QUADRATUM AUCTUM

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There is a commonly held view that the logical relations exhibited by a square of opposition can only be so displayed for a limited class of assertoric sentences. On this view there are certain kinds of such sentences that find no place on the square. Until very recently I too held this and have defended versions of it publicly on several occasions.(1)

Nevertheless, I propose here to reject that view. Instead, I want to show that a close inspection of the features of the square reveal a rarely realized, or even suspected, power and range. To be sure, the square I speak of is not exactly the traditional square of opposition. What I have in mind is an amanded and augmented version of the old square. In almost every case these new features of the square are the result of distinctions which have always or usually been overlooked by modern logicians. Most of them are due to Fred Sommers, and I take this opportunity to pay homage to his keen, clear logical vision. The paths I follow here are usually ones he has discovered. Sommers has produced a steady flow of logical studies during the last two decades.(2) But it is his new book, *The Logic of Natural Language*,(3) especially chapter 14, which is the strongest and most recent inspiration for my following remarks.

(1) See, for example, "Trivalence and Absurdity," *Philosophical Papers*, 4 (1975); and "The Square of Opposition," *Notre Dame Journal of Formal Logic*, 17 (1976).

(2) "Types and Ontology," *Philosophical Review*, 72 (1963); "Predicability," *Philosophy in America*, ed. M. Black (Ithaca, 1965); "On a Fregean Dogma," *Problems in the Philosophy of Mathematics*, ed. I. Lakotos (Amsterdam, 1967); "Do We Need Identity?" *Journal of Philosophy*' 66 (1969); "On Concepts of Truth in Natural Languages," *The Review of Metaphysics*, 23 (1969); "The Calculus of Terms," *Mind*, 79 (1970); "Structural Ontology," *Philosophia*, 1 (1971); "Existence and Predication," *Logic and Ontology*, ed. M. Munitz (New York, 1973); "The Logical and the Extra-logical," *Boston Studies in the Philosophy of Science*, 14 (1973); "Distribution Matters," *Mind*, 84 (1975); "Logical Syntax in Natural Language," *Issues in the Philosophy of Language*, eds. A. Mackay and D. Merrill (New Haven, 1976); "On Predication and Logical Syntax," *Language in Focus*, ed. A. Kasher (Dordrecht,

1. What is the most basic device available for making reference? In other words, how is initial reference made? Now there are, of course, a variety of proffered answers. For some the claim is that reference is initially and fundamentally achieved by the use of proper names. For others reference is so achieved by the use of 'logically proper names'. For still others it is the result of the use of an indefinite description. Without arguing much for it,(4) I want to hold that initial, primary reference is made, either explicity or implicity, by the use of indefinite descriptive phrases such as 'a man', 'an egg', 'someone', 'something', 'some girl', etc.(5)

I shall also accept without arguing for it a thesis suggested by Aristotle and advocated by Leibniz. It is the claim that all assertoric sentences can be viewed as, in some way, logically categorical, consisting of a single subject and a single predicate.(6)

Finally, I accept without arguing (because it has already been argued for extensively by Sommers) the important distinctions between denial and predicate negation and between denial and sentential negation. One can deny a predicate of a given subject as well as affirm that predicate of that subject. Moreover, one can affirm or deny the negation of that predicate of that subject. Contradiction is the relation between two sentences sharing a common subject and a common predicate, but such that the predicate is affirmed in one case and denied in the other. This contrasts with the modern view which takes contradiction to be a relation between a sentence and its

1976); "Frege or Leibniz?" *Studies on Frege*, III, ed. M. Shirn (Stuttgart, 1976); "The Grammar of Thought," *Journal of Social and Biological Structures*, 1 (1978); and "Are ther Atomic Propositions?" *Midwest Studies in Philosophy*, 6 (1979).

(3) Oxford, 1981.

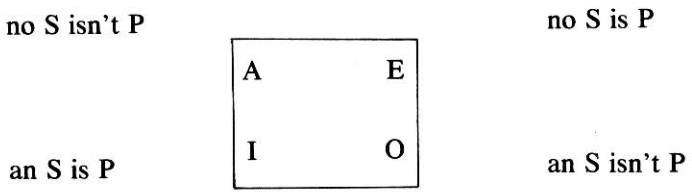
(4) For arguments or discussions see Z. Vendler, *Linguistics in Philosophy* (Ithaca, 1967), chapter 2; C. Chastain, "Reference and Context," *Language, Mind, and Knowledge*, ed. K. Gunderson (Minneapolis, 1975); F. Sommers, "The Grammar of Thought," *loc. cit.*; F. Sommers, *The Logic of Natural Language*, *loc. cit.*; and E. V. Paduceva, "Anaphoric Relations and their Representation in the Deep Structure of a Text," *Progress in Linguistics*, eds. M. Bierwisch and K. Heidolph (The Hague, 1970).

(5) For more on reference see F. Sommers, "Distribution Matters," *loc. cit.*; and G. Englebretsen, "Denotation and Reference," *Philosophical Studies* (Ireland), 27 (1980).

(6) In addition to Sommers' logical studies see G. Englebretsen: "On Propositional Form," *Notre Dame Journal of Formal Logic*, 21 (1980); *Logical Negation* (Assen, 1981); and *Three Logicians* (Assen, 1981).

negation (achieved by the application of a sentence function – sentential negation)(7).

Given these brief preliminary remarks, let us say that a *primary sentence* is any assertoric sentence whose subject is a phrase which can be used to make an initial reference, or the contradictory of such a sentence. Sentences like 'a man is coming', 'some girl is teasing Jim', and 'someone isn't being honest' are primary. In traditional terminology each of these is an I or O proposition. Each is a particular affirmative or particular negative. Note that what is negative about O propositions is the predicate. Thus, 'someone isn't being honest' could be rephrased as 'someone is being dishonest'. Sentences of the form 'some S is P' and 'some S isn't P' (= 'some S is non P') are both affirmations. The O form simply affirms the negation of the predicate affirmed in the corresponding I form. So sentences of the I and O forms are primary. Their contradictories are primary as well. The contradictory of an affirmation is a denial. Consider 'a man is coming'. How is this denied in English? Sometimes by prefixing a negator (e.g. 'not a man is coming', cf. 'not a creature was stirring'). Thus the modern logician is easily led to believe that contradiction is achieved here by the application of sentential negation. But the 'not' here does not negate a sentence. It indicates that the predicate, 'is coming', is being denied of the subject, 'a man'. Most often we contract 'not a' to get 'no man is coming'. So if 'an S is P' and 'an S isn't P' are primary, then their contradictories, 'no S is P' and 'no S isn't P', are primary as well. This suggests the following *primary square of opposition*.



(7) See Sommers' *The Logical Syntax of Natural Language*, Appendix B; and Englebretsen's *Logical Negation*.

Notice that I've taken the liberty of labeling the A and E sentences. 'No S is P' is the usual formulation for an E sentence, but the labeling of 'no S isn't P' as A is admittedly unusual.(8) One misses the universal quantifier here. I can only say for now that the universal quantifier is not far off, and besides, I think we can learn to love my A form.

Taking the I and O forms ('an S is P', 'an S isn't P') as primary (in part because they represent our initial modes of reference), the respective A and E forms are simply generated by forming the contradictories of I and O. The purpose of forming any square of opposition is to display the logical relations which hold among an intimate group of syntactically close sentences. These relations are dictated by the rules which govern the construction of the square. The first, and most obvious rule governing the primary square is the *law of excluded middle*.

(LEM) Either a sentence or its contradictory is true.

In terms of our square LEM says that either I or E is true and either O or A is true. LEM immediately calls for a second rule which excludes the possibility of both a sentence and its contradictory being true. This is the *law of noncontradiction*.

(LNC) A sentence and its contradictory are not both true.

The primary square is constructed in accordance with LEM and LNC. No other law determines the primary square.

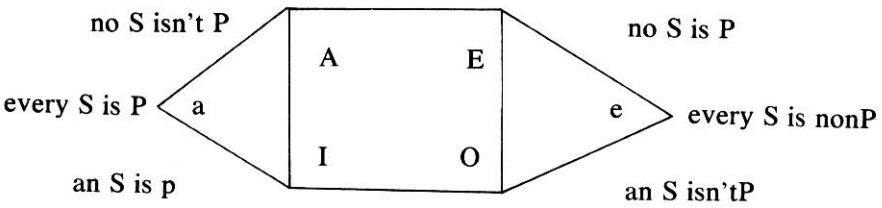
I want now to augment the square by adding to it certain elements in what will appear as shocking arrangements. I begin with universally quantified sentences. We must find a place on our square for sentences of the forms 'every S is P' and 'every S is non P'. I will call these the *a* and *e* forms, respectively. Where do a and e belong on the square? It is clearly not possible for an S to be P while every S is nonP, nor for an S to be nonP while every S is P. This suggests that I and e, as well and O and a, form opposite pairs. Now LEM and LNC

(8) F. BRENTANO, in *Die Lehre vom richtig Urteil*, ed. F. Meyer-Hillebrand (Bern, 1956), defines A and E in a similar fashion. I and O are given as 'there is an S which is...', and A and E are then the contradictories of these, viz. 'there is not an S which is...'.

will sufficiently rule here only on the condition that A = a and E = e. I will call the law which governs the oppositions of I/e and O/a the *law of quantified opposition* (where two affirmations are quantified opposites when their subjects differ only in quantity and the predicate of one is the negation of the predicate of the other.)

(LQO) A sentence and its quantified opposite are not both true.

What LQO says is that I and e are not both true and that O and a are not both true. We can add these new features to the primary square to get this *augmented square of opposition*.



The quantified opposite of a sentence will be its contradictory (i.e. the above square will simply collapse into the primary square) only if A = a and E = e. Now it certainly is the case that a logically implies A and that e logically implies E. For example, if every god is immortal then no god is mortal. But does A imply a, and does E imply e? I want to show later that such implications do not always hold. Until then just consider the two sentences 'no unicorn is unridden by me' and 'every unicorn is ridden by me'.

It is tempting to assume that, given any subject, any predicate is such that either it or its negation will hold of that subject. (9) Let us call two sentences which differ *only* in that the predicate of one is the negation of the predicate of the other *logical contraries*. I and O are logical contraries; so are a and e. We are tempted, then, to adopt the *predicative law of excluded middle*.

(PLEM) Either a sentence or its logical contrary is true.

(9) P. GEACH is so tempted. See his *Logic Matters* (Oxford, 1972), § 2.5.

A companion law says that a and e cannot both be true. This law undoubtedly holds and was recognized as early as Aristotle.([10]) We can call it the *law of incompatibility* (since logical contraries are incompatible).

(LIC) Logically contrary universal sentences are not both true.

While LIC says that a and e are not both true, PLEM says that one of them is true, and also that I or O is true. Now there are no reasons to reject LIC. But there are times when PLEM does not hold. In other words, there are sentences which are not true in their I, O, a, or e forms. Such sentences are *vacuous*.([11])

2. At *On Interpretation* 21a26-28 (and again at *Categories* 13b14-19) Aristotle argued that if Socrates exists then either 'Socrates is ill' or 'Socrates is well (= nonill)' is true, but that if Socrates doesn't exist neither are true. In other words, PLEM fails when the subject fails to refer. Here 'Socrates is ill' and ' Socrates is nonill' are logically contrary. PLEM holds (i.e. one or the other is true) only as long as 'Socrates' refers successfully. Let us say that a vacuous sentence is one for which PLEM fails. One kind of vacuousity is due to the failure of reference by the subject. But there are other sources of PLEM failure.

Sometimes when I produce 'an S is P' my audience is justified in concluding 'an S exists', Not because 'an S is P' logically entails 'an S exists' (contra Russell), for it doesn't. Nor because 'an S is P' presupposes 'an S exists' (contra Strawson), for it doesn't. Were the Russellian point correct there would be an argument of the form

Some A is B
therefore, some A is C

which is invalid. Were the Strawsonian point correct there would be an argument of the form

some A is B
some A is C
therefore, some A is C

([10]) *On Interpretation*, 24b7-10. *Metaphysics*, 101b15-17.

([11]) See F. Sommers, "Predicability," *loc. cit.*; G. Englebretsen, "Vacuousity," *Mind*, 81 (1972); G. Englebretsen, "Trivalence and Absurdity," *loc. cit.*; and G. Englebretsen, "Presupposition, Truth, and Existence," *Philosophical Papers*, 2 (1973).

which begs the question (note that what is presupposed has the status of a suppressed premise). How can my audience validly and without begging any questions draw the conclusion 'an S exists' from my 'an S is P'? Only by admitting a suppressed premise of the form 'every P exists'. The argument scheme then is

an S is P
every P exists
therefore, an S exists

a Darii syllogism.([12])

Let us suppose now that the conclusion, 'an S exists', does not hold. Then either 'every P exists' is not a suppressed premise, or 'an S is P' is false. In our normal discourse we take our refernces to succeed. We presuppose that every thing of which we speak exists. I say 'a man once walked on the moon', presupposing that whatever has walked on the moon exists, and thus that he, being one of them, exists. Such discourse is *factual*. When we produce 'an S is P' in a factual discourse situation we presuppose 'every P exists', and thus imply 'an S exists'. It is the presupposition which qualifies our discourse as factual. So, in a factual discourse situation, whenever 'an S exists' is false, so is 'an S is P'. But sometimes our discourse is not factual but *fictitious*.([13]) In a fictitious discourse situation 'an S exists' is false but 'an S is P' may still be true since the presupposition, 'every P exists', is not made. Clearly, failure of reference results in vacuousity only in factual discourse situations. You would misunderstand me if you concluded from my ' a man called Santa lives at the North Pole' that a man called Santa exists. For the conclusion requires the hidden premise that whoever lives at the North Pole exists. I haven't got that presupposition because my discourse here is (normally) fictitious. Were the situation not fictitious but factual (suppose I'm a young, gullible child), then the fact that a man called Santa does not exist would indeed render my sentence false.

In general, then, for factual discourse, if there is no S then both 'an

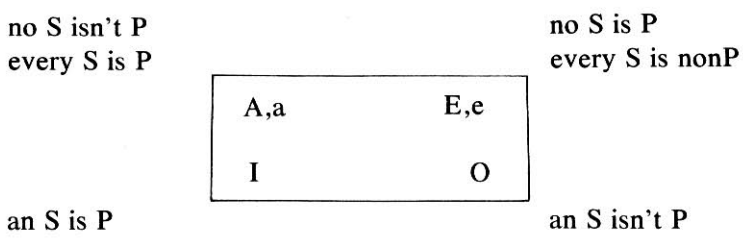
([12]) The above remarks are a drastic, but hopefully accurate, summary of Sommers' arguments in chapter 10 of *The Logic of Natural Language*.

([13]) See the discussion in G. Englebretsen, "Presupposition, Truth, and Existence," *loc. cit.*

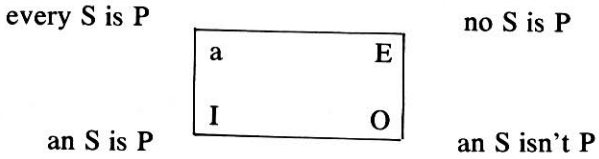
S is P' and 'an S isn't P' will be false – PLEM will fail. What of 'every S is P' and 'every S is nonP'? When the subject is empty (i.e. both I and O are false), a and e will be undefined (in effect, a is defined as the conjunction of A and I while e is defined as the conjunction of E and O). That is why we can say 'a unicorn is in my house' is false, it's contradictory, 'no unicorn is in my house', is true, but cannot say 'every unicorn is out of my house' (= 'every unicorn in non-(in my house)').

Failure of existence for referents in factual discourse is only one source of vacuousity (i.e. PLEM failure). PLEM also fails to hold whenever a subject is underdetermined with respect to its predicate. Suppose I say 'a man will walk on Venus in 2190'. Maybe. We just don't know yet. The subject is underdetermined (indeed, undetermined for now) with repect to the predicate. We *do* know now that either a man will walk on Venus in 2190 or no man will (i.e. LEM holds), but we don't know which. We are following Sommers in saying that sentences of the form 'every S is P' and 'every S is nonP' (a and e) are undefined whenever I and O are both false (as when, in factual discourse, 'an S, fails to refer) or whenever I and O are undetermined with respect to truth-value (as when 'an S' is underdetermined with respect to 'P' and 'nonP'). In either case PLEM will fail to hold.

Suppose PLEM does hold. Then either I or O is true, and either a or e is true. In fact, in such cases A = a and E = e. For such nonvacuous cases, in other words, A will imply a and E will imply e (the converses always hold). To see this notice, for example, that if A is true O is false (LNC); if O is false then I is true (PLEM); if I is true then e is false (LQO); if e is false then a is true (PLEM); therefore, if A is true a is true. So for nonvacuous cases we could simplify the augmented square to give us



The traditional rule of obversion (i.e. A = a, E = e) obtains only for this square, i.e. only for nonvacuous, PLEM-governed sentences. One version of the simplified square is the *traditional square*.



Consider now an S (say an egg). Is it P or nonP? To some this question seems very odd. To others it seems in perfect order. For the latter, no matter what P is, S is P or nonP. Our egg is green or nongreen (O.K.); it is round or nonround (O.K.); it is happy or unhappy (??); it is patriotic or nonpatriotic (!); it is poetic or nonpoetic (!!). In a series of studies beginning in 1959 Sommers([14]) attempted to establish and reinforce the notion that not every predicate is appropriately, sensibly predicable of every subject.([15]) Some things *can* be sensibly said of our egg, others cannot. Notice that what can be sensibly said of a thing need not be true of it. Thus we can sensibly say of our egg that it is green. In general if 'P' is predicable (can be sensibly predicated) of a given subject then so can any term contrary to 'p'([16]). For example, 'green' is predicable of whatever 'red', 'yellow', 'bleu', 'pink', etc are predicable. The *logical* contrary of a term can be defined as the disjunction of all of its contraries. So 'nongreen' = 'red or yellow or blue or pink or...'. This means, in effect, that when considering predicability we can ignore the distinc-

([14]) See especially: "The Ordinary Language Tree," *Mind*, 68 (1959); "Types and Ontology," "Predicability," and "Structural Ontology."

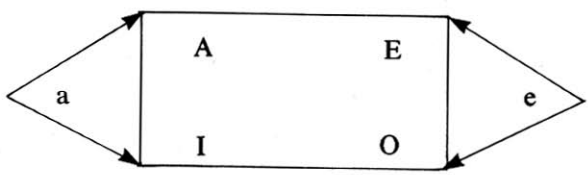
([15]) I'm ignoring here the subtle, but often very important distinction between predicability and spanning. See G. Englebretsen, "Elgood on Sommers' Rules of Sense," *Philosophical Quarterly*, 21 (1971); G. Englebretsen, "Vacuousity," *loc. cit.*; and C. Sayward and S. Voss, "Absurdity and Spanning," *Philosophia*, 2 (1972).

([16]) See Sommers: "Types and Ontology," "Predicability," and "The Ordinary Language Tree," and Englebretsen: "Knowledge, Negation, and Incompatibility," *Journal of Philosophy*, 66 (1969), and "A Note on Contrariety," *Notre Dame Journal of Formal Logic*, 15 (1974).

tion between a term and its negation (logical contrary). 'P' and 'nonP' are always predicable of the same things. Sommers' notation '/P/' (reminding us of the mathematician's notion of an absolute number) can be used to indicate either 'P' or 'nonP'. '/P/' is read 'absolute P'. If an S is P then it is /P/ (the converse does not generally hold). Likewise, if S in nonP it is /P/.

Suppose now that we have an S which is not /P/ (e.g. our egg, which is not /poetic/. If 'an S is /P/' is false then so are 'an S is P' and 'an S isn't P' (= 'S is nonP'). So PLEM will not hold – the sentences are vacuous. In other words, a sentence will be vacuous when its predicate is impredicable of its subject. Such sentences are often classed as category mistakes; they are senseless. Category mistakes, like sentences with empty subjects and sentences with subjects underdetermined with respect to their predicates, are vacuous, false in their I and O forms – PLEM does not hold.

We can summarize what has thus far been established by the following augmented square, to which we add arrows to indicate valid implications.



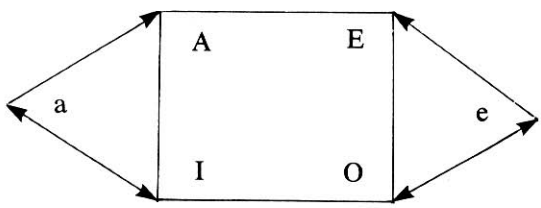
For nonvacuous cases we add arrows from A to a and from E to e.

3 Aristotle generally ignored singular subjects.([17]) The scholastics tended to take sentences with singular subjects to be implicitly universal. The view adopted in the present study is that all assertoric categoricals consist of a subject and a predicate. Moreover, a subject is a syntactical complex, consisting of a term and a quantifier. Reference is the role of subjects, and is achieved by the combined efforts of the quantifier and the denotation of the subject term. Let us say that the denotation of 'logician' is Aristotle, Leibniz, Frege,

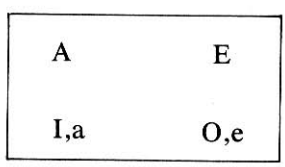
([17]) But see G. Englebretsen, "Singular Terms and the Syllogistic," *The New Scholasticism*, 54 (1980).

Russell... The universal subject, 'every logician', refers to the entire denotation of 'logician', i.e. Aristotle, and Leibniz, and Frege, and Russell, and... The particular subject, 'some logician', refers to an undetermined (perhaps determinable) part (perhaps all) of the denotation of 'logician', i.e. Aristotle, or Leibniz, or Frege, or Russell, or... (with inclusive 'or'). Scholastics took singular subjects to be implicitly universal since they refer to all of their denotations. Thus 'Socrates' denotes Socrates and refers (when in the role of logical subject) to all of that denotation, i.e. Socrates. Later Leibniz([18]) and still later Sommers([19]) discovered that singular subjects could be taken as implicitly either universal or particular – arbitrarily. For the reference of 'some Socrates' is just a part of the denotation of 'Socrates', which, since it has but one part, is again just Socrates. So 'every Socrates' = 'some Socrates' = 'Socrates'.

The fact that singular subjects have this "wild" (Sommers) quantity has interesting consequences for the logical relations displayed by a square of opposition. The singularity of the subject can be manifested by recognizing the implications from the I form to the a form and from the O form to the e form. Thus:



Indeed, this could be simplified as a *singular square*.



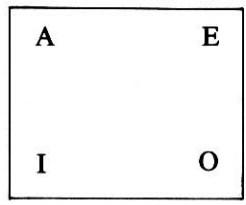
In the case of vacuous singular sentences the I,a and O,e forms will be false and their contradictories, A and E, will be true.

([18]) *Leibniz: Logical Papers*, ed. G. H. R. Parkinson (Oxford, 1966), p. 115.

([19]) See "Do We Need Identity?", "The Calculus of Terms," and *The Logic of Natural Language*.

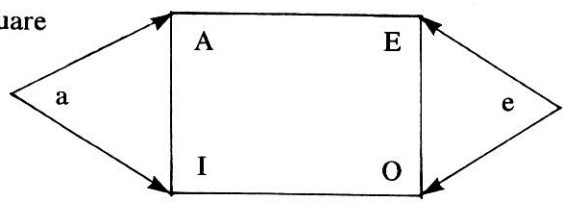
4. I want to summarize at this point the features of the augmented square of opposition and then offer some sample sentences. The augmented square is arrived at by adding to the primary square.

Primary Square



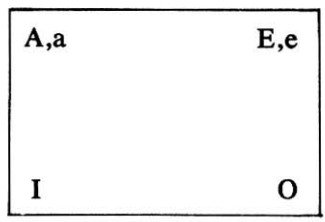
The primary square is governed by LEM and LNC. The augmented square adds positions for universally quantified forms, a and e. Keep in mind that primary reference is achieved by indefinite, particularly quantified, or singular terms. Reference by universally quantified terms must be considered secondary. Indeed, the universal forms are defined in terms of the primary sentence forms.

Augmented Square



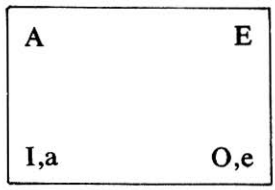
LEM and LNC still apply. LQO and LIC also hold. Whether the law PLEM now holds depends upon what further nonlogical, extrasyntactical information we have. PLEM will hold only if the subject is nonempty, determined with respect to the predicate, and the predicate is predicable of it. Otherwise, PLEM does not hold – the sentences are vacuous and false in their I and O forms. When PLEM holds (non-vacuous cases) arrows of implication from A to a and from E to e can be added. Or, alternatively, we can produce the simplified

Nonvacuous Square



Knowledge that the subject is singular is an extra bit of semantic information that can also be displayed on the square by adding implication arrows from I to a and from O to e, or simply

Singular Square



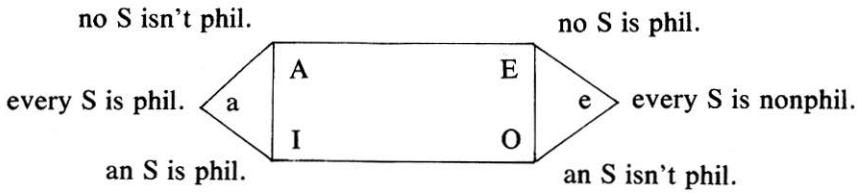
Finally notice that if we know that our sentences are both singular and nonvacuous we can add arrows from A to a, E to e, I to a, and O to e. This amounts to combining the nonvacuous and singular squares, which simply collapse together into the

Singular, Nonvacuous 'Square'

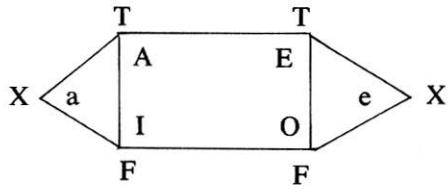
A,I,a---------E,O,o

Note that these various simplifications of the augmented square always require additional, extralogical information. In the absence of any such information the augmented square displays all we know of the logical relations which hold among the various sentence forms.

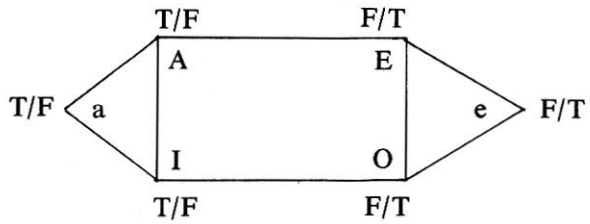
Now some examples. Consider the sentence 'an S is philosophizing'. We have no knowledge of 'S' here, so the most we can offer is an augmented square.



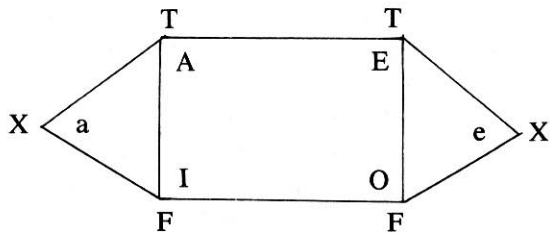
Let 'S' be 'snake'. Since 'philosophizing' makes no sense of (is impredicable of) 'snake', 'a snake is /philosophizing/' is false. Thus the original sentence is vacuous. It is false in its I and O forms. The case will likewise be vacuous when 'S' is 'Saturndweller', since here the subject is empty. Likewise for 'S' as 'Santa's elf' since the elves which help Santa are underdetermined, in the stories and tales, with respect to their intellectual activities. For such vacuous cases we can use an augmented square with truth-values added to indicate the effects of vacuousity ('X' stands for 'undefined').



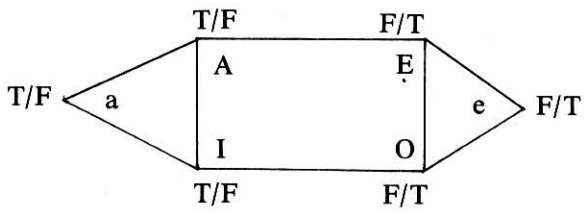
Now let 'S' be 'scientist' – a clearly nonvacuous case.



Suppose 'S' is a singular term which is empty (say 'daughter of Prince Charles') or impredicable by 'philosophizing' (say '6'), or underdetermined with respect to 'philosophizing' (say 'Sinbad'). Then we have



Finally, let 'S' be 'Strawson'.

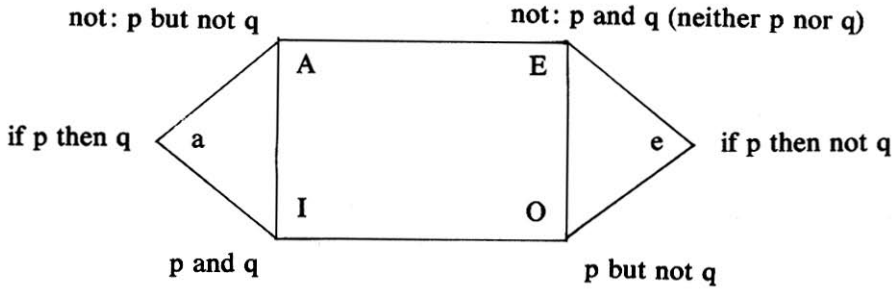


5. In this final section I want to show that even the so-called truth-functionals (compound sentences) find their place on the square of opposition. Moreover, the discovery of square relations among compounds reveals further important and interesting parallels between categoricals and compounds. Not the least of these is the one between the paradoxes of material implication and the paradoxes of existential import.

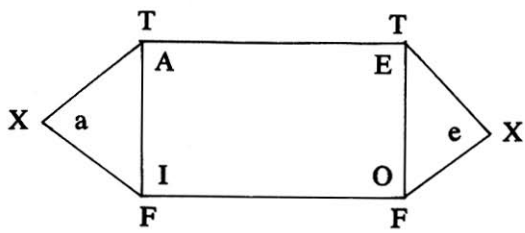
The old view was that compound sentences could be reduced to categorical forms.([20]) Kant held the view that categoricals and compounds are completely separate and irreducible to one another. And contemporary logicians generally take categoricals to be reducible to compounds since they must be parsed in terms of conditionals, conjunctions, etc. Sommers has opted([21]) for a view once held by Pierce.([22]) According to this view, categoricals and compounds are mutually independent but share a common underlying formal structure. The result, for Sommers, is that one can build an algorithm which

([20]) See, for example, Leibniz, *op. cit.*, pp. 17 and 66.
([21]) In *The Logic of Natural Language*.
([22]) See C. S. Pierce, *Collected Papers* (London, 1933), 4.3.

can be used to analyze inferences involving either categoricals or compounds. Compound forms are not reducible to or from categorical forms, but they are isomorphic with those forms. This isomorphism is sufficient to permit a single algebra to model inferences involving either categoricals or compounds. Thus a conjunction is syntactically isomorphic to a particular, while a conditional is isomorphic to a universal. Letting 'p' and 'q' abbreviate two different sentences, we can construct an augmented square with compound sentences replacing their corresponding categoricals.



All the relations which hold for the categorical square also hold for this compound square. In particular, whenever I and O are both false a and e are undefined (A and I are then both true since LEM, as always, still holds). Vacuousity occurs whenever both I and O are false, i.e. whenever 'p' is false. In such cases both a and e are undefined. Just as universal forms are defined by particular quantity, denial, and predicate negation (e.g. 'every S is P' = 'no S isn't P' = 'not an S is nonP') only for nonvacuous cases, so conditional forms are defined by negation and conjunction (e.g. 'if p then q' = 'it is not the case that p but not q') only when 'p' is true. When 'p' is false we have vacuousity.



Given the usual notion of material implication now in use, a false sentence materially implies every sentence. For example, 'Napolean won at Waterloo' materially implies '2 + 2 = 6'. Indeed, this notion of material implication, along with the standard parsing of universals in terms of conditionals, also leads to the paradoxical view that every predicate holds of an empty subject. For example, since there are no unicorns, every unicorn is blue. For, 'every unicorn is blue' is parsed as 'if anything is a unicorn then it is blue', a conditional whose antecedent is false. But on our view, both 'if Napolean won at Waterloo then 2 + 2 = 6' and 'every unicorn is blue' are undefined since their corresponding I and O forms are all false. While in nonvacuous cases A=a and E=e, the paradoxes of material implication and existential import are easily avoided by the recognition of the A/a and E/e distinctions for vacuous cases.

The augmented square of opposition preserves the relations found on the old square while at the same time recognizing linguistic and ontological distinctions which result in a richer array of logical relations. The added information displayed on an augmented square permits it to have a much wider range of applicability and far greater flexibility than has hitherto been suspected.

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