University of Pennsylvania

TRANSFORMATIONS AND DISCOURSE ANALYSIS PAPERS

54. The Elementary Transformations

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INTRODUCTION

In transformational theory, the first result is that there is an equivalence relation among certain subsets of sentences in respect to their word choices. More exactly, consider a set of sentences S_a of a given structure, where a structure is a sequence of n word-categories, with in certain cases some fixed individual morphemes called constants: e.g. N V, N is A. Each sentence of S_a is a particular ordered n-tuple of words, members of the n ordered categories of the structure, plus any constants of the structure. Considering each word-category as a variable ranging over the words which are members of that category, we can say that each of these word-n-tuples is an n-tuple of values of the variables which 'satisfies' the structure, yielding a sentence of the set S_a. Thus, if the set of sentences S_a has the structure N V, the ordered n-tuples are seen in such sentences as The ice melted, The man slept, The gas burned, The man melted, The gas melted. In each set, some n-tuples are more normally or clearly acceptable than others, by whatever standards of acceptability one chooses: e.g. the pair man, melt makes a somewhat restricted N V sentence, and the last pair gas, melt makes a still less normal N V sentence. When the set of n-tuples has one or another formulation of acceptability-differences which applies to the occurrence of the n-tuples as satisfactions of the structure of S_a, the set will be called here the set of word-selections of S_a.[1]

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1. Whereas a word-cooccurrence is an n-tuple of words that occurs in a given structure to produce a sentence of that structure, a set of word-selections is a set of word-cooccurrences among which there is stated some difference in the acceptability of the sentence that the individual word-cooccurrences produce.

If the differences in acceptability among the word-selections in S_a is preserved for the same word-selections in another set of sentences S_b, then S_b is a transform of S_a, $S_b \longleftrightarrow S_a$. The relation of being a transform is an equivalence relation, and is fixed for particular sets of sentences no matter what standards of acceptability one chooses and no matter what uncertainties there were in this respect.[2] Transformational theory shows that all the sentences of a language participate in a network of transformational relations.

The transformational relation brings up the possibility of setting up operations for deriving one sentence from another. In the narrow sense of structural linguistics, as long as we only consider sentence structures, we find partial similarities among structures, and can describe structures in terms of others; but there is no natural reason for an over-all operation of deriving. However, once we see that the same set of word-selections appears in several sentence-structures, preserving acceptability differences, we can consider an operation which would take the word-selections from one structure to another. Equivalently, we could say that the operation takes the sentences of S_a into those of S_b: $S_a \rightarrow S_b$ or $S_b = \varphi S_a$; we could consider the structural form itself as constituting

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2. Whatever uncertainties may be involved in determining the word-selections for S_a will appear equally in the case of S_b.

the operator.[3]

A survey of the transformations of a language shows that they are not just an otherwise uncharacterized set of changes from one structure to another. A small number of constants appear in many transformations, and only a few types of structures are seen in the resultants. If, therefore, we consider a transformation as possibly an operation on word-selections, or on the elementary sentence structures that are satisfied by these characteristic word-selections, we may seek to break such operations down into a small set of elementary operations.

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3. The transformational relation as an equivalence relation holds among sentences which are members of different structural sets but which have the same n-tuples (with the same acceptability-difference to the other n-tuples of the set). The derivational operation, however, is more conveniently defined on the structure of a sentence set, in order to avoid dealing here with morphemes or permutations which may be present in some or all sentences of the set but which are not relevant to the derivation. To say that a particular sentence B is derived from sentence A means then that the stucture of the set of sentences of S_b is derived from the structure of S_a, and that the individual sentences B and A can be obtained in a regular and specified way from these structures.

In the present chapter we will set up a system of elementary operations which will suffice to yield the transformational operations of English.

In considering this matter, it must first be understood that every transformation is a relation between whole sentences, and every operation taking sentence A into sentence B must be a change on the whole sentence. This observation has to be made because if we look at transformations, e.g. He designs bridges ⟷ He is a designer of bridges ⟷ The designing of bridges is by him, it might seem that there are various component changes: in one case designs → is a designer; in the other, he → by him, designs → the designing; in both, bridges → of bridges. These apparent components, however, do not occur independently of each other: Such partial changes as in *He the designing of bridges produce structures which are in no way sentences. Only certain interrelated combinations of these local changes occur as transformations, so that a particular change in one part of a sentence is always balanced by one or another change in a distinguished other part. Each transformation on A is thus a coordinated change of various parts of A. B does not result from some one change in one part of A plus some unrelated change in some other part of A, but from a single recasting of the whole A.

The search for elementary operations is supported by the fact that there are many cases of apparently unrelated transformations containing in part the same constants: e.g. -ing in

He is reading it.
He began reading it.
His reading of it was denied.
I saw him reading it.
The reading of it was by him.
Every student reading it will get credit.

In a morphological analysis of language this would constitute no problem, since we would merely say that -ing is added to V in various circumstances. However, it is clear that -ing and other affixes are not merely morphological operations, since they appear only in conjunction with particular other changes in other words of the sentence. Each appearance of -ing on V is therefore part of a coordinated occurrence of a number of changes in specifiable parts of the sentence; i.e. it is only part of a larger (transformational) change over the whole sentence.[4] But if we have a fair number of transformations each of which contains -ing as part of it, we would then have a number of unrelated whole-sentence changes each of which involves the adding of -ing to V. This is not reasonable. We would like to show that all addings of -ing have one source. But we have seen that each transformation is made up not of separately existing changes in various parts of the sentence, but of a single transformational change over a whole sentence; and if a transformation φ_1 is decomposable at all into components, then each component is itself a transformation over the whole sentence, and φ_1 is simply a succession (product) of the component transformations. Therefore, if we want one

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4. 'Change' here refers to: the adding of a morpheme which doesn't occur in elementary sentences (called sentences of the kernel), e.g. affixes, such as -ing; the appearance, as a constant of transformations, of certain morphemes which occur also in kernel S (e.g. informationally weak V like be, do; metaphorical uses of certain V like take, and of P like by); the permutation of certain kernel-S parts (e.g. of Σ and Ω in So says he.). S indicates sentence. The kernel is the set of sentences which map into the identity of the set of transformations; these are the elementary sentences in respect to this set of transformations. For the symbols, see section 0 below. K indicates a structure or sentence of the kernel.

source for the addings of -ing, we have to find one elementary transformation, which adds -ing to V as part of a change over the whole sentence; this elementary transformation is then included as a stage, i.e. a component transformation, in obtaining every transform that contains -ing.

We now present a set of elementary transformations φ which operate on the elementary sentence structures K, yielding φ K, and which also operate on φ K in such a way that every φ φ ... φ K is a possible sentence structure (given that the constants required by the φ find the environment which permit their occurrence), and that every actual sentence is a satisfaction of one of the φ φ ... φ K. It should be remarked at the outset that a list of elementary transformations, adequate for the above purpose can be stated in several different but of course closely related ways. The main result is not that there exist these particular operations rather than others, but that it is possible to find one or another set of a few elementary operations such that between any two sentence-sets which are transforms of each other, there exists a succession of sentence-sets, each obtainable from (i.e. different from) the preceding one by one of these elementary transformations, with each intermediate set containing sentences of the language or forms which are constructed like sentences except that the particular n-tuple involved refuses to admit the constants required by that elementary transformation.

It will be further seen that the elementary transformations are not merely such as suffice for the above purpose, but also have a very reasonable character. They consist of: (1) three types of increments, i.e. structures added to K: insertions among the K-positions, operators on K, and connectives between two K; (2) a morphophonemic zeroing of recoverable redundant words; (3) extensions of the above operations to new subclasses of their operands; (4) a few permutations of K-segments. This simple character of the elementary transformations makes it preferable to provide for aberrant sentence-sets as special K-types rather than as special transformational types.

0. SENTENCES OF THE KERNEL (N).

We begin with certain categories of words which can be defined morphologically by what affixes they take, or alternatively in a circular manner by the major transformations which can operate on all the words of a particular category:

N: noun (man, book)
V: verb (exist, take, rely)
P: preposition (in, of)
A: adjective (large, clear)
D: primitive adverb (here, now, very, almost)
t: two tense morphemes: -s (and zero, Ø) 'present', -ed 'past'.

Each elementary sentence K is a particular ordered n-tuple of words (with the assertion intonation or punctuation) satisfying one of the following structures, i.e. sequences of categories.[5]

Σ	t	V	Ω_1	Ω_2	
N	t	V_o			A man came.
N	t	V_n	N		The man found gold.
N	t	V_p	PN		The man relied on gold.
N	t	V_{np}	N	PN	The man attributed the letter to Shaw.
N	t	V_{nn}	N	N	The man gave Shaw a letter.
N	t	be	N		A whale is a mammal.
N	t	be	PN		The book is on the desk.
N	t	be	A		The box is small.
N	t	be	D_e		The box is here.
It	t	V_{it}			It rained. It's May 8.
There	t	V_{th}	N		There's hope.

5. The occurrence of articles and other ancillary words will be discussed in ch. 5 (as primitive inserts) and ch. 9 (as residues of inserted K).

The symbols Σ (subject), t, $\breve{V}$, Ω (object), will be used to indicate the K-segments which are listed beneath them.[6] The subscripted V indicate particular subcategories of V which occur with the particular values of Ω. Some members of these subcategories are two-word sequences $\breve{V}\ D_p$ (D_p: certain prepositional adverbs): look up (as in look the number up vs. look up the street); these could also be analyzed as ordinary $\breve{V}$ with a restricted D_p adverb following, but some of the positions of D_p are different from those of D.[7] Where the particular t is irrelevant, the t will be omitted from formulas, and t be will be written is.

The V_{nn} is a small subcategory of dative verbs. Its sentences could be obtained from the V_{np} structure, at the cost of a special transformation. The D_e is a small category of locational adverbs. The V_{it} is a small category of V, including be followed by certain time-subcategories of N and A. The structure differs from those above it in that Σ contains only the one word it, which does not take inserts or plural (as N does) though it accepts other operations that N accepts. The last K structure differs from the others in that there is not a member of N, and takes almost no transformations of N; and the plurality of its verb (a morphophonemic operation) depends on the N in the Ω column, whereas it otherwise depends on the Σ column. The V_{th} contains V_o and

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6. In addition to these symbols, X_j (where j = one of the defined subcategories of X) indicates the j subcategory of X, and Xy indicates a word of category X which upon receiving affix y occurs in the position of category Y. X_i, where i is a number or an undefined subscript of X, indicates an individual member i of X. K(X) indicates K containing X; aside from this, (X) indicates that X is omittable from the form in which it appears. $\breve{X}$ indicates a pronoun of X. Occasionally, X/Y will be used to indicate 'X or Y'. * or ∄ before an example indicates that it does not occur as a sentence of the language; (*) indicates that it is uncomfortable except in suitable context.

7. The position which a word X occupies in a structure A will be called the position of X; or a position in A, or an A-position.

be. It would be possible to derive this structure from N t V_o and K(be), but at the cost of an aberrant transformation.[8]

One or two additional K-structures may be needed for small subcategories of V, e.g. N t V_c N_c, where the Ω contains collective or plural N (including *a* and N, etc.): They collected a crowd.

The words in the K consist for the most part of single morphemes (e.g. house, not establishment). A word in K which contains more than one morpheme, is not divisible transformationally; that is, the sentence containing the complex word cannot be transformationally related to a sentence containing that word minus some of its morphemes: e.g. nation.

It is clear from the above that a slightly different set of K structures could be proposed instead of the list given here. Each difference would have to be compensated for by some corresponding alteration in the transformations which operate on the K. The over-all differences would be small, and the character of the theory would not be affected.

It is also clear that all the K structures fit into a single family of partially similar category-sequences. They are all cases of a single sequence Σ t V Ω, where each of these symbols is a disjunction of a few interrelated categories with restrictions as to which value of one symbol can occur with which value of another: Σ is N, or rarely it or there; V is a disjunction of the subcategories of V; Ω is the sequence Ω_1 Ω_2; Ω_1 is N, PN, A, D_e; Ω_2 is PN or N.

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8. Aberrant in respect to the other elementary transformations, which appear in the following sections.

1-3 THE INCREMENTS

1. INSERTION

Each category, whether in the K structures or in the increment structures below, may have certain morphemes before or after it in the K or increment, without affecting its position in the structure, i.e. its occurrence as a value of Σ, t, V, Ω_1, Ω_2, or of a particular segment of an increment. E.g. there may be appended:

next to N: a, some and other quantifiers on the left (q_ℓ); certain D and PN (and some PA), like only, in particular, on the right (q_r): He in particular should go.

next to V: morphologically elementary adverbs quite, just and D_b (e.g. merely, simply) which are morphologically derived but not syntactically derived, i.e. are not transforms of their morphological source: (He merely slept, ∄ His sleeping was mere). Here also not and emphatic stress, placed between t and V (6.4).

next to A: morphologically elementary adverbs quite, very: and certain suffixes, e.g. -ish (The box is small, The box is smallish). To the comparative adjectives A_c, chiefly, less, more, there may be appended certain adverbs of comparative degree: far, little : His seriousness is little less than yours.

left of t: The almost closed set can, may, will, etc. can be viewed as inserted before t, or else as members of the category t.

right of X: To the right of various categories or segments X of K or increment, certain primitive CX may be inserted: back and forth, more or less.

within K: placed before or after any word of K (less comfortably before N in Ω): adverbial asides such as however, moreover, in general, in particular. These are called sentence adjuncts.

As insertions we also count the large sets of locally-inserted adverbs D, PN which can appear also as predicates is A, is PN on the whole K:

D_m: Adverbs and PN_m of manner, appended to V (except be, in general) and to A: He sang the songs slowly; also in the form A_m in His singing of the songs was slow. Particular members of D_m occur naturally with particular members of V, A, much like the word-selection differences within K. No other increments, neither the other D nor any other increments, have restrictions of an intra-K character on co-occurrence. This would make it desirable to consider the D_m as part of the K, or as part of a second K with connective, e.g. He sang the songs and The singing was slow. However, any convenient formulation of this type can be shown to be transformationally equivalent to setting up He sang the songs and His singing of the songs was slow, so that we end up with D_m being appended to the K as a whole.

D_g: adverbs and PN_g of degree, appended to A: He is only moderately successful; also (though less naturally) in the form A_g in His success is only moderate.

D_c: adverbs of comparison appended to A when the comparative conjunction follows: They are less clear than I expected; also in the form A_c in Their clarity is less than I expected (see 3.2). The most characteristic D_c are: ~~before~~ than: -er (A_c form: more), less; before as: as (A_c form: as much); before for--to: enough, too (A_c: too much); before that: so (A_c: such).

D_t: adverbs and PN_t of time, appended to K: He sings these songs frequently; also His singing these songs is frequent (occurs frequently).

These categories of D and PN can be considered as being primitively inserts, which are transformable into sentence-operators (2.3) is A, is PN (and occurs D_t, occurs PN_t).

Alternatively, they can be considered as being primitively sentence-operators, which are transformable into D, PN. The considerations for this will be discussed below. In any case, a number of alternative formulations are possible for D (and PN) in general and for D_m in particular.

Some of the individual inserts proposed here are similar to larger classes of incfements, e.g. to D or CK in general. However,they are unique in form or position and would requ$re special transformations to derive them from the larger classes of increment. We therefore take them as primitive inserts, and indeed may use these as models for some transformational extensions of occurrence of the larger classes. This is much the same as the choice in the case of the special K-structures which can more easily be taken as primitive than be derived from the major K-structures.

2. OPERATORS ON VERB AND SENTENCE

There are certain increments on K which occupy some of the Σ, V, Ω positions of the sentence that results from their operation, hence are not merely inserts: e.g. I deny operates on he came, yielding I deny that he came, where Σ = I, V = deny, Ω = that he came. Each of these increments consists of a new word which is morphologically a member of v (know, expect, is, etc.), plus certain words or morphemes affixed to the K which is receiving the increment or to the v of that K: know that K, expect N's ving of Ω (where N V Ω is the K), is ving (where V is the v of the K). In addition, the new V of type 2.3 have their own Σ or Ω (but not both, so that they do not constitute a whole K). It will be seen that these increments can be considered as operators on K.[9] The subtypes are:

Operators Y on verb (2.1), e.g.

He studies eclipses → He is studying eclipses.

Operators U on VΩ (2.2), e.g.

He studies eclipses → He is a student of eclipses.

He studies eclipses → He makes studies of eclipses.

Operators W on whole K (2.3), e.g.

He studies eclipses → We know that he studies eclipses.

He studies eclipses → His studying eclipses surprised us.

He studies eclipses → That he studies eclipses is clear.

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9. While all the elementary transformations (increments, excisions, analogies, asyntactic) will be called operations, only the set in section 2 will be called operators.

2.1 OPERATORS Y ON VERBS

There are two operators be--ing, have--en, on V which send

N t V Ω → N t be Ving Ω,

N t V Ω → N t have Ven Ω.

The v on which these Y operate includes all other v, including the V in the U and W operators noted below; Y do not operate on Y, except that have--en operates on be--ing: He has been studying eclipses, but ∄ He has had studied eclipses, ∄ He is being studying eclipses, ∄ He is having studied eclipses. Also be--ing does not normally operate on be and on certain v such as know: ∄ I am knowing this.[10]

2.2 OPERATORS U ON V Ω

A far more complex set of operators U contains subtypes graduated from similarity to Y over to similarity to W! They all have the form:

N t V Ω → N t U Vm P Ω,

where P Ω stands for P (usually, of) plus Ω if Ω begins with N, and for Ω alone otherwise (i.e. P = zero if Ω does not begin with N). The Vm here stands for Vn, Ving, to V; and when U = be or certain related verbs, also Va. In some subtypes of U there is a transformation (5.24) which repeats the Σ, yielding a W-like form as though both the U and also the K on which it operates each had a Σ:

N_i t U Vn P Ω → N_i t U N_i's Vn P Ω

He takes a walk daily → He takes his walk daily.

This repetition of N_i does not occur for the U of 2.21-22 or for U_t, U_{ht} (2.23-24) but occurs with the other U.

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10. A third, very restricted member of this set, the be--en of He is gone, is discussed in ch. 5.

The various subtypes of U operate on V, U and W within the restrictions specified for that subtype; but they do not operate on Y: ⊅ He began having studied eclipses.[11]

The main subtypes are:

2.21. be--a. Each of the operators in this subtype operates on a particular subcategory of V and on a particular co-occurrence set of its Ω. (Co-occurrence restrictions for increments are rare).

N t V Ω → N t be Va P Ω

This destroys our trust → This is destructive of our trust.
This irritates us → This is (very) irritating to us. (≠ Y)
He is clever → He is being clever. (≠ Y: be--ing does not operate on be)

The door sticks → The door is stuck.

2.22. be--n. For a great many V (especially when n = -er), and for a particular subset of n affixes:

N t V Ω → N t be Vn of Ω

He studies eclipses → (*) He is a studier of eclipses.
He studies eclipses → He is a student of eclipses.

2.23. U_g, U_t. For every V:

N t V Ω → N t U_g Ving Ω
N t V Ω → N t U_t to v Ω.

He began studying eclipses, (*) He ended studying eclipses.
He began to study eclipses, He managed to study eclipses.

U_g and U_t have mostly the same members.

2.24. U_{hg}, U_{ht}. For every Y: A different subcategory of U which effects the same transformation as in 2.23, except that the Σ of the K (which becomes the Σ of the U) is restricted to "human" N.

N t V Ω → N t U_{hg} Ving Ω, N t U_{ht} to v Ω

He tried studying eclipses, He tried to study eclipses.

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11. There may be some question about V_t: He began to be studying eclipses. He tried to be going there at the time is more acceptable (U_h is closer to W, which does act on Y).

"Human" N is a loose subset of N based on co-occurrence, rather than a sub-category of N. It appears as the Σ of W. It contains nouns of humans and of complex organisms and instruments, but also other N taken in somewhat human sense.[12] Since the transformation makes the Σ of the K on which U operates into the Σ of the U in the resultant sentence, U_{hg} and U_{ht} operate only on K whose Σ is of this "human" co-occurrence. Furthermore, any transformation which would bring an N not of human type into the position of Σ for these U cannot be carried out on these U:

∃ Eclipses began to be studied by him.

∄ Eclipses tried to be studied by him.

2.25. U_d. For a great many V, with varying acceptability:

$$N\ t\ V\ \Omega \rightarrow N\ t\ U_d\ Vn\ of\ \Omega$$

He does studying of eclipses, He does the studying of eclipses.

He makes studies of eclipses, He made a joke.

He thinks of a better world → He has thoughts of a better world.

He slept well → He had a good sleep.

Most of the U in 2.23-24 also appear here:

He began the studying of eclipses, He began the study of eclipses.

He tried the studying of eclipses, He tried the study of eclipses.

Depending of the particular U_d, the Vn may be Ving, or also (or necessarily) the Ving, or also (or only) Vn or the Vn (as in the study).

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12. This is distinct from the human subcategory of N which is pronounced by he, she; -o, -om (after wh-).

2.26. U_n. For particular subcategories of V:

$$N\ t\ V\ \Omega \rightarrow N\ t\ U_n\ a\ Vn\ P\ \Omega$$

He kicked the door → He gave a kick to the door.

He looked at it → He took a look at it, He gave a look at it.

Here the article a is almost always present, and the n is usually zero.

2.27. U_{ap} For particular V:

$$N\ t\ V_i\ \Omega \rightarrow N\ t\ U_{ap_i}\ V_i\ n\ P\ \Omega$$

He slept quietly → He slept a quiet sleep. [13]

He feared → He felt fear.

The U_{ap_i} is an operator which effects a transformation similar to the other U, as is seen here. However, it consists not of an absolute subcategory of verbs, as is the case with the other U, but of particular "appropriate" verbs determined relatively to the particular V_i: the U_{ap_i} is thus the U_{ap} of V_i. For $V = V_o$ the U_{ap_o} is often the same verb-morpheme as V_o. For some V_i, the U_{ap_i} contains the same morpheme that $N_{c\ell_i}$ contains in the S-structure $V_i n$ is $N_{c\ell_i}$: He feels fear; Fear is a feeling.

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13. The P Ω is, of course, zero if Ω is zero.

2.3 OPERATORS W ON K

This set of operators consists of two main types: $W_{.s}$ in which the K is after the operator, and appears as Ω of the operator; and $W_{s.}$ in which the K is before the operator and appears as its Σ. $W_{.s}$ consists of $N\ V_{.s}$ before the K; and $W_{s.}$ consists of $V_{s.}\ \Omega$, is A_s, is N_s after the K. Depending on the subtype of V_s,[14] A_s, N_s the K itself is deformed ("nominalized"):

by inserting that, whether, before K: that he bought books;
or by N (t) V Ω → for N to V Ω: for him to buy books;
or by changing (t) V → Ving or Vn; and subject N → N's,
by N, or of N; and (1) Ω → P Ω (usually of Ω), or
(2) leaving Ω unchanged even if it begins with N:
(1) His purchase of books, (2) his buying books,
the buying of books by him, the singing of birds.[15]

The various subtypes yield the following, operating on He wrote the letter:

$W_{.h}$: → I know that he wrote the letter.[16]

$W_{.w}$: → I wonder whether he wrote the letter, I wonder what he wrote.

$W_{.f}$: → I prefer (for) him to write the letter.

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14. V_s indicates either $V_{.s}$ or $V_{s.}$.

15. The forms N's, of N, by N which the Σ receives, and the form (1) P Ω which the Ω may receive, are similar structurally (and in their acceptance of amny further operations) to certain primitive inserts on N (sec. 1). They will be called insert-forms of Σ, Ω. The forms Ving, Vn are similar to N in their acceptance of many operations (including plural).

16. A special subset $W_{.h}$ is seen in It seemed that he wrote the letter, It is merely that he wrote the letter, etc., where be plus not or D_g, and a few V of the be-set (ch. 6), occur only with It as Σ (as in the K structure with It).

$W_{.f}$ is a subset of $W_{.h}$ which requires that the K on which it operates have t = should:

I prefer that he (should) write the letter.

The deformation of K (including of K with increment) by adding that, whether, for will be marked Kn^{o}.

$W_{.g}$: → I awaited his writing of the letter.

W_{pg}: → She responded to his writing the letter.

The deformation of K (with possible increment, except be--ing), into N's Ving Ω will be marked Kn'; the W_{pg} have P Kn' as Ω.

$W_{.n}$: → They imitated his signing of the letter, This inhibits the formation of colonies by the bacteria.

W_{pn}: → This differs from his signing of the letter.

The deformation of K (including of K with increment, except Y) into N's Vn of Ω (n including -ing) will be marked Kn; the W_{pn} have P Kn as Ω. Kn may have, instead of N's, also by N or, if $V = V_{o}$, also of N : They imitated the signing of the letter by the clerk, They imitated the singing of birds.

The Kn deformation of N is A, N is N is:

N is A → N's An, and as above An of N: He stressed its clarity.
N is N → N's Nn: They sought his friendship.

Kn (and in respect to the Σ, also Kn') is similar to N with inserts on it, in respect to many further operations.

$W_{h.}$ (comprising $V_{h.}$ is A_{h}, is N_{h}) with deformation of K into that K:

→ That he wrote the letter surprised me.
→ That he wrote the letter is clear.
→ That he wrote the letter is a fact.

$W_{w.}$ (comprising $V_{w.}$, is A_w, is N_w) with deformation of K into whether K:

→ Whether he wrote the letter worried them, What he wrote worried them.

→ Whether he wrote the letter is unclear, What he wrote is unclear.

→ Whether he wrote the letter is a question, What he wrote is a question.

$W_{f.}$ (comprising $V_{f.}$, is N_f; and is A_f with possibly of N, for N after it), with deformation of K into for N to V Ω, and also into that N should V Ω:

→ For him to write letters angered them, That he should write letters angered them.

→ For him to write letters is queer, That he should write letters is queer.

→ For him to write letters is the plan, That he should write letters is the plan.

→ For him to write letters is nice (of him), That he should write letters is nice.

→ For him to write letters is important (for him), That he should write letters is important.

$W_{g.}$ ($V_{g.}$, is A_g, is N_g), where the deformation of K is Kn':

→ His writing the letter angered them.

→ His writing the letter is surprising.

→ His writing the letter is a fact.

$W_{n.}$ ($V_{n.}$, is A_n, is N_n), with deformation of K into Kn:

→ His writing of the letter simulates earlier styles.

→ His writing of the letter is intelligent.

→ His writing of the letter is a piece of high style.

We can look upon these W as operators on K, or as verbs which make a K into their subject or object. In addition, there are verbs which make their object an ordered pair (N, K), or else (N_i, K with N_i as Σ and with t = should):

W_{nt}: I told him (that) it was late, I said to him that she had come.

W_{nw}: I asked (of) him whether she had come.

W_{nv}: He commanded them to lead ~ (*) He commanded them that they should lead.

These can be considered as operators on the N, K pairs indicated.[17] The K on which the W operate can take all increments, except that one of the Y cannot occur on a K which is deformed into Kn', and no Y on a K which is deformed into Kn. The K on which the W operate can also take almost all other transformations. Therefore the operand of W may be written Sn instead of Kn (i.e. nominalized arbitrary sentence).

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17. Although the Kn^{o} are most conveniently analyzed as Σ and Ω of W, like Kn' and Kn, an alternative analysis could take them as separate K connected by that, whether, for to another K built out of the W. Such an alternative is particularly suggestive for the W which have N as well as K in their object. There is indeed a similar form in certain marginal C_s: that in He fled to the woods, (in order, so) that he might live; for in He shouted loudly, (in order) for them to notice him; They called a strike, (in order, so as) to protect their working conditions; whether in I'll go, whether they come or not. Whereas the C_s connect a K_2 to a preceding K_1, these three (with if also) connect K to an operator W which may be looked upon as an "incomplete" K: N V or V Ω. The reasons for saying that W is not a K will be considered in ch. 6.

In addition to the W, there are secondary (derived) sentence-operators, namely the adjuncts D, PN, and the subordinate conjunctions C_s, which appear not only in their original forms as inserts at the V, or as conjunctions, but also in a sentence-operator form: D_m, etc., in the list of section 1: He sang quietly, His singing was quiet; C_s in He sang the anthem because they insisted, His singing the anthem was because they insisted. The deformation of the K (with whatever increments), when it becomes the subject, is Kn' and Kn for some of these sedondary operators, Kn alone for the others:

$$N\ t\ V\ \Omega\ D_t \rightarrow N's\ Ving\ \Omega\ t\ be\ A_t$$

He wrote this letter recently → His writing this letter was recent.

Similarly $K\ PN_t \rightarrow Kn'\ is\ PN_t$ (He wrote the letter on Monday, His writing the letter was on Monday), and $K\ C_s\ K \rightarrow Kn'\ is\ C_s\ K$ (He wrote the letter before he knew, His writing the letter was before he knew). In all of these cases a certain subcategory of V (occur, take place, etc.) can appear in the place of be. Note that the t which is lost from Kn' appears in the sentence-operator verb: He wrote ...; His writing was ... . For the adverbs of manner, we have similarly:

$$N\ t\ V\ \Omega\ D_m \rightarrow N's\ Ving\ of\ \Omega\ t\ be\ A_m$$

He sang quietly → His singing was quiet.

and similarly for PN_m, and for the adverbs of degree:

$$N\ t\ be\ D_g\ A \rightarrow N's\ An\ t\ be\ A_g$$

He was moderately angry → His anger was moderate.

and similarly for D_c, the comparative adverbs.

The operator form of these D, PN, and C_s is less comfortable than their adverb and conjunction form, and is morphologically more complex, (requiring be and the deformations of the K; though the D is complex in that it adds -ly to the A). However, the combination of these operations with other operations on the same K is more easily stated on the basis of the sentence-operator form of these operations than on the basis of the adverb

and conjunction forms.

It will be seen later that the forms here called secondary sentence operators can be derived from the insertion (D, PN) and conjunction (C_sK) forms, and that secondary insertion-forms can be derived from the W (That he wrote it is clear → Clearly, he wrote it; For him to write the letter was important for him → He wrote the letter, importantly for him). Also most W which take Kn^o deformations on their K can secondarily take Kn' (or P Sn') deformations:

I know that he bought the books → I know of his buying the books;

and W which take Kn' can also take Kn:

His buying the books occurred Tuesday → His buying of the books occurred Tuesday.

3. CONNECTIVES

There is also an operation on two sentences, which inserts a connective C before the second sentence (which begins after the primary sentence). It can be looked upon as a binary transformation: $C(S_1, S_2) = S_1\ C\ S_2$; for some connectives, the $C\ S_2$ is inserted at an appropriate interior point of S_1. Or it can be seen as a succession of two unary operations: C operating as a string-head on S_2 to yield $C\ S_2$ (which is not in general a sentence and can be considered a non-nominal deformation of S_2), followed by $C\ S_2$ operating as a right or interior insert to S_1.[18]

3.1 C_s: The large set of subordinate conjunctions *if*, *because*, *while*, *when*, *after*, *-ing*, *so that*, *rather than*, etc. occur in $S_1\ C_s\ S_2$, and take the transformation $\rightarrow S_1$n' is $C_s\ S_2$: *He waited because he hoped they would come*; *He waited, hoping they would come*.

3.2 C_{co}. The comparative conjunctions *than*, *as* (and *for-to*, *that*) have some of the properties of C_s, but are restricted to occur after a primary Σ is $D_c\ A_i$ sentence (with appropriate D_c which in some cases follows the A_i); in the sentence-operator from this becomes

A_in of Σ_1 is A_c than (or: as) A_in of Σ_2

A_in of Σ_1 is A_c for--to (or: that) S:

The play is less clear than the novel

⟷ The clarity of this play is less than the clarity of the novel.

The play is sufficiently innocuous for the censors to pass it.

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18. The insert-character differs for the various C: C_sS is like an insert on K (sentence-adjunct); *wh* S is like an insert to the right of N; C_cX (as residue of C_cS, inserted to the right of X) is somewhat like an adjunct on X, but an N subject in singular with *and* N inserted after it takes plural verb.

$\leftrightarrow$ The innocuousness of the play is sufficient for the censors to pass it.

The C_{co} are like C_c in the zeroings they permit (4.2). For D_c, see 1 above.

3.3 C_c. The coordinate conjunctions *and* (including comma intonation), *or*, *but*; these occur in $S_1\ C_c\ S_2$ but do not take the sentence-operator transformation which we saw in $C_sK \rightarrow$ is C_sK (i.e. ~~∃~~ His coming is or her going, etc.). The three C_c are distinguished in that *and* requires no difference between S_1 and S_2, *or* requires at least one difference, *but* requires at least two differences (or one, in the case of paired predicates):

He went and he went.
He will come or she will come.
He will go but she will not go.

(~~∃~~ He will go but she will go, but ∃ He will go; but he will return).

3.4 *wh*. The morpheme *wh* connects, to a primary S_1 which contains some N_i, a second sentence S_2 which contains (or, after permutations, begins with) the same N_i. (In the case of adverbial PN of time, and place, manner, etc. S_2 begins with PN_i.)

I know the man. wh The man came. = I know the man who came.
I know this place. wh In this place he lived. = I know the place where he lived.

The N_i (or PN_i) of S_2 is then pronouned into the second part of the *wh*-word; and *wh* S_2 is then inserted directly after the N_i in S_1. If $S_1 = X\ N_i\ Y$, and if we write $\breve{X}$ for the pronoun of X, and S-X for S with the X part of it omitted, then we have:

$$S_1 \text{ wh } S_2 = X\ N_i\ (,)\ \text{wh}\ \breve{N}_i\ S_2\text{-}N_i\ (,)\ Y.$$

The man left. wh The man was here.
= The man (,) who was here (,) left.

The (,) indicates that *wh* S_2 may be separated off by commas from S_1, or not. When *wh* S_2 is not separated off by commas,

the meaning of the wh is somewhat different and N_i is not (in general) a proper noun; and under certain conditions (depending on the t and the differences between the S) this wh S_2 takes a transformation related to the subordinating conjunctions (in particular, if, provided that, and the like):

$$S_1 \text{ wh } S_2 \rightarrow S_1 \; C_s \; S_2$$

where C_s is any of several C_s related to if, according to the word choices in S_1, S_2:

People who are jobless are bitter.

People are bitter if they are jobless.

Like C_c, so also wh does not have a sentence-operator form.

4. REDUNDANCY REMOVAL

The three incremental types of operations above operated on K (or K plus certain increments) and added something to it; these were all of the operations which add an increment to a K. We now consider a set of operations which operate on sequences of K, or K plus operator or insert. These operations eliminate from (usually) secondary members of the sequence such words Z as can be determined (up to local synonymity [19]) from the particular wprds which occupy certain positions (in the sequence) distinguished relative to Z. Z, which therefore carries no information in the given sentence, either is dropped (i.e. changed into zero) or is replaced by a pro-morpheme of the same category (in most cases a pronoun). The zero and the pro-morpheme carry the same information in respect to the given sentence as does the original morpheme in that position. In most cases both forms occur, with and without pronouning or zeroing. In a very few cases (after certain sentence-operators and comparatives) the zeroing occurs always (i.e. necessarily), for reasons that will be discussed under those operations. [20]

In all cases, what is removed is a redundancy that has arisen out of the juxtaposing of a K with operator or insert, or with another K (or a long disjunction or conjunction of K). Loss

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19. 'Local synonymity' is used for synonymity in respect to the particular environing words in a structure.

20. In spite of this considerable regularity, there is as yet no uniform explanation of the cases in which redundancy removal fails to operate. For example, we can drop the CS sequence in I ask whether S_1 or S_2 ... or S_n → I ask whether S_1 or not (S_1) → I ask whether S_1; but the CS sequence is not dropped in S_o, whether S_1 or S_2 ... or S_n → S_o, whether S_1 or not (S_1); I'll go, whether you do or not.

of material out of sentences is not arbitrary, but is restricted to redundancy-removal and to certain particular inverses of incremental operations (5.21-23 below). And as to the removal of redundancy, it will be seen to occur only in certain specific and crucial conditions. One condition is in regard to the preservation of K-likeness (sec. 7), i.e. to the fact that the resultants of transformations retain considerable similarity to K-structure. The sentences which lack a word, due to a redundancy removal, have structures of the same kind as sentences without redundancy removal: e.g. He denied his having slept, He denied having slept (where the Ω loses a word, but remains Ω). This is so because most redundancy removal is in those parts of a sentence which have the form of an insert on the structure (e.g. the his above, which is like an insert in the Ω), or in a limited way in the Ω of the sentence. It will be seen, below in 7.4, that the resultant of a redundancy-removal is still K-like, even though some portions of the structure defined before redundancy removal (mostly among the inserts) have to be listed as having new form.

The 4.1 type removes material which is in inserts or in Kn (i.e. the Σ or Ω operators); in most cases the removed material is itself similar to insert-form. Or else, the 4.1 type removes Ω, which is the one K-part whose removal does not destroy K-likeness (since there are K with Ω = zero). The 4.2 type excises repeated material which appears in secondary K. The 4.3 type drops such insert-forms and Ω as contain indefinite pronouns; it also zeroes pronouns which are accompnaied by inserts that can mark the presence of those pronouns.[21]

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21. In the present section, attention will be given chiefly to zeroings and to bound pronouns (namely, pronouns affixed to wh-). Free pronouns (e.g. he) and indefinite pronouns (e.g. any) will be considered in detail in ch. 10.

In most cases, what is removed has itself the form of an insert (e.g. the his above). In such cases, the removal is the inverse of the insertion operation (sec. 1 and 5.21). In other cases, what is removed does not have the form of an insert, but it is part of an insert, and not of the K-structure: e.g. He came and he spoke → He came and spoke, where and he spoke is not the primary K-structure (which is He came) but a segment adjoined to that K-structure.

The second condition is that the presence of the dropped material is always indicated (except for ambiguities) by the structural residue, that is, by the sequence of categories and subcategories from which it had been removed. Thus, if we find

$$N\ t\ V\ N\ \ C_c\ \ N\ N \leftarrow N\ t\ V\ N\ \ C_c\ \ N\ t\ V\ N$$

He plays violin and she piano ← He plays violin and she plays piano

the sequence C_c NN after N t V N indicates (4.2) that t V had been dropped. And if we find

$$N_2\ N_1\ t\ V_1\ \Omega \leftarrow N_1\ wh\ \breve{N}_1\ t\ V\ N_2\ V_1\ \Omega$$

The milk man was here ← The man who delivers milk was here,

the presence of the extra N in N N t V Ω indiactes (4.1) that wh $\breve{N}$ t V had been dropped.[22] Or if we find (where $\breve{N}$ indicates an indefinite pronoun, e.g. things)

$$N\ V_n \leftarrow N\ V_n\ \breve{N}$$

He writes ← He writes something

the presence of V_n without its required Ω indicates (4.3) an indefinite pronoun of that Ω which has been dropped.

The final condition is that the particular word which has been dropped in the given position is indicated by the particular environing words which appear in certain other positions

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22. This left-insert N of a compound noun can also indicate other sources, or even a primitive compound noun. See ch. 9.

of the sentence. The dropped word is either the appropriate word for its environing words (4.1), or a repetition of one of them (4.2), or an indefinite pronoun (4.3) appropriate to the environing V.

In view of the last two conditions which are satisfied by all zeroing, we can say that the dropped (or pronouned) word has not been eliminated but merely altered morphophonemically into zero phonemes (or into the phonemes of the pronoun): the word is still present in its site, but it has a zero (or pronominal) morphophonemic variant in the presence of its environment. The redundancy removal can thus be considered to be a change not in the morphemic content but only in the phonemic shape of the sentence.

In any case, the excision operation has reality in the grammar, for the pairing of sentences with and without word-zeroings furnishes a base for inverses of the redundancy-removal operation: these inverse operations repeat words, on the analogy of the elimination here of repeated words.

4.1 V_{ap}

The first type of redundancy removal operates in an insert or a secondary K, i.e. a C K, or a K that is under an operator. The operation replaces a word Z by zero (or by a pro-morpheme of Z) if the remaining words of the secondary K, or the word to which the insert or secondary K is being adjoined, or the operator under which K appears (as Σ or Ω), suffice to determine the Z.

To consider the actual forms, it will be helpful first to define "appropriate X", X_{ap}; X here ranges over the relation-expressing categories V, P, the operator N V_s, and perhaps classifier-nouns $N_{c\ell}$. The X_{ap} of a particular word in a structure is the member (or members) of X which is the main co-occurrent of that word in that structure, for the given subject matter. That is, X_{ap}, in a K or insert or operator, is a particular member of category X which in the given culture or subject-matter (e.g. conversation, or science) is accepted as the main word to occur with the particular other words of that K or insert or operator, or with the particular word to which the K or insert is adjoined. In a form $W_i\ X_{ap}\ Y_i$, the X_{ap} means not its full dictionary meaning but 'that which primarily carries out the X-relation (e.g. verb-relation) of W_i to Y_i (in the present discourse).[23] Several words of category X may equally satisfy $W_i\ X_{ap}\ Y_i$; they are then locally synonymous in respect to W_i .. Y_i.

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23. This is an extreme example of the fact that when a word occurs in a sentence, it does not carry its full dictionary meaning, but only such meaning as can constitute a normally-accepted (or, depending on the discourse, a jocular, shocking, etc.) meaning in relation to the other words with which it is grammatically juxtaposed.

In many circumstances, specified below, the X_{ap} can be eliminated; other members of X cannot. There is no loss of information, for the absence of the X which is required in the W X Y structure (whose presence is evidenced by the remaning W Y), points to the X_{ap} which is determined (up to local synonymity) by the individual words of the W_i Y_i. Thus from violin-prodigy we reconstruct violin-playing prodigy, and from violin-merchant we reconstruct violing-selling merchant. In any case, the grammatical reality of X_{ap} lies in the fact that it and not other X can be zeroed in this way (or that X_{ap} is the only X that occurs in the given position). This treatment enables us to relate in a simple and reasonable way such abberrant forms W Y (e.g. compound nouns N N) with grammatically regular forms W X Y.[24]

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24. Though the determiners of X_{ap} may be the other words of the K, the zeroing does not occur in a K by itself, but only when one form is juxtaposed to another (as happens also in morphophonemics). Within a K or an insert or operator by itself there is no redundancy which is removable. In those K in which a particular sub-category of Ω, or a particular Σ, Ω pair, determine that a particular V (or set of locally synonymous V) is the main one, the V may be replaced by a constant of low semantic specificity (e.g. have or be or is P), or may receive lower stress; but the V will not be zeroed (something which would produce a new kind of V-less sentence):
He wrote a book → He did a book; ⁄ He book.

4.11 Conditions for dropping V_{ap}

The chief environmentally-determined redundancy is in V_{ap} and the related is P_{ap}, which may be dropped when it occurs in an insert, or in the Σ or Ω of an operator. E.g. many compound-noun

$$N_2\ N_1 \leftarrow N_2\text{-}V_{ap}\text{ing}\ N_1 \leftarrow N_1\ V_{ap}\ N_2$$

as insert to N_1 (The milk-man came ← milk-delivering (man) as insert in The man came). When N_1 is $P_{ap}\ N_2$ is an insert to N_1, we obtain $N_2\ N_1$: He painted the clothes-closet ← He painted the closet wh- The closet is for clothes (or The closet contains clothes, or the like). The is P_{ap} may be derived from $V_{ap}\ P_{ap}$: The clock hangs on the wall → The clock is on the wall → the wall clock; or the is P_{ap} may come from have and similar V by the analogic operations of 5.51 below.

Under an operator, when the K, as Σ or Ω of that operator, is deformed, with N V → Ving of N (Brecht wrote → writings of Brecht) and V N → to V N (to study French), the Ving and to V can be dropped if V is V_{ap}.[25]

I read the writings of Brecht → I read Brecht.

I began to study French → I began French.

Under U, the appropriateness may be based on the Ω of the V_{ap}, as in I began French (to hear would not drop in I began to hear French); I began the book (to read, to write, but not to buy). Here we have

$$N\ U\ \text{to}\ V_{ap}\ \Omega \rightarrow N\ U\ \Omega.$$

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25. Here the V_{ap}ing and to V_{ap} do not have the form of inserts. However, when to V drops or moves from its Σ or Ω, this may have some relation to the fact that to V (for V with zero Ω) occurs in the status of insert as well as in the status of Σ or Ω of an operator. And the dropping of Ving may go through a structure in which the Ving has received an insert form (as in 5.23, 5.53), perhaps N's Ving → N in its Ving: the storm in its occurrence, Brecht in his writings. But this is not supportable at present.

Under W, the appropriateness may be determined by the operator, as in The storm (crash, noise, etc.) caused the damage (= the occurrence of the storm, etc.). In contrast, in The ending of the storm caused the damage, The brevity of the storm caused the damage, the words the ending of, the brevity of, would not drop.[26] Here we have

$$V_{ap}\text{ing of N } V_{s.}\ \Omega \rightarrow \text{N } V_{s.}\ \Omega.$$

And When do you expect him to come? (or to arrive, etc.) → When do you expect him?; but in When do you expect him to speak (or to leave), the to V, not being to V_{ap} for the operator expect, does not drop.[27]

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26. Although the evidence that one form has been derived from another by the dropping of some material is of the same kind here as throughout, it is less obvious in the cases discussed here. The evidence that (1) N_1 caused N_2 ← (2) The Ving of N_1 caused N_2 is that for every sentence of form (1) there exists a sentence of form (2), the difference in acceptability between various N_1, N_2 choices in (1) being the same as in (2). Furthermore, this holds only for V = occur, happen, act, etc. and not for V = end, is brief, etc. In contrast, for N_1 ate N_2 we don't find The Ving of N_1 ate N_2. Hence cause here is not a V which simply occurs in a K, but is a sentence operator. I.e., its Σ (and Ω) is a deformed K. When we find N as its Σ, this N is obtained from the deformed K by dropping the Ving; and the Ving drops only if it is the appropriate one for cause. (We are here considering cause after the $N_3 \rightarrow \Sigma$ operation of 5.23; there is also cause as $V_{.s}$ with "human" subject, which is the source of this.)

27. Dropping to V_{ap} is different from zeroing V_i on to V_i after an antecedent to V_i (4.2): I spoke and I expect him to.

Under W, the V_{ap} may also relate to its own Σ: The letter caused him to come ← The contents of the letter ... or the like. Or the appropriateness may be fixed by both the operator and Σ: I read Brecht ← I read the writings of Brecht (but not normally the letters of Brecht. Similarly, to V_{ap} drops under the operator is A_s (if it is appropriate either to its Ω or to the operator):

For N to V_{ap} N_2 is A → For N N_2 is A

For me to solve the problem is easy → For me the problem is easy

(but to translate would not usually drop in For me to translate the problem is easy).[28]

Much investigation is still needed around the question of X_{ap}, since careful justification is necessary before absent words are reconstructed. Consider, for example, those N which require an article before them except when they are in the object or transformed therefrom: e.g. The content is important, They discussed content, They had a discussion of content. When we find such an N lacking an article, and occurring as apparent subject of a verb which can be either a verb of K or else a sentence-operator, we can explain the lack of article by saying that the N is here Ω of the dropped V_{ap} (with the V_{ap} and N together being the subject of the sentence-operator): Content is important ← Considering content (or: the consideration of content) is important.

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28. Since both for N and to V are moveable, as though inserts, to the right of N_2 is A_1, the dropping could be derived from this insert position: The problem is easy for me to solve → The problem is easy for me.

Evidence of a dropped V_{ap} is particularly clear when a plural Σ has a singualr verb: Too many cooks spoils the broth ← Having (or: The action of) too many cooks spoils the broth. (The common form Too many cooks spoil the broth is not understandable literally); Two apparently opposed parties is the answer ← Having ... . As another example, consider a word which must be followed (when in category P) by a N_t of time, or (when in category P_c) by Kn, but which appears followed by N not of time: It's the best bargain since Manhattan ← ... since the purchase of Manhattan.[29]

There are also situations in which P_{ap}, D_{ap}, and other words (including $P\ N_{ap}$ when the N is a classifier), are dropped when they are appropriate to the words or word-pairs of their environment. Thus V_{sc} for N_{sc} → $V_{sc}\ N_{sc}$, where N_{sc} is a measure on a particular stateable scale and V_{sc} is a V which is measured by that scale: He ran for three miles, He ran three miles; but in He spoke for three miles the for does not drop.

There are also various more limited or even idiomatic X_{ap}, some of them N_{ap}, D_{ap}. Clear examples are He behaved today ← He behaved well today (other D objects of behave do not drop:

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29. Going beyong language to specialized subject-matter languages which contain greater restrictions, methods of this kind could be used to achieve more simply characterizable Σ, Ω, etc. E.g. to measure a room could be taken as reduced from to measure the length (etc.) of a room; to rig the convention from to rig the voting (or the activity, etc.) of the convention, to load the gun from to load the cylinder of the gun. In this way the Ω of the V would also become more explicit.

He behaved badly today); She's expecting (i.e. a baby); The more the merrier ← The more there are the merrier it will be, or the like. Less clear examples, but of more general relevance, are cases in which either V_{ap} or perhaps a classifier noun has been dropped, yielding an unusual Σ: From here to there is 8 miles ← For someone to go from here to there is 8 miles, or The distance from here to there is 8 miles.

A case of Ω_{ap} is each other as Ω of reciprocal V. The reciprocal V (for which N_1 V N_2 ⟷ N_2 V N_1: She met him, He met her) do not occur without Ω except as a result of a dropped Ω = each other (see ch. 4): He and she met ← He and she met each other; while Tom and Jim argued ← Tom and Jim argued with each other, or ← Tom argued and Jim argued. But in non-reciprocal V, the each other does not drop: He and she dislike each other.

4.12 Dropping of Constants

The dropping of words which are constants of certain forms can be taken as an extension of the dropping of X_{ap}: the constants are X_{ap} of the forms. In some particular insert and object forms of those K whose V is be (or has been reduced to be), the be is dropped. We can understand this in terms of be being a structural V_{ap}, i.e. a V_{ap} determined not by particular environing word-choices but by particular categories. In the people here ← the people who are here we have the tense plus be dropped from the insert who are here (for the concomitant dropping of the wh-word, see below), whereas another V (including ordinary V_{ap}) in this position would not be dropped: the man who delivers milk. When a K whose V is be becomes the object of certain W operators or of certain P_s, the be, to be or being may be dropped: They found him ill

but They found him delivering milk:[30] While ill, he thought of it, but While delivering milk, he thought of it.

The dropping of a constant in a particular form gives rise to one of the most common transformations, namely the "sharing" transformations which takes two K that contain identical N_i and makes the residue of the second K into an adjective or other insert to the N_i in the first K (3.4, 5). We start with K_1 wh K_2, in which K_2 necessarily contains an N_i which also occurs in K_1. K_2 is permuted so that N_i is its first part. The N_i at the head of the K_2 is replaced by a pronoun which becomes the second part of the wh-word: I picked up the book which fell. The wh-word (i.e. wh plus pronoun) may be replaced by that, which carries less information than who, which, etc., since it does not specify the subcategory of N_i; (something which however can be discovered from the N_i itself immediately preceding). Furthermore, in all cases where the constant, whether wh-word or that, is not followed by the verb of K_2, the wh-word or that may be dropped: I picked up the book which you dropped, I picked up the book you dropped.

It may be mentioned that if the wh-word were dropped when the word following it is a verb, local mis-analysis could result. Thus if in I described the tree which fell, the which here has been dropped, yielding the non-existent *I described the tree fell, the sequence the tree fell would look locally like Σ V. Here, however, an additional use of the redundancy-removal operation comes into play: If the verb following the wh-word is the constant be (or certain U_d operators like do

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30. Under certain sentence-operators, the K is only (or primarily) of the be type: and after certain of these the be is then always dropped: I call him a fool; I consider him a fool, I consider him to be a fool.

in He does writing), or V_{ap}, then both the wh-word and the V-constant or V_{ap} of K_2 may be dropped:

I described the tree which was nearby →

I described the tree nearby.

When the determinable (and hence recoverable) V of K_2 is dropped together with the wh-, the N preceding these cannot be in apparent Σ-position to the (now dropped) V of K_2.[31] We thus obtain the very frequent and important situation of wh-less K_2 inserts on N, including the one-word left (and right) adjuncts of N: e.g. I saw the people present from I saw the people who (that) were present, I saw the new book from I saw the book which (that) was new, I saw the milk-man from I saw the man who (that) delivers milk (or brings or sells milk). But if the V of K_2 is not be or the appropriate verb, the wh-word remains: I saw the man who buys milk (unless this man has been familiarly considered as being the person with a characteristic relation to milk, in this case an inveterate buyer of it: he might then be referred to as the milk-man).

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31. It is true that this N is identical with the lost Σ of K_2; but its occurrence here is as part of K_1.

4.13 Dropping of performative operators

Related to the dropping of predictable material is the dropping of certain sentence-operators which have performative force (so that no information loss results from dropping them) and whose existence is indicated by characteristic intonations in the K on which they had operated. This is the case in English for the question and the imperative. As will be seen in the chapter on sentence-operators, all questions (both yes-no and wh-) are obtainable in a simple way, and without appeal to special transformations, from

I ask (you) whether S_1 or S_2 ... or S_n

which is an operator on a disjunction of S. Similarly,

I request (order, etc.) you that you (please) V Ω

yields the imperative

(Please) V Ω! [32]

Once the derivation of question and imperative from the respective performative operators is recognized, we can consider that the operators are dropped, as X_{ap}, from the transform in which they appear in insert-form:

I ask you whether he will come (or not) →
Will he come? (or not), I ask you →
Will he come? (or not). [33]

In the case of the imperative, it can also be shown that the Σ of the operand K is you, so that dropping the Σ of operand K under the imperative is the dropping of a specific N_{ap}.

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32. And the rare Would that S! or Oh that S! is derivable from I would that S! in which the W operator I would with the optative intonation may also perhaps be understood as a performative.

33. The question mark is placed here at the end of the interrogative intonation.

4.14 S_{ap}

There is also the as yet unclear question of S_{ap}, sentences which can be determined (again, up to synonymity) from neighboring S or Sn. If such S_{ap} occur in a discourse (or, better, in a sequence of joined S), they are redundant; if they are not present, we can say that they have been omitted. Reconstructing the S_{ap} may yield a stronger requirement for sentence-sequences under conjunction, and yields a stronger characterization of the various conjunctions. Some conjunctions or connective V (i.e. V with Kn both for Σ and Ω) require closely parallel structures between the two K which they connect: e.g. *exceeds*, *equals* (related to the comparative *than*, *as*), where the parallel structure results from the fact that this connective is defined on a particular Kn form *An of N*. Some conjunctions do not have such a strong requirement, but make use of any parallel structures which occur in the sentences they connect by zeroing identical parallel material (see 4.2 below). Other conjunctions and connective V usually have certain repetitions between the K which they connect; and if this is not the case, it is possible to construct K with connectives which will fill out the repetition-pattern without changing the meaning of the discourse. This also holds for the S-pair of a question and its answer. There are also single sentences that contain certain individual morphemes, such as *the*, *no*, *-est*, *-er*, which lead to the reconstruction of a lost S_{ap} connected to the sentence in which they appear.

4.2 REPETITIVE MATERIAL

The second type of redundancy removal also operates only in secondary K, and permits or requires the dropping or pronouning of a word (with certain appended constants, if they are present) if the same word precedes (rarely, follows) it, as antecedent, in a distinguished position of the primary K or of the operator on the K.

The simplest case is in K_1 wh K_2, where the common N immediately following the wh is pronounced and becomes the second part of the wh-word (3.4).

A repetitive insert-form Σ or adverbial PN (but not normally Ω) is zeroed under W, P_s. E.g. when certain sentence operators N_i V $_{.s}$ or N V $_{.s}$ N_i operate on a K whose Σ is N_i, the second N_i drops if it is in insert-form: in I prefer that I should go first there is no zeroing, but in the transform of this I prefer for me to go first [34] → I prefer to go first. Similarly I insist that I should go, I insist on my going → I insist on going. There are other operators after which a repeated N_i is not zeroed: I demand that I should be released, I demand my release, (*) I demand my being released. And there are other operators (e.g. oppose) after which the zero before Ving (e.g. I oppose smoking) is of type 4.3 below. In the N W N. operators, we have I ordered him that he should go, I ordered him to go (although the intermediate I ordered him for him to go is at best doubtful). [35] Similarly, I told him to go ← I told him that he should go; but there is no zeroing in I told him that she should go, I told him that he was wrong.

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34. Though uncomfortable, this is constructed like I prefer for you to go first.

35. That N should → For N to (with insert-form for N) is common elsewhere, though not here.

When the W operator comes after the operand K, the Σ of the K, if in insert-form, can be dropped if it is the same as the Ω of the V_s, Ω operator, or the same as a PN on the $is\ A_s$ operator:

To be the first would delight me.

← For me to be the first would delight me.

But Your relying on her would encourage her ↛ *Your relying would encourage her.

Phoning the good news was nice of him.

← His phoning the good news was nice of him.

In contrast, Phoning the goods news was nice ← The phoning (by whoever phoned) was nice (for you, for us, for whoever is the object of concern), and belongs in 4.3.

Several conditions for zeroing a repeated Σ are found in K_2n after certain P_s. Thus: He stopped after entering ← He stopped after his entering (or: entry); since after is also C_s, we also have He stopped after he entered. After while, we have (as C_s) He stopped while he spoke and (as P_s) He stopped while speaking, but the intermediate is lacking: ∄ He stopped while his speaking. Zeroing of the Σ of K_2n is the same whether the antecedent is the Σ of K_1, as above, or the Ω of K_1, as in He stopped her after (her) entering. In many situations, therefore, the zeroed Σ is ambiguous as to antecedent: He caught them while leaving the hall.

A different kind of zeroing of repeated words is found after the independent connectives C_s, C_{co} and C_c. Here a word may be zeroed in K_2 if it is the same as the corresponding word in K_1. After C_s, only the V Ω (and not the t or Σ) may be zeroed in this way, and the zeroing may even occur in K_1 instead of in K_2 (especially if the primary K_1 comes after the secondary K_2). I will go if you will. If you will, I will go. If you will go, I will. (*) I will, if you will go. After C_c, and with certain modifications after C_{co}, any K member can be dropped if it is the same as the corresponding

member in the K before the C (with some provisions noted in ch. 10). He came and left. He plays viola and she flute. It is not clear how the difference in zeroing conditions may be related to the mobility which C_s K_2 has but which the other conjunctions do not.

The answer after a question, and the question after an assertion, may zero the V Ω, or the whole sentence except for the answering or questioning word: I will go. You will?, What will he get? A book.

There are thus cases of whole S being zeroed. This is the case in answers, in which parts or all of the question-sentence may be zeroed: Is he there? Yes. ← Yes, he is. ← Yes, he is there; Who took the book? John. ← John did. ← John took the book. There is also the possibility that when a sentence-operator takes the adjunct form N $V_{.s}$ that S → S, N $V_{.s}$ (I know that he came; He came, I know) we have really to do with a comma-conjunction on a zeroed operand: ← He came, I know that he came. Similarly He came, I think ← He came, or so I think ← He came, or I think that he came. However, this raises problems as to whether the Kn under the operator can be zeroed as a repetition of the K (not Kn) preceding the operator, a question which also arises in regard to the dropping of S_{ap} (4.14).

4.3 Zeroing of Indefinite Pronouns

The third type of redundancy operation permits the pronouning (or, in certain cases, dropping) of disjunctions (more rarely, conjunctions) of all the words in a category or subcategory. These disjunctions of words come from disjunctions of elementary sentences. If n is the number of words in subcategory N, we have (in steps of the elementary transformations 4.2, 5.6):

$$N_1 \text{ or } N_2 \ldots \text{ or } N_n \; V_i \; \Omega_i$$
$$\leftarrow N_1 \; V_i \; \Omega_i \text{ or } N_2 \ldots \text{ or } N_n$$
$$\leftarrow N_1 \; V_i \; \Omega_i \text{ or } N_2 \; V_i \; \Omega_i \ldots \text{ or } N_n \; V_i \; \Omega_i .$$

I or you ... or she will go.

I will go, or you, ... or she.

I will go or you will go ... or she will go.

That disjunctions of K, and thence disjunctions of words of a category, appear as operands in linguistic structure is seen in the *whether* operations (both sentence-operators and C_s) and in the indefinite pronouns (e.g. *Someone will go.*).[36] Here we consider the cases in which the disjunction of the words in a category or subcategory is dropped. It is clear that no loss of information results from such zeroing, since the disjunction could carry no information (beyond the grammatical presence of the category, which remains evident from the environing residual structure).

When what is zeroed is a disjunction over a category we may suppose that the disjunction is first replaced by an indefinite pronoun, and that this pronoun is then zeroed in the conditions stated below. The pronouning occurs in a variety of positions; the zeroing of indefinite pronouns occurs only in insert-forms, except for the zeroing of indefinite pronoun in Ω and before *wh*-insert.

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36. This is discussed in detail in ch. 7, 10.

Dropping of insert-form indefinite pronouns (e.g. someone's, by someone) is seen when secondary K receive the form of adjectives or P N (2.3,.3), and may be dropped, with a meaning equivalent to the indifinite pronoun of Σ and Ω.[37]
Thus

The place has been taken.
← The place has been taken by someone.
← The place has been taken by N_1, or by N_2 ... or by N_n.
← The place has been taken by N_1 ... or the place has been taken by N_n.
← N_1 took the place ... or N_n took the place.

Under certain sentence-operators, the insert-form Σ of the operand K is zeroed when it is an indefinite pronoun, rather than when it is identical with the Σ or Ω of the operator (4.2 above):

He opposes drinking. ← He opposes anyone's drinking.
He says to wait. ← He says for people to wait.
The job requires having patience. ← The job requires one's having patience.

The same is the case for

To find the book is important.
← For someone to find the book is important.

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37. However, a missing insert-form Σ or Ω may also result from the inverse of sharing (5.23, 24), in which case the Σ or Ω may be a pronoun or may be a specific N. This N's or by Σ, and of Ω, are missing in To have a description would be important, which is obtained as a decomposition product, together with Someone's (or N_1's) description is of N_2 from To have someone's (or N_1's) description of N_2 would be important. So also in The description is of N_2, or The description is by N_1, which are obtained by sharing-inverse from The description by N_1 of N_2.

When this Σ of the K is not in insert form, the disjunction is pronounced but not zeroed:

We doubt that anyone came.

Other types of disjunction-zeroing take place in certain particular non-insert positions.

The most widespread of these is the zeroing of indefinite object, which occurs with many but not all V: He reads ← He reads something ← He reads N_1 or N_2 ... or N_n.[38] That this Ω-zeroing is indeed of the disjunction of objects for the given V, and not of a single Ω, is supported by the fact that metaphorical and idiomatic objects are not pronounable or zeroable: from He kicked the bucket, there is no *And he kicked it suddenly, or *He kicked.

There is also a situation in which, given a pronoun for a single N[39] or for a conjunction or a disjunction of N, which carries a wh-insert, the pronoun is dropped, leaving the insert to carry the grammatical relations of the N (or, we might say, leaving a zero N whose presence is recognized from the insert).[40] This is the case of forms like

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38. There is a possibility that this Ω-zeroing can be derived through the Kn form, where Ω has insert form.

39. In the example given here, what can be replaced by whatever; and what has been dropped is anything, the things, etc., which are pronouns for disjunctions of N. However, there are also cases in which what can be relaced by the single thing that, or the like; in such cases, what has been dropped is a pronoun or a classifier N_{cl} for a single N: I heard what he said and you heard it too; What he planted has grown to be quite a tree.

40. A partly similar case is the rare dropping of pronoun or N_{cl} which may occur after certain the A, where the the indicates a lost wh-insert connected to that N: the true ← the things which are true. This is mine ← This is my N_1 or N_2 ... or N_n; This is his ← This is his N_1 or N_2 ... or N_n.

I read what he writes.

← I read that (or: the things) which he writes.

← I read N_1 which he wrote and M_2 which he wrote ... and N_n which he wrote.[41]

That we indeed have here a zero N, invisible as to phonemes but tangible morphemically, is supported by the fact that certain transformations which operate on wh-forms do not operate on those wh-forms which are merely inserts to a zeroed N. Thus, the operation which yields Σ = It (5.6) operates on sentences whose Σ is of the form Sn^o, i.e. not only on Sn^o under V_s operator:

$$Sn^o \; V \; \Omega \rightarrow It \; V \; \Omega \; Sn^o$$

What he will say is not known. → It is not known what he will say.

Who will come doesn't interest me. → It doesn't interest me who will come.

but also on the extraction form of K (with that in place of what):

$$wh \; \breve{N}_i \; S\text{-}N_i \; is \; N_i \rightarrow It \; is \; N_i \; that \; S\text{-}N_i$$

What he needs is money. → It is money that he needs.

(*)Who said so was John himself. → It was John himself who said so.

However, the transformation to Σ = It does not operate on

What he writes is widely read.

⊅ It is widely read what he writes.[42]

even though the Σ is of the same form as in the extraction. This is so because the Σ here has zero N:

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41. This dropping of N before wh-inserts is what has been called, in previous papers, nilpotent sharing (The glass broke wh The glass fell → The glass which fell broke → What fell broke) in contrast to idempotent sharing (3.4 without 4.3): The glass broke wh The glass fell → The glass which fell broke.

42. The apposition with comma is different: It is widely read, what he writes.

What he writes is widely read. = That which he writes is widely read.

with that zeroed, but present. Indeed, when the pronoun is human, it is usually not zeroed:

The one whom they opposed was noted down.

In contrast, there are forms in which a disjunction of N has not been zeroed but only pronouned into wh-: In the wh-forms which are not inserted onto an N, we have disjunctions of N headed by whether, with the disjunction being replaced by a pronoun suffixed to the wh (something which gives the impression that the disjunction has been zeroed):

I wonder whether N_1 or N_2 ... or N_n V_i Ω_i →

I wonder who V_i Ω_i

where the -o replaces the disjunction of all nouns in its (human) N subcategory. With the addition of ever:

Whether N_1 or N_2 ... or N_n is coming, I can't wait →

Whoever is coming, I can't wait;

Whoever called wouldn't give his name

← N_1 who called wouldn't give his name or N_2 who called wouldn't give his name ... of N_n who called wouldn't give his name;

I came when they left.

← I came at N_{t_1}, when they left, or at N_{t_2}, when they left, ... or at N_{t_n}, when they left.

(N_t: subcategory containing time nouns.)

5. ANALOGIC EXTENSIONS

In addition to the incremental and redundancy-removing operations, each of which is defined on some class or subcategory of operands, there are certain analogic extensions which apply one or another operation to some further subclass of operands related to but outside that for which the operation had been defined. These extensions work in only a small number of specifiable ways. In the main, given two transformationally related sentence sets, $S_a(X')$ and $\varphi\ S_a(X')$, which contain subclass (usually a word-subcategory) X' of X, and given a case $S_a(X'')$, of the same sentence structure containing a different subclass X'' of X, the analogic extension yields $\varphi\ S_a(X'')$.

In 5.1-6, we give examples of the specific kinds of extensions. Many transforms, such as the passive, can be reached as end-points of not one such extension but a succession of them. It will be seen that these extensions do not open the way to arbitrary forming of sentences. They all lead to only a certain range of sentence structures: only structures which are identical with the resultants of the incremental and redundancy operations above, except for permitting additional subclasses in stated positions within the resultants. And even of these structures, most of the analogic operations (all except that of 5.6) produce only such sentences as can be obtained from the previously existing sentences by extending to a new subclass a previously existing difference (in most cases transformational) among sentences of some other subclass. Thus, where previously we had the difference between S_a and $\varphi\ S_a = S_b$ just for X' (with X'' occurring only in S_a), now we have that difference also for X'' (since X'' now occurs in both sentence forms). The extensions thus bring in neither new sentence forms (if the forms are defined in terms of classes X rather than of subclasses X') nor, except for the

5.6 case, now transformational pairs of sentence-forms.

It must be stressed, however, that the choice of which subclasses become the subject of analogic extension, and which do not, seems quite arbitrary, within present knowledge. There are no clear criteria which determine, within the limits stated above, where analogy will act. Some of the factors at work here may be the same as those involved in historical change; but this would require considerable investigation.

5.1 EXTENDING AN ELEMENTARY OPERATION

The simplest kind of analogic extensions is the case in which a transformation from S_a to $S_b = \varphi S_a$ has been defined over a subcategory X' and the starting form, S_a, exists for another subcategory X'' of the same category X:

From $S_a(X') \rightarrow S_b(X')$

and $S_a(X'')$

We obtain $S_b(X'')$

A simple example of this is the moving of many A ly and PN members of post-V inserts into the other insert positions in a K on the analogy of the sentence-adjunct category (whose members are primarily of the form A ly and PN) which are defined as occurring both in the post-V and in the other insert positions in K. Thus, given He prefers Bach generally, He generally prefers Bach, Generally he prefers Bach, we obtain from He solved the problem slowly, He solved the problem with difficulty, also He slowly solved the problem, Slowly he solved the problem, and He with difficulty solved the problem, With difficulty he solved the problem.[43] Note

43. Various A, PN are variously comfortable in these positions, and there is some confusion with those A ly, PN (usually separated by commas) that come from N is A, N is PN; Slowly, he rose (in the sense of 'being slow', not 'in a slow manner').

that pre-V inserts such as quite, and post-V adverbial A (not A ly) such as in He ran fast, do not share this extension.[44]

This permutation of adverbs into all insert positions extends also to A_s ly, P V_sn (adverbial forms of sentence-operators, 5.25) and to the many forms of C_sS (subordinate connectives). All of these sequences share with $A_m$ly a certain range of positions.[45] They all occur as inserts (in effect, adverbially) at K end, and they all can take the K as their subject (K_n is A_m, Kn is A_s, Kn is C_sS). The fact that they can all move into the various insert-positions of K can be taken as an analogic extension, to this whole set of inserts, of the mobility of the $A_m$ly subset of this set. Thus we obtain

He, clearly, is the one. Clearly, he is the one.

He at our suggestion went there. At our suggestion he went there.

The student's missing of the solution was because he didn't ask the right question.

The student missed the solution because he didn't ... .

The student, because he didn't ..., missed the solution.

Because he didn't ..., the student missed the solution.

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44. A rather special case of this moving of sentence-adjunct-like material may be involved in For N to V N_2 is A_s → N_2 is A_s for N to V: For him to say this is easy, This is easy for him to say. The for N has indeed the form of a mobile insert, but the to V is only distantly similar to the to V Ω which is a C_sS insert, for here the to V is moved, while Ω remains. The separation of to V from its Ω might be understood if the permutation of the to V went through an intermediate Ω Σ V operation (6.1) yielding N_2 for N to V is A_s: This for him to say is easy.

45. I.e., they can all, together with A_m be looked upon as subclasses of a super-class of sentence-predicates, defined by occurrences in this range of positions.

Another example of this simple analogy is seen in the extension of the transformation

$$Sn^{o}\ V_{s.}\ \Omega \rightarrow It\ V_{s.}\ \Omega\ Kn^{o} \quad (5.6)$$

to operate on sentences of the form (1) wh- K is X as well as on $Sn^{o}\ V_{s.}\ \Omega$. The $Sn^{o}\ V_{s.}\ \Omega$ includes wh- K is A_{s}, wh- K is N_{s}: Whether he took it is unclear, Whether he took it is the question, What he took is the question, Who took it is the question, etc. The sentences of the form (1) wh- K is X (5.52) constitute an important set of sentences, extracting from K a class which is in the range of X = N, PN, Ving Ω, D, and certain Ω including A: What he took is a book, Who said so is John, Where he stayed was with me, How he argued was quitely, What he is is clever. Although these are very different from (2) $Sn^{o}\ V_{s.}\ \Omega$ in range and in grammatical character, there are a number of structures in (1) and (2) which are similar, as sequences of constants and classes. In any case, we find the It form (with that replacing the wh-words except for who and rarely when, where), yielding It is X that S-X: It is a book that he took, It is John who said so, It was clearly that he argued, etc.[46]

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46. In this way all sentence forms whose Σ has the form Sn^{o} receive the It transformation. Note, however, that the analogy does not extend to What she cooked is nice (* It is nice what she cooked is at best doubtful, especially without comma). For here the subject is not a sequence beginning with wh, but a zeroed pronoun plus wh- sequence: That which she cooked (see 4.3 above).

5.2 INVERSES

The possibility of extending a transformational operation to a new subclass does not depend upon the direction of the operation.

from	$S_a(X') \rightarrow S_b(X')$
and	$S_b(X'')$
we obtain	$S_a(X'')$

Given a transformation from structure S_a to structure S_b, for sentences containing a subcategory X' of X, and given a structure S_b which contains in the corresponding position a subcategory X'' of the same X, we often find a back-formed S_a of X''. The set of sentences $S_a(X'')$ not only extends the transformational relation between S_a and S_b to the subcategory X'', but also shows that a transformational relation between S_a and S_b can be obtained (in terms of our basic operations) in the sense $a \rightarrow b$ in the case of X' and in the sense $b \rightarrow a$ in the case of X''.

We thus have inverses of the basic operations. This does not mean simply the undoing of an operation which has occurred; that would not be apparent unless the operation had left some morphophonemic or other effect which was not removed when the operation was undone. Rather, it means the carrying out of the inverse operation on a sentence in which the operation has not occurred (but which has a form similar to the resultant of the operation, for otherwise the inverse would not find the conditions necessary for its being carried out).

The possibility of carrying out such inverses (as contrasted with simple undoing) rests on our being able to find material which looks like the forms produced by the $a \rightarrow b$ transformation but which in fact did not result from $a \rightarrow b$. 'Looks like' means, as before, consisting of a (different) subcategory (X'') of the same category X to which the X' subcategory belongs, and

carrying an outside (last)affix of the same kind as X' receives in the course of a → b (if indeed X' receives any affix in the course of a → b). A major source of inverses is in the resultants of the sentence-operators, for when the Σ or Ω of the operator has such forms as N's Ving of N, Vn of N by N deformed from N V N, the N's and PN here have the form and position of inserts which we would expect if just the Ving, and Vn, as N-equivalents, were the Σ or Ω of the operator, and if the N's and PN had been brought in as inserts from The Vn is PN or the like (by 3.4 and 4.12).

5.21 Inverse of insertion

Since insertion is the placing of certain word-category sequences into a K (as sentence adjunct), or next to a part of K (as local insert), its inverse would be the excision, from an S, of insert-like material, i.e. of material that is similar to inserts in its word-class and affix composition, and is similarly placed, but which was not in fact brought in as insert. These latter may be called pseudo-inserts. Such pseudo-inserts are the subjects and objects of S under operators, which take such forms as Σ's, of Ω. As was seen above, certain ones of these drop, whereas Σ (and in most cases Ω) not in adjunct form do not. However, such PN and N's drop only when the N is redundant (section 4). Inverses of insertion do not seem to occur except under these conditions.

5.22 Inverse of sentence-operators

Since the sentence-operators, though verbs, are in general different from the verbs of a K, there is little opportunity to remove a K verb as though it were a sentence-operator-verb V_s. However this possibility arises in the case of the U_b operators, especially have, do, make, and U_{ap}, which are morphemically identical with certain K-verbs. Thus, we have $N\ t\ V_2 \rightarrow N\ t\ U_{ap}\ V_2n$ (or with V_2n otherwise in the Ω of U_{ap}): He dreamt → He dreamt a dream; He fought → He put up a fight. When we now have N_2 which occur in $N_1\ t\ V_{ap}\ N_2$ (or with N_2 otherwise in the Ω of V_{ap}, we obtain $N_1\ t\ N_2(v)$, where the (v) indicates that the N_2 is operated on as a V even though it carries no verbalizing suffix v (i.e. it has v = zero): He ate (had) breakfast → He breakfasted; He put up a wall around it → He walled it. Thus, just as V_2 above was replaced by $U_{ap}V_2n$, so here we replace $V_{ap}N_2$ by $N_2(v)$.

In most cases, given $S_a(X') \rightarrow S_b(X')$, any additions of an affix to X' would occur in the derived S_b as part of the a → b effect. If we find a derived form that contains a zero affix (on some subclass X''), the likelihood is that the derivation is obtained by an inverse operation, and that the resultant is affixless because it parallels the source form on a related subclass X''.

5.23 Inverses of connectives; Denominalization

Situations arise in which a connective which was not originally in the sentence is removed, so that S_1 C S_2 → S_1 • S_2. This can happen only if the connective had been brought in secondarily by the inverse of a connective-dropping operation. Such a situation occurs widely and with many different resultants, out of a K under sentence operator. Some of the examples below could indeed be routed differently as the inverse of the nominalizing deformation which sends K → Kn under W.

From 2.3 we have N_o V .s acting on N V N_2 (or N V PN_2) to yield N_o V .s N's Vn PN_2 (where Vn includes Ving): We reported their purchase of gouaches, from They purchased gouaches. If we apply here the inverse of the wh, is constant-excision (4.12) we bring in a secondary wh, is obtaining

N_o V .s Vn wh N's Vn is PN_2

or

wh Vn PN_2 is N's.

We reported a purchase. wh Their purchase is of gouaches.

If we now apply the inverse of the wh-operation (the operation 3.4 that takes two sentences, S_1, S_2 with common N_i, and produces S_1 wh $\breve{N}_i$ S_2-N_i, we obtain two sentences

N_o V .s Vn. N's Vn is PN_2.

or

Vn PN_2 is N's.

We reported the purchase. Their purchase was of gouaches.

or

The purchase of gouaches was theirs.

The same process takes place for by N in the position of N's.

From We reported the purchase of gouaches by them.

or We reported the purchase by them of gouaches.

we obtain We reported the purchase. The purchase by them was of gouaches.

or The purchase of gouaches was by them.

or also The purchase was of gouaches.

and The purchase was by them.

This variety of forms arises from the fact that each is-excision (4.12) changes one Ω into a pseudo-insert, i.e. into something which has the form and transformability of an insert:

The picture which was on the wall fell → The picture on the wall fell.

The picture which was new fell → The new picture fell.

The new picture which was on the wall fell → The new picture on the wall fell.

When we find in a sentence an N (or an N-equivalent such as Vn, 5.2 above) with two inserts or pseudo-inserts, we can apply the inverse of is-excision to one insert in such a way as to carry the other insert with the N into the newly-constructed sentence, or to leave it in the sentence from which we started:

The new picture on the wall fell →
The new picture which was on the wall fell →
The picture fell. The new picture was on the wall.

or

The new picture on the wall fell →
The new picture which was on the wall fell →
The new picture fell. The picture was on the wall.

The constructing of a new sentence by such bringing in of is before pseudo-inserts, will be called denominalization.

The denominalization described here produces the is PN forms of adverbial PN which were discussed in section 1. Thus the form his writing of the letter with trepidation, which has the form of N (i.e. Ving) with pseudo-inserts (N's, PN), becomes His writing of the letter was with trepidation, which has the form of a sentence. We have:

	K PN_m:	We wrote the letter with trepidation.
→	Kn PN_m (under W)	We doubt his writing of the letter with trepidation.
→	Kn is PN_m:	His writing of the letter was with trepidation.

Similarly for C_sK:

	K C_sK:	He wrote the letter because he was angry.
→	Kn' C_sK:	We doubt his writing the letter because he was angry.
→	Kn' is C_sK:	His writing the letter was because he was angry.

The situation is more complicated for $A_m$ly, because here there is a change to A_m:

He wrote the letter hesitantly.

We doubt his writing the letter hesitantly.

To obtain the A_m,without -ly, in His writing of the letter was hesitant we have to appeal to the analogy of A_s (His writing of the letter is certain) in 5.6.

In denominalization, the necessary is can be brought in only before such sentence-segments as are of the kind before which is would have been dropped in nominalization (2.3) or in constant-excision (4.12). Hence this does not occur for C_cK: He wrote the letter and she mailed it. Under W, we have Kn C_c Kn: We doubt his mailing the letter and her sending it. No is can be brought in before C_cK.

A possible example of the inverse of an inverse is the case of PN (and P Sn) inserts to a K which become the subjects of that K. These are forms like the instrumental:

(1) He broke the plank by (or: with) a blow of the fist.

(2) A blow of the fist broke the plank;

or verbs like cause, indicate, demonstrate which have both

He caused their return by (his) publishing the news.

and

His publishing the news caused their return.

The second member of each pair can be obtained from the first by the following extension:

If we begin with N_1 V N_2, we can obtain under certain W operators the deformation the Ving of N_2 by N_1, from which we can reconstruct, as above, The Ving of N_2 is by N_1, which is thus a transform of N_1 V N_2.

Now if we begin with

N_1 V N_2 by N_3: He broke the plank by a blow of the fist

we obtain under the W the deformation

N_1's Ving of N_2 by N_3: his breaking of the plank by a blow of the fist

from which we can reconstruct not only

His breaking of the plank was by a blow of the fist

but also (since not all the pseudo-inserts have to be included)

(3) The breaking of the plank was by a blow of the fist. The Ving of N_2 is by N_3.

If we extend to this form the transformational relations of the similar The Ving of N_2 is by N_1 above, we have that (3) is a transform of

(2) N_3 V N_2: A blow of the fist broke the plank.

In this double inverse we have two successive extensions to new subcategories. First, whereas is-excision was defined on the K_2 after a wh-connective, its inverse here acts on the Σ and the adverbial by-inserts of the main K itself under an operator. Second, we extended to the adverbial by-inserts the inverse of the operation which had given us is by N_1 from an N_1 subject.

The inverse of an inverse also appears in the following succession: Given, e.g.

(1) N is A P N , N V Ω P N

He is silent about his past,

we get, under operators:

(2) N's An P N , N's Ving Ω P N

His silence about his past.

and by inverse of is-excision:

(3) N's An is P N , N's Ving Ω is P N

His silence is about his past.

as well as other forms (e.g. (An P N is N's).

When the inverse of this while succession (or of the first change above) is applied, by extension, to forms (2, 3) in which the N's is not derived from the Σ of the V or the A , we obtain new sentences of the form (1) N is A P N, N V Ω P N in which the subject N is not the kernel Σ of this is A, V Ω:

His smoothness in speaking →

He is smooth in speaking.

(*) The book's surprise to us is in (its) selling well →

The book surprised us in selling well.

(*) The book's oddness in selling well →

The book is odd in selling well.[47]

Another case of this inverse produces a peculiar English sentence form, whose character can be explained only by some such derivation. This is the form containing is to: The bomb is to go off at three. On the one hand, such sentences are peculiar in that no auxiliaries can be added: ∄ The bomb will be to go off at three. On the other hand, each is to sentence carries the meaning of intention or of arranging for an outcome, even though the intender does not appear in the sentence. Now if we consider the sentence operators which take the form

(1) N t V_{nh} (P) N_i that N_i should V Ω →

(2) N t V_{nh} N_i to V Ω

we find that they have a characteristic meaning of arranging the V Ω for the N_i: set the bomb to go off, fix the show to open abroad, etc. If on (2) we carry out successively the two inverses used above, we obtain:

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47. For the source forms, see 5.53. Those with (*) are uncomfortable, but can be found in context.

$N\ t\ V_{nh}\ N_i$ to $V\ \Omega$ →

$N\ t\ V_{nh}\ N_i$ wh N_i is to $V\ \Omega$ →

$N\ t\ V_{nh}\ N_i.$ N_i is to $V\ \Omega.$

He set the alarm to go off at three →

He set the alarm, which is to go off at three →

He set the alarm. The alarm is to go off at three.

The form (2), which alone can serve as the base for these inverse operations, is formed only out of (1) containing in its operand K the auxiliary should to which of course no further auxiliary can be added. The to of (2) is a morphophonemic shape of this auxiliary should (in particular, should in the sense which it has in the operand of set, arrange) under certain operators, i.e. in certain new (insert-like) environments. The K-like form which the inverses produce out of (2) merely adds the V-constant be to this to. Hence no auxiliaries can be added to is to, and the meaning of the source arrange that N should is retained in N is to.

5.24 Inverse of redundancy removers; Extraction

In 5.23 we saw various cases of the inverse of the is-excision and the wh-excision (4.12) operating on nominalized S (under W). A somewhat different case operates on an original wh (3.4) but then produces a secondary wh (by inverse of wh, is-excision) yielding the very important 'extraction' structures. We start with K_1 wh K_2, say $K_1 = N\ V\ N_i$, $K_2 = N_2\ V_2\ N_i$, or $N_i\ V_2$, obtaining

(1) $N\ V\ N_i$ wh $\breve{N}_i\ N_2\ V_2$

I know the mayor whom he meant.

(2) $N\ V\ N_i$ wh $\breve{N}_i\ V_2$

I saw the book which fell.

Now in I bought the book which was on the shelf → I bought the book on the shelf, we have excision of the constants wh, is. If the inverse of this excision is applied by extension to (1, 2), where the wh had never been excised, we obtain

$$N\ V\ N_i\ \text{wh}\ \breve{N}_i\ \text{is wh}\ \breve{N}_i\ N_2\ V_2$$

I know the mayor who is whom he meant.

$$N\ V\ N_i\ \text{wh}\ \breve{N}_i\ \text{is wh}\ \breve{N}_i\ V_2$$

I saw the book which is what fell.[48]

If we separate the two sentences in each case (inverse of connective, 5.23), we obtain

I know the mayor. The mayor is whom he meant.

I saw the book. The book is what fell.

We thus have The book is what fell as transform of The book fell, The book is what he took as transform of He took the book, etc.

In various situations there take place inverses of the operations which zero words after an antecedent (4.2). Here belongs the pleonastic repetition of the subject after certain U operators, which makes them similar to W operators (He began his studying ← He began studying). Here too we may mention the repeating of the Σ which takes N is A in Ving Ω (← N V Ω A ly, below) into N is A in N's Ving P Ω: He is lengthy in presenting these reports, He is lengthy in his presenting of these reports.

The inserting of classifier $N_{c\ell}$ in some forms may also be taken as the inverse of the dropping of $N_{c\ell}$ before wh- inserts and after A inserts (4.11 and 4.3, footnotes 39 and 40)"

$$N_2 \text{ is } A_s \text{ for } N_1 \text{ to } V \rightarrow N_2 \text{ is an } A_s\ N_{c\ell} \text{ for } N_1 \text{ to } V$$

A novel is easy (for anyone) to read →

A novel is an easy book (for anyone) to read.

---

48. The change from which to what here presents a problem.

5.25 Inverses of analogic extensions

Once an analogic extension is established, there may be an inverse of it on yet some other subclass. Thus if $A_m ly \rightarrow$ is A_m and $PN_m \rightarrow$ is PN_m (on an analogy between Am_{ly} and is A_s, 5.6 below), we then have further the inverse is $A_s \rightarrow A_s ly$:

His being the right one is clear, →
He is the right one, clearly;

and from is P V_sn we have adverbial P V_sn:

His resigning was at our suggestion.
(from We suggested his resigning, 5.23, 52) →
He resigned at our suggestion.

In this way the sentence-operators are transformable into adverbs of the K on which they had operated.

Another example is a possible inverse of insert-moving. The rare moving of wh-$\breve{N}_i$ S-N_i from its position after N_i to the end of the K (if no N is passed on the way) can be taken as the inverse of the moving of $C_c N_i$ from the end of the K to the position after N_i. My friend came, whom I had mentioned to you ← My friend whom I had mentioned to you came. Compare: My friend came, and I too → My friend and I came.

Here also belong the inverses of inverses seen in 5.23.

5.3 MISSING SOURCES

There are cases in which a form, S_b, appears for one subcategory X' (for for all subcategories except X'') only as a result of a transformation ($\leftarrow S_a$), whereas for another subcategory, X'', only S_b occurs and not S_a.

$$S_a(X') \rightarrow S_b(X')$$
$$S_b(X'')$$

but $\not\exists\ S_a(X'')$. If S_b is understandable only as a transformational resultant, how is the source S_a absent for X''? This situation appears most obviously when $a \rightarrow b$ involves affixes, and the absence of a sentence form S_a is due to the absence of its morphological form in the case of words of the X'' subclass. Thus, from He believes this we have He finds this believable. This is believable to him; we have also He finds this credible, This is credible to him, but $\exists$ He cred- this. Here we either have to set up a source outside the set of actual S, namely $* S_a(X'')$, or else $S_b(X'')$ has to be taken as an elementary form even though S_b is a derived form on another subclass X'.

An only distantly similar case is that in which the $S_a(X')$ is not missing but rare, or has a particular twist of meaning. Thus, from N t V Ω we have N t be Ving Ω, K C_s N t V Ω, etc. for non-zero Ω, e.g. He studies physics, He is studying physics, He tires when he studies physics, whereas for many V with zero Ω the first form occurs by itself only very limitedly: He is coming, They flee when he comes, etc., but only in special circumstances He comes. From the point of view of construction, the N t V Ω form is the source for these V as it is for the others.

5.4 INTERMEDIATE RESULTANTS; PRODUCTS OF OPERATIONS

A related but less difficult situation arises in:

$$S_a(X') \rightarrow S_b(X') \rightarrow S_c(X')$$
$$S_a(X'') \qquad\qquad S_c(X'')$$

but $\not\exists S_b(X'')$. Here $S_c(X')$ is such that it is best obtained from S_b (and not directly from S_a), but the form S_b either does not exist or is very restricted for the subcategory X''.

5.41 Rare Intermediates

We first consider intermediates which are missing or at least marginal for some members of a category, but are acceptable for other members.

Consider:

Who came? (He came).
What will he take? (He will take the book.)
When will he come? (He will come later.)

We see that the question can be related to its set of answers by substituting a wh-word for the Σ, Ω, or adverbial inserts (D, PN, because S) of the answer (and then permuting t with Σ). This however seems not to explain the form

What will he do? (He will write an answer).

The what here clearly substitutes for the $\vee\Omega$ (write an answer), but the do is inexplicable: It cannot be a pro-verb since the other wh-questions (above) do not contain a pronoun of the questioned word (other than in the wh-word itself). The do cannot be an auxiliary because an auxiliary (will, etc.) is present. The only way to explain this form in the same terms as the other wh-questions is to relate it to (*) He will do the writing of an answer in which the Ving Ω is the Ω of do. This form is obtained by U_b operator do on He will write an answer

(2.25),[49] and occurs for many verbs, at least in special circumstances,[50] but not for all. We thus have a known operator-transformation N t V Ω → N t do Ving Ω, for a large subclass of V, and a known wh-transformation operating not on V but on Σ, and on adverbial inserts, and hence on Ving Ω when it is the Ω of an operator, e.g. N t V Ω → what t N V? (He wrote an answer. What did he write?, He tried writing an answer. What did he try?).

The only unusual feature here is that many V undergo the do operator-transformation only when the resultant receives the wh-transformation immediately thereafter. The do resultant does not exist by itself. This is tantamount to saying that whereas for some V we have do operating on V, and then wh operating on the resultant, for other V only the product (succession) of wh on do acts as a single operation.

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49. The same intermediate N t do Ving Ω ← N t V Ω is needed for Writing letters is what he does all day ← (*) He does writing letters all day ← He writes letters all day, and for All that he does is feel bad ← * He does only feeling bad ← He only feels bad.

50. One might not think, for example, that do dying occurs, but cf: What does one learn from Berenson's last years except that dying is better done in Italy? Or: Most generals do their dying in bed.

5.42 Missing Intermediate

An analysis of the above kind is needed also for the cases of intermediate resultants of an operation succession φ_1, φ_2 which are missing when φ_1, φ_2 act on one morphological category but which are present when φ_1, φ_2 act in the same way on other morphological categories.

Consider:

	The book and also the pencil fell.
from:	The book fell and also the pencil.
from:	The book fell and also the pencil fell;
or:	I can and will finish it.
from:	I can finish it, and will.
from:	I can finish it, and I will finish it;
or:	He may, but you must, attend that session.
from:	He may attend that session, but you must.
from:	He may attend that session, but you must attend that session.

It is clear that on N t V Ω C_c N t V Ω there are two transformations here: one zeroes those parts of the second K_2 which are identical with corresponding parts of the first K_1[51]; and then in the resultant, if the residue after C_c is an unbroken segment of K_2, there is a permuting transformation which sends C_c plus the residue to the position right after the corresponding segment of K.

If now we take He bought the rings and he wore the rings, we find He bought and wore the rings, but no * He bought the rings and wore; similarly He bought and she wore those rings but no * He bought those rings and she wore. If we account for this by saying that V Ω is a single element, we find that it is

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51. See ch. 10 for details, and for some explanation of the special case of Ω discussed here.

not so in the case of C_{co} (He bought more rings than he wore, He bought more rings than she wore), and in various other forms. In the present terms we can simply say that on Ω in $C_c K$, only the product of the permuting and zeroing transformations acts, whereas on the other K parts each of these acts separately; i.e. on these others the resultants of the first transformation exists independently of its being acted on by the second.

Another example is in zeroed Σ after C_s. We have for certain C_s:

$K_1\ C_s\ K_2$	He said it after he drove here.
$K_1\ P_s\ K_2 n$	He said it after his driving here.
zeroed Σ's	He said it after driving here.

but for while:

	He said it while he drove here
∄	He said it while his driving here.
	He said it while driving here.

We have to say that for a subset of C_s the two transformations, $K_2 n$ and zeroing occur only as parts of a product of elementary transformations, and not separately.

5.43 Required transformations and morphophonemics

The methods which have here been seen to be necessary in order to account for certain forms can also be used to describe required changes in syntax or morphology. A required change is always a change which takes place in the position or phonemic content of some word in a sentence when the word or sentence enters a particular situation. The change is always conditioned upon some other change. Thus when, compared with walk-walked, we have go → went, the change go → wen- occurs if the past-tense morpheme is added (this morpheme in turn having the forms -d, -t, etc. depending on what it is added to). In our present terms we can say that whereas other V accept the past tense independently, go accepts only the product of go → wen- and past tense,

but not either of them independently.

There is little advantage in such a formulation, since a go → wen- operation is not otherwise known. The case was different in examples of 5.41-42 where both of the operations which are involved were known for a certain class of operands, and the peculiar situation could be explained by saying that for a subclass of these operands the operations indeed occurred but not separately. Nevertheless the use of such a formulation even when one of the operations is unique may be of interest in that it separates out the common operation which is then to be acting on the unique member of a class no differently than it acts on the rest of the class.

There is here a further consideration of policy. Since transformations are a relation on (non-ordered) sentence pairs, both sides of the relation naturally exist as sentences. When we evoke a system of directional operations sufficient to characterize the transformations, the source and resultant of each operation are directly relatable to existing sentences (see fn. 3), since these operations are simply a base set, with direction, selected out of the set of transformations. Since both sides of an operation exist, the operation is not required; i.e. we have a sentence whether or not we carry out the operation. The cases of transformational changes which are required are few and have a limited character, as in the zeroing of repeated A in the comparative (He is taller than she), or in the t Σ permutation in the question. It would be of some interest to be able to formulate these exceptional changes in a way more similar to the main body of transformations. Now in 5.41-42 we saw certain aberrant situations which could be produced out of the known transformations, without denying the lack of intermediate forms, by saying that in certain cases only a product of operations acts, and not each operation separately. It is not the operations which are required for the particular subclass of operands in question, since the sublcass can avoid both together. What is

required for the given subclass is the succession, i.e. that the application of one operation implies the application of the other. Once we have to do with such required products we can extend the succession-requirements to do the work that is otherwise done by required transformations, if we can show that at least one part of each required operation (which, as noted above, always contains two parts) consists of an operation which is known on other operands, and is there independent and not required. This is indeed always the case. Both for the conditional variants of phonemics and morphology and for the few required operations in syntax, it is possible to separate out (1) a non-required event acting on a class of operands, and (2) for a particular subclass a change in composition or position, perhaps unique, such that subclass will not undergo (1) without (2), i.e. it will undergo only the product of the two.

As an example we note the transformational relation between The man has white hair and The man with white hair: ∃ The man is with white hair. But we have N has N → N is P N (5.51) for other P (for certain N pairs). We can say that N has N → N is with N (and in many cases → N is of N) takes place only when followed by the is-excision operation (4.12): the man who has white hair → *the man who is with white hair → the man with white hair. That is, only the product of the two occurs.

5.5 EXTENDING A TRANSFORMATIONAL RELATION

There are cases of a normally obtainable $S_a(X'')$ and an inexplicable $S_b(X'')$ where $a \rightarrow b$ does not exist as an elementary transformation, but where for another subcategory X', $S_a(X')$ and $S_b(X')$ are transforms of each other by reason of some complicated chain of elementary operations, or by reason of both being derived from the same source. These intermediate steps do not exist for X''. In such cases, we can say that

from	$S_a(X') \leftrightarrow S_b(X')$
and	$S_a(X'')$
we obtain	$S_b(X'')$

These situations can be considered as merely special cases of X'' missing the intermediate steps through which X' goes, except that the succession of elementary operations that make $S_b(X')$ a transform of $S_a(X')$ is clearly irrelevant to X'', whereas in 5.3, 4 the missing forms would make syntactic sense for X'' as for X', and are missing for morphological or similar reasons.

5.51 Secondary U

One type is that in which $S_a(X')$ and $S_b(X')$ are both obtained from the same source via two members of the same set of operations. For example, the category of operations U contain subcategories of operators which are closely related to each other in form (all utilizing the be, have which are also members of Y) and in meaning:

N t V Ω →	N t be Va P Ω	He is responsive to it, He is suspicious of it.
N t V Ω →	N t be P Vn P Ω	He is in receipt of it.
N t V Ω →	N t have Vn P Ω	He has love for it, He has suspicions about it.

Somewhat less closely related are the further subcategories of U:

N t V Ω → N t U_n P Ω He takes a look at it.

N t V Ω → N t U_{ap} Vn P Ω He feels love for it.

These all have a transformational relation to each other, with small differences in meaning of a modal rather than substantive kind. The relation can be stated as a succession of operations (including inverses) from one U to another: e.g. N has Vn ⟷ N U_{ap} Vn is decomposable into N has Vn → N V N U_{ap} Vn. The existence of this relation on Vn, Va is the basis for an occasional and not always comfortable operation on N, A which is in effect a transformation among secondary U, operating on N, A instead of on Vn:

is A ⟷ is P An ⟷ has An ⟷ U_{ap} An [52]:

It is adequate, He is young.

It is of adequate quality.

It has adequacy, He has youth.

It exhibits adequacy.

V_{ap} N ⟷ has N ⟷ is P N ⟷ is Na:

He has money, He has wit.

He is in the money.

He is moneyed, He is witty.

As an indication of the U_{ap} character of certain V_{ap} before N, note that in He had a party ⟷ He gave a party, He threw a party, the pronouning of party (e.g. in *He threw it) is limited, like the pronouning of Vn in N U Vn (*He took it ← He took a look), and not like the pronouning of N after ordinary V).

Such transformations among sentences containing U and V_{ap}, together with adverbs and nominalization (K → Kn) and denominalization (Kn → K), account for a variety of unusual sentence-types, such as He plays a fast game, His game is fast. (see ch. 5, 7).

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52. For An we may find A with classifier N_{cl} of that A.

5.52 Mirroring

There is an operation of mirroring X is Y → Y is X (occasionally X is P_i Y → Y is (P_j) X), which occurs only for is which is brought in by analogic operations (e.g. inverse of constant-excision, and is P ← has).[53]

This operation can be accounted for in a number of ways. One way is to start with the fact that in the N is $N_{c\ell}$ type of K the order is reversed when the $N_{c\ell}$ has a specific insert: (1) A trout is a fish, (2) This fish is a trout.[54] The latter is thus derived from the former in the course of inserting this. With addition of wh K_2 we obtain The fish which you saw is a trout, etc. Now if the $N_{c\ell}$ is of a very general kind a particular analogy arises. This happens if we take, e.g. The thing is a book, That is a book, together with The thing fell, That fell. We obtain:

The thing which fell is a book.

That which fell is a book.

Similarly

The one whom he meant is the mayor.

This form differs from (5.24)

The book is what fell.

The mayor is whom he meant.

in about the way that (2) differs from (1). The forms are in part analogically extended toward each other, producing:

What fell is a book. What fell is the book.

A book is that which fell. The book is that which fell.

This Y is X ⟷ X is Y, where X = N, P N, Vn of Q and Ving, and Y = the remainder of the K (X) plus constants, is then the basis for an operation Y is X → X is Y (or Y is P_i X → X is P_j Y where

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53. After mirroring, the Y is the new Σ: thus if the new Σ is a N in the plural the is becomes plural.

54. This will be discussed in ch. 4.

the is has come in as noted above.[55] Examples of this mirroring are:

N's Vn is of N_2 → N_2 is N's Vn

His purchase is of these books, These books are his purchase.

Vn of N_2 is N's → N's is Vn of N_2

The purchases of books were his, His were the purchases of books.

N's Ving of Ω U_{ap} $A_m n$[56] → $A_m n$ is P N's Ving of Ω

His speaking has (or: shows, etc.) elegance,
Elegance is in his speaking.

5.53 Σ of K into Σ of operator

Equivalent sources can give rise to a transformational relation, as in the two ways of dropping redundant Σ in insert form: For certain W operators (and for U operators after they have received a pleonastic subject for their operand), we have redundancy-removal of the following type:

N_i's $V_s$ing of N_i's Ving Ω → N_i's $V_s$ing of Ving Ω

and

N_is $V_s$ing of N_i's Ving Ω → The $V_s$ing of N_i's Ving Ω

His beginning of his painting of landscapes
His beginning of the painting of landscapes
The beginning of his painting of landscapes.

For these $V_s$ing and Ving, we thus have relations of the following type:

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55. This mirroring does not occur for the is-ing of He is buying books, where the is is part of a discontinuous constant of the verb-operator.

56. From N's Ving of Ω is A_m, by transformation among the U (5.51); and this latter from N V Ω $A_m$ly, by 5.6.

N's $V_s$ing of Ving Ω ⟷ The $V_s$ing of N's Ving Ω.

This type of relation is extended, as an operation, to those $\underline{V_s}$ which did not have their own $\underline{\Sigma}$, and to certain $\underline{A_s}$ in $\underline{W}$, and more weakly to $\underline{A_m}$:

The surprise to us in the book's selling well →

(*) The book's surprise to us in selling well;

The oddness of the book's selling well →

(*) The book's oddness in selling well;

The smoothness of his speaking →

His smoothness in speaking.

In this way the insert-form $\underline{\Sigma}$ of the operand appears as the insert-form $\underline{\Sigma}$ of the operator.[57]

5.54 Derived V

There are also more complicated cases of transformational equivalences. For example: We have seen transformations which send $\underline{V}$ into $\underline{V_a}$, $\underline{V_n}$; and $\underline{A}$ into $\underline{An}$; and $\underline{N}$ into $\underline{Na}$. These have been described here as the "nominalization" of $\underline{K}$ under operators and as analogic extensions of this operation. The few cases of $\underline{Nv}$, $\underline{Av}$, $\underline{Vv}$, in which a $\underline{V}$ is morphologically created, present a different problem. They cannot be merely inverses of the above, for they involve unique affixes which must be primitive:

It is red, It reddens.

It is large, He enlarges it.

They sat, He seated them.

They were in a house, He housed them.

The first is like an inverse of 2.21:

It shakes → It is shaky, It is shaken.

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57. A further operation on these is seen at the end of 5.23.

The others bring in a new causative Σ and thus parallel the W operators:

It is large, He made it large.

They sat, He had them sit.

They were in a house, He put them in a house.

The parallel between N_o t Xv N and N_o t V_s N X (e.g. He enlarged it and He made it large) as two equivalent transforms of N t X (X: small subcategories of N, A, V; with be added to t before X = N, A) is extended: in the case of N, into a productive N_o t Vn N, where the X is a N with zero v suffix:

They booked a reservation.

(They put a reservation into a book) [58];

and in the case of V, into a productive "zero causative" N_o t V N, where we can consider the V to be, also, v with zero v suffix:

They walked the patient.

(They helped him walk).

5.55 Passive

As a difficult and doubtful example, we take the passive: The inverse of wh, is-excision (5.23) followed by mirroring (5.52) and a transformation among secondary U (5.51, with intermediates absent, as in the last paragraph of 5.43) provides a complex path to the passive. That (1) the passive, is related to (2) the constructing of a sentence out of the operand of a W (5.23), is clear from the similar forms and restrictions in (1) and (2). Under W, one of the Kn forms is

Ving of Ω by Σ

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58. In 5.51 we had N with zero v suffix in N_o t N_1 v N_2 ← N_o t V_{ap} N_1 P N_2 as inverses of N_o t V_{ap} V_m P N_2: He watered the plants, He gave water to the plants; He kicked the door, He gave a kick to the door.

and the by Σ, which is a characteristic of the passive, occurs in Sn primarily if the V has an Ω beginning with N (2.3), which is again a characteristic of the passive. Interestingly enough, the range of Ω and pseudo-Ω which are difficult or impossible for the passive are also difficult or impossible for this Kn. From The Champion ran a mile, The candidate spoke two hours:

(They reported) the running of a mile by the champion.
A mile was run by the champion.
∄ (They reported) the speaking of two hours by the candidate.
∄ Two hours were spoken by the candidate.

Furthermore, this Sn form, like the passive, does not apply if V = be or verbs of the be-set (seem, become). From the Kn form above, we obtain:

by 5.23:	(The) Ving by Σ is of Ω
by mirroring:	Ω is P Ving by Σ
by U-transformations:	Ω is Ven by Σ,

the -en being a particular adjectivizing suffix after V (as in 2.21). The intermediate forms exist hardly or not at all, and we would have to say, as in 5.43, that it is only the product of these elementary operations (and not each of them separately) which takes us from:

He saw the book.

through: N V_s the seeing of the book by him.

to: The book was seen by him.

5.6 NEW RELATIONS

In a few cases an operation is formed where no relation had existed. In these cases,

given $S_b(X')$

and $S_a(X'')$

we obtain $S_b(X'')$

Here, not only are X', X'' closely related subcategories of X, but also the differences between S_a and S_b must be within some specifiable limit, of the kind that can be traversed by a single new operation. However, a general statement about the limits for this differences between S_a and S_b is not available at present.

The operation

$$S\ A_m ly \rightarrow Sn\ is\ A_m$$

He wrote the letter hesitantly → His writing of the letter was hesitant,

has to be accounted for by some route such as the following:
We have by denominalization (5.23)

$$S\ PN_m \rightarrow Sn\ is\ PN_m$$

He spoke with trepidation → His speaking was with trepidation.

We also have nominalization of sentences containing PN_s members of W (when the whole sentence is nominalized under further W):

$$Sn\ is\ PN_s \rightarrow Sn\ PN_s$$

His speaking is at my suggestion →

(I deny) his speaking at my suggestion.

In the same class as PN_m there is $A_m ly$; and in the same class as is PN_s there is is A_s (is certain, etc.). We can say that on this analogy, $A_m ly$ is denominalized into the new is A_m, yielding

His writing of the letter is hesitant,

like: His writing of the letter is certain.

There is an inverse of this operation, which takes Sn is A_s → S, $A_s$ly, and more rarely makes the other W operators into adverbial inserts in the S which was the operand of the W:

He wrote the letter, certainly.

He wrote the letter, to my knowledge.

A similar situation may explain the permuting of the residue of $C_c S$ after zeroing. There is a small number of primitive $C_c X$ (i.e. ⇍ $C_c S$) adjoined to the right of a word of class X: good and ready, by and large. In $K_1\ C_c\ K_2$, if $K_1 = Y_i\ X_i\ Z_i$ and $K_2 = Y_i\ X_j\ Z_i$ (X, Y, Z: successive portions of their identically-structured K), then K_2 is zeroed down to X_j, and

$$Y_i\ X_i\ Z_i\ C_c\ X_j \rightarrow Y_i\ X_i\ C_c\ X_j\ Z_i.$$

The permuting of $C_c\ X_j$, which makes it similar to, though in certain respects not identical with, an insert to the right of X_i is a case of 5.6, if we take

$$S_b(X') = C_c X'$$

as primitive insert on the right of X_i, and

$$S_a(X'') = C_c X'' \leftarrow C_c S$$

when it is after K_1, producing

$$S_b(X'') = C_c X''$$

when it is to the right of X_i.

The forming of a new relation also seems to account for

$$Sn^o\ V\ \Omega \rightarrow It\ V\ \Omega\ Sn^o.$$

We have a primitive

It seems that S, It is merely that S,

e.g. It's merely that I couldn't wait, etc., as a W (of N $V_{.s}$ type) on S which gives a resultant like the It type of K. Here the position of it cannot be taken by any other word: and no source with Sn^o as Σ is possible: ∄ That S seems, ∄ That S is merely. These therefore cannot be taken as transforms of some other form. In That S $V_{s.}$ Ω and the other $Sn^o\ V_{s.}\ \Omega$, we can see an extension of It V that S from the small subcategory $V_{.s}$ = seems, is merely, etc. to V = those $V_{s.}$, is A_s, is N_s which have Σ = that S, whether S, for S.

Other cases of new relations may be

$$Sn^{o} \rightarrow Sn', \quad Sn' \rightarrow Sn$$

as operands of W, so that a W whose operand was Sn^{o} can also take Sn' etc: this presumably because some W had both.

I know that he went, I know of his going.

Also $C_s S \rightarrow P_s Sn$: He left since I came, He left since my coming; presumably because some words were in both C_s and in P; and because P, which in K occurs only before N, comes to occur before Vn and Kn under U and W (2.22, 23). Similarly, the fact that most, but not all, U_g are in U_t and vice-versa (2.23) may be obtained from separate U_g and U_t memberships (with perhaps some overlap), with words then spreading from one to the other.

Also $N\ V_{nn}\ N_2\ N_1 \rightarrow N\ V\ N_1$ to N_2 (V_{nn} = give, write, etc.) on the analogy of $N\ V_{np}\ N_1$ to N_2 (V = attribute, affix):

He gave me the book.

He gave the book to me.

He attributed the book to me.

6. ASYNTACTIC PERMUTATIONS

There are a few permutations (mostly either literary or else required as morphophonemics) which differ from all the above operations in that they produce a sentence-structure which differs from the K structures, and in that the permuted parts retain their pre-permutation relation to the other parts of the K (i.e. the apportionment of transformational effects on the various K-parts.[59] Thus in This say all the scientists, Ω V Σ ← Σ V Ω, the number-agreement with the V is retained by the original Σ. The effect is thus that the grammatical relations are not changed; no syntactic realignment has taken place. There is also no increment involved in these permutations, and no extension of an operation to new subclasses.

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59. A few other transformations lead to more limitedly novel structures, as in the Σ-loss in the imperative V Ω1 (4.13), marked by the imperative intonation. The non-K-like structure of the question derives in part from the performative-dropping (4.13) which again is marked by intonation, and in part from 6.4.

6.1 EXTRACTION WITHOUT WH

This transformation permits Ω, or any N (not preceded by that, whether, for) of K, or of K with operator, to be extracted to the front of the sentence:

I like this → This I like.

She is not clever → Clever she is not.

He attributed the idea to John → The idea he attributed to John.

He attributed the idea to John → To John he attributed the idea.

I know that scientists say this → That scientists say this I know, This I know that scientists say,

I think scientists say this → Scientists I think say this, This I think scientists say.

The operation is repeatable:

The scientists I think say this, This the scientists I think say.

To John he attributed the idea, The idea to John he attributed.

The examples above show that this operates on K which has received an operator; that the operator can act on K which has received this operation is seen in:

The scientists say this → This the scientists say → I know that this the scientists say.

Since this, and the permuting of adverbial P N to the front (5.1), bring to the front of the sentence precisely the material which is pronounced into the wh-connective, we may presume that the wh- operates not on arbitrary sentences but on sentences which as a result of these two transformations, have their to-be pronounced material up front.

6.2 INVERSION

A rare transformation, with rather literary flavor, is

$$\Sigma \text{ t } V \text{ X} \rightarrow \text{X t } V \Sigma$$

where $\underline{X} = \underline{\Omega}$ (including either $\underline{\Omega_1}$ or $\underline{\Omega_2}$ but not both together) or adverbial $\underline{D}$ or $\underline{PN}$:

A man sat nearby → Nearby sat a man.

The Don rolls quietly → Quietly rolls the Don.

The scientists say this → This say the scientists.

He is a fool → A fool is he.

This differs from mirroring in that the $\underline{X}$ in the new position is still the $\underline{\Omega}$, and the $\underline{V}$ does not change its number to agree with the $\underline{X}$. Also the $\underline{V}$ remains unchanged and is the $\underline{V}$ of the $\underline{K}$, not one produced by an operation. This permutation is comfortable when the $\underline{\Sigma}$ is very long.

The following units, A, B, and C, are returning home →

Returning home are the following units: A, B, and C.

It is the more uncomfortable, the more possibility there is of $\underline{X}$ being mistaken as the $\underline{\Sigma}$: <u>The girls saw five Martians</u> → <u>Five Martians</u> (as $\underline{\Omega}$) <u>saw the girls</u>.

6.3 CONCESSIVE PERMUTATION

After certain $\underline{C_s}$ chiefly of concessive meaning:

$$C_s \text{ N t } V \text{ } \Omega \text{ D} \rightarrow \text{D } C_s \text{ N (t) } V \text{ } \Omega,$$

$$C_s \text{ N t } V \text{ } \Omega \rightarrow V \text{ } \Omega \text{ } C_s \text{ N t } (\underline{U} \text{ not including } \underline{be})$$

$$C_s \text{ N t } V \text{ } \Omega \rightarrow \Omega \text{ } C_s \text{ N (t) } V$$

Though he plays the flute softly → Softly though he plays the flute.

Though he would play the flute → Play the flute though he would

Though he would play the flute → The flute though he would play

Though he is young → Young though he is.

The (t) indicates that in certain cases, even in current English, the t is missing in the resultant (Young though he be).

6.4 t Σ PERMUTATION

For certain K-initial D it is required or permitted to have D t Σ V Ω instead of the usual Σ t order:

Little did I think that he would come.

This order also occurs when the if variant of whether is dropped after V_s whose Ω begins with whether:

I wonder if (whether) he will come or not →

I wonder, will he come or not.

The D in question have in most cases a concessive or restrictive meaning, but not in all cases:

They will never know it, They never will know it, Never will they know it.

They will hardly guess it, They hardly will guess it, Hardly will they guess it.

They will only slowly return, They only slowly will return, Only slowly will they return.

We also have

(*) Little I would have guessed it, Little would I have guessed it.

Much I would have like it, Much would I have liked it.

This permutation also appears with the dropping of the C_s member if: Had I known I would have gone; Should he come, I will call you. Also in S_1 of the D S_1 than S_2 construction: Hardly had he left than she returned. Also with a few non-

concessive introducers of secondary S: (He went and so will I (go).[60]

When t is a suffix or zero, then if V = be (whether as Y or otherwise), or if V = have as member of Y (or optionally otherwise), what permutes is t be, t have. Before other V, a suffix or zero t which remains separated from its V receives the non-morphemic morphophonemes of do, whereupon it becomes pronounceable as a word. To understand this, we start with the form Σ t V Ω, and say that in those cases where the tense is not a word (but a suffix, or zero: Ø) it is then morphophonemically moved to be appended after the V:

The man will arrive

*The man -ed arrive → The man arrived.

*The man -s arrive → The man arrives

*The men Ø arrive → The men arrive.

When the t is separated from the V by its permutation with Σ (or, as will be seen below, by certain D), this morphophonemic moving does not take place. The suffix or zero t is not pronounceable by itself as a word. The morphophonemes of do which are then placed before it give it word structure.[61] Thus did, does, do are not verbs or pro-verbs (there is room for neither since a V follows), nor operators on V (as is have), but morphophonemic carriers for -ed, s, and Ø tense affixes.

Certain D, chiefly not and emphatic stress, are inserted between t and V, yielding, e.g.

Σ t not V Ω.

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60. Properties of both the D and C_s cases are seen in the t Σ permutations in Neither will he go (or: Neither he will go) nor will you.

61. Morphophonemes, not phonemes, of do; because this non-morphemic carrier of the tense goes through the same morphophonemic changes as would do in the same environemnt.

The resulting forms are not due to a permutation of the t, but rather to the prevention of the normal moving of suffix t to after the V:

The man will not arrive.
The man did not arrive.
The man does not arrive.
The men do not arrive.
The man did arrive.

6.5 LENGTH PERMUTATION

Permuting of a shorter portion of a form to occur before another (usually longer) portion takes place in certain specified situations: It takes place within the material following a V Σ V X Y → Σ V Y X if X is longer: X Y are chiefly Ω_1 Ω_2 or Ω D. This is required in some cases, optional in most: *They broke up it → They broke it up,[62] They broke up the game → They broke the game up; He attributed the painting to her → He attributed to her the painting (but He attributed it to her does not change); He read a very long letter which was on the desk slowly → He read slowly a very long letter which was on the desk (but He read the letter slowly does not change).

It takes place also between N and the material that is inserted to the right of it. The problem arises particularly with the wh-K_2 insert, whose length can be reduced by excision of the wh- and is. If after the dropping of the wh-word and is,

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62. Instead of this, we can merely say that the pronoun it can replace the game in They broke the game up, but not (for reasons of length) in They broke up the game.

the residue of K_2 is only an A (including Ving, Ven without explicit or zeroed Ω or D following) or a compound word, or in certain cases just another N, then the residue permutes to the left of the N: long book, China doll, broken promises, sleeping beauty, wood-burning stove; but the promises broken (by them), a person sleeping (at the time); and the man here, the man present. This permutation is required. The position of the insert to the right or left or N always depends on the length of the insert (before and after any excisions).

In all these cases length is understood not purely in terms of number of phonemes or morphemes. It is a grammatical quantity, roughly correlating with number of morphemes (and, to a slight extent, of phonemes), but in detail formulated so as to describe accurately which parts appear to the left of which other parts.[63] Note that comma is itself a contributor to length, so that comma-containing inserts on N (e.g. wh K_2 with comma) never permute to the left.

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63. Thus the D_e adverbs, e.g. here do not permute (as in the man here) while A permute (as in the long book).

7. KERNEL-LIKE RESULTANTS

If we now consider the resultant of an elementary transformation on a sentence structure, we find that this resultant is itself identical with some of the previously recognized sentence structures, or different from it in only a manner to be specified here. The well-formedness conditions for an elementary sentence structure are that it be a sequence Σ t V Ω, where the symbols indicate precisely the categories or subcategories of words listed in section 0.[64] The well-formedness conditions for the resultants of an elementary transformation are the same, except that the insertions given in section 1 are permitted before or after the indicated parts of the elementary sentence, and the definitions of Σ, V, Ω are extended to include certain new subcategories or sequences. In this sense, the resultant of an operation on K (or on a K-like structure) is K-like, where 'K-like' means that the structure is identical with K except for the additions and definition-extensions noted in 7.1-5. In addition, the asyntactic operations add the permutations listed in 7.6.

We now consider the resultants of each of the elementary transformations.

7.1 The resultant of an insertion which adds J_r to the right or J_ℓ to the left of X in K satisfies the well-formedness conditions for K if we accept X J_r or J_ℓ X whenever we would accept X in K.

7.2 The resultants of the sentence-operators and verb-operators satisfy the well-formedness conditions for K if that K, whether K, for N to V Ω and N Ving Ω are permitted to satisfy Σ or Ω_1 (the N case) or Ω_2 (the PN case) in K, and if Ving Ω, and Ving, and Vn and An are permitted to occupy the position of Σ and of N in Ω, with N's or of N or by N (with various restrictions) being right and left inserts to these, and P Ω being

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64. There are also certain exclamations and petrified expressions.

a right insert to Ving or Vn, and finally if Ving Ω, Va and PVn are permitted to occupy the position of A in Ω. In addition we note that the operators themselves satisfy the well-formedness conditions for parts of an elementary sentence, consisting as they do of either V (for the Y and U operators) or V Ω, or N V, including be with A, N, PN objects; to the latter we have to add C_s K and P_s Kn as Ω of be. The various subcategories of V brought in by these operators are in many cases morphemes which were not members of V in K.

7.3 The resultants of the connective operation satisfy the well-formedness conditions for an elementaey sentence only if we add to these conditions the permission for K to be followed by C_s K or C_c K or C_{co} K (in which latter case there must be a D_c in the first K), and for N to be followed by wh K as right insert.[65]

7.4 The redundancy operation does not disturb the well-formedness schema because it is so restricted as not to affect the Σ or V or K,[66] but only the Ω of K, and secondary K or inserts into K. The zeroing of Ω in 4.3 produces a sentence of N V_o type. In this case the well-formedness conditions have to be extended so that a verb which was in the category requiring Ω = N, PN object must now be included also in the category which is followed by Ω = zero. The zeroing of constants and appropriate words occurs only in a K_2 which has been adjoined to a K_1, and the zeroing of non-insert-form words on the basis of an antecedent occurs only in a K_2 on the basis of an antecedent in K_1.[67] Thus the verb

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65. The connectives carry additional well-formedness restrictions, within the general restrictions on K, as to similarities among the K on which they operate.

66. Redundant Σ is dropped in the imperative and in such special forms as Coming!

67. With the exception of zeroed V Ω in primary K_1 from antecedent in $C_s K_2$: If you won't go, I will.

be, even though it is a constant of a transformation, cannot be zeroed in This is what I took; but the be of K_2 after wh is dropped with the wh as in The cable from home arrived. Note that if a noun has an antecedent within the same K it is not zeroed, but may be replaced by pronoun plus self, as in He saw himself. As to the zeroing of words which are in insert-form, this obviously does not affect well-formedness since inserts are merely permitted (7.1). These remarks referred to the zeroing of elements. In contrast, the pronouning of elements can occur in any positions of secondary or paired structures (with the antecedent in the other structure); or the pronoun replaces a disjunction of N from a disjunction of sentences. To include pro-morphemes in the well-formedness conditions, we need only include the pro-morpheme of a category as a member of that category. In this way the redundancy operation permits zeros to occur in certain positions of an adjoined K_2, thus affecting the well-formedness for such insertions; but it does not otherwise affect the well-formedness conditions for K.

7.5 The analogic extensions operate on given well-formed sentences and produce only a sentence set identical to one of the given forms except for a stated different subcategory or sequence occurring in place of one of the categories of the given form. The mirror operation produces a novel form in that all the Ω of be, and not only N, may appear in Σ position if they are missing in a certain way from the new Ω e.g. Here is where he was, Here is where he stood, Nice is hardly what he is.

7.6 The asyntactic permutations produce in general sentence structures which are not K-like, but are describable in terms of K-structure, as permutations of its parts.

7.7 We can summarize the operands and resultants of the elementary transformations in the following table, omitting all details:

Transformation	Operand	Resultant
Insertion J	X of K	$J_\ell X$ or $X J_r$ substituting for X
Verb-operators Y	N V Ω	N Y Ving/en Ω
V Ω-operators U	N V Ω	N U (N's) Vm (of) Ω [69]
Sentence-operators W	S (incl. K)	N V $S\bar{n}$, $S\bar{n}$ V Ω [68]
Connectives C (exc. wh)	S_1, S_2	S_1 C S_2
Connective wh	K_1 (N_i), S_2 (N_i +) [70]	K_1 (N_i wh $\breve{N}_i$ S_2-N_i)
Redundancy removal	Sn, CS, and a few other increments	reduced forms of Sn, CS, and in a few cases, of K.

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68. $S\bar{n}$ stands for Sn^{o}, Sn', and Sn.

69. For Vm, see 2.2.

70. K may contain J and a few J-like reductions of wh, but not other connectives. S(N_i+) means that the N_i is the first word of S, at least after a permuting operation.

8. SUCCESSIVE APPLICATION OF THE OPERATION

Each transformation φ_i has been defined here as operating on an operand of a certain form; a K or K-pair structure, which the φ_i may require to have certain limitations as to subcategories of words in stated K-parts, or as to identity of certain words in the two K. Now each transformation φ_j produces specified changes in the form; and for certain transformations, φ_i operates on the resultant of φ_j in the same way that φ_i operates on a K. This can be expressed by broadening the definition of the operand of φ_i to include the additions, subcategory-changes, etc. that φ_j has introduced.

8.1 THE TRACE OF A TRANSFORMATION

For this purpose, it is useful to specify the changes introduced by each φ.

We define the trace of φ_i as the difference (in V, pre-tV, and post-tV parts) in the resultant of φ_i as against the operand of φ_i.

φ	Trace
J:	J before of after stated parts of K.
W:	V_s for V, with mostly human N for Σ (i.e. the pre-tV part), S$\bar{\text{n}}$ for Ω (i.e. the post-tV part); or else Sn for Σ, and V_s. Ω (incl. is A_s, is N_s) for V Ω.
U:	U for V, Vm (of) Ω (with possibly N's repeating the N of Σ).
Y:	Y for V, Ving/en Ω for Ω.
C_c, C_{co}:	C_cS as J_r after K; C_{co}S as J_r after Σ is A_c.
with zeroing:	C_cX as J_r after X; C_{co}S as J_r after X containing D_c.

φ	Trace
C_s:	C_s S as J on K.
wh:	wh N_i S-N_i as J_r on N_i.
zeroing:	Vn Ω, Vn instead of Sn', Sn as Ω of W; zero instead of N as Ω of certain V; etc.

The traces of the various analogic extensions and inverses consist in that a particular subcategory (or category or sequence) in a stated part of K is different from the subcategory for that part in the definition of K, or of the φ on that K.

It can be shown that the trace of a transformation is never entirely zeroed (or, rather that this is a safe assumption to make), even though parts of the trace may be zeroed.

We can now say that if φ_i operates on a resultant $\varphi_j K$, then φ_i operates on $\varphi_j K$ precisely as φ_i operates on the parts of K, except that if any part X_i of the K has been replaced by a trace of φ_j, the φ_i operates on that trace of φ_j in X_i as it would operate on the X_i. It is then possible to say for each φ_i whether it will or will not operate on a given φ_j: for particular i, j, either φ_i ($\varphi_j K$) occurs or it does not occur.

To sum up: Because the resultant of an operation φ_j on K is K-like, it is possible for an operation φ_i defined on K to operate on the resultant of φ_j on K. In general, φ_i can operate on K if the K has the particular conditions required in the definition of φ_i. And φ_i can operate on φ_j if φ_j introduces the conditions for φ_i, or if K had the conditions for φ_i, and φ_j did not destroy them, or, finally, if the definition of φ_i is extended so as to accept in a stated K position the new material brought into it by φ_j. It is therefore possible to draw up a table showing which operations can be carried out on the resultants of which operations. Each operation φ_j produces a particular kind of K-like structure, so that if an operation is able to act on the resultant of φ_j it can do so no matter whether φ_j in turn had been applied to a K or to the resultant of some φ acting on a K, and so on.

8.2 INDEPENDENT TRANSFORMATIONS ON K

In principle we do not need the additional concept of two transformations operating separately on a K. However, for may classes of φ, $\varphi_j\ \varphi_i\ K = \varphi_i\ \varphi_j\ K$; and furthermore both these resultants are identical with what we would get if we could combine separately the effect of φ_i on K and the effect of φ_j on the same K. This happens when the traces of φ_i and φ_j do not alter the operand of the other, as when one J is added to one part of a K and another J to another part of the same K, or when a J is added to a part of a K while a sentence-operator $N\ V_{,s}$ that is added to the whole K. Even when two J are added to the same part X of the same K, their action is independent if each operates only in respect to the X:

$$J_\ell: X \rightarrow J_\ell X\ ;\ J_r: X \rightarrow X J_r$$

$$J_\ell\ (J_r X) = J_r\ (J_\ell X): X \rightarrow J_\ell X\ J_r.$$

If the two J on the same X are added to the same side of X, they are independent if the second J to be added operates withoutt reference to the earlier J, i.e. operates only in respect to the X. In this case the latter-added J would be closer to the X than the earlier-added J:

Hence, if

$$J_r: A\ X\ B \rightarrow A\ X\ J_r\ B,$$

then $$J_{r1}: A\ X\ B \rightarrow A\ X\ J_{r1}\ B$$

and $$J_{r2}: A\ X\ J_{r1}\ B \rightarrow A\ X\ J_{r2}\ J_{r1}\ B$$

Thus $$J_{r2}\ (J_{r1} x) = X\ J_{r2}\ J_{r1},$$

while $$J_{r1}\ (J_{r2} X) = X\ J_{r1}\ J_{r2}.$$

It should be noted that while J_{r1} follows J_{r2} to yield $X\ J_{r1}\ J_{r2}$, and J_{r2} follows J_{r1} to yield $X\ J_{r2}\ J_{r1}$, both orderings of J_{r1}, J_{r2} are possible in this example, to yield one sentence or another.

Although we have defined no separate primitive activity of summing the separate operation of two φ on the same K, we can say that in the above conditions the effect of φ_i on φ_jK is the same as a summing of the independent effects of φ_j on K and φ_i on K. The need to specify that φ_i occurs on φ_jK remains only for transformation pairs in which the operand K-parts of one are altered by the trace of the other.

8.3 TRANSFORMATIONS OPERATING ON RESULTANTS

J, which are defined to operate on the K-parts, can also operate on the new N V$_s$ or V$_s$ Ω (including is A$_s$, is N$_s$), U, and Y, since these are simply new subcategories of the categories occupying K positions. But J does not operate in general on the new Σ and Ω which are deformed from the underlying S or V Ω on which W, U operate. Nor does J operate in general on J, or on C.[71]

W, U, Y operate on any resultant of these, since each of these produces an N t V Ω, which is the form of the operand. Where the Σ or Ω of W is Sn^o, the S (in Sn^o) can carry any transformations, since Sn^o is merely any S preceded by that, whether, for--to. Where the Σ or Ω is Sn' or Sn, the S can carry only such transformations as can be operated on by these nominalizations.[72]

The C operate on two sentences S_1, S_2 to produce a single sentence $S_3 = S_1$ C S_2 (with C S as J on K), or $S_3 = S_1$ plus a local J as residue of the C S_2. Therefore they can operate on their own resultant: C (SCS, S) and C (S, SCS), as well as

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71. The occurrence of D$_g$ on C$_s$ originates in the sentence-operator form: He came primarily because she was sick ← His coming was primarily because she was here. Thus, primarily is D$_g$ on was rather than on C$_s$.

72. Some details were given in 2.1-3; for the rest, see ch. 5, 6.

on resultants of almost all other φ. In the case of C_{co}, each of the two S has to be of the form An is A_c (or a form derived therefrom), with the result that C_{co} can only repeat on a pair $SC_{co}S$, $SC_{co}S$.

In the repetition of wh, two different results are obtained, according as whether the N_i common to S_2 and S_3 is the same as the N_j common to S_1 and S_2, or not. If $i = j$, then we have from S_1 wh S_2:

$$X_1\ N_i\ Y_1 \text{ wh } N_i\ S_2\text{-}N_i = X_1\ N_i \text{ wh } \breve{N}_i\ S_2\text{-}N_i\ Y_1$$

and repeating the operation for $(S_1 \text{ wh } S_2)$ wh S_3:

$$(X_1\ N_i \text{ wh } \breve{N}_i\ S_2\text{-}N_i\ Y_1) \text{ wh } N_i\ S_3\text{-}N_i =$$

$$X_1\ N_i \text{ wh } \breve{N}_i\ S_3\text{-}N_i \text{ wh } \breve{N}_i\ S_2\text{-}N_i\ Y_1$$

Thus, S_1 wh S_2:

The book which he wrote is rather poor;

with wh S_3:

The book which sold so well which he wrote is rather poor.

If $i \neq j$, i.e. if different N in S_2 are involved in the two applications of wh, then, taking as an example $S_2 = N_j\ V_2\ N_i$:

we have from S_2 wh S_3:

$$N_j\ V_2\ N_i \text{ wh } N_j\ S_3\text{-}N_j = N_j \text{ wh } \breve{N}_j\ S_3\text{-}N_j\ V_2\ N_i$$

and from S_1 wh $(S_2$ wh $S_3)$:

$$X_1\ N_i\ Y_1 \text{ wh } (N_i\ N_j \text{ wh } \breve{N}_j\ S_3\text{-}N_j\ V_2) = X_1\ N_i \text{ wh } \breve{N}_i\ N_j \text{ wh } S_3\text{-}N_j\ V_2\ Y_1.$$

Thus, S_2 wh S_3:

The quartet which the prince commissioned was to make him famous.

with wh S_1:

The quartet which the prince who favored Beethoven commissioned was to make him famous.

We see here that the repetition of wh takes two different forms, not because of a different mode of operation, but because of the extra degree of freedom in wh as to which N is common to the participating sentences.

The zeroing operations have only limited possibilities of repetition, because of the way they operate originally. Thus given $S_1\ C_c\ S_2 \rightarrow S_1\ C_c\ X_2$, there are only limited possibilities for zeroing in S_3 in the resultants $(S_1\ C_c\ X_2)\ C_c\ S_3$ or $S_3\ C_c\ (S_1\ C_c\ X_2)$.
Thus from $S_1\ C_c\ S_2\ C_c\ S_3$:

John likes Bach and I like Bach and I like Stravinsky.

we obtain $(S_1\ C_c\ X_2)\ C_c\ S_3$:

John and I like Bach and I (like) Stravinsky,

where the second I cannot be zeroed because its would-be antecedent I is only in an insert $(C_c\ X_2)$ within S_1. Or we obtain $S_1\ C_c\ (S_2\ C_c\ X_3)$:

John likes Bach and I (like) Bach and Stravinsky.

where the second Bach cannot be zeroed because it carries an insert $(C_c\ X_3)$ in S_2 which its antecedent in S_1 does not. Similarly, in $S_1\ C_c\ S_2\ C_c\ S_3$:

John likes Bach and I prefer Mozart and John likes Stravinsky.

nothing can be zeroed because S_2 contains no words with antecedents in S_1, and S_3 none with antecedents in S_2.[73]

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73. This chain property characterizes the zeroing procedure of C_c but not all zeroing procedures. The chain appears in C_c even when zeroing is not involved: the difference which or, but require in connected S do not apply between S_3 and S_1 in $S_1\ C_c\ S_2\ C_c\ S_3$ (see. ch. 9). C is an operation on pairs.

We thus have different repetition effects: In a sequence of conjoined S, the zeroing (and difference-counting) in each S depends on the preceding S. In any sequence S_1 wh S_2 wh S_3, the form of wh S_3 depends on S_2 or on S_1 (depending on the N which S_3 shares with its antecedent.) In a repetition of J on a K, each J acts independently on the K. And C_{co} repeats only on a C_{co} pair. All these effects, however, differ only because of the conditions met in each case by the single mode of operation of φ on φ defined above.

8.4 SAME INCREMENT IN DIFFERENT TRANSFORMS

If a particular increment can be transformed from one φ-type into another, e.g. from J or C to W, it will have a different relation to other φ-applications, according to the φ-type in which it is appearing. For example, since the C increment in S_1 C_s S_2 can be transformed into the W increment in S_1n is C_s S_2, we can have this W from repeat, yielding (S_1n is C_s S_2)n is C_s C_3:

His going there was because he thought she was still in.
His going there being because he thought she was still in was because he wanted to see her.

This can be transformed back into S C_s S form:

He went there because he thought she was still in, because he wanted to see her.

But we also have wh on this Sn is C_s S, yielding

(S_1n is C_s S_3) wh (S_1n is C_s S_2) → S_1n C_s S_2 is C_s S_3: [74]

74. The form Sn is C_s is often uncomfortable. However, it is a possible form, and is subject to wh because Sn is operated on here in the same way that N is. If we did not want to go through this form we would need another formulation for this kind of C_s repetition.

His going there was because he wanted to see her.
His going there was even though he was still tired.
His going there even though he was still tired was because he wanted to see her.

Transforming back into S $\underline{C_s}$ S form, we obtain

He went there, even though he was still tired, because he wanted to see her.

In a similar way, one can obtain

(S_1n is P_s S_2n) wh (S_2n is C_s S_3)

His going there was because of his wanting to see them.
His wanting to see them was because they were famous.
His going there was because of his wanting to see them because they were famous.
He went there, because he wanted to see them because they were famous.

Other combinations of repeated $\underline{C_s}$-transforms are possible, all ultimately reducible to a sequence of subordinate conjunctions S $\underline{C_s S \ldots C_s}$ S, in which the various transformational equivalents are discernible as different readings, partially distinguished by commas, of the long sentence.

In a similar way we have:

His quiet announcing of the defeat affected everyone.

from:

wh { His announcing of the defeat affected everyone. (W)
   { The annaouncing of the defeat was quiet. (<u>W</u> form of $\underline{D_m}$)

Without zeroing of <u>wh-</u> and the constant <u>was</u>, this is identical with:

His announcing of the defeat, which was quiet, affected everyone.

In contrast, there is:

His announcing the defeat quietly affected everyone

from <u>affected everyone</u> operating as $\underline{V_{s,}\ \Omega}$ on:

He announced the defeat quietly.

But the latter has the transform (as above)

His announcing the defeat was quiet,

and if the W Ω operates on this transform we obtain the equivalent

His announcing of the defeat being quiet affected everyone.

In the first case, we have W on K and D_m on K (the latter necessarily in W form) connected by comma-wh. In the second case, we have W operating on D_m which has operated on K.

9. THE NETWORK OF SENTENCE DIFFERENCES

We can now consider what is the effect of the elementary operations above, and hence all transformations (which are only successions of these), on the set of sentences in the language. The fact that the resultants of these operations (except for the asyntactic) are K-like means that given an initial set of K sentences which have different K structures for different subcategories, the operations yield additional sets of sentences showing the same structural differences, except that for the new sentences, these structural differences now obtain between sentence sets which have the same sets of word-selections. Furthermore, the fact that the analogic operations do their part of this only by paralleling existing transformational relations (except in the case of 5.6) means that the kinds of structural difference for same word-selection are only those brought in by the increment and redundancy operations (and by the 5.6 analogy). Each of the elementary operations increases the variety of material (subcategories, sequences) occupying K-positions (Σ, V, Ω or next to these), without adding to the stock of word-selection-acceptances of sentences of the kernel.[75]

The main effect, then of elementary transformations is to bring the word-selections of one K_i structure into the form of

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75. A partial exception: The D_m (adverbs of manner, section 1), alone of all the increments, have a selection restriction, to the V, of the kind that obtains within a K. While the D_m appears in an insert position, various transformations bring it and its V into positions of a K structure, thus producing a new selectional relation within a K structure. As to the asyntactic operations, they neither increase the variety of material nor do they add to the stock of selections.

another K_j structure; i.e. a transformation φ_i takes the sets of simultaneous occupants of the K_i positions, together with some constants of φ_i, into particular positions of K_j. It is for this reason that we can look upon a transformation as an operation, which derives the presence of a particular set of word-selections occupying the positions of K_j from their occupancy of positions of K_i.

The problem of transformations as directional operations can only be touched upon here. There are many considerations which support a view of the elementary transformations as being directed operations, and not merely equivalences. In the case of the increments (including affixation) and redundacy-removing, it is clearly natural to think of an operation from a structure A to a structure consisting of A plus increment or excision, rather than merely to say that a set of word-selections occurs with and without these increments or excisions. There is also the fact of linguistic productivity, in which we can see the novel appearance of the word-selection of some structure A appearing in a structure B in which it had not occurred before. There are also situations in which the word selections of form S_a and those of S_b appear both in S_c and in S_d. This can be conveniently described by saying that while two operations took the word-selections of S_a into S_c, and of S_b into S_c, one further operation took those of S_c into S_d. Thus forms with $\Sigma = Sn^o$ come from various sources, but all participate on $Sn^o \; V \; \Omega \rightarrow It \; V \; \Omega \; Sn^o$.

The existence of operations along a directed path may be seen in the residue left by some of the intermediate operations. An example of this is in the transformations which require or prefer the presence of a D, even though the D seems not to be involved in the transformationally related forms. For example, there is for certain V a transformational relation between

N_1 V N_2 and N_2 V D, a relation which is supported by the fact that it is productive, though uncomfortable:

People sell this book, This book sells easily.

They pasted the wallpaper, The wallpaper didn't past nicely.

The N_2V cannot be directly related to the N_1 V N_2 by any known operation; and in any case we have to explain why the form is much more acceptable with D than without it. The D, however, can serve to indicate a possible succession of elementary operations which would account for N_2 V D:

(1) N_1 V N_2	He sells this book.
(2) N_1 V N_2 A ly	He sells this book easily.
(3) One V N_2 A ly (indefinite pronoun)	One sells this book easily.
(4) One's Ving of N_2 is A	One's selling of this book is easy.
(5) The Ving of N_2 is A (drop indef. Σ)	The selling of this book is easy.
(6) N_2 V A ly	This book sells easily.

We obtain (6) from (5) by the inverse of the K A ly → Kn is A operation (section 5.6) which had given (4) out of (3). The form Ving of N is A has two sources, one in which the N is the Σ (The singing of birds was soft), and one in which the N is the Ω (The singing of the chorales was loud.); these are in general discriminable only by co-occurrence. If a sentence of this form receives an inverse of K A ly → Kn is A toward the 'wrong' source, we obtain such a result as (6) from (1) above. In this way there arises a limited relation N_1 V N_2 A ly → N_2 V A ly. The D is present, therefore, because it was a step in the succession of operations; since it was the nominalization of K under is A that made it possible to reconstruct N_2, instead of the lost N_1, as the Σ.

There can thus be little doubt as to the descriptive value of a succession of operations to take us from one form to another. Nevertheless, there are many difficulties in the way of taking a directed operation as the only relation between different S-forms of the same word-selections set. One is the existence of inverse operations (5.2), which , even though they act on a different set of word-selections than the operation they are paralleling, show that the direction of the original operation was not a determining characteristic of it. In fact, nothing in the analogic extensions, which is to say nothing in the way the first operations (1-4) are used for further extension, depends upon the direction of the initial set of operations. A → B and B → A, and sequences of such, serve equally well as a model for producing a new B' out of A'.

The fact that some forms B' can be described as related to A' on the analogy of a relation between B and A, even though an A' source does not exist (5.3), or at the cost of saying that only the product of the operations involved in A → B acts on B' (5.4, 5), suggests that it is not the (directed) path to B that is paralleled in producing B', but rather the pairing A, B.

Finally, if S_b can be related to S_a by a long succession of elementary operations, it will often be found that it can also be related to S_a by other successions of elementary operations. The long paths are often not unique.

There are thus many problems about a system of directed operations which takes us from the K to all the resultant sentences of the language. But even if one does not wish to accept a particular path of elementary transformations between S_a and S_b as a 'derivation' of S_b from S_a, it remains that if the difference between S_a and S_b is more than an elementary transformation, then sentences having partial (intermediate) differences between S_a and S_b exist, in most cases. And even if the particular

K and elementary operations proposed here are rejected in favor of some other set of K and transformations, the fact would remain that for every sentence in the language we would be able to find other sentences containing the same word-selection and differing from it in structure by only the differences exhibited in the elementary operations above (or in some equivalent set of elementary differences) or in some succession of them. The elementary transformations constitute, for the sentences of the language, a system of connectives more than of derivations.

It is this network of elementary differences among sentences, in particular sentences of the same word-selection, that is the most definite result. Indeed, small differences reaching over a range of sentence structures can be seen even outside of transformations. The similarity of all K structures, as expressed in Σ t V Ω, is not transformational. In the U operators, we saw several sets of operators which ranged in many properties from ones similar to Y to ones similar to W; but the various subcategories of U contained different words, so that in general one U form is not a transform of another.

In the case of sentences which are transformationally equivalent, the differences are of a much more definite kind: They are not simply a matter of similarity, but are the precise differences which are sufficient to house the increments and excisions in kernel-like forms (i.e. in a stated and minor extension) of the K structures). The differences thus form a system, namely that of 2.1-4. It is natural to view the moving of a word-selection set over one of these differences as a derivation.[76] But in some cases a descriptively possible

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76. The historical and the psychological reality of these derivations is another matter. Some undoubtedly reflect the path of development of a form. Others may be only a way of exhibiting the parallel to various component transformations. Still others may show an analogic trend which is growing in the language. What does not show the past may be showing the future.

derivation is historically unnatural. For example, it is possible to derive the plural affix from sequences N and N ... and N; whereas and cannot be derived from the plural affix. Similarly, by using otherwise existing operations, it is possible to derive all question forms and imperative forms from assertion forms with performative W operators; but one might hesitate to claim that indeed questions exist in the language only by virtue of this derivation. The descriptive derivations are nevertheless of interest both for a systematic analysis and a normalization of the structure of language, and also for the transformational equivalence which they show between, e.g. singular and plural sentences, or assertions and questions.

10. SUMMARY

We have seen here that the sentences of English can be characterized by a small family of elementary sentence structures and a few small families of elementary transformations on these. Specifically:

1. a small family of elementary sentence forms $\underline{K} = \underline{\Sigma\ V\ \Omega}$ ($\underline{\Sigma} = \underline{N}$; $\underline{\Omega}$ = zero, $\underline{N}$, $\underline{PN}$, and a few more), each $\underline{K}$-form having particular word-selections for its categories.

2. three types of increment to $\underline{K}$: inserts to $\underline{K}$ or to parts of $\underline{K}$, mostly short, and all in very small classes except for the adverbs; operators on $\underline{V}$ and on $\underline{K}$ which themselves become the $\underline{V}$ of the resultant $\underline{K}$-like structure; connectives which adjoin a second $\underline{K}$ to a first.

3. the removal of material which becomes redundant when two entities ($\underline{K}$, insert, or operator) are juxtaposed in accordance with 2 above. The zeroing is carried out in such a way that the resultant maintains a $\underline{K}$-like structure (7). Since only material that can be determined is dropped, we can say that the material is still morphemically present, that only its phonemes become zero, and that the language therefore has no dropping of morphemes.

4. analogic extensions of these operations and their inverses, to subcategories on which they had not been defined, but in such a way as to produce new sentences of structure similar to extant sentences. Only rarely does this involve the setting up of new transformational relations.

5. a very few asyntactic operations which permute the parts of a $\underline{K}$ so that it is no longer $\underline{K}$-like.

These structural components are also semantically characterizable. Strong co-occurrence restrictions on words appear only within a $\underline{K}$, and between $\underline{V}$ and the $\underline{D_m}$ ($\underline{PN_m}$) insert. The

insertions are in general modifiers of that next to which they are inserted. The V of the K, and the Y, U and W operators are all verbs or predicates with distinct semantic differences between one set and the other. The semantic differences among the various types of C can be readily related to differences in the requirements which they make as to the similarity between the two K which they connect. And so down to more delicate distinctions in subcategories. Idioms and metaphors are distinguishable as word-cooccurrences which do not accept all of the transformations that the others in their set do. Linguistic jokes and nonce forms are distinguishable as extensions, usually of type 5.6, made on one member of a word-selection set and not on the rest.

And above all: all substantive information is contained in the K and the incremental operations. Redundancy removal, analogic extension, and the asyntactic permutations vary the style or subjective character of a sentence but not its information. And every S can be mapped by these transformations onto the K and increments it contains (in their particular interrelation).

The elementary operations are not so loose as to permit all word combination to appear as an English sentence. One can study the total range of structures (say, within any given length) that can be produced by any combination of these operations, and it will be seen that they produce a particular set of category-sequences and, within these, only particular rearrangements of the occupants of K positions. As a result, the structure of English sentences, without taking into account the K-occupant rearrangements, remains the Σ t V Ω of the K, except that the values of these variables is now given not only by the list for K, but also by the additions and changes due to the elementary operations.

Every K structure is a model for some transformation, and every word-selection set is present in more than one structure,

i.e. enters into transformations. Every transformation is an elementary operation (an elementary difference) or a succession of these. Every sentence is a K, or can be said to be obtained from a K by a succession of elementary operations. No new concepts are needed to explain the form of this or that sentence, except for restrictions on the application of elementary operations, or for the arbitrariness of which subclass extensions are made by the analogic operation. More generally, aside from specifiable petrified forms, only such sentences exist in the language as differ from other sentences of the same word-selections by various ones of the elementary differences only or by products of these. If we think in terms of the obvious gross transformations, such as passive and question, then we see that each sentence makes its large transformations out of material that is also used in different combinations in other transformations; each use of such material being necessarily itself a component transformation over the whole sentence. Thus for a sentence to fit into the grammar is for it to participate in this network of transformational differences.