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University of Pennsylvania

TRANSFORMATIONS AND DISCOURSE ANALYSIS PAPERS

70. Decomposition Lattices

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1967

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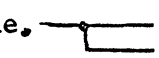
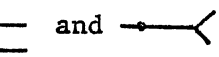
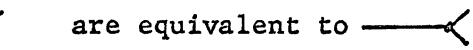
Decomposition Lattices

These pages present the transformational decomposition of paragraphs from scientific texts. The decomposition is displayed in a form that shows the order relation among the transformations. It will be seen that each decomposition is a lattice if the sentence contains only one kernel-sentence ("kernels"), and a semi-lattice otherwise.

Only the "correct" reading is presented for each sentence; we assume that, given a set of all possible decompositions of a sentence (each differing in meaning from the others), it will be possible, by comparisons among neighboring sentences, to select the "correct" (intended) reading.

Though many detailed problems remain, it seems that the decompositional path to a given set of kernel sentences (K) is unique. However, in the present state of transformational theory, it may be that for certain sentences, a particular reading can be decomposed into different kernels and transformations, depending on whether we use certain conjectured transformations; examples of this are given (e.g. parts 2, 3 of S1 of text 1).

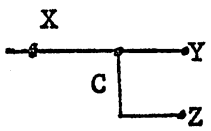
The procedure for obtaining the decomposition is as follows: Starting with the given sentence (S), we ask what unary or binary transformation can be undone at this point; the residual sentence must be transformationally related to the given sentence. We present a unary as a node on a line going to the right, and a binary as a node joining a downward or upward line to the line going right. If more than one transformation can be undone in this sentence, we treat them as an unordered set of transformations at this point. The resultant of undoing a transformation or an unordered set of transformations is again a sentence, and we repeat the procedure on the resultant sentence. (We may find unordered sets of sequences of transformations, as in more and more - appears as in part 1 of S1 of text 1.) The procedure can be checked by recomposing the sentence from the kernels obtained by the decomposition. In the resulting lattice, the universal points are sentences, the residual kernel sentences being the null points at the right. (This orientation is used here, instead of having the universal point at the top, in order to facilitate writing the language material along the lattice lines.) Nodes along a line are

unary transformations; nodes at a junction of two lines which don't meet again are binary transformations. Each transformation operates on the combined resultant of all transformations not to its left to which it is connected by lines. As a pictorial convention, transformations operating independently on subject, verb, object, are written in that order from top downwards (e.g. it, probably, the in S3 of text 1). (Right angles in the drawing are made so that the unary transformations on a K should appear along a horizontal line,  and  are equivalent to  .)

The set of all component sentences of the given S is obtained from the lattice of transformations as follows: Going in either direction: For each node (including S and K, at the ends), with n lines entering the node, each choice of m of these lines ($1 \leq m \leq n$) identifies a sentence which is the joint resultant of the nearest nodes on these m lines, operating on the resultants of the next nodes further out. Each such sentence is transformationally intermediate between the sentences, connected to it by lines, to its left and those not to its left. Both directions have to be used if all component sentences are to be obtained.

For an example of component sentences, for m = 1, taken in each direction, see under S1 of text 1. For an example of the cross-product component sentences (for each choice of m, $1 \leq m \leq n$), see under S8 of text 1.

One type of component sentence may not be obtained from the above, as follows: In



X may be an operator on C, or it may operate on Y or on Z in the form which they receive under C, or on the YCZ entity. In all these cases, X could not be applied to the right of C. But in some cases, the X could have operated on Y and on Z separately, with the resultant of XYCXZ being the same as X operating on YCZ. In such cases, XY and XZ are component sentences too, although the figure shows only X (YCZ). Examples of such X: D, plural, zeroings in both Y and Z. E.g. in S4, of text 1.

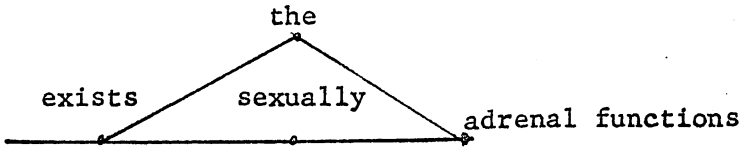
Remarks about the transformations:

V_{ap} indicates any appropriate verb for the given kernel or transformation.

U indicates any appropriate verb-operator: $NV^{\Omega} \rightarrow NUVnP^{\Omega}$ (e.g. effects removal of gland, has function, suffers death, has importance). Ω indicates the object of a V; P: preposition; V: verb; N: noun.

U → S, including specified U such as is Va → S, means that the V^{Ω} of S are operated on by the U: N is important → N has importance. A tumor masculinizes → A tumor is masculinizing.

W → S, where W represents any verb having a sentence (nominalized) as its subject or object (but not both), means that the S receives an appropriate nominalized form:



A sexual function of the adrenal exists.

$\overset{o}{wh}$ indicates connective wh-word (which, etc.) which is zeroed together with following is: adrenal gland ← gland which is adrenal. Although derivation via wh is uncomfortable in many cases, such as the above, it fits the rest of the grammar: prime gland ← gland which is prime.

In all cases of A → wh → B, C , B and C have a noun in common, and it is understood that C is transformed so that this common noun comes first, if it is not already first in C: adrenal is a gland → (the) gland is adrenal.

V_{ss}: A, B indicates $AnV_{ss}Bn$: Its removal leads to death. (Xn: nominalized X; V_{ss}: connective verb)

Conj: A, B indicates A Conj B : He came and he left. The book which he wants is here. Conj. may be C, wh, or other conjunctions.

$\overset{o}{X}$ indicates the zeroing of X.

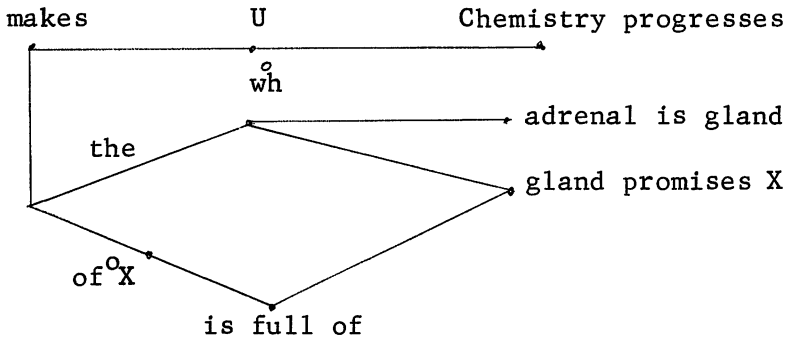
the, this, and other pro-adjectives are traces of lost CK:

e.g. the adrenal ← adrenal (pair) is unique.

it and other pronouns are traces of lost CK too.

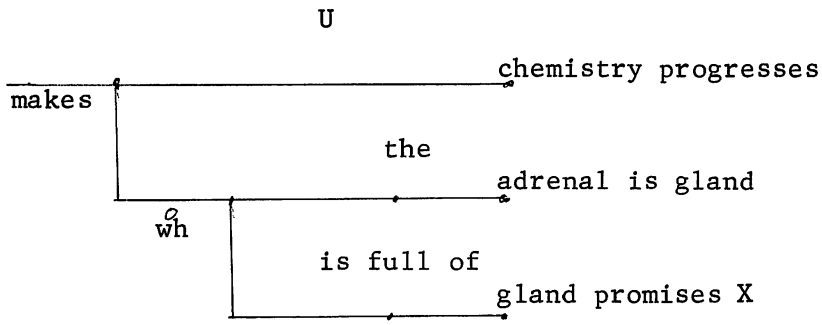
all, plural, and other quantifiers and indefinite pronouns are traces of conjunctions and disjunctions of K, hence of CK...CK.

In some cases, imperfectly established limited transformations would yield more reasonable K; this may be the only source of non-unique decomposition (above). Informationally unreasonable and repetitive K are in any case unavoidable. Thus in S5 of text 1 gland is gland is inescapable if we are to have an occurrence of gland to which we can attach whose different functions... . The source without gland is gland would be:



which yields Progress of Chemistry makes the adrenal gland full of promise; then whose functions... would have to be attached to the first gland, which would differ in meaning from the given S5.

We could also have:



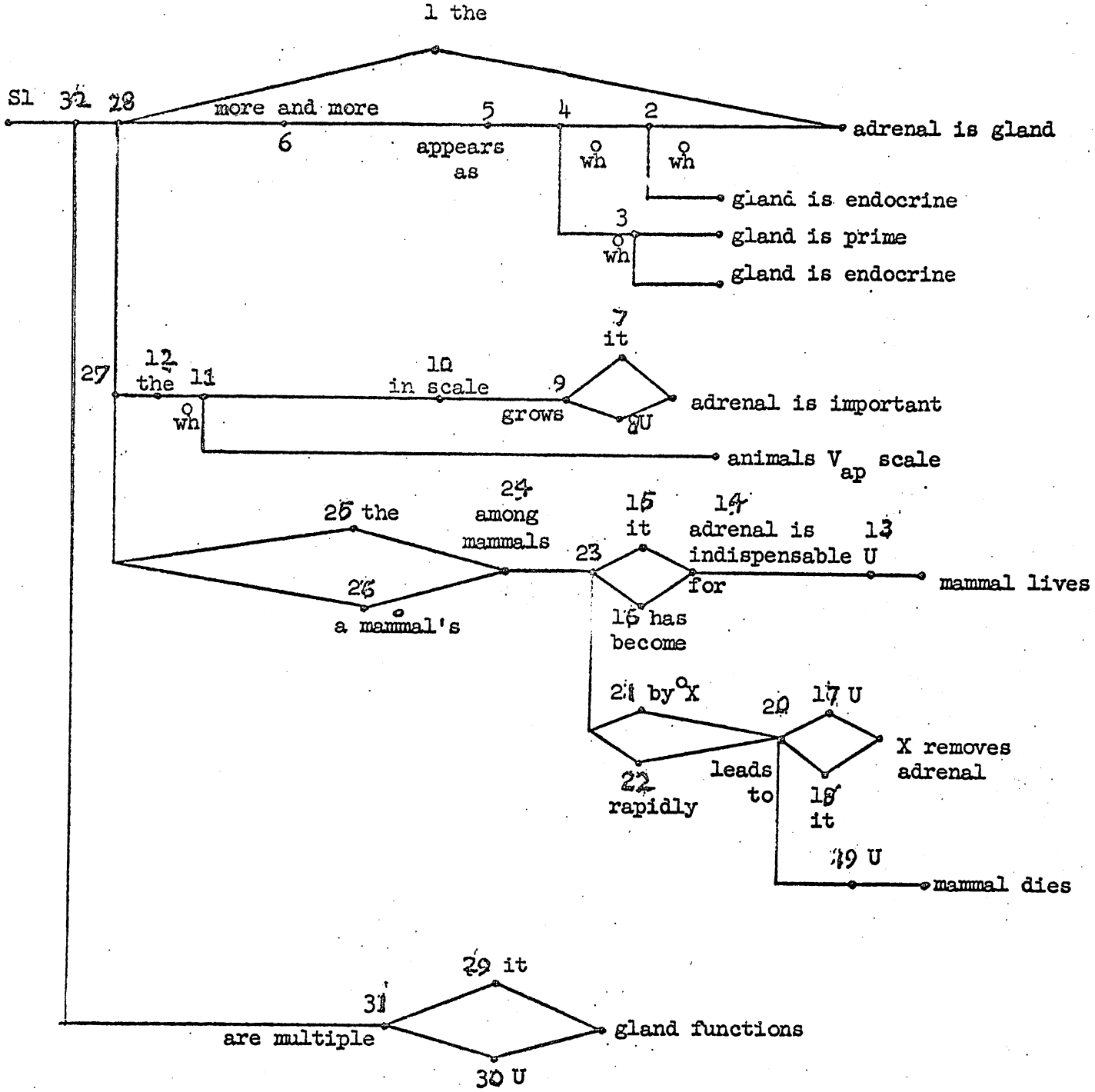
yielding: The progress of chemistry makes the adrenal (into) a gland full of promise.

However, this contains: The progress of chemistry makes the adrenal (into) a gland, and this may not be a desired component sentence of S5.

Text 1

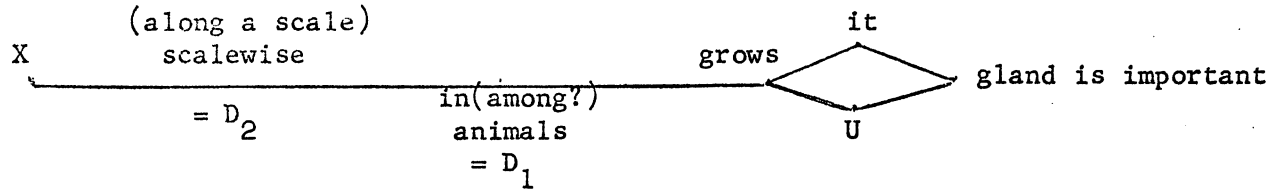
P. Delost, La fonction sexuelle de la cortico-surrénale, sentences 1-9, translated.

S1: The adrenal appears more and more as a prime endocrine gland; its importance grows in the animal scale; among the mammals, it has become indispensable for life, its removal leads rapidly to death; its functions are multiple.

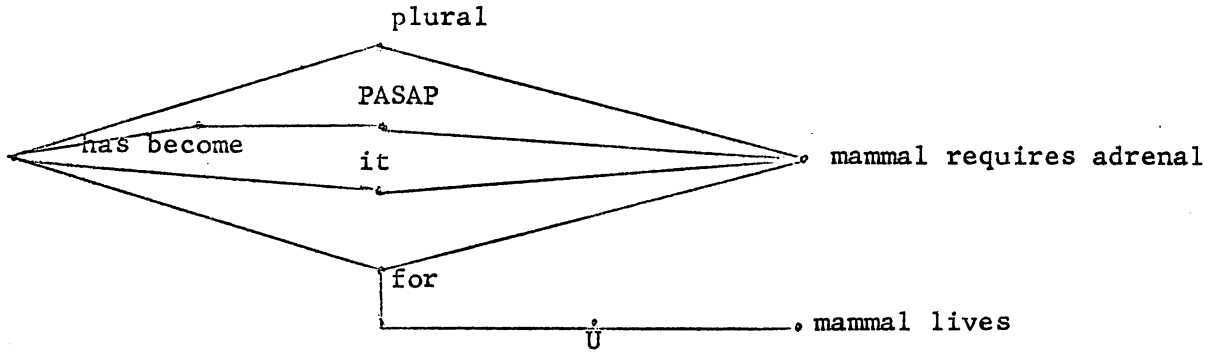


Alternatives:

Part 2: In the following, the transformation X would have to rearrange the words of D_1, D_2:



Part 3: PASAP is the appropriate passive-like transformation, e.g. X requires Y → Y is indispensable for X. It could be avoided by having as K: Adrenal is indispensable for mammal. But it is not clear that this yields among mammals (or only for mammals).



We assume that part 3 (nodes 14-27) is especially related to part 2 (i.e. adjoined to it), while parts 2-3 and part 4 are independently adjoined to part 1.

Examples of component sentences, excluding the cross-product ones (with automatic features such as a added):

Resultant of node

1: The adrenal is a gland.
2: An adrenal is a gland which is endocrine.
" " " an endocrine gland.
3: A gland which is endocrine is prime (of prime importance).
An endocrine gland is prime.
4: An adrenal is an endocrine gland which is prime.
" " " a prime endocrine gland.
5: An adrenal appears as a prime endocrine gland.
6: An adrenal appears more and more as a prime endocrine gland.
7: It is important.
8: An adrenal has importance.

9: Its importance grows. Note that grows operates on the combined resultant of it and of U. When a sentence-operator, W, or a conjunctional verb, V_{ss}, operates on the resultant of a verb-operator, U, on K, the effect is as though W operated on a complete nominalization of K: thus

is important ——U——> gland functions

yields: A gland has function; then: A function of a gland is important.

whereas

is important ——————> gland function

yields: Functioning of a gland is important; or: That a gland function is important.

The V_{ss} case appears below in leads to.

10: Its importance grows in (along) a scale.
11: Its importance grows in an animal scale (or: a scale of animals).
12: Its importance grows in the animal scale.
13: A mammal has life.
14: An adrenal is indispensable for a mammal's life.
15: It " " " " " "
16: An adrenal has become " " " " " "
17: X effects an adrenal's removal.
18: X removes it.
19: A mammal suffers death.
20: Its removal by X leads to a mammal's death.
21: Its removal leads to a mammal's death.
22: " " by X leads rapidly to a mammal's death.
23: It has become indispensable for a mammal's life; its removal leads rapidly to a mammal's death.
24: Among mammals, 23.
25: " the " , 23.
26: Among mammals, it has become indispensable for life, its removal leads rapidly to death.
27: 13; resultant of 25 and 26.
28: The adrenal gland appears more and more as a prime endocrine gland; 27. (The resultants of 1 and 6 are not combined until the operation of 28. If part 1 (nodes 1-6 and their K) had been a separate sentence, the resultants of 1 and 6 would have been combined immediately.)
29: It functions.
30: An adrenal has a function.
31: Its functions are multiple. (Under W, the resultant of U is completely nominalised into A function of an adrenal, or, with the resultant of it, into Its function. Certain W, such as are multiple, automatically introduce a plural on the subject of this nominalised operand.)
32: 28; 31. This ≡ S1.

Examples of the component sentences of part 1, going in the decompositional direction in which each node indicates the removal of the transformation named at that point:

-1: An adrenal appears more and more as a prime endocrine gland.

-6: The adrenal appears as a prime endocrine gland.

-5: The adrenal is a prime endocrine gland.

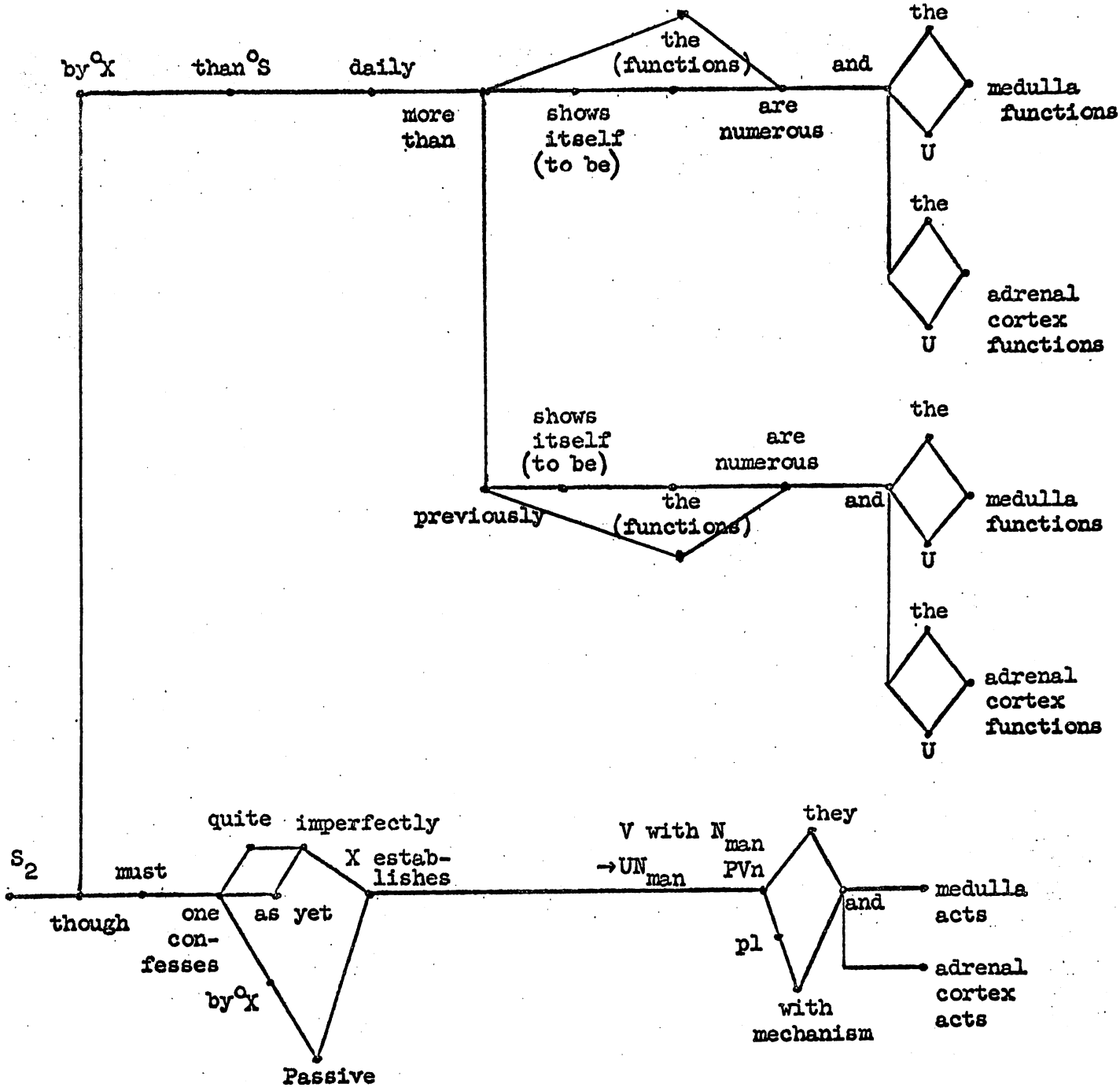
-4: The adrenal is an endocrine gland. The endocrine gland is prime.

-3: A gland is prime. The gland is endocrine.

-2: The adrenal is a gland.

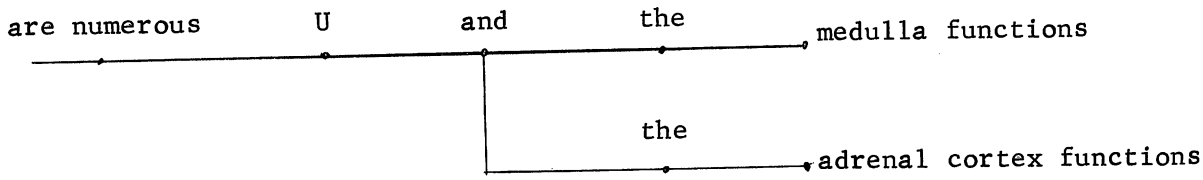
Note that most of these component sentences are not quite identical with those obtained in the other direction, above.

S2: Though the functions of the medulla and of the adrenal cortex daily show themselves more numerous, one must confess that their mechanisms of action are as yet quite imperfectly established.

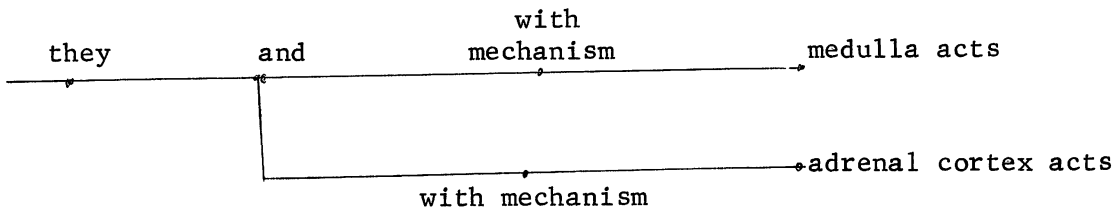


Part 1: What is conjoined by more than is lost, but in the presence of the adverb daily on U (shows itself), the than S which would be most readily zeroable here would be: than the functions.. had previously shown themselves to be numerous.

The U is assumed to be in the operand of numerous because of is repeated. In contrast, The functions of the medulla and the adrenal cortex might perhaps be better obtained from:



Part 2: A slightly different reading (and meaning) would give:



N acts with mechanism → N has mechanism of action; like N talks with great speed → N has great speed of talking.

N_{man}: certain nouns of manner.

Here as elsewhere we assume that nominalized sentences (Sn) under sentence operators (e.g. X establishes their mechanism of action, or The adrenal's removal leads to death) are obtained via a U which first nominalizes the verb:

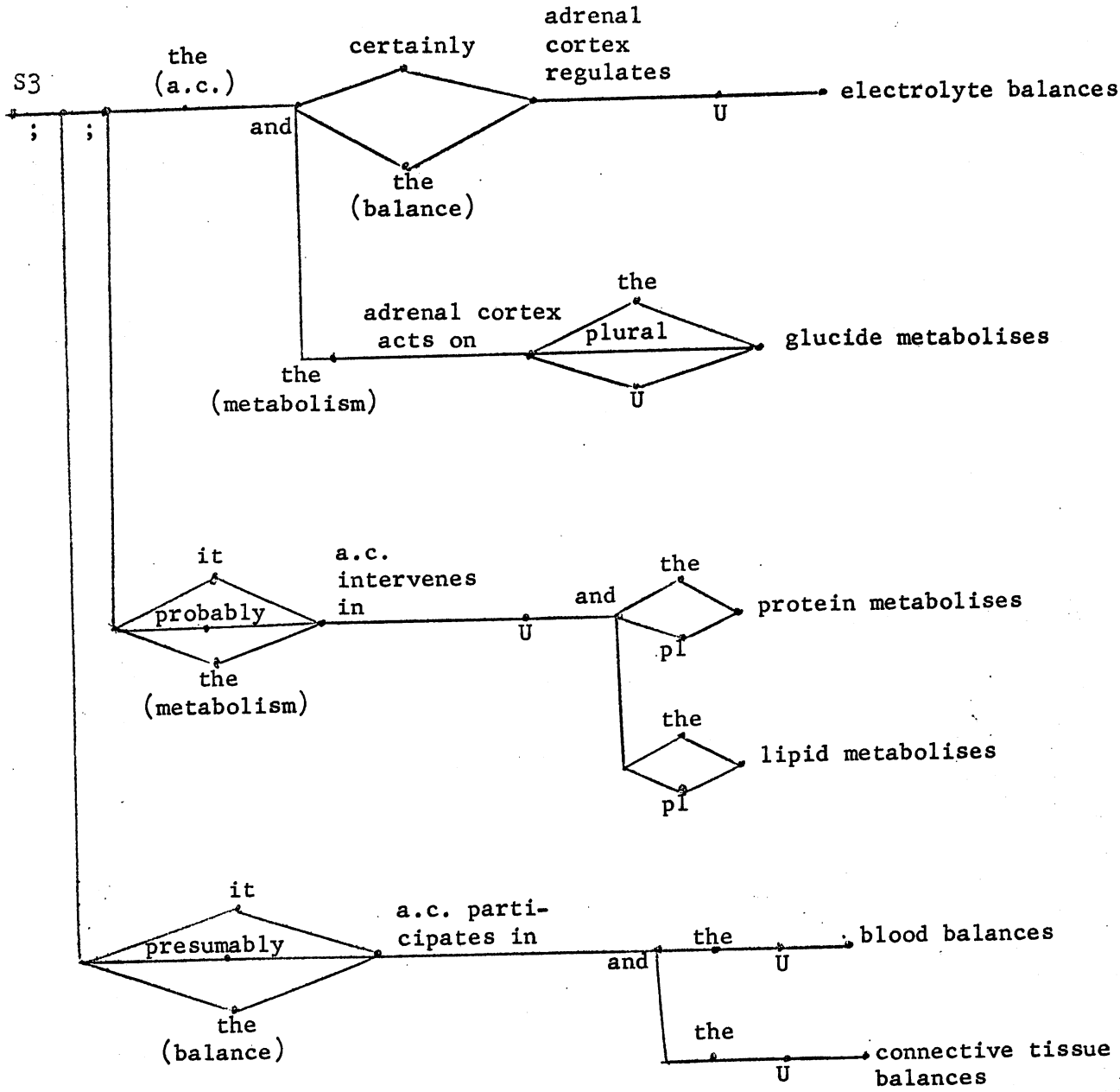
X removes adrenal → X effects removal of adrenal
Y dies → Y suffers death
} → X's removal of adrenal leads to Y's death.

But in many cases the Sn is more natural than the presumed intervening U:

N talked with speed ?→ N shows speed of talking → } N's speed of talking impressed me.

Part 1 is placed above Part 2 to indicate the order in the sentence. In some cases it is difficult to represent the order of words and segments in the sentence (as distinct from the order of transformations).

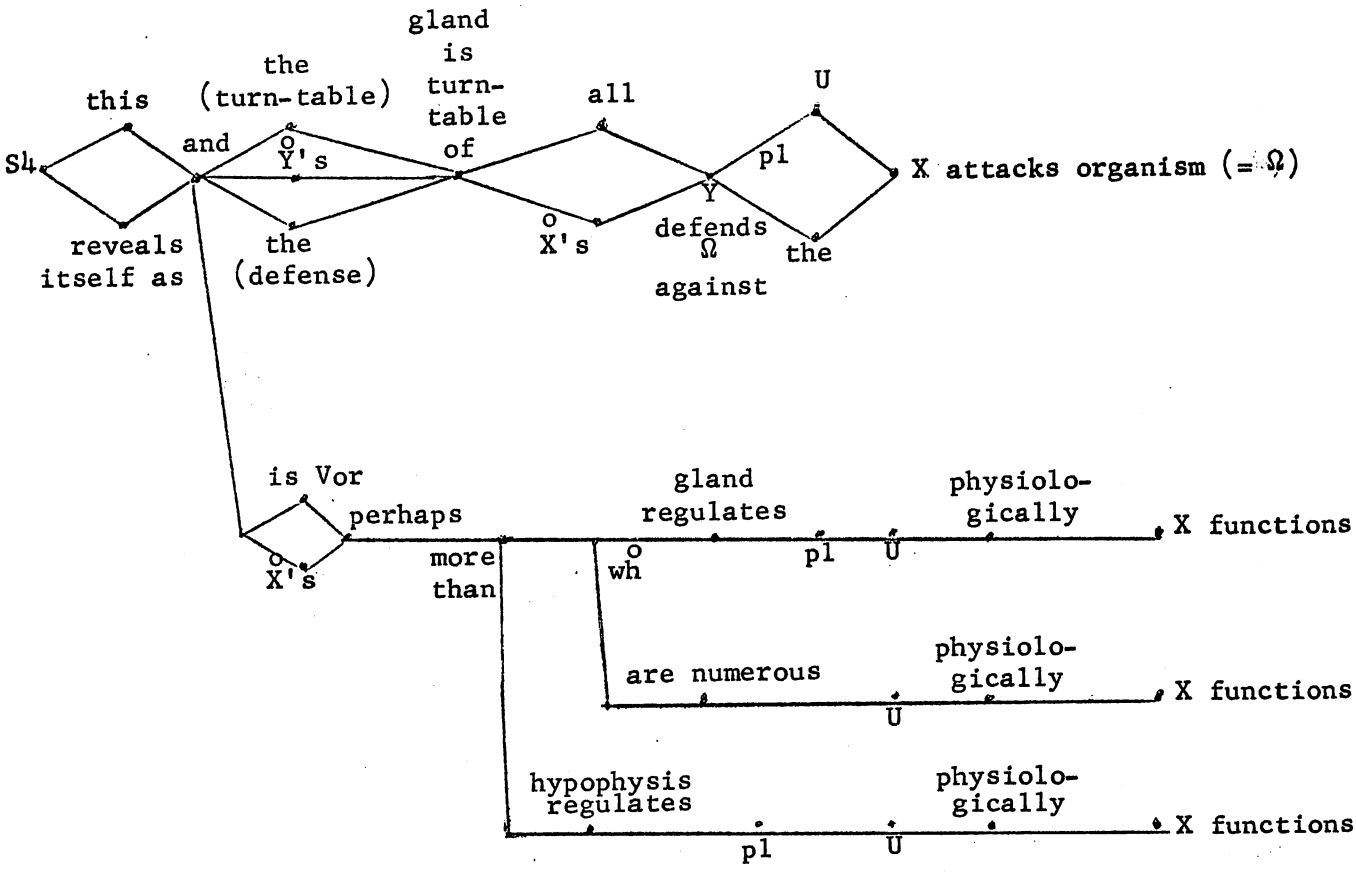
S3: The adrenal cortex certainly regulates the electrolyte balance and acts on the metabolism of the glucides; it probably intervenes in the metabolism of the proteins and the lipids; it presumably participates in the balance of the blood and the connective tissue.



Part 1: The sentential residue should perhaps be Electrolyte is in balance, in the form of U operating on a dubious Electrolyte balances.

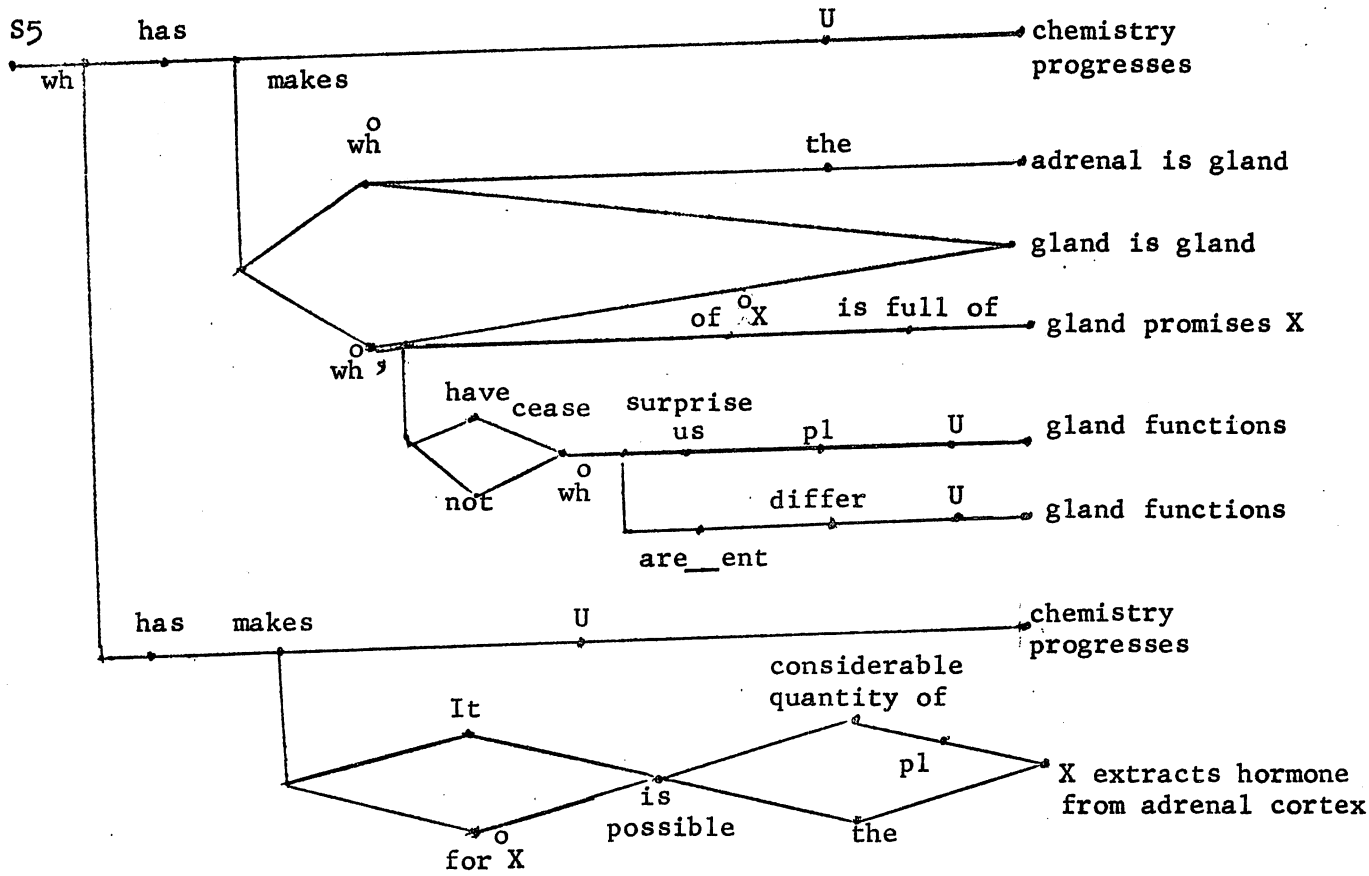
In sequences of and or ; or , it is not clear whether the third part should be added to the first part (as is done above) or to the second; and so on. It should be clear that in all cases of a conjunction, we assume that there appears to the left of the conjunction a zeroing of identical portions of the secondary sentence sufficient to yield the resultant sentence as it appears here.

S4: This gland reveals itself as the turn-table of the defense of the organism against all attacks, and as regulator, perhaps more than the hypophysis, of numerous physiological functions.



Parts 2 ff.: Perhaps o X's should come immediately to left of regulates, are numerous. No plural is given to the right of numerous, because plural is automatic with numerous.

S5: The progress of chemistry, which has made it possible to extract from the adrenal cortex a considerable quantity of hormones, has made the adrenal gland into one full of promise, whose different functions have not ceased to surprise us.



considerable quantities of is a quantifier with its classifier (quantity):
= in considerable quantity, considerable as to quantity, etc.

Here, wh inserts a conjunctional sentence S_2CS_3, into S_1, with the first word of S_2 and of S_3 being the noun which each of these has in common with S_1: gland.

S_1: The adrenal gland is a gland.

S_2CS_3: A gland is full of promise; the gland's functions have not ceased to surprise us.

When we insert the S_2CS_3 into S_1, by wh, we obtain:

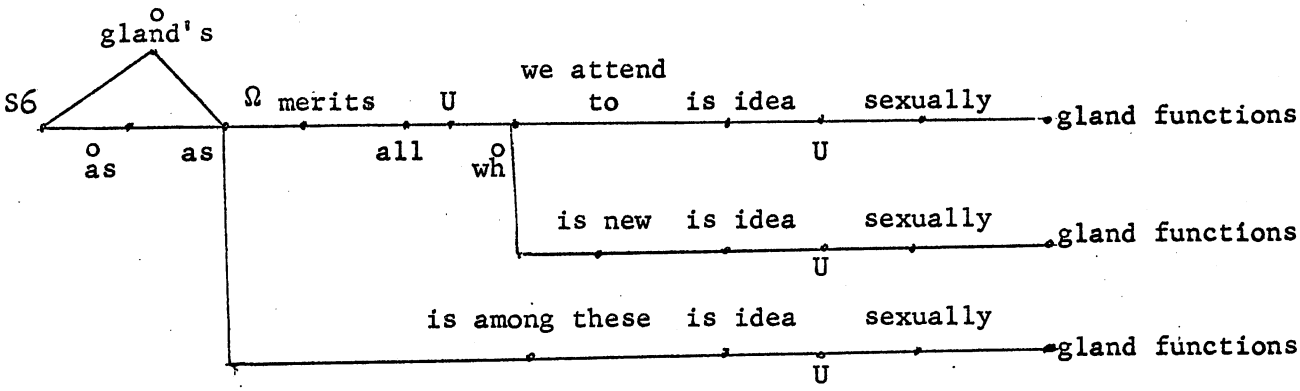
The adrenal gland is a gland which is full of promise, whose functions have not ceased to surprise us.

The second wh-word is not subject to the zeroing of wh-word plus is, while the first one is. Hence when we perform this zeroing, only the first is affected, yielding:

The adrenal gland is a gland full of promise, whose functions have not ceased to surprise us.

In contrast, note $\overset{o}{wh}$ on S_1 and S_2, in S7, where the parallelism in S_1 and S_2 permits a zeroing in S_2.

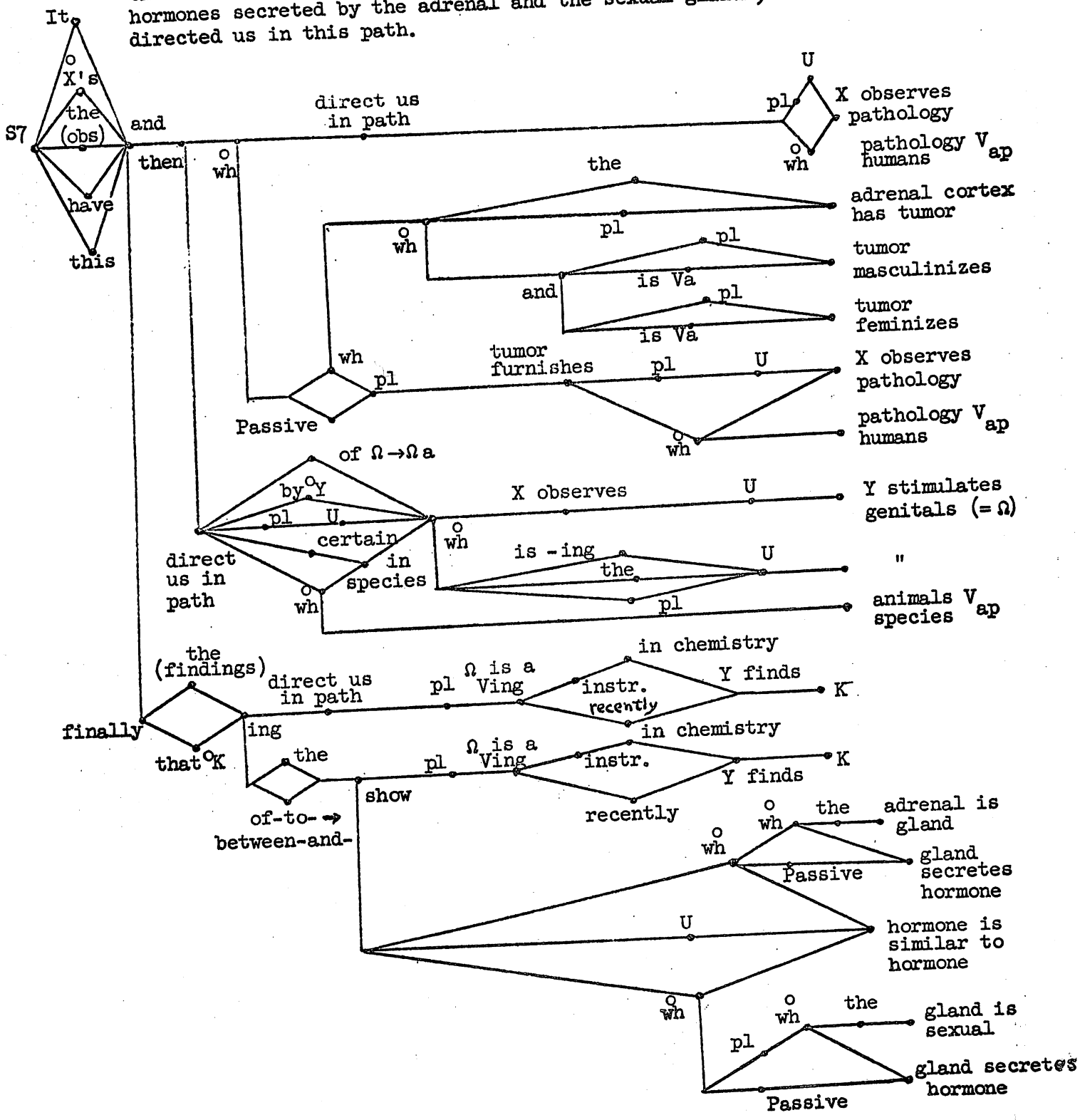
S6: Among these, the new idea of a sexual function merits all our attention.



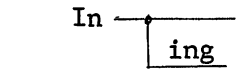
$\Sigma V\Omega \rightarrow$ Ω merits Σ's Vn.

The analysis of Among these is not certain.

S7: It is the observations of human pathology, furnished by the masculinizing and feminizing tumors of the adrenal cortex, then the observations, in certain animal species, of a genital stimulation coming from the adrenals, and finally the recent findings of chemistry, showing the similarity between the hormones secreted by the adrenal and the sexual glands, which have directed us in this path.



Xa indicates adjectivized X.

In  the ing is a subordinate conjunction.

Instrumental: Y finds that K, in chemistry → Chemistry finds that K.

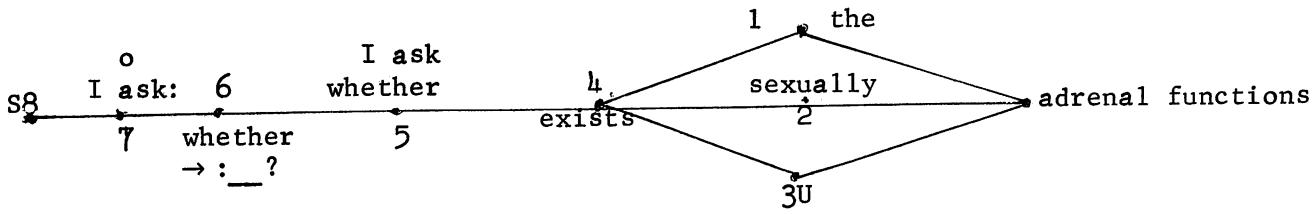
$\Sigma V^{\Omega} \rightarrow \Omega$ is a V ing of Σ: that K is a finding of chemistry.

Then: Findings of chemistry that K direct us in this path... .

Such K as gland is sexual are of course dubious; gland V_{ap} sex would be better.

If the meaning was that the three contributions together, not severally, "directed us in this path," we would take S7 as zeroed from It is the combination of A then B and finally C which has directed us. For It, see S9.

S8: Does a sexual function of the adrenal exist?



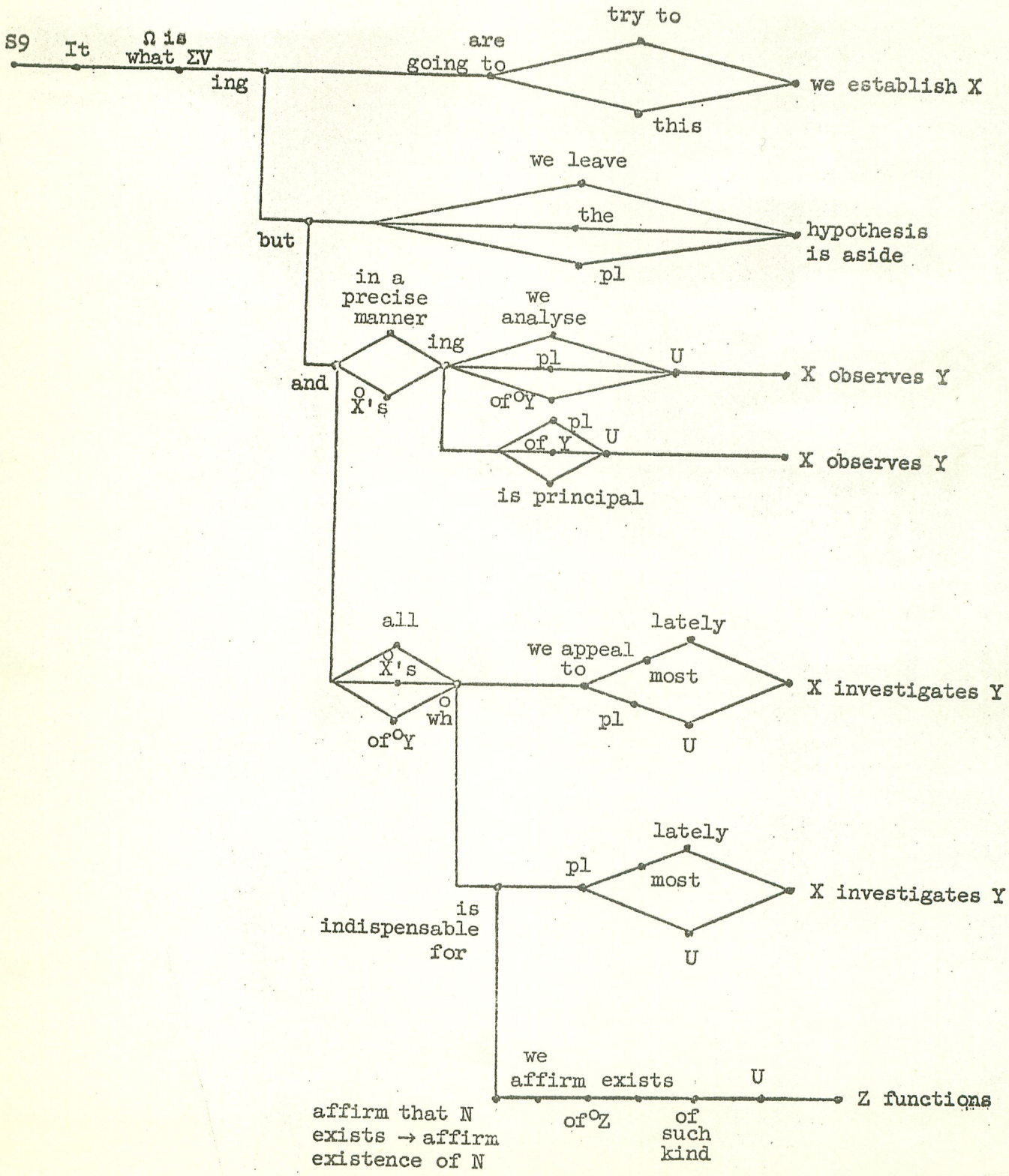
The complete list of component sentences, in the direction of composition, is:

K: An adrenal functions.
1: The adrenal functions.
2: An " " sexually.
3: An " has a function.
1,2: The " functions sexually.
1,3: The " has a function.
2,3: An " has a sexual function.
1,2,3: The " " " " "
4: A sexual function of the adrenal exists.
5: I ask whether a sexual function of the adrenal exists.
6: I ask: Does " " " " " " exist?
7: Does a sexual function of the adrenal exist?

The same components appear in the direction of decomposition:

S: Does a sexual function of the adrenal exist?
-7: I ask: Does a sexual function of the adrenal exist?
-6: I ask whether " " " " " " exists.
-5: A sexual function of the adrenal exists.
-4: The adrenal has a sexual function.
-3: The adrenal functions sexually.
-2: The adrenal has a function.
-1: An adrenal has a sexual function.
-3,2: The adrenal functions.
-3,1: An adrenal functions sexually.
-2,1: An adrenal has a function.
-3,2,1: An adrenal functions.

S9: It is this that we are going to try to establish, leaving the hypotheses aside, but analyzing in a precise manner the principal observations, and appealing to all latest investigations, which are indispensable for affirming the existence of such a function.



Ω is what V: We establish this → This what we establish.

$$\left.\begin{matrix}\text{That}\\ \text{wh}\\ \text{for}\end{matrix}\right\} \text{KV}\Omega \rightarrow \text{It V}\Omega \left\{\begin{matrix}\text{that}\\ \text{wh}\\ \text{for}\end{matrix}\right\} \text{K.}$$

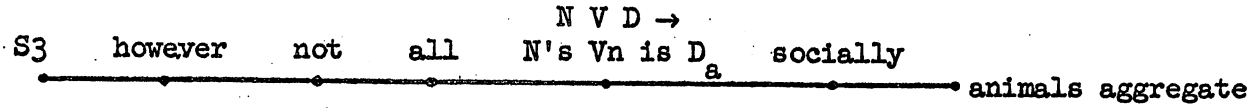
If the sentence on which It operates is N is what ΣV we assume an intervening → what ΣV is N, and then the It operation. Similarly, $\Sigma V\Omega \rightarrow \Sigma$ is what $V\Omega$ → what $V\Omega$ is Σ → It is Σ that $V\Omega$, as in S7: Observations direct us → It is observations that direct us.

Clearly, the objects of the K here, and hypotheses (and pathology in S7) come from K, so that establish, is aside, observe, investigate (and V_{ap} humans in S7) are operations.

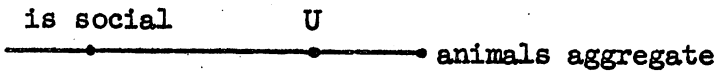
Text 2

N. Tinbergen, Social behaviour in animals, p. 1, sentences 3 - 6.

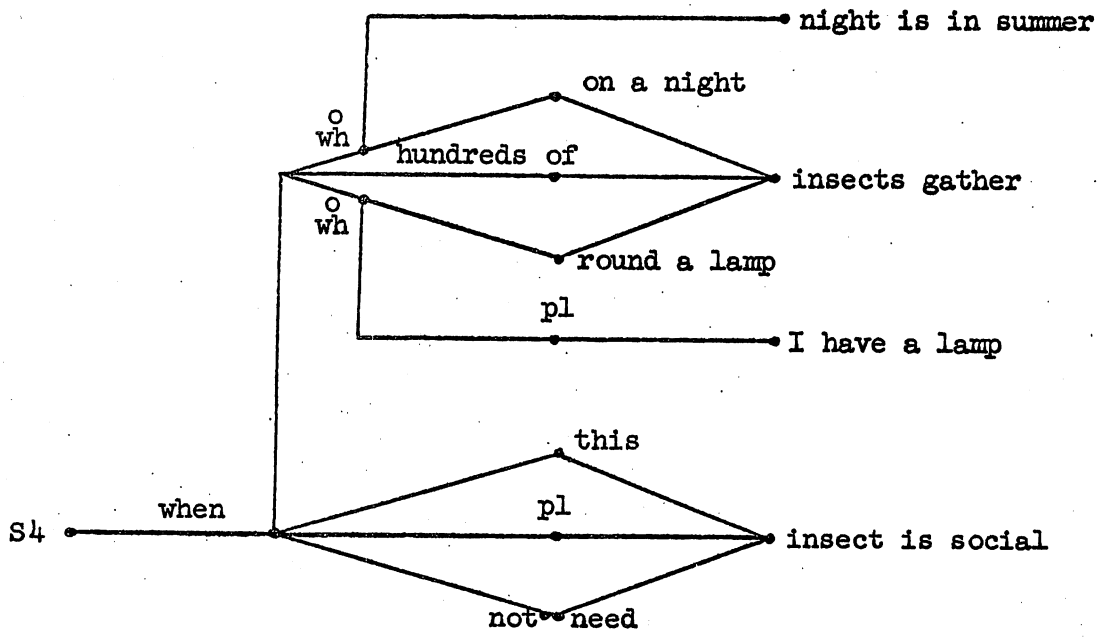
Not all aggregations of animals however are social. When, on a summer night, hundreds of insects gather round our lamp, these insects need not be social. They may have arrived one by one, and their gathering just here may be clearly accidental; they aggregate because each of them is attracted by the lamp. But Starlings on winter evenings, executing their fascinating aerial manoeuvres before settling down for the night, do really react to one another; they even follow each other in such perfect order that we may be led to believe that they have superhuman powers of communication.



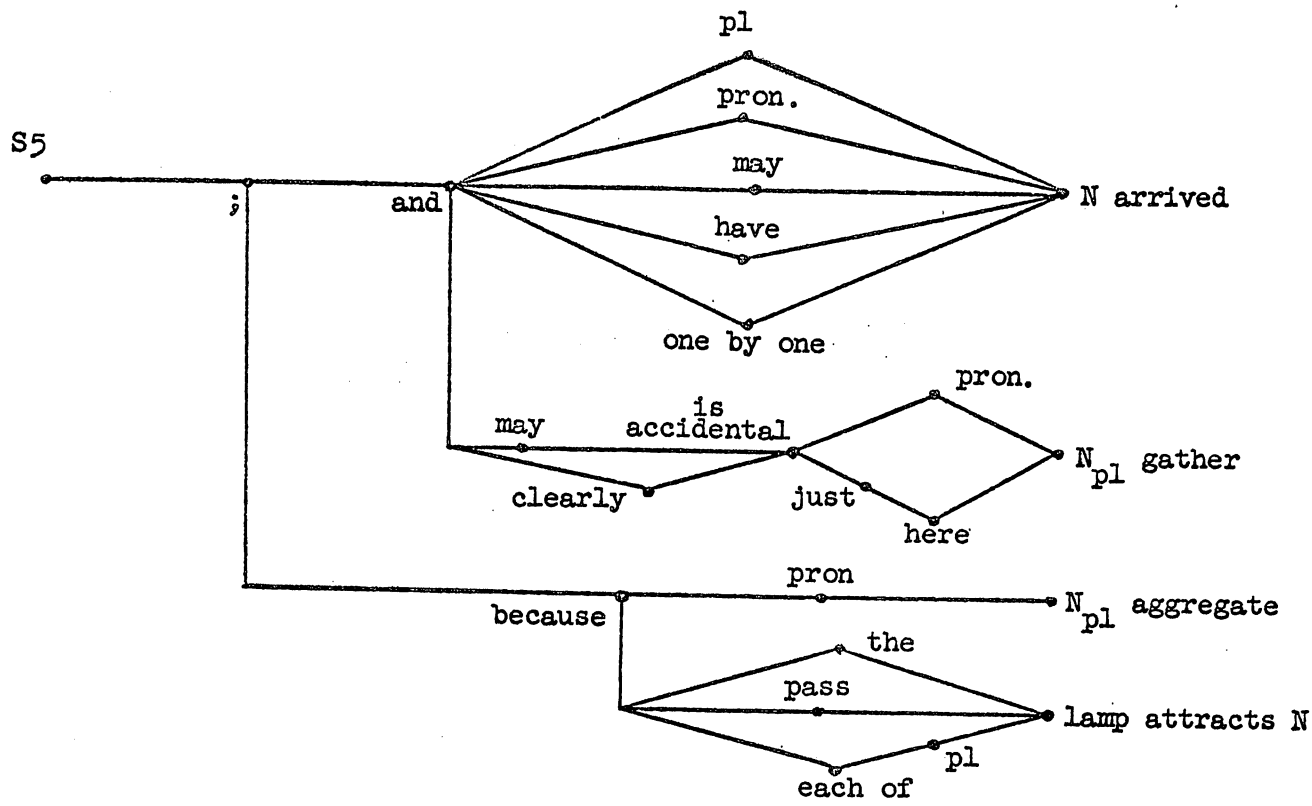
or



depending on how such adverbs are treated.

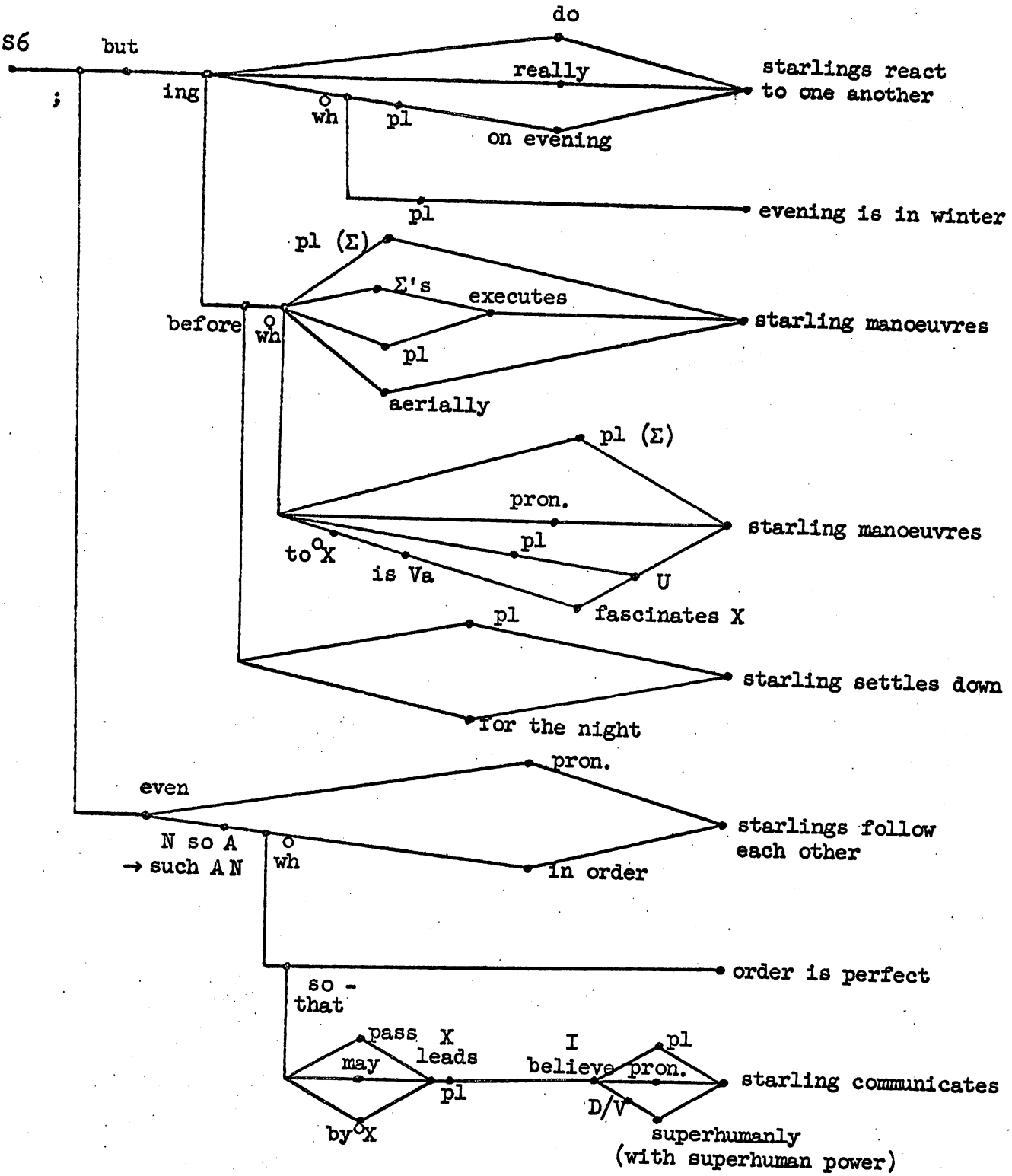


If two transformations operate as a product but not singly, they are written together (in the order fitting their other occurrences) so that no sentence is formed between them: need not.



Since the N is one which can be pronouned in this environment, it must be insects.

Each of, and differently one another, each other, decompose into disjunctions of the K to which they are attached; but for simplicity this is not shown here. Even plural could be treated in this way. Pronouns (they, this) and pro-adjuncts (the, this) also are derivable from C K.


S6
but
;
ing
do
really
starlings react to one another
wh
pl
on evening
pl
evening is in winter
pl (Σ)
Σ's
executes
before
wh
starling manoeuvres
pl
aerially
pl (Σ)
pron.
starling manoeuvres
to X
pl
is Va
U
fascinates X
pl
starling settles down
for the night
pron.
even
starlings follow each other
N so A
→ such A N
wh
in order
order is perfect
so - that
pass X
may
leads
pl
I
believe
pl
pron.
starling communicates
D/V
by X
superhumanly
(with superhuman power)

Σ's: repeat subject under the U:

starling executes manoeuvre → starling executes its manoeuvre

In the next section, we have

It (starling) makes a manoeuvre → Its manoeuvre is fascinating.

Although the two cases of its manoeuvre have different sources, wh can operate on them:

Starling executes its fascinating manoeuvre.

In for the night, the is part of an idiom?

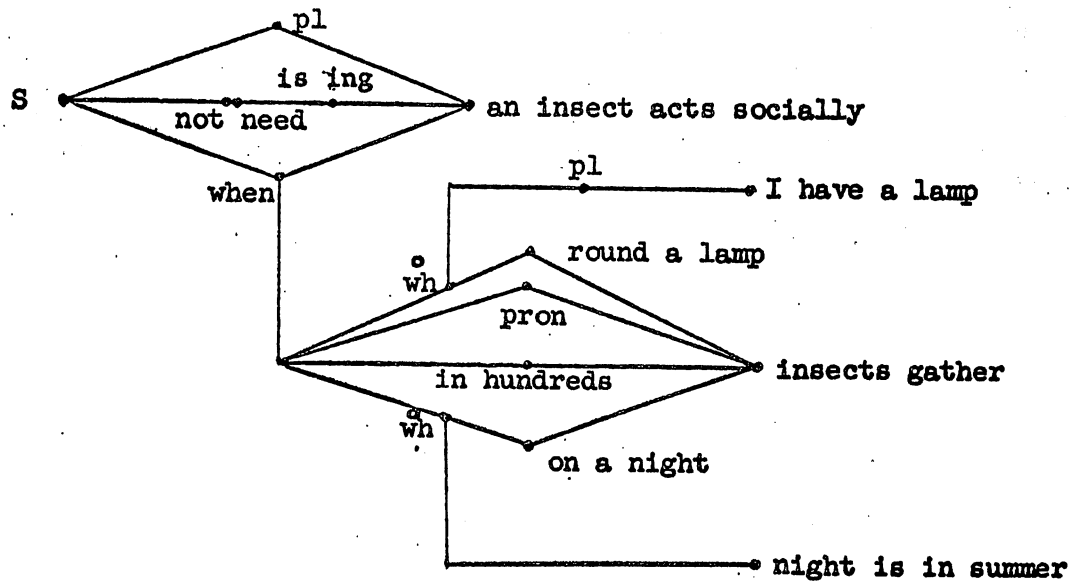
manoeuvre aerially → executes aerial manoeuvres, since aerial is adjunct of place or type; but fascinating is from W on manoeuvre and therefore must be brought in by wh.

Superhumanly, with superhuman power, etc. is D of means,

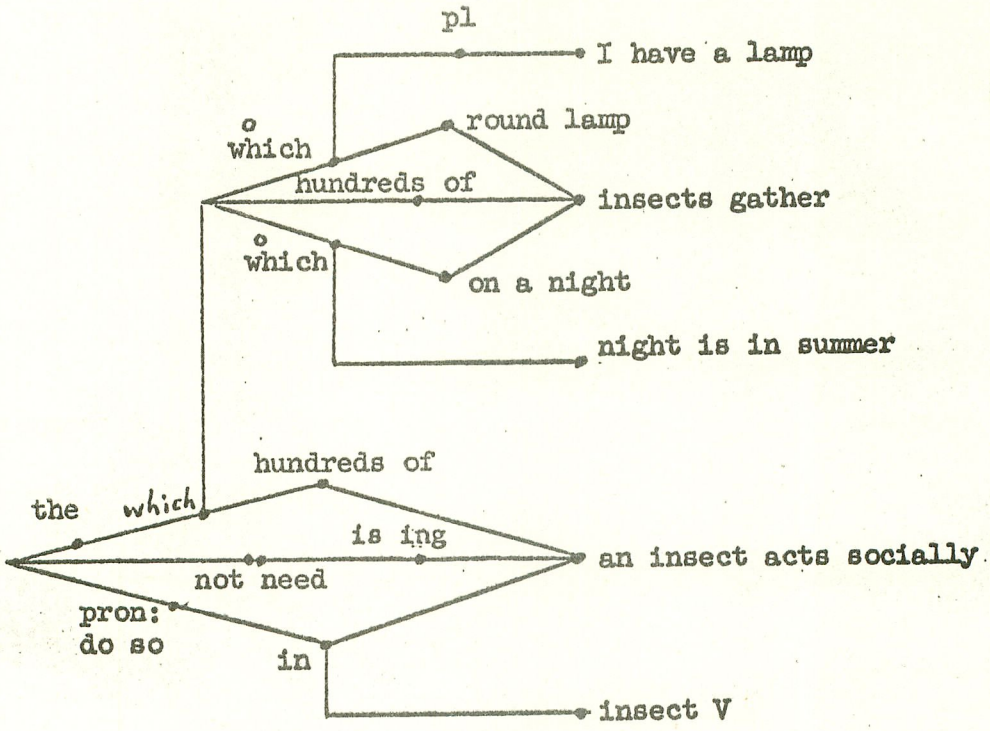
D/V: N V D_{means} → N is Da in Ving; N V P N_{means} → N has N_{means} of Ving.

Because S4 seemed stilted, two paraphrases of it were attempted, in order to see how their analyses would compare with that of S4:

Insects need not be acting socially when they gather in hundreds round our lamp on a summer night.



The hundreds of insects which gather round our lamp on a summer night need not be acting socially in doing so.



APPENDIX

The lattices, together with the left-right orientation, are nothing more than a presentation of the partially-ordered transformational decomposition of a sentence. When a sentence S is fully decomposed into its elementary (kernel-) sentences K and transformations φ (especially into its base transformations), the result is an excessively repetitive structure. This constitutes no shortcoming, because such a derivation of the given S is somewhat comparable to writing out a proof with the full regalia of logical symbolism and with every step fully presented. It is necessary to see that this can be done. For practical purposes the lattices can be simplified by recognizing certain common transformational products as single named steps in a transformational derivation. This is especially desirable for the analogic φ (e.g. Passive) but is also desirable for other paraphrastic products (e.g. Extraction: This fell → This is what fell, What fell is this; It-extraction: → It is this that fell, Question; Imperative; plural and numbers instead of conjunctions of S; indefinite pronouns instead of disjunctions of S). This applies also to recognizing wh as a separate conjunction, though it is derivable from and or if. Other common paraphrastic products are:

φ_s → D: His arrival is on Tuesday → He arrives on Tuesday.

V/D interchange: He speaks hurriedly → He is hurried in speaking

This is limited in complicated ways.

Nominalization - strengthening:

I know that he buys books → I know of his buying books
I wonder whether he buys books → I wonder about his buying books
I prefer that he (should) come → I prefer his coming
His writing letters is frequent → His writing of letters is frequent.

Differences in detail in how we define the transformations (and their ability to repeat) lead to somewhat different lattices for the same (unambiguous) S. One can choose definitions which lead to a simpler algebra of transformations. Or one can choose definitions which lead to simpler lattices. There are also different ways of analyzing certain subclasses (including words like system, kind, etc.) which can support transformations that other words cannot.

When at a φ_c one S is secondary, it enters the φ_c node on a horizontal line. When the φ_c is a verb (e.g. states) neither S is secondary; the first (leftmost) S is then the subject of the connective verb.

If the trace (physical effect in the sentence) of φ_1 appears earlier in the sentence than the trace of φ_2, φ_1 will be shown to the left of φ_2 in the lattice, as far as is possible. Also where possible, wh on the left (or above) connect to the subject of their primary S, and wh on the right (or below) to its object.

$\check{N}$ indicates an indefinite pronoun, which will be zeroed as soon as it enters an adjunct form (e.g. of $\check{N}$); this zeroing is not shown in the lattice.

plural (pl) is a non-paraphrastic φ which can be considered a member of φ_a (local adjuncts); or it can be derived from a conjunction of the kernel-sentence or operator on which it operates.

Paraphrastic non-base operators are named (e.g. Passive), or their effect is shown (e.g. $\rightarrow$ the, $\rightarrow$ of like kind).

In these decompositions, we use a definition of wh which permits more than one wh to operate, unordered, on a single $\overline{N}$.

wh requires that the secondary S should begin with a N (or PN) which appears in the primary S. If this shared N is not at the head of the secondary S a permutation brings it there; in some cases we do not show this permutation, for simplicity.

The usual lattice form is illustrated only for $S_{1,2}$. It is easier to read but harder to write.

APPENDIX

UNIVERSAL CONSTANTS AND NATURAL ATOMIC UNITS

Measurements in physics are statements of relation of the quantity measured to quantities of like kind which are called units. It is customary to build up the system in such a way that the unit of any kind of physical quantity is defined in terms of three conventional units of mass, length and time. The choice of the basic units for these quantities is wholly arbitrary, the general order of magnitude in the centimetre-gram-second system being such that the numerical measure of quantities occurring in ordinary laboratory experiments is of the general order of unity. Thus the velocity of light in the c g s system is 3×10^{10} cm sec^{-1}. The centimetre and second being so chosen that 1 cm sec^{-1} is of the order of velocities of common experience, the bigness of the number measuring velocity of light on this system is simply a statement that velocities of common experience are very small compared with that of light.

There is, therefore, nothing especially fundamental about the c g s basis. Its basic units are of convenient magnitude for common laboratory apparatus, so ultimately the foundation is anthropomorphic since laboratory apparatus is built and designed on a scale convenient for manipulation and observation by a human observer. To recognize this fact is not to deplore it. Certainly the c g s system is convenient for description of the macroscopic apparatus which provides the refined sense-data of physics. But the fact shows us clearly that a metric resting on such a basis will probably not provide units of convenient size for dealing with another branch of physics like the theory of atomic structure.

This is in fact the case. The basic universal constants of atomic theory have values which are very large or very small compared with unity. For example*:

Electron charge:	$-e = -4{\cdot}770$	$\times 10^{-10}$ g$^{\frac{1}{2}}$ cm$^{\frac{3}{2}}$ sec^{-1};
Quantum constant:	$h = 1{\cdot}043$	$\times 10^{-27}$ g cm^2 sec^{-1};
Electron mass:	$\mu = 9{\cdot}035$	$\times 10^{-28}$ g;
Light velocity:	$c = 2{\cdot}99796$	$\times 10^{10}$ cm sec^{-1}.

These great powers of ten are rather inconvenient in theoretical calculations. There are two ways of avoiding them which might be adopted. One is the way which the metric system has already adopted for extending itself to larger

* We use the values of the universal constants as given by Birge after a critical survey of all the relevant data: Rev. Mod. Phys. 1, 1 (1929); Phys. Rev. 40, 228 (1932). For later modifications see Birge, Phys. Rev. 42, 211 (1933); Mechtelson, Pease, and Pearson, Science 81, 100 (1935).

Remarks to S_1:

Depending on how φ_s is defined, we could say that φ_s here operates on φ_v. φ_s alone would yield: N's measuring of quantity is in physics. φ_v alone would yield: N makes measurement of quantity. φ_s on φ_v would yield: N's measurement of quantity is in physics. One could also attempt a definition in which these φ_v and φ_s were independent of each other.

The explanation of the as due to repetition of quantity required us to assume that the object of the first K was quantity, which is zeroed after the first K is connected to q relates to q . This means that the first occurrence of quantity in the connected sentence is zeroed on the basis of a later occurrence. Such direction of zeroing is so limited that the present case may not fit the rest of the language. Since it is by no means a certain derivation, and other derivations for the could be proposed here, the peculiarity of the zeroing may make this analysis unjustified. The alternative is N measures N as first K, and something like quantity is under consideration here (or: is unique) instead of q is same as source for the.

Remarks to S_2:

The system ← system is (constituted) of things mentioned above.

as to kind is a φ_a on any, which is φ_a on quantity. We go through this route because the alternative would be unit is of a kind (← a kind has a unit) and kind is of quantity (← quantity exists or appears in kinds), which is very unsatisfactory. The φ: any as to kind → any kind of occurs for certain property-classifiers (e.g. sort, size, manner, form).

In a science-sublanguage we would probably have a single K: unit_1 is defined in terms of unit_2, which is semantically better.

Note that the other sense of conventional (human subject) would be derived from N follows convention.

The number n before X is a pronoun for n-1 occurrences of and X after the X in question. When 3 units are of... is joined by wh to in terms of units we get in terms of 3 units of. Somewhat similarly if ideas are acceptable in science is joined by wh to express ideas we get either express ideas (which are) acceptable in science or express acceptable ideas in science.

Instead of φ_c: in such a way that we could have in a way or in way X both to N builds up system and to N defines unit (as a φ_s), and then the φ_c is just that (or so that). There are various problems with the dropping of the second in a way and the entering of pro-adjective such.

Remarks to S_{3-5}:

V is for V_{ap}, the appropriate verb, in this case has or the like. Further down it is measures, consists of, has to do with, etc.

We take as K: N has-velocity X, though if no regard were given to the special subclass properties of velocity, the preceding K could be derived from two K: N has velocity, velocity is X. Words of the subclass of velocity, size, cost, etc. are classifiers of certain values on a scale. Certain paraphrastic transformations are possible with these words, as in:

N costs $ 5.
The cost of N is $ 5.
$ 5. is the cost of N.
The cost of $ 5 . . .
The $ 5. cost . . .

Some of these transforms appear here for velocity, and for kind, order.

$\varphi_s \rightarrow$ D: virtually all sentence operators can be transformed into adverbs: I know that he came → He came to my knowledge, He came, as known to me. That he came surprised us → He came, surprisingly for us. His writing is slow. → He writes slowly.

$\overset{oo}{wh}$ indicates a wh which is followed by the zeroing of the preceding N, i.e. the N which had been common to the two sentences connected by the wh.

X is small compared with Y
wh: X is a velocity of common experience
X which is a velocity of ... is small ... → velocity of common experience is small ...

We take as single K: X is small-compared-with Y
and : X is large-compared-with Y
like the comparative K: X exceeds Y, X is larger than Y
and : X equals Y, X is as large as Y.

S_s shows some of the zeroings of adjunct $\overset{V}{N}$, not shown elsewhere.