socrates. The predicate being applied to '*Plato' is 'admired *Socrates'. Clearly 'admired' is predicated of '*Socrates'. The entire predicate term of 'Plato admired Socrates' consists of a quantified term ('*Socrates') and a qualified term ['(did) admire']. In other words, the predicate term of a relation can be construed as itself a sentence (subject plus predicate). [Sommers has fully explored this in (40)]. We can easily accommodate this additional logical insight by adding the following rewrite rule, which allows that every term is either a term or a sentence (i.e. every sentence is itself a term).

(iv) t → t, s

Given this new rule, we can complete our analysis of (*e*) like this :

(e.1)



This analysis suggests two things about the logical syntax of natural language :

(1) it economizes on formal elements whenever possible, and

(2) it puts no particular constraints on the order of subjects and predicates.

With respect to (1), traditional logicians recognized that a small amount of distortion was sometimes required to fit natural language sentences for the task of transcription into logical notation. Such "regularizing" was wanted to facilitate logical reckoning. Consider the syllogism

(A) Theatetus runs
Every runner is a mover
Therefore, Theatetus moves

The minor contortions required to get this into standard (B) pattern are obvious.

(B) Theatetus is a runner
Every runner is a mover
Therefore, Theatetus is a mover

(This could just as easily have been regularized as

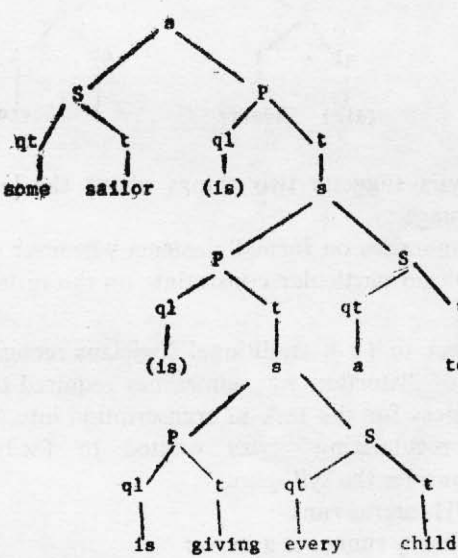
(C) Theatetus does run
Every runner does move
Therefore, Theatetus does move

but tradition seemed to favour nouns over verbs), (A) is a natural, more economic version of (B), or (C). In particular, natural languages economize, in part, by suppressing the quantifiers of singular subjects, and the qualifiers of affirmative predicates. (e.1) returns all of these in the formal analysis.

Concerning (2), natural languages, such as English, usually construct sentences in the order of subject and then predicate. But not always. Consider : " Gold is my true love's hair. And blue, like the sky, are her eyes ".

As a further illustration of our analysis of relationals, consider the analysis of the following example [from Sommers (39)].

(*f*)



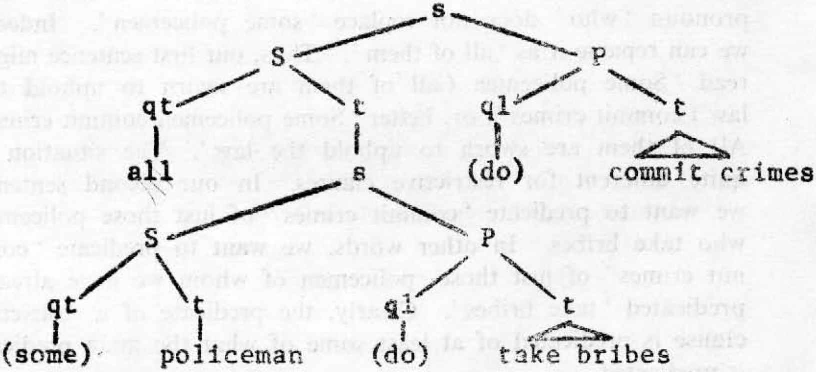
4. Predicates are often made complex by containing relationals, so that their terms must be analyzed as themselves sentences consisting of a subject and a predicate. Subject terms can be complex as well. (Keep in mind here that 'complex' is not 'compound'.) A quantified term is often modified by a restrictive adjective or adjectival clause. We say, for example, 'Every good man has a chance', 'Tricky Dick lost his office', 'Every child who loves his father is wise', 'Some politicians who knows the President will be named ambassador'. Notice that each adjective can be replaced by a restrictive clause. Thus we can get 'Every man who is good has a chance' and 'Dick who is tricky lost his office'. Logically the subjects here conform to the general pattern : quantifier-term-restrictive clause. Moreover, the quantifier operates not just on the term, but on the complex term constituted by the term and its restriction : quantifier-(term-restriction).

Restrictive clauses have the general form : relative pronoun-qualifier-term. So it is an easy and obvious step to : relative pronoun-predicate. Now we might think that in such a clause the predicate is predicated of the pronoun, which, as a pronoun, is simply taking the place of the subject of the main clause. But the result would be to eliminate the distinction between restrictive and non-restrictive adjectival clauses. Compare 'Some policemen, who are sworn to uphold the law, commit crimes' and 'Some policemen who take bribes commit crimes'. The adjectival clause in the first sentence is non-restrictive. The pronoun 'who' does not replace 'some policemen'. Indeed, we can reparse it as 'all of them'. Thus, our first sentence might read 'Some policemen (all of them are sworn to uphold the law) commit crimes'; or, better 'Some policemen commit crimes. All of them are sworn to uphold the law'. The situation is quite different for restrictive clauses. In our second sentence we want to predicate 'commit crimes' of just those policemen who take bribes. In other words, we want to predicate 'commit crimes' of just those policemen of whom we have already predicated 'take bribes'. Clearly, the predicate of a restrictive clause is predicated of at least some of what the main predicate is predicated.

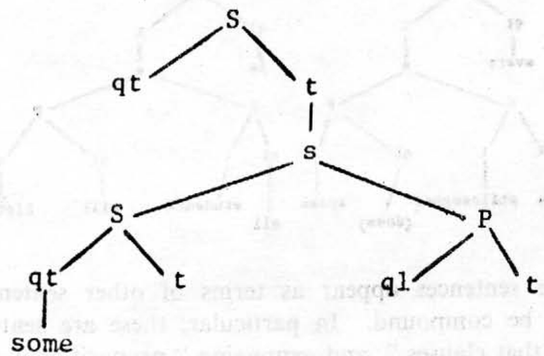
We are at the task of determining the logical subject of a restrictive clause. Compare ' Some policemen who take bribes commit crimes ' and ' All policemen who take bribes commit crimes '. It is clear that the subject term of the restrictive clause in each case is ' policemen '. The question is one of quantity. Does the subject of a restrictive clause share the quantity of the main subject ? If so, then in ' All policemen who take bribes commit crimes ' the predicate would be predicated of ' all policemen '. But surely this is not what we normally want to say when using such a sentence. The use of a restrictive clause *restricts* the subject. The policemen who take bribes constitute an undetermined part (perhaps all) of the denotation of ' policemen '. This suggests that the quantity of the subject in a restrictive clause is always particular. Generally, then a subject term of the form ' A which is B ' can be reparsed as ' some A is B ', a sentence [cf. (25) and (41)]. Notice that the restriction of a singular, e.g. ' Dick ' is equivalent to a nonrestrictive modification, since the denotation of such a term, as we have seen, has only one part.

Since we have already formulated rule (iv), allowing us to take sentences themselves as terms, we need no other special rule for analyzing sentences containing restrictive adjectives or adjectival clauses. A term and its restriction logically constitute a sentence. As an illustration we analyze ' All policemen who take bribes commit crimes.'

(G)



And generally a restricted subject is analyzed by



5. We have formulated four rewrite rules for analyzing the structure of natural language sentences.

(i) s → S + P

(ii) S → qt + t

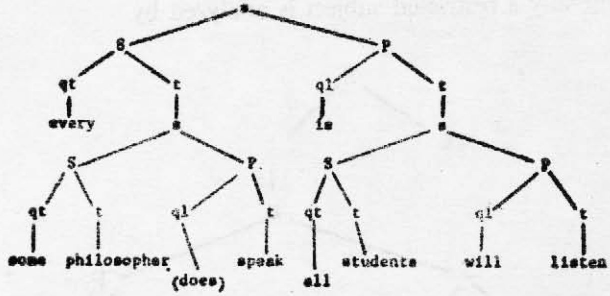
(iii) P → ql + t

(iv) t → t, s

We have seen that these rules are sufficient to generate structural analyses for a very wide range of kinds of natural language sentences. They show that these sentences are categorical (i) and have as their ultimate elements nothing but quantified and qualified terms (ii, iii, iv).

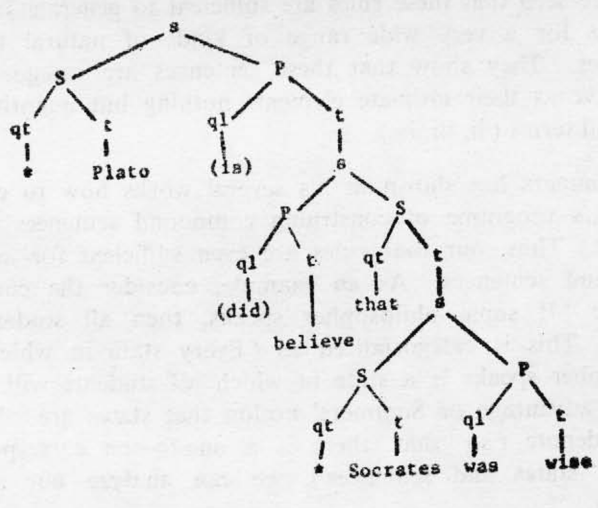
Sommers has shown in his several works how to complete Leibnitz's programe of construing compound sentences as categoricals. Thus, our four rules are even sufficient for analyzing compound sentences. As an example, consider the compound sentence 'If some philosopher speaks, then all students will listen'. This is categorialized as 'Every state in which some philosopher speaks is a state in which all students will listen'. Taking advantage of Sommers' notion that states are what sentences denote (so that there is a one-to-one correspondence between states and sentences), we can analyze our sentence like this.

(*h*)

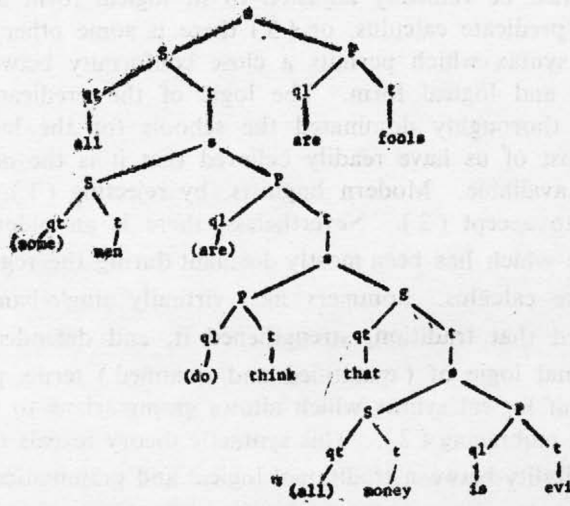


Often sentences appear as terms of other sentences which need not be compound. In particular, these are sentences containing " that clauses ", and expressing " propositional attitudes ". Examples, in English, are ' Plato believed that Socrates was wise ', ' All men who think money is evil are fools ', ' It is deplorable that Nixon is free '. These sentential terms are clearly singulars, for states are individuals, each of which may be designated (denoted) by a sentence. Thus the demonstrative ' that ' is quite appropriate in such cases and can serve to indicate its logical analogue ' * '. In each case the sentential clause is a sentence occupying the place of a quantified term. We could analyze each example using, again, just our four rules.

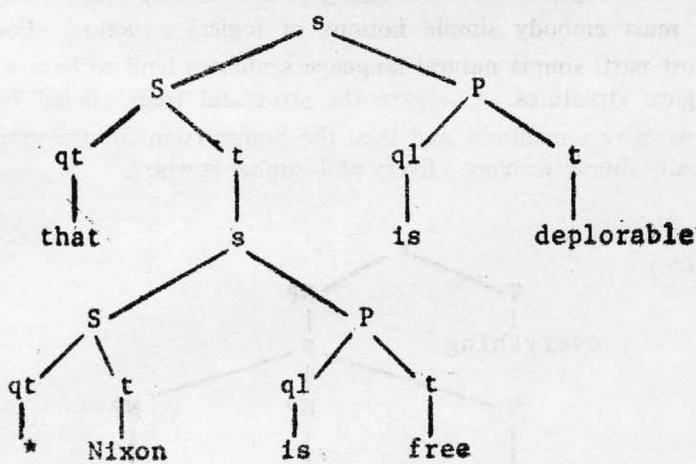
(*i*)



(*j*)



(*k*)

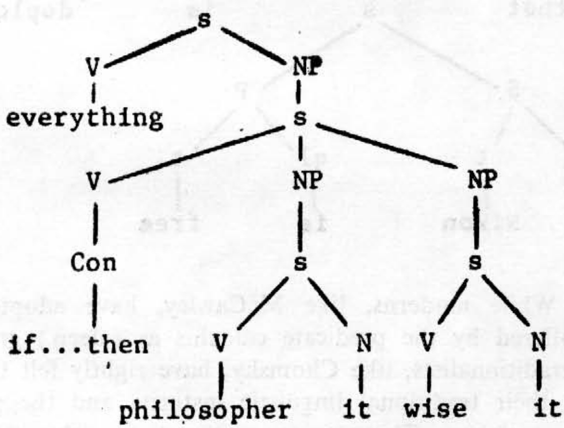


6. While moderns, like McCawley, have adopted logical forms offered by the predicate calculus as (deep) grammatical forms, traditionalists, like Chomsky, have rightly felt the tension between their traditional linguistic instincts and the projections of modern logic. The tension means that either (1) logical form and grammatical form are unrelated, or (2) grammatica

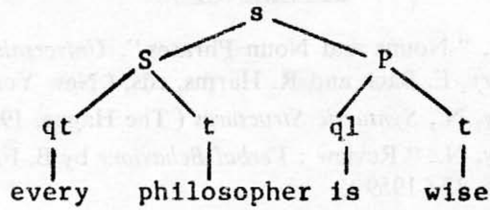
form must be radically adjusted to fit logical form as dictated by the predicate calculus, or (3) there is some other theory of logical syntax which permits a close conformity between grammatical and logical form. The logic of the predicate calculus has so thoroughly dominated the schools for the last century that most of us have readily believed that it is the *only* logical system available. Modern linguists, by rejecting (1), felt compelled to accept (2). Nevertheless, there is an older tradition in logic which has been mostly dormant during the region of the predicate calculus. Sommers has, virtually single-handedly, reanimated that tradition, strengthened it, and defended it. The traditional logic of (quantified and qualified) terms provides a theory of logical syntax which allows grammarians to reject (1) without embracing (2). This syntactic theory reveals the ancient compatibility between traditional logical and grammatical insights.

The logic of natural language must be simple to be natural. It must embody simple notions of logical structure. For the most part, simple natural language sentences tend to have simple logical structures. Compare the structural trees offered by the generative semanticist and then the Sommersian for the grammatically simple sentence ' Every philosopher is wise '.

(G.S.)

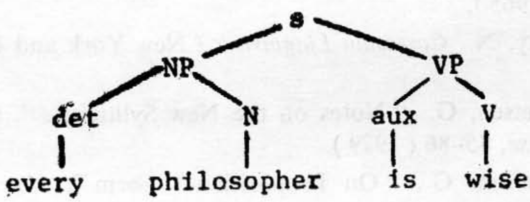


(S.)



The close parallel with the transformation (Chomsky) analysis of the same sentence is obvious.

(T.)



The differences between (S.) and (T.) seem not much more than verbal.

A final note. Chomsky has opted for an innateness theory as the best way of accounting for grammar acquisition. When one thinks of grammar (rules of syntax) as highly complex then one naturally tends to account for our acquisition of it as either correspondingly complex or as innate. Yet, the fact that we acquire that grammar so early in life, and so quickly and easily, seems to count out the first possibility. We seem left, then, with the following choice : the rules governing the syntax of natural language are innate or they are not highly complex. Our view is that the second alternative is much more promising than the first.

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REFERENCES

1. Bach, E., " Nouns and Noun Phrases ", *Universals of Linguistic Theory*, E. Bach and R. Harms, eds. (New York, 1968).
2. Chomsky, N., *Syntactic Structures* (The Hague, 1957).
3. Chomsky, N., " Review : *Verbal Behaviour* by B. F. Skinner ", *Language*, 35 (1959).
4. Chomsky, N., *Current Issues in Linguistic Theory* (The Hague, 1964).
5. Chomsky, N., *Topics in the Theory of Generative Grammar* (New York, 1964).
6. Chomsky, N., *Aspects of the Theory of Syntax* (Cambridge, Mass., 1965).
7. Chomsky, N., *Cartesian Linguistics* (New York and London, 1966).
8. Englebretsen, G., " Notes on the New Syllogistic ", (*Logique et Analyse*, 85–86 (1979).
9. Englebretsen, G., " On Propositional Form ", *Notre Dame Journal of Formal Logic*, 21 (1980).
10. Englebretsen, G., " Singular Terms and the Syllogistic ", *The New Scholasticism*, 54 (1980).
11. Englebretsen, G., " Denotation and Reference ", *Philosophical Studies* (Ireland), 27 (1980).
12. Englebretsen, G., " A Note on Predication ", *Dialogue*, 19 (1980).
13. Englebretsen, G., *Logical Negation* (Assen, 1981).
14. Englebretsen, G., *Three Logicians : Aristotle, Leibniz and Sommers, and the Syllogistic* (Asser, 1981).
15. Fillmore, C. J., " The Case for Case ", *Universals of Linguistic Theory*, E. Bach and R. Harm , eds. (New York, 1968).
16. Fodor, J. A., and Katz, J. J., *The Structure of Language* (Englewood Cliffs, N. J., 1964).
17. Friedman, W. H., " Calculemus ", *Notre Dame Journal of Formal Logic*, 21 (1980).
18. Geach, P., *Reference and Generality* (Ithaca, 1962).
19. Jacobs, R. A. and Rosenbaum, P. S., *Readings in Transformational Grammar* (Waltham, Mass., 1970).

20. Lakoff, G., " Linguistics and Natural Logic ", *Semantics of Natural Language*, D. Davidson and G. Harman, eds (Dordrecht, 1972)
21. McCawley, J. D., " A Program for Logic ", *Semantics of Natural Language*, D. Davidson and G. Harman, eds. (Dordrecht, 1972).
22. McCawley, J. D., " English as a VSO Language ", *Language*, 46 (1970).
23. McCawley, J. D., " The Role of Semantics in Grammar ", *Universals of Linguistic Theory*, E. Bach and R. Harms, eds. (New York, 1968).
24. Noah, A., " Singular Terms and Predication ", Ph.D. thesis (Brandeis University, 1973).
25. Noah, A., " Predicate Functions and the Limits of Decidability ", *Notre Dame Journal of Formal Logic*, 21 (1980).
26. Quine, W. V., " Variables Explained Away ", *Selected Logical Papers*, (New York, 1966).
27. Quine, W. V., " Algebraic Logic and Predicate Functors ", *The Ways of Paradox*, revised edition (Cambridge, Mass., 1976).
28. Quine, W. V., " The Variable ", *The Ways of Paradox*, revised edition, (Cambridge, Mass., 1976).
29. Sommers, F., " On A Fregean Dogma ", *Problems in the Philosophy of Mathematics*, ed. I. Lakatos (Amsterdam, 1967).
30. Sommers, F. " Do We Need Identity ? ", *Journal of Philosophy*, 66 (1969).
31. Sommers, F., " On Concepts of Truth in Natural Languages ", *The Review of Metaphysics*, 23 (1979).
32. Sommers, F., " The Calculus of Terms ", *Mind*, 79 (1970).
33. Sommers, F., " Existence and Predication ", *Logic and Ontology*, M. Munitz, ed. (New York, 1973).
34. Sommers, F., " The Logical and the Extra-Logical ", *Boston Studies in the Philosophy of Science*, 14 (1973).
35. Sommers, F., " Distribution Matters ", *Mind*, 84 (1975).
36. Sommers, F., " Logical Syntax in Natural Language ", *Issues in the Philosophy of Language*, A. MacKay and D. Merrill, eds. (New Haven, 1976).

37. Sommers, F., " On Predication and Logical Syntax ", *Language in Focus*, A. Kasher, ed. (Dordrecht, 1976).

38. Sommers, F., " Frege or Leibniz ? ", *Studies in Frege*, III, M. Shirn, ed. (Stuttgart, 1976).

39. Sommers, F. " The Grammar of Thought ", *Journal of Social and Biological Structures*, 1 (1978).

40. Sommers, F., *The Logical Syntax of Natural Language*, (Oxford, forthcoming).

41. Vendler, Z., *Adjectives and Nominalizations* (The Hague, 1968).
