II Operators

0. Method, and elementary arguments.

We begin with words, not bound morphemes. Their only structural property (i.e. their only classification) is by their argument-requirement, which determines their order of entry into a discourse (or sentence). The only arguments which we will recognize are word-classes previously defined by argument-requirement. Thus no words will be defined as being restricted to operate on some ad hoc set of words as arguments. We will also avoid as much as possible having a single word appear in more than one classification (what Bloomfield called class-cleavage); but this will not always be possible.

The above program can be satisfied because we can define first a set of elementary arguments, i.e. words whose argument requirement is zero. These are a subset of nouns, N, generally those of concrete meaning (in any case not relational ones like father, and not derived ones like truth, suggestion), and also indefinite nouns like thing, person (someone), that, set. Each operator has inequalities of likelihood of occurrence (called selection) in respect to the individual words in its argument domain. Some operators have relations whose properties can be stated in a general way, not merely by listing the inequalities. And certain operators are similar to each other in their selection.

1. Elementary operators (on elementary arguments only):

O_n, etc.

1.1 O_n: sleep: John sleeps

old: John is old

up: John is up

The differences between verbs, adjectives, etc. as operators are due to tense (IV 2). It is not clear whether there are nouns in O_n: the classifier nouns

(is a man, is a mammal) should perhaps be considered as the second argument of the O_{nn} is a member of. Then A cat is a mammal is in effect derived from A cat is a member of (the set) mammal, with the appropriate verb is member of the set being reduced to is. One difficulty with this is that classifier-nouns often have adjectival forms: we would have to say that this does not make them direct operators, but the adjective form is due to a further (aspectual) operator on the is-member-of with its second argument (the classifier-noun).

Certain occurrences of O_n as apparent O_{nn} (John slept a long sleep; or John dreams, John dreamt a dream) can be analyzed as noun-form variants (in many cases re-using the operator word) of a bounding "perfectivizing" operator on the O_n (i.e. on sleep, etc.).

1.2 O_{nn}: eat, wear: John eats fish, John wears hats.

near: John is near the house.

father: John is father of Frank.

The occurrence of these operators without second argument is due to zeroing (III 1.3): John eats (but *John wears), John is near, John is (a) father. Perhaps in some cases a word that appears both as O_n and also with a second argument may be independently a member of both classes. Thus it is not clear whether John thinks has an independent O_n, or only a zeroing from John thinks things (or the like) as indefinite of John thinks that S (where S indicates any sentence).

In many languages the second argument is marked not only (or necessarily) by order but also by an affix or preposition (accusative, dative, or genitive case). If some operators have one case on their second argument, while other operators have another, we merely consider the case-affix part of the operator: e.g. rely on. However, if an operator X, can have two different cases, we would have to analyze the case-affix or preposition as an O_{on} operator connecting X to the N which had seemed to be second argument of X.

1.3 O_{nnn}:

It is not certain that English has operators whose argument requirement is three or more elementary arguments. Some apparent O_{nnn}, such as represents and is ambassador occur also as O_{nn}, in situations which are not necessarily analyzable as due to a zeroed indefinite third argument: X represents his school at this meeting, but also X represents the new wave; X is is ambassador of France to England but also X is ambassador at large, X is the king's ambassador. Also, most apparent O_{nnn} have several possible prepositions before their third argument (represent at the conference, represent in this circle, represent to a given government); in most cases the best analysis seems to be at, in, to, etc., as O_{on} operators on the pair: (a) represent (and similar O_{nn} operators) and (b) conference, government, etc.

A more difficult case is seen in put, for which an O_{nn} form does not seem to exist: John put money on the table, but *John put money. However, there are many different prepositions before the third argument, and many adverbs in place of this: John put money in a box, John put money near the lamp, John put the book down, John put the picture up; for some second arguments the adverb gives an extended or almost metaphoric meaning, as in John put the cat out, John put the idea over. We cannot say that the arguments of put are two nouns and an adverb (or PN), because in the present theory no parts of speech are primitive entities, and the arguments of an operator can only be word classes defined previously in the grammar. The only convenient way of analyzing put in terms of the present theory may be to treat it as a variant of an O_{no} operator such as cause, which the cause can take when the operator under it is locational: John caused the picture to be up John put the picture up. The restriction on the third argument of put thus becomes a restriction on the put- variant of cause with respect to the second argument of the second argument of cause.

A different problem is met with in between, as in Paris is between Versailles and Vincennes. We can look for a derivation from something like Paris is in an interval which is bounded by V. and V. (with between as morphophonemic variant of in an interval which is bounded by); here the and is a bi-sentential operator on Versailles bounds the interval, Vincennes bounds the interval.

Analyses such as the above for put and between are a step in the direction of distributionally-based vocabulary factorization. Such factorization, though based on the distribution of the existing vocabulary, can go beyond the system presented here, and requires careful preparation.

2. Operators on one discourse only: O_o

fact: His being French is a fact.

question: His being French or Belgian is a question. Whether he is French or is Belgian is a question.

important: His being French is important. For John to see this is important.

possible: His being at fault is possible.

continue: The child's crying continued.

When a discourse (sentence) becomes an operand of a further operator it receives an indicator -'s-ing, or that...; certain operators impose whether... on their operand, which consists of or on two or more discourses. The explanation for this is given in 4 below. These indicators can be considered portions of each O_o operator, which are attached to the operand of the O_o. An operand N_1 V N_2 can receive not only the form N_1's Ving N_2 but also N_1's Ving of N_2, Ving of N_1 (especially if V is O_o), N_2's Ving by N_1. (See IV 3.5.) If the operand receives a tense, (see IV 2), the tense enters the that... or whether... form. Operators which are characteristically before their operands in time can attach the variant that...should... (or that... with no tense), or for...to... to their operand. We do not know what determines

the use of one -ing form or another, nor why certain operators impose to... on their operand without having the above time-relation. The facts can readily be stated, but in the present theory we would wish to account for them by zeroed operators or by likelihood relations, not by free variation or by creating subsets and restrictions. The analysis of whether... presents a problem for the present theory, because the operators which impose it require or (i.e. a disjunction of discourses) as operand. It may be necessary to analyze these operators as derived from 0_{oo} (see 5.2).

In some 0_o operators which have that... as well as whether... or... on their operands the whether...or... is due to an intermediate zeroed appropriate operator: Whether he should stay or go is a problem←The alternative as to whether S_1 or S_2 is a problem. This differs from Whether he should stay or go is the question or ...is what I asked.

Certain apparent 0_o nouns have received their noun-form secondarily, due to durativizing aspectual operators on 0_o adjectives, or on 0_o or 0_{no} verbs: His being at fault is a possibility; His returning home was joyous to us, His returning home is a joy. Others are due to a reduction from appropriate-verb to is: His learning French involves a problem (or: His learning French involves the problem of whether S_1 or S_2)→His learning French is a problem. All these apparent (derived) 0_o nouns do not take the same variants (transformations) that the original 0_o nouns do. Thus The fact of his being French..., The fact that he is French...; but The joy in his returning home..., *The joy that he returned home...; and The problem of his learning French..., The problem in his learning French..., *The problem that he is learning French....

An extremely important but little-recognized set of 0_o operators are the aspectual ones, such as the "perfective" or "momentaneous" (occur) at a moment, or the "imperfective" or "durative" (last) throughout a period, or the "bounded" by (or up to) a moment. As a matter of selection, certain operators

occur normally under the momentaneous (e.g. arrive), others normally under the durative (e.g. sleep), others neither or both (e.g. speak). As will be seen below, these aspectual operators generally zeroed, but leave effects on the tense suffixes which the operators (verbs) under them receive (especially in languages with richer tense systems, such as French), on the combinability of the verbs with before and after, and on the affixal shifting of words as between verb-form, noun-form, adjective-form (e.g. receptive is more durative than receive).

Certain 0_o verbs or adjectives, mostly having an aspectual (durativizing or momentaneous) effect are also found (in the same or variant form) before their -ing or to... argument: The child continued crying, The child continued to cry. This variant position will be discussed in III 2.6. There are also aspectual 0_o with prepositional form which do not have this variant: He ate it up, from He ate it.

A particular set of these (can, could, may, might, shall, should, and the combination of operators need not and optionally ought not) have neither -ing nor to... on their immediate verb-argument, and appear primarily before it (i.e. in the above variant position): The child can talk. In the standard position, after the argument, these operators have only suppletive paraphrases: something like The child's talking is an ability of his. These operators have their origin in 0_{no} verbs which occurred properly after their first argument: can as operator on child and a sentence whose verb is talk. When this latter sentence permanently zeroed its subject because it was always the same as the subject of can, the can became no longer an 0_{no} operator, but an 0_o operator, e.g. purely on child talks (even though child was the subject of can as well as of talk). As 0_o, can can be paraphrased by an 0_o after talk, carrying a reference indicating that the subject of talk is also the subject of can. The word will commonly considered to be in this set is now best analyzed as a

variant of after, comparable to the -ed variant of before, i.e. a tense. (The original O_{no} will also exists: He wills that she should win.) Could, might, should, would in some of their occurrences are can, may, shall, will plus past tense (see IV 2).

Another O_o operator with the above-mentioned variant position is not, which is indirectly aspectual, having a durativizing effect. In the basic O_o position we have to assume is not the case, is not so or the like; the usual form, not, is in the variant position: His being responsible is (was) not the case, He is (was) not responsible. In the present theory, these forms arise from the tense entering after the not or aspectual or other operator has entered (and after it has thereupon taken the variant position, if it does at all). (If not, or continue, enters after the time operator, we would get is not before and continues to be before.) Whereas on the other aspectuals, as for all operators, X, before and as operators have as variants -ed and as suffixed to X, on not the before and as are placed before the not, with the word do carrying these suffixes: He continued to study, He did not study.

3. Operators on elementary arguments and one discourse.

3.1 O_{no}

A simple case is seen in John reported Frank's escaping the police. In the passive many of these look like O_{on}: Frank's escaping the police was reported (by John). For some operators, the second (i.e. discourse) argument has a particular preposition (case, as in 1.2): John knows of Frank's escaping the police. There are some operators for which it is difficult or impossible to find an -ing form of the operand: I believe his being innocent is dubious (I believe his coming more so), and I believe in his being innocent uncertain, while I believe in his innocence is derivable from I believe in the situation of his being innocent: this is derivable from the O_{nn} operator believe in (I believe in him) joined by which to His being innocent is a situation

(with the situation of his being innocent→his innocence, (as in III 2.3). As to the second argument of the O_{no} operator believe, we may have to accept the that... form rather than the -ing form; this is a situation more common in French than in English.

One might consider an alternative analysis in which report, know, believe, etc., would be taken as having for second argument not a discourse (sentence) but a noun: fact, or the like. Then I know that he is here would be analyzed as I know the fact that he is here←which on I know a fact, That he is here is a fact. Here, fact would be the second argument of know, and also the operator on He is here, and it can be zeroed here as intermediate operator (III 1.4). However, some of the O_{no} have no noun which can occur instead of a discourse as second argument: e.g. hope, believe (but perhaps believe a statement). One could, of course, use the indefinite pronoun something, or the like: I hope something, I believe something, I know something. But this something is doubtfully an operator: That he is here is something is only with difficulty available as a component for I believe something which is that he is here, which is what would be needed as a source for I believe that he is here. A more serious objection to this analysis is that, aside from the indefinite pronouns, the nouns needed as replacements of the second argument of O_{no} operators are quite different from the nouns which are second arguments of O_{nn} operators: eat has meat, ice, etc., and with low likelihood box, oxygen, etc., but not at all fact, statement; know, hope, believe can have fact, statement, situation, but not at all meat, oxygen, etc. Hence this analysis does not reduce the O_{no} set to O_{nn}; the difference between the two sets of operators remains as different sets--not different selections--of second arguments. Since in the present theory it is possible to define the arguments of each operator set in terms of previously defined word-sets, it is preferable to give the second argument of know, hope, etc., as the set of operators

(or discourses) rather than as the only indirectly definable set of fact, situation, etc. (which are merely certain O_o operators on discourses).

Most O_{no} operators have a rather strong preference for human or higher-animal subjects (first argument). However, it is not possible to exclude any elementary argument from being a subject of these operators, at least as a far-reaching or fairy-tale or nonsensical use: The balloon hoped the little boy would buy it. Hence the human first-argument is a strong selection of these operators, rather than a specific subclass to which they are restricted.

As to the operand-indicator which the O_{no} imposes on its second argument, certain O_{no} impose different indicators in addition to or instead of those listed in 1.2. Thus for see, hear we find not only I saw John's crossing the street, I saw that John crossed the street, but also I saw John cross the street; prevent has I prevented John's crossing the street (but not *I prevented that John crossed the street or *Iprevented John to cross the street) and also I prevented John from crossing the street. It may be possible to consider these other indicators as simply variants of the -ing form, for the particular O_{no}.

As in the case of O_o, there is a subset of O_{no} operators which impose whether on their discourse-operand, in which case that operand is restricted to being or on two or more discourses: John wondered whether Frank arrived is derivable by appropriate-zeroing from John wondered whether Frank arrived or Frank did not arrive. And as in the case of O_o, we are left with a restriction, which is unsatisfactory for the present theory: the second argument must be or, i.e. a disjunction of discourses. An alternative analysis will be presented in 5.2.

A very important operator in O_{no} is I say, I report. It will be seen below that this operator has to be assumed to have existed (and usually to have been zeroed) at the head of every discourse, and at many interior points of a discourse.

3.2 O_{on}: e.g. surprise in John's crossing the street surprised me.

Passive and passive-like transformations yield O_{no}-like forms: I was surprised by John's crossing the street, I was surprised at John's crossing the street. The human selection (in the second argument) is similar to that in O_{no}.

A type of O_{on} which is crucial for many analyses is that in which the operator gets the form of a preposition (IV3.1) and relates its first argument--an operator--to nouns of time, or place, or amount, or manner, or other widespread properties: on Tuesday, in 1973, at 3 P.M., at a moment, during the day, throughout a period, till 3 P.M., since morning; in Paris, near the road; up to an amount, in an amount, in a degree; in a slow manner (←in a manner which is slow); etc. There are also O_{on} of this prepositional form which have narrower selections, relating particular operators (in the first argument) to particular relevant nouns: e.g. N's representing France is at this conference, or to this government.

3.3 O_{nno}: e.g. John told Frank of Mary's winning the prize; John asked Frank whether Mary won the prize or was leaving town. Some impose a preposition on the discourse-argument: John informed Frank of Mary's winning the prize. John blamed Mary for losing the money; John blamed the losing of the money on Mary.

4. Operators on two discourses: non-associative.

E.g. John's telephoning caused Frank's return; so also entail, involve, resemble, underscore, etc. Some of these also occur as O_{nn}, e.g. resemble, and others occur also as O_{no}, e.g. possibly cause. Some O_{no} cases can be analyzed as appropriate-zeroings from O_{oo}: e.g. John caused Frank's return← John's actions caused..., The storm caused the toppling of the trees←The occurrence of the storm caused... This analysis fits the fact that nouns which don't appear as first arguments of cause also don't appear as first arguments of the appropriate-verbs act, occur. Thus *The house caused Frank's return

(except in the sense of the zeroing of some discourse-appropriate verb such as Having to do something about the house caused Frank's return).

Certain cases of operators which appear both as O_{oo} and as O_{nn} can be analyzed as original O_{nn}: Thus given 5 exceeds (or: is more than) 3 and His reading exceeds (or: is more than) her reading, we can analyze the latter as His reading is in an amount which exceeds (or: is more than) the amount of her reading He reads more than she. And given 1973 preceded (or: was before) 1974 (here precede is O_{nn}) and His election preceded (or: was before) her election, we can analyze the latter as His election was at a moment which preceded (or: was before) the moment of her election. These analyses will be seen to regularize these apparent O_{oo}, especially in the case of the comparative (IV5.1).

As with O_{nn} and O_{no}, some O_{oo} operators (some verbs and all adjectives and nouns) impose a preposition on their seocnd argument: e.g. differ from, reduces to.

In all O_{oo} the tensing of the first argument (IV 2) changes the grammatical form of the O_{oo} from a bi-sentential verb to a bi-sentential preposition: John telephoned, causing Frank's return; He was elected, before her election. In some, tensing the second argument leads to dispensing with the operand-indicator (that); the effect of both tensings is to make the O_{oo} into a subordinate conjunction: He was elected (IV 3.3) before she was elected. Many O_{oo}, however, retain the second-argument indicator (even if only in zero form) and do not become complete conjunctions: He was elected due to her election; I will go, provided that she goes (or with zeroed that: I will go, provided she goes).

It is in these O_{oo} that the essential effect of the operand indicators is seen. Since they are non-associative in meaning, an O_{oo} on an O_{oo} would lead to major ambiguities if there were no operand indicators: If the first

argument of an O_{oo} is itself an O_{oo}, we would have $S_1O_{oo}S_2$ as first argument followed by the new O_{oo} and its second argument S_3--in all $S_1O_{oo}S_2O_{oo}S_3$. If the second argument of an O_{oo} is itself an O_{oo} we would have the first argument, S_1, followed by the new O_{oo} and its second argument $S_2O_{oo}S_3$ (produced by the new-operand O_{oo})-- in all $S_1O_{oo}S_2O_{oo}S_3$. In mathematical notation these two situations are distinguished by parentheses, which indicate what operates on what: $(S_1O_{oo}S_2)\ O_{oo}S_3$ and $S_1O_{oo}\ (S_2O_{oo}S_3)$. In language, the effect is obtained by the above-mentioned indicators, i.e. phonemic changes (chiefly additions) which the operator imposes on its operand. Thus, for S_1 = John telephoned, S_2 = Frank returned, S_3 = everyone was angry, we have: $(S_1O_{oo}S_2)\ O_{oo}S_3$ = John telephoning leading to Frank's return caused everyone's being angry; $S_1O_{oo}\ (S_2O_{oo}S_3)$ = John's telephoning led to Frank's return's causing everyone's being angry. The importance of these operand-indicators for distinguishing the different associations (parentheses-placings) is seen in the fact that those O_{oo} which are largely associative in meaning (primarily and, or) do not impose these indicators on their operands: John telephoned and Frank returned and everyone was angry has no indication of which and operated on which, nor does this in most cases make any difference in meaning. So also for wh (see 7).

There is also an apparent set O_{noo} as in John attributed his winning the prize to his having worked hard. However it may be that all of these can be derived by the distribution-based vocabulary factorization (end of 1.3) to an O_{no} (e.g. consider) whose second argument is an O_{oo} (e.g. cause, due to): John considered that his winning the prize was due to his having worked hard.

5. Associative operators on two discourses: and, or.

5.1 As noted in 4, the O_{oo} whose repetition is generally associative in meaning do not impose indicators on their operands: John phoned and Frank returned in contrast with John's phoning caused Frank's return. Hence they are (coordinate) conjunctions between two sentences rather than (as in 4) verbs

between two nominalized sentences; the (subordinate) conjunctional forms in 4 are secondary being derived from the verbs by tensing the two operands.

Some additional coordinate conjunctions can be derived from and bearing particular operators of a reducible type. Thus but and contrary to expectation or the like.

All types of occurrence of and can be derived, to all-around advantage, from and on sentences (i.e. on discourses). This will be seen under the reciprocal and collective verbs and elsewhere (IV 6.6,7).

5.2 The operators which impose whether.

It was seen in 2 that the O_o operators which impose whether on their operands (e.g. is a question) present a problem, because their operand is restricted to being or on two sentences. A similar problem arises for the apparent O_{no} operators ask, wonder, etc. The fact of the restriction cannot be eliminated, but it is possible to give such a derivation of these operators as makes the restriction arise only in their variants. We start with unrestricted or on two sentences (the or being of course repeatable). On this we take O_o and (as at the end of 4) O_{no} operators which are free to act on any operator, including a single sentence or any O_{oo}. Among these are some operators which are especially frequent (relatively) on or (with its operand sentences): Whether he will go or he will stay is a toss-up, ...is a question, ...is unclear; I wonder whether he will go or he will stay, I don't know..., I know..., I must decide.... All or almost all of these further operators also act on single sentences and on other O_{oo}, in which case they impose -ing or that... on their operand: His getting away with it is a question, That he will go is unclear; I wonder about his going, I wonder that he went. When they act on or they impose, instead, -ing or whether...: His going or staying is a toss-up, His going or staying is unclear; I wonder about his going or staying. When operators impose that... on or, there is a zeroed

intervening operator on which the that... had been imposed: I decided that he will go or stay←I decided that there is a choice as to whether he will go or stay, as contrasted with I decided whether he will go or stay.

There are also O_{nno} on or, e.g. I asked her about his going or staying, I asked her whether he will go or stay. Such operators have an appropriately different meaning when they act on or than when they act on other operators, e.g. I asked her that he go immediately (with tenseless operand because it is necessarily later than its operator), I asked her that he go or stay but stop hesitating (i.e. ...that it be decided whether he goes or stays). Some problems nevertheless remain with the whether operators.

6. Metadiscourse operators: O_o.

In addition to the operators listed above, there are certain O_o and O_{oo} operators which contain the addresses of arguments under them. Words referring to locations in the same discourse occur in language, e.g. the latter. Here we propose explicit address-bearing operators. As an example of the O_o: on I bought a book and she bought a book there may be the operator has second argument of first argument same as second argument of second argument (written has 1.2 same as 2.2). Here 1.2 and 2.2 are the addresses, locating particular arguments under the and on which the address-bearing O_o is operating. The operator above is the basis for the variant I bought a book and she bought one. Operators which contain an address in their arguments will be called meta-discourse operators. They may seem to be peculiarly complex and merely a figment of theory, but in fact they are inescapable for a simple analysis of language. For, as will be seen below, such operators account in a natural way for zeroing an pronouning, without appealing to any further grammatical apparatus than exists otherwise in grammar. Without these operators, one would have to announce the facts and conditions of zeroing and pronouning in various meta-linguistic statements--statements made in the grammar about the sentences

of the language. However, if we consider such grammar-statements, we see that they are (or can be) made overtly in the same language which they are describing, and that they have to include the same information as is given in the operators exemplified above. This makes possible a different approach, which reduces the mechanics of the zeroing and pronouning. In the usual grammatical approach we have: (a) the information about sameness, which is crucial to understanding the sentence, is known to the speaker and hearer (how?) outside the sentence to which it refers; and (b) a grammatical description outside the sentence directs us to the given sentence and provides instructions about changing the word-shapes to zero and pronoun. Instead of this, we can say that the information about sameness is given (to the hearer) in the sentence itself (together with all the other information in the sentence). Naturally, the information about sameness can be given only after (in the order of operator entry) the two words which are the same have both entered the sentence: hence it must be an operator on whatever brought the two words together in the sentence. And when the sameness-operator specifies which words are the same, the simplest way of addressing them is by their entry-order in the operator history of the sentence; the alternative, to say that it is the nth word of the sentence, requires knowing the entry-order of the operator and then making in addition a calculation of how this results in the word-order. It will be seen (III 1, 2.4) that using this addressed information for pronouning and zeroing is not different from the other ways of establishing variants (III).

The sameness-operator may say not that the two addresses have the same words, but that they refer to the same individual (the same referent). Thus I wrote John and I phoned John has the variant I wrote and phoned John only if the operator on and is has in 2.2 the same individual as in 1.2, and not if the operator were has in 2.2 the same word as in 1.2. (But same word, or more briefly same, is sufficient for she bought one in the example above). Here the word individual can be considered an operator on the operator same.

Of course, the particular wording of the proposed metadiscourse operators is arbitrary: we need the simplest wording sufficient to determine the various zeroings and pronounings which occur. The relevance of these operators will become clear in III 1, where it will be seen that assuming a few different metadiscourse operators suffices to give in a regular and non ad-hoc manner precisely the many repetitional zeroings and pronounings which are actually found.

It may also be useful to assume certain one-address metadiscourse 0_o acting on certain operators, e.g. in respect to the first argument (of the argument) operating on continue, etc., to determine the permuting of continue in III 2.6.2 (see IV 5.5).

In addition to the two-address operators, which give essential information about sameness, there are one-address metadiscourse operators which give grammatical and dictionary information about the words at particular addresses in a sentence. Thus John ate can carry the operator is a sentence of English, and also has an 0_{nn} operator, and also has a zero variant of the indefinite noun ("pronoun") as second argument. The relevance of these grammatical operators on a sentence is seen in the fact that an otherwise unknown sequence of English syllables becomes a sentence of English if we can add to it operators which say, for example, that the first portion of it is a (little-known) elementary argument of English and the remainder of it is an 0_n verb of English. Thus the decisive grammatical question of whether a given phoneme sequence is a sentence depends on the metadiscourse operators on that phoneme sequence.

7. Metadiscourse 0_{oo}: wh-.

There is one metadiscourse operator which is 0_{oo} rather than 0_o: this is the wh- which makes the relative clause and indeed all sentence-segments which the grammarians would call modifiers - whether or noun, or verb, or sentence, or whatever (III 1.3, 2.4, 2.5). Operators on a sentence can become parts of a "noun-phrase" or any other "word-phrase" (i.e. word with its modifiers) only via wh-.

We consider first the more obvious cases of wh-, in the noun-phrase on a given N_1:

In the first place, it is inescapable that we have to do here with a second sentence which has been connected to the N_1. The alternative would be to say that the segment headed by wh- is something new, to be called a modifier, which is added directly to the N: as though The man who was here left is formed from left operating on The man who was here, and The man whom I saw left is formed from left operating on The man whom I saw (this noun-phrase being formed in turn from whom I saw being added to the man). There are various disadvantages with such an analysis, one of them being that if we consider all possible wh- modifiers on N_1 we find that they are all sentences containing N_1 with N_1 omitted: e.g. was here, I saw. There is no independent structural characterization of the segments which can be added to N_1; we have to say that these segments are sentences which contained N_1 and in which the N_1 has received zero shape.

Secondly, once the segment brought in by the wh- is seen to be a sentence, there is little to be gained from saying that it operates on N_1 rather than on the sentence containing N_1. The chief advantage that would have been gained from having the segment operate directly on N_1 would have been if we could have eliminated the zeroing, if we could have said that in The man who was here left we have not two sentences but two operators on a single argument. But this has been seen to be unworkable because the two segments on N_1 are not merely operators but are whatever can be a sentence containing N_1--with the N_1 missing; and these two sentences are structurally independent of each other, their only similarity being that each contains N_1.

In this way we see that wh- must be an O_{oo}, connecting two sentences. It must be a metadiscourse operator, since it requires that some argument in one sentence be the same as some argument in the other. The metadiscourse statement

of sameness at the two addresses cannot be an operator on an independent 0_{oo}, as was the case in 6 above, because there is no conjunction which has the properties of wh- without the sameness requirement. We therefore have to say that the addressed sameness is itself the 0_{oo} operator which brings two sentences together (rather than an 0_o sameness operator on an 0_{oo}, such as and); naturally it operates only on two sentences which in fact have an identical argument. The wh- would be a variant of this metadiscourse 0_{oo} operator. Thus The man whom I saw left would be a variant of 'The man left' has (argument) 1 the same as (argument) 2 in 'I saw the man'. The fact that this sameness operator acts directly (as 0_{oo}) on the two sentences, i.e. on their operators (left and saw in this example), whereas the other sameness operators (in 6 above) acted on the 0_{oo} (and, etc.) on two sentences, may explain why the sameness-requirement of wh- applies only to arguments, whereas the sameness-operators on 0_{oo} can apply to anything under the 0_{oo}--both the arguments and the operators of the two sentences, all of which are in the arguments of the 0_{oo} (and, etc.). This restriction of sameness to the arguments of the two sentences is a major pecularity of wh-.

Finally, we consider what happens to the repeated argument at the second address. When the wh- word is that, the repeated argument has clearly been zeroed: The man that I saw left. When the wh- word is which, who, whom, etc. we can still say that it has been zeroed, in which case we have to say that the wh- receives a required ending which accords with the zeroed argument (non-human: -ich; human first argument: -o; human second argument: -om). Alternatively, we can say that the repeated argument has not been zeroed but has been pronouned into the -ich, -o, -om, etc., the pronoun variants corresponding to human, argument-order, etc., classifications of the arguments; in this case we have to say that the pronouns are permuted from the argument position to the wh- connective.

There are certain limits to the second argument of wh and to the depth of the address in that argument. Thus wh- does not take as second argument S and S: *The book which John bought and Mary bought a magazine is excellent. But we have The book which the boy who found a dollar bought is excellent from (The book is excellent) wh (The boy who found a dollar bought a book); The second argument of this wh is in turn the resultant of (The boy bought a book) wh (The boy found a dollar). The second address cannot be from the second argument of a conjunction under the wh: We have: The book which the boy bought after he found a dollar is excellent; but not *The dollar which the boy bought a book after he found was counterfeit: This would be from (The dollar was counterfeit) wh (The boy bought a book after he found a dollar) And we do not have *The dollar which the boy who found bought a book was counterfeit: This would be from (The dollar was counterfeit) wh (The boy who found a dollar bought a book), where as was seen above dollar is in the second argument of the second wh.

8. Metalinguistic operators and discourses; grammar.

There are also operators which contain no address to the arguments of the operator, but whose argument is a segment of some discourse: Mary is a word. Mary is a name. Mary contains four letters. I came is a sentence. I came is in English. These will be called metalinguistic operators. Such operators do not have to be attached to an otherwise exciting discourse, as was the case with the metadiscourse operators. With their arguments, which are bits of English, these operators form separate discourses. Indeed they form the grammar of the language.

It may be possible to derive metalinguistic operators from metadiscourse ones by replacing the above examples by: An occurrence (in a discourse?) of Mary is an occurrence of a word (possibly: An occurrence of Mary is a word.),

An occurrence of Mary contains four letters. But one could also derive in the other direction: An occurrence of the word Mary... from A word occurs, Mary is a word (under which).

The verb occur operates on word, sentence, and on all other proper parts of a discourse, and can be considered a transform of has place in a discourse. It differs from occur as an O_{on} verb on a sentence, as in His departure occurred yesterday, which has a selection disfavoring many adjectives and predicate nouns as operands (e.g. His being fat occurred last year, Its being a mammal occurs frequently are marginal). Note that The discourse occurred is the O_{on} case, and not the metalinguistic case.

Quotation-marks (for what is called mention) are written intonation-like variant of is word, etc., precisely analogous to the question-intonation as variant of I ask you. Given quotation-marks, or their zero equivalent in speech, word, etc., can be zeroed. Thus "Mary" contains four letters ← The word "Mary" contains four letters wh- operating on A word contains four letters, and "Mary" is a word. (← Mary is a word).