On the possible origin of lexicon-grammar tables: speculations from an unpublished manuscript of Zellig Harris

Takuya Nakamura

Takuya Nakamura

Université Paris-Est, Laboratoire d'Informatique Gaspard-Monge (UMR 8049), CNRS
takuya.nakamura@univ-mlv.fr

On the possible origin of lexicon-grammar tables: speculations from an unpublished manuscript of Zellig Harris*

Résumé
Nous présentons quelques hypothèses sur l'origine des tables du lexique-grammaire. Elles s'appuient sur la découverte, dans les archives laissées par M. Gross, d'un manuscrit non publié qu'il semble possible d'attribuer à Z. Harris, ainsi que de quelques lettres échangées par ces deux linguistes dans les années 60. L'analyse de ces écrits suggère que l'idée de représentation tabulaire de constructions syntaxiques (en colonne) et d'éléments lexicaux (en ligne) trouve sa source chez Harris et que M. Gross en aurait bénéficié pour construire ses tables du lexique-grammaire.

5 mots-clefs
M. Gross, Z. Harris, tables du lexique-grammaire, correspondance Gross-Harris, manuscrit inédit de Z. Harris

Abstract
In this report, assumptions are presented as for the origin of lexicon-grammar tables. The speculation was made possible by virtue of the discovery in M. Gross' archives of an unpublished manuscript that can be attributed to Z. Harris and some letters exchanged between them in the 1960s. It is suggested from the analysis of these writings that the idea of tabular representation of syntactic constructions (in columns) and lexical elements (in rows) find its source in this unpublished manuscript and that M. Gross would have benefited from that to construct his lexicon-grammar tables.

5 key words
M. Gross, Z. Harris, lexicon-grammar tables, correspondence Gross-Harris, unpublished manuscript by Z. Harris

1. Introduction

This is a brief report on a recent discovery of some historical documents consisting of personal correspondence between Maurice Gross (1934–2001) and Zellig Harris (1909–1992) and an apparently unpublished typed manuscript, which is thought to be part of a book chapter by Harris. This discovery is of a particular interest, since these fragments appear to throw light on the origin of lexicon-grammar tables -- binary matrices that represent the exhaustive lexical and syntactic/transformational properties of a language.

2. Lexicon-grammar

Lexicon-grammar is a French-born research program in descriptive linguistics initiated by M. Gross in the late 1960s and subsequently continued by him and his research team. The goal of this research group was to enumerate all the lexical items which function as nuclear elements (e.g. verbs, adjectives and nouns) in a language, draw up exhaustive classes of kernel sentence forms associated with their transformations, and verify for each lexical item the possibility of accepting each transformed sentence structure or not. The results were represented in the form of many binary matrices, known as "lexicon-grammar tables," each row in a table listing the lexical items in that class, and each column denoting possible corresponding syntactic constructions, using plus (+) or minus (-) signs at their intersections.

* The author would like to thank Peter Machonis for his technical help in writing this article. He has also benefited from conversations with Franz Günthner and Bruce Nevin. All remaining errors are his alone.

These tables may therefore be considered to be a sort of "syntactic lexicon" or "syntactic dictionary" of a language, as Gross (1968: 171) envisioned:

> Ces matrices sont extrêmement proches d'un système entièrement formalisé qui intègre à la fois le dictionnaire et les règles de la grammaire.

The starting point of this enterprise goes back to Gross' stay at the University of Pennsylvania to study Harris' transformational theory in the 1960s. At that time, Harris gave Gross a precise research project, as described in a letter sent to him (see below): application of Harris' English transformations to the French language. In 1968, the research results were published in English under the title *Transformational Analysis of French Verbal Constructions*, as the 74th paper of the collection "Transformational and Discourse Analysis Papers," and in French under the title *Grammaire transformationnelle du français 1 : syntaxe du verbe*, by Larousse. In this work, one of the most important achievements is that Gross established a list of French sentence structures, at least one of whose nominal is sentential (e.g. a predicate complement, an infinitive, etc.), transformational relations between them, and typical verbs entering into each of the structures.[1]

At that time, however, the use of syntactic tables, or lexicon-grammar tables, had not yet been put forward; in fact, only one sample page from a syntactic table appears in the Appendix in the titles cited above. It wasn't until 1975 that we would see what shape a large-scale description of a language using syntactic tables might look like. In his 1975 book, *Méthodes en syntaxe*, Gross revealed the canonical example of what a Lexicon-Grammar of a language would consist of: 19 different tables (=classes) each defined by a particular elementary sentence form, enumerating all the verbs entering in each definitional sentence structure. The sentence structures studied in this book are the same as those already described in the previous book: i.e. sentence structures with at least one sentential subject and/or object(s). Consequently, verbs described in these structures are those akin to operators of type W (and certain types of operators of type U). For each class, transformational "properties" associated with each base structure head columns in a table. Here is an introduction to representation by tables given by Gross (1975: 150):

> Nous avons représenté un segment de la grammaire du français au moyen de matrices binaires (i.e. tableaux rectangulaires de signes + et –). Chaque matrice, c'est-à-dire chaque table, correspond à une classe de structures. (…) Rappelons qu'une ligne correspond à une entrée verbale, une colonne à une propriété syntaxique. Le signe + à l'intersection d'une ligne V et d'une colonne P indique que le verbe V a la propriété P, le signe – indique que V n'a pas la propriété P.

The "properties" used vary from distributional/semantic ones (e.g. *N±hum*: "Human noun complement or not") to clearly transformational ones (e.g. $N_0\ V$, in tables defined by the structure $N\ V\ \Omega$ where $\Omega \neq$ zero, signifies the grammatical possibility of eliminating an eventual object). But ultimately they represent a set of equivalent sentence structures, a list of acceptable (and verified) syntactic structures associated with each lexical entry. As Gross (1975: 152) notes:

> Chaque colonne peut être interprétée comme représentant une structure $N_0\ V\ \Omega$ dans laquelle un verbe peut entrer ou non. Une ligne de table correspond donc à un paradigme syntaxique.

Following the methodology clearly proposed by Gross, his collaborators applied the same technique to describe the "simple sentence structures" of French verbs (lexical core items): Boons, Guillet and Leclère (1976a) described classes of intransitive structures; Boons, Guillet and Leclère (1976b),

---

1 These verbs correspond to *W* operators described in Harris (1964 [1970]): they are increments on a kernel sentence, which is realized either as their subject or object as a nominalized form by means of insertions (e.g. *that*, *whether*, in English). These operators come with their own subject or object: e.g. *He studies eclipses → We know that he studies eclipses*.

classes of non locative transitive structures; and Guillet and Leclère (1992), classes of locative transitive structures. Their research results constitute a genuine map of French verbal sentence structures associated with the lexicon, not as a set of rules, but as an inventory of all the possible syntactic operations and structures (called equivalent sentence structures) a particular lexical item may undergo.[2]

3. **Gross' archives**

Maurice Gross directed the CNRS research team known as LADL (Laboratoire d'Automatique Documentaire et Linguistique) at Université Paris 7 for well over twenty years. At the beginning of the 21st century, however, he transferred his team to another CNRS research laboratory in the suburbs of Paris: the LIGM (Laboratoire d'Informatique Gaspard-Monge), located in Marne-la-Vallée at Université Paris-Est.[3] Gross spent a short period of time at LIGM before his death, where he left a fair amount of documentation in sealed boxes.

The contents of these boxes are not all of a scientific nor personal nature: some contain papers varying from memos on what to buy on the way home, to originals or copies of LADL administrative reports (bills of diverse nature, travel authorizations, etc.). Among the scientific materials, there were boxes containing manuscripts or type-written documents of Gross' published papers and books, as well as notes of a diverse nature (lecture notes, lists of words or grammatical constructions, etc.). Some files were worth examining, however, because they contained papers of a more personal nature, dating back to the 1960s: for example, the notes Gross took down after reading some of Harris' and Chomsky's papers, which could perhaps shed light on the intellectual path Gross took in establishing the innovative field of linguistics called "lexicon-grammar".

Among these personal papers from the 1960s were copies of letters that Gross wrote to Harris, as well as original letters from Harris to Gross. These letters are first and foremost important clues concerning the possible origin of lexicon-grammar tables. We will try to reconstruct the discovery process below, starting by examining a key term that appears in a copy of a letter written by Gross to Harris.

4. **1963 Letter from Gross to Harris**

In one of the oldest letters from Gross to Harris, dated 25th November 1963, Gross asked a certain number of questions about Harris' transformational grammar, which he had begun to study (*"After a first reading I am just able to ask a few general questions, I think after a more careful study, others will come."*). The first of these is formulated as follows (emphasis mine):

> "About the general picture of your system, summarized in part in **your matrix : n-tuples X structures**, I have been wondering whether you have or not two rather independent levels. A first level would be the description of sequences of categories (elementary sentences, adjunctions, transformations) which would be independent of the [particular][4] n-tuples satisfying these structures. These would be purely syntactic operations.
>
> - a second level: description of the n-tuples of the language and ~~the~~[5] relations they have to structures (sequences of categories) and ~~some of the~~ relations [between n-tuples] being directly induced by the transformations operating on structures. Other

[2] It is worth noting that a different, semantic approach was taken to describe English verb classes by B. Levin (1991), which gave birth to a large database of English verbs called VerbNet (Kipper-Schuler 2005). A French VerbNet, VerbeNet, was created (Danlos et al., to appear), making use of lexicon-grammar tables, among other things.

[3] To be precise, at the time of the transfer, the laboratory was called IGM (Institut Gaspard-Monge) and the University, University of Marne-la-Vallée.

4 When a word (or expressions) is inserted in the original manuscript, it is transcribed between "[ ]".

5 When a word (or expressions) is struck out in the original, it is represented as such in the transcription.

> constraints (depending on the syntactic operations) would occur, in this level all operations have many semantic characters."

What clearly stands out in this letter is Gross' reference to "(your) matrix", composed of "n-tuples X structures". This passage is of particular importance to those interested in lexicon-grammar, since a lexicon-grammar table is in fact a binary matrix, as explained above. But as far as the origin of lexicon-grammar tables is concerned, two closely linked questions come to mind: (1) where did Gross get the idea of representing lexical and distributional/syntactic/transformational properties in the form of a "matrix"? ; and (2) could it be possible that Gross was actually inspired by Harris in this aspect? Even though Gross frequently declared that his work was a direct application of Harris' transformational model to French, it must be pointed out that the use of a "matrix" is not particularly characteristic of Harris' work, except for tables enumerating phonetic or morphemic environments of segments in structural linguistics.[6]

The passage cited above gives a clue as to the answer of the second question: Gross explicitly refers to Harris' matrix, so Harris must have used some form of matrix in some way, as well. What could it be? To which Harris text was Gross referring in his letter? This letter confirms that Gross was asking Harris for some clarifications on a grammar that Harris had apparently sent to Gross in manuscript form. Although in the paragraph cited above, there is no mention of a page or chapter number where the word "matrix" appears, in his correspondence, Gross did make explicit references to other parts of the same manuscript in the following remarks:

> "*In 1-4 (page 58) you write: "the occurrence of an n-tuple in a productive structure is facilitated by the presence of adjuncts" (…). "
>
> "p.s. In the first chapter of your book (the typed version) I miss pages 76 to 99, if they are available please have them sent to me."

It appears from these passages that the Harris manuscript in question must be a "typed version" of his "book", lacking pages 76 to 99, and which contains a paragraph (1-4) in which he talks about "the occurrence of an n-tuple in a productive structure". The next step was to find this document among Gross' archives. But before proceeding to the next step, it would be helpful to examine another point of view, i.e. a letter written by Harris to Gross, which preceded the letter cited above.

5. **1963 Letter from Harris to Gross**

One of the letters from Harris to Gross which was conserved in its original form dates back to September 28th 1963, two months before the letter of Gross discussed above. In this letter, after telling Gross what to expect upon his arrival in the United States, Harris describes "the transformational method [he] use[s]" so that Gross could conduct research on "French transformations", whose "fundamental approach (…) [must] be the same (…) as it was in [his] English work". In that letter, Harris also promised Gross "a draft of the introductory section" of "a long book [he] is writing". This is how it is worded by Harris:

> "As to the work: the transformational method I use is a continuation of the original approach of over ten years ago. Aside from mimeographed paper, this analysis appears only in a paper called "Co-occurrence and Transformations" and in a long book I am writing now; I will soon send you a draft of the introductory section."

It would be logical to assume, given the description above of a manuscript Harris intended to send

---

6 For example, in the index of Harris' *Structural linguistics* (Fifth edition, 1961, version possessed by Gross), the term "matrix" does not appear, although similar terms such as "tabulating" or "diagram" do. It is easily seen, if one checks corresponding pages, that the terms are used, however, to represent purely phonetic or morphemic environments.

Gross (*"a draft of the introductory section of a long book"*), that it was probably this manuscript that Gross had read and about which he was asking questions in the letter cited above.

What can this manuscript be? Which book of Harris' is based on this manuscript? The first "long book" published by Harris after the year 1963 is *Mathematical Structures of Language*, dating to 1968. But, in this book, there is no mention of any "matrix" of n-tuples and structures. There is some use of tabular-like representations, but these are limited to one table showing the applicability of operators on other operators (p. 91) and a few tables representing the decomposition of a scientific discourse into equivalent classes (p. 150-151).[7] The canonical tabular-like data representation of the latter type is found in Harris' research in discourse analysis, as seen in his *Discourse Analysis Reprints* published in 1963, as well as in a book published in 1989 under the title *The Form of Information in Science*.

In Harris' published works, it is not possible to find any mention to this "matrix" in question. So the investigation must be focused on this unpublished manuscript. Some clues exist as to the identity of this document: the page indications given by Gross in his letter. These are two: (1) "*In 1-4 (page 58) you write: "the occurrence of an n-tuple in a productive structure is facilitated by the presence of adjuncts" (…). " ; (2) "p.s. In the first chapter of your book (the typed version) I miss pages 76 to 99, if they are available please have them sent to me."

The manuscript in question must lack pages 76 to 99 and contain page 58 where the cited passage appears. And a bundle of typed onion skin papers was found in one of the Gross archival files.

6. **Harris' *The transformational structure of language: with application to English***

This document has the title *The transformational structure of language: with application to English* but lacks the author's name.[8] It is comprised of pages numbered continuously from 1 to 108, except for pages 76-99, which corresponds precisely to the description made by Gross of the Harris manuscript he was reading. On page 58, section 1-4, moreover, the following line is found, which seems to correspond to the reference made in the Gross letter:

> "In many cases, the occurrence of an n-tuple in a productive structure is facilitated by the presence of adjuncts: by the side of The horse jumped we have He jumped his horse (made it jump), but while we have The paratroopers stood the civilians against the wall (The civilians stood...) we do not have (*[9]) The paratroopers stood the civilians."

It is very likely that Gross read this manuscript and asked several questions. As for the authorship of this manuscript with no signature, it would be safe to attribute it to Harris; besides circumstantial evidence, in a footnote there is a direct reference to other works by Harris, as well as other researchers:

> "(footnote, page 18) 8. Transformations were indeed, the result of a search for a simple normal form for sentences, which was to be used in the analysis of connected discourse: and a preliminary list of transformations is given in the first published paper on Discourse Analysis, Language [blank]. More recent work appears in various issues of transformations and Discourse Analysis Papers,

---

7 This table is a partial reproduction of a larger table which appeared in Harris (1963: 44-49), as "Table 1", which "presents this optimal transform [of the discourse], which we may read through as a roughly equivalent paraphrase of the original text. Each successive line (row) in the table is a period. Each column is an equivalence class, i.e. every member of a column is related to every other member of the column by one of the equivalences listed above." (Harris 1963: 43).

8 There is no item with this title neither in a comprehensive bibliography of Harris (Koerner 2002) nor in an updated on-line version based on (Koerner 2002) http://zelligharris.org/ZSHbibliography.html.

9 Harris used a barred existential operator to show that a sentence does not belong to language. In this transcription, we used an asterisk instead of the original sign.

> Linguistics Department, University of Pennsylvania. Attention should be called to the important and widely-known work of Noam Chomsky who has integrated transformations into his generative scheme of grammar description, beginning with his University of Pennsylvania dissertation, [blank] and continuing in his <u>Syntactic Structures</u> (Mouton, 1957) and many other papers. Cf. Also both for methodological considerations and for specific transformations, various papers of Henry Hiż, especially [blank]."

6.1. Harris' "table" (part 1)

In this manuscript, Harris uses two types of "tables" to represent relations between lexical items (n-tuples of words) and syntactic structures. The one referred to by Gross is described in section 1.3, entitled "Relations of word n-tuples and sentence structures". Here we present the entire transcription of this section[10]:

> "//TSL 24// Let us consider a table, which is impractical to construct in detail and can only be sketched, constructed as follows: Each row is assigned to an n-tuple of words, specifically a member of the product set of members of word-category sequences. For convenience, we take the category sequences which appear in short sentences[9], distinguishing X_1, X_2, etc. if the category X occurs twice or more in the sequence. This includes, for example, all N V_n pairs, all N_1 $V_{n,n}$ N_2 and N_1 $V_{n,pi\ n}$ P_i N_2 triples (these are different because the members of $V_{n,n}$ are for the most part different from the members of the $V_{n,pi\ n}$ P_i pairs), all N_1 $V_{n,n\ pi\ n}$ N_2 P_i N_3 quadruples, also N A and N_1 N_2 pairs and N_1 P N_2 triples (which occur in sentences with <u>be</u>), and then all of these plus A (or also plus P N pairs) to catch the single adverbial adjuncts that participate in some transformations. Finally we provide rows for any one of these n-tuples inserted whole between any two categories of any n-tuple (except between P and N)[10].
>
> Sentence structures, of from two to, say, twelve categories[11], are assigned each to a column: N t $V_{,\Omega}$ Ω, N t $V_{,\Omega}$ Ω A ly, N t be A, //TSL 25// N t be A in $V_{,\Omega}$ ing Ω, N_1 t V N_2, N_2 t be Ven by N_1, N_2 t be Ven, N_2 t be wh $\check{N}_2$ N_1 t V[12], N t $V_{n,t}$ to V_Ω Ω, N_0 t $V_{n,h}$ that N t $V_{,\Omega}$ Ω, The $V_{,\Omega}$ ing Ω of N $V_{s,n}$ N_2, N_1 which t $V_{1\ x,\Omega}$ Ω_1 t $V_{2\ x,\Omega}$ Ω_2, N_1 t $V_{2\ x,\Omega}$ Ω_2 if N_1 t $V_{1\ x,\Omega}$ Ω_1, etc.
>
> We now ask which n-tuples of words are accepted, and in what way, for each of these sentence structures, with the proviso that each n-tuple may not be interrupted more than once by any other occurrence of an n-tuple. Thus, if two n-tuples occur in a sentence they may be one after the other or one wholly nested as an interruption within the other[13]. We may even ask if an n-tuple lacking a particular one of its members occurs in this way in any sentence structure[14]: e.g. the first two words of certain triples (which appear in N t $V_{n,n}$ N sentences) may also appear in certain N t V sentences (<u>He reads books</u>, <u>He reads</u>, <u>He smokes cigarettes</u>, <u>He smokes</u>)[15]. //TSL 25a (insert) at end of p.25// If we speak of an n-tuple (or part of it) occurring in x sentence structures, this refers to the choice of words, not their order: the orders of the members of the n-tuple may differ in different structures. E.g. the pair <u>bird, sing</u> (and many others) appears in N t $V_{n,}$ <u>Birds sing</u> but also in The $V_{n,}$ ing of N $V_{s,n}$ N_2 <u>The singing of birds awakened me</u>. With the addition of <u>erratic</u> we have the disjoint combination N t $V_{n,}$ A ly <u>Birds sing erratically</u> but also the nested combination N t be A in $V_{n,}$ ing <u>Birds are erratic in singing</u>. Nor is a word restricted to occurring only where its own category appears in a sentence structure. A word of category <u>X</u> can appear in the position of any category <u>Y</u> if it

10 The original page number is marked on the upper right side of each paper preceded by TSL. We insert the page number between // and //.

carries an affix y (even if consisting of zero phonemes) which enables it to do so: Xy occurs in the positions of Y; e.g. the pair man, sick occurs not only in N t be A (The man is sick) but also in N t $V_{n,}$ (The man sickened)[*].

//TSL 26// As to acceptability, a particular n-tuple in a particular sentence structure is responded to in some one of several different kinds of acceptability, or in the grammatical sense of the substantive relations which the n-tuple members have to each other in some particular other sentence structure. All of these responses will be called modes of acceptance: For example, in a given sentence structure: Some n-tuples have normal acceptability – and this will include intentional (with whatever frequency of occurrence) and unintentional falsehoods and nonsense (Friday the 13th is unlucky). Others are accepted as normal (simple) sentences but describing unreal situations, e.g. The house spoke up: this is fairy-tale talk and the response would be along the lines of I guess you can say it if that's what you mean or But houses don't speak. There are other n-tuples which are regularly accepted but only in a special or metaphorical sense, e.g. The House spoke up where House is accepted not as a building but as a parliament. And there are cases which are not standardized, in which an n-tuple is accepted if at all only by taking some part of it metaphorically, e.g. The fact spoke up, where it could be assumed that some special meaning has been given to spoke up (as in These facts speak to us is the sense of affect us).

Finally, there are some combinations which are not accepted in any guise, such as For him to come spoke up. These are also n-tuples which are understood and accepted as nonce forms or as jokes – sentences which in one way or another go beyond the range of n-tuples which are normal for a particular sentence structure, e.g. [left blank] And there are sentences whose acceptability is uncertain or which are on the borderline of being acceptable, e.g. With it now clear that he wouldn't come, we left (acceptable), It certain that he wouldn't come, we left //TSL 27// (somewhat doubtful), It a fact that he wasn't coming, we left (more unacceptable); There seems too much trouble here (somewhat doubtful), There seems a man coming (more unacceptable); With there a man coming, we left (doubtful), There a man coming, we left (unacceptable).[16] Finally, certain n-tuples when they occur in particular structures are understood (or have an alternative interpretation) in the sense of some other structure. Thus the pair poet, reads in The older poets read more smoothly than the younger appears in N t V in two different grammatical senses: an ordinary N t V, speaking of the poets' stage performance (here the substantive relation of poet to read is of actor to action); and as referring to some such sentence as N reads poets (in this sense the substantive relation of poet to read is of recipient of action to action) speaking of how directly one can read them. Another pair, book, read is understood in N t V only in the sense of a sentence N reads books: This book reads well.[17] Somewhat differently, The whole house spoke up would be accepted as referring to some unstated N_x spoke up, with whole house of (as also houseful of and other receptacle-nouns plus of) operating on N_x and with of N_x being then deleted.

If we now consider this only partly constructible table, we will see that //TSL 28// in each sentence-structure each n-tuple occurs, in a particular permutation, with one or another kind of acceptability, or is not acceptable at all, or occurs in more than one grammatical sense. In the latter case, all but one of the grammatical sense, or all, refer to other sentence-structure in which the n-tuple occurs; this may be also if the n-tuple occurs in only one sense in a given sentence structure, or in the case of This book reads well.

We now seek to establish connections between n-tuples and sentence structures. We find that there are sets of n-tuples which have the same modes of acceptance in the same range of structures. That is, all n-tuples of the set occur in a particular set of structures, and the mode of acceptance that any one of them has in a given structure is the same as all the others have in that structure. E.g. child, read, book; man, build, house; man, see, house; etc. all occur normally in N_1 t V N_2, N_2 t be V en by N_1, N_2 t be what N_1 t V (The book is what the child read); with $V_{s,n}$ N in V ing of N_2 by N_1 $V_{s,n}$ N (The reading of the book by the child surprised me); but not in N_2 t V N_1 (The book read the child), or in P N N t V or N t V P N (For the book the child read in normal sense, as For an hour the child read, The child read for an hour). A subset of this set may also occur in other structures, e.g. The book reads well in N_2 t V in the sense of N_x t V N_2 (but not The house sees well). Furthermore, there are n-tuples which occur in the same range of sentence structures as this set but with a different mode of acceptance, and which maintain this difference throughout the range of structures or part of that range, e.g. man, read, water would occur with some kind of ungracious acceptance in whatever meaning one could give to it in N_1 t V N_2, and with the same acceptance in The reading of the water by the man surprised me, and with the //TSL 29// same acceptance plus the sense of N_x t V N_2 in The water reads well (i.e. is readable).

In summary, then, we can say that the modes of acceptance of n-tuples in sentence structures show a grouping of sentence-structures into batteries,[18] such that all the structures in one battery have a number of n-tuples in common, and that the difference in mode of acceptance between n-tuples is constant throughout the battery: If one n-tuple is accepted normally and another as fairy-tale or in the sense of another structure, this difference between them will remain for all the structures of the battery. The sentence-structures within a battery thus have a common set of n-tuples, and if there is a difference between the mode of acceptance or the relation to adjoined material of an n-tuple in one sentence structure as against another, this difference will obtain for all n-tuples, in these structures. Furthermore, the substantive grammatical relations among the members of an n-tuple are the same in all structures of the battery: they are invariants of the battery. The two senses of poets, read above are not in the same n-tuple; but Poets read poems, Poems are read by poets contain one n-tuple in the battery, while N reads poets, Poets are read by N, Older poets read well are another n-tuple. A sentence-structure S_i may be a member of more than one battery: S_i may have certain n-tuples (or parts of n-tuples) in common with S_j, S_k, and certain n-tuples (or parts of n-tuples) in common with S_m, S_n. A subset of the n-tuples in a battery may also occur in other sentence-structures: i.e. the subset has an additional battery of its own. E.g. the triples with certain verbs (read, less acceptably build, but not see) also occur in N_2 t V, especially with certain adverbs or comparatives on //TSL 30// the V (The book reads well, Prefab houses build easier than other). The only useful definition of a battery relates ranges of structure to sets of n-tuples, not to single n-tuples. If an n-tuple occurs in a unique range of structures, we would try to divide its occurrences into those of two homonymous n-tuples (perhaps with different meanings to one of the words) each of which occurs in a known range, as a member of a set of n-tuples.

We define a transformational relation, written →, as holding between the various sentence-structures (or between any two) of a battery. If a sentence structure has the n-tuples of two other sentence structures we can say it is a transform of the pair: N_1 which t $V_{1,\Omega}$ Ω_1 t $V_{2,\Omega}$ Ω_2 → N_1 t $V_{1,\Omega}$ Ω_1, N_1 t $V_{2,\Omega}$ Ω_2 (The glass which fell broke, The glass fell, The glass broke). It should be clear that in order to show a transformational relation between two sentence-structures (or a structure and a pair of structures) it is not necessary to have a fixed list of n-tuples that do or do not occur in each; it is only necessary to know that no matter what n-tuples we choose, their difference in mode of acceptance will remain constant for the sentence structures in question. A transformation is not a relation between a sentence structure and word n-tuples, but an equivalent relation between sentence structures in respect to the modes of occurrence (in them) of word n-tuples.

If a table of the kind described above is constructed up to some convenient point, say with some hundred of varied n-tuples and with some scores of sentence-structures, and if we then test how somewhat different n-tuples would compare in their structure-range with those that are present, it will be seen empirically that certain types of n-tuples and certain sentence structures are sufficient, and may be considered elementary, in the following sense: First, that if we add longer n-tuples and longer structures, the only correlations we will be able to make in the longer entries will be repetitions of the correlations between n-tuples and structures in the //TSL 31// shorter entries. For example, the many pairs of triples of the form N_1, $V_{2n,n}$ N_2; N_1, $V_{3n,n}$ N_3 (man, buy, book; man, know, author; man, believe, review) can be found in the structure N_1 wh $\check{N}_1$ t V_3 N_3 t V_2 N_2 (The man who knew the author bought the book), and the many pairs of triples of the same form can be found in the structure N_1 t V_2 N_2 and t V_3 N_3 (The man believed the review and bought the book); the triples of these triples, however, will be found in longer structures which are all directly composable from the structures of the pairs: The man who knew the author and believed the review bought the book, The man who knew the author believed the review and bought the book, etc. And if we choose the n-tuples differently, we will simply obtain fewer correlations because the differently chosen n-tuples will not occur in as many structures or will have irregularly different modes of acceptance.

For example, if we chose pairs rapid, write and rapid, pour, and letter, man and water, man, we would find them in The rapid pouring of the water by the man. But in Rapidly, the man poured the water we would not be able to retain the nesting property which is otherwise maintained.[19] And we would have no way of saying why The man poured the water and The man wrote the letter have normal acceptance while The man poured the letter and The man wrote the water do not. For English, the elementary n-tuples and structures are roughly those indicated at the beginning of 1.3: they will be listed in detail and with justifications in chapter 2.3. The sufficiency of a single depth of insertion for the sentence structures in the table is due to the fact that transformations are at most binary operators on sentences: as will be seen below, there are no transformations whose arguments are three or more sentence structures. Hence, if an n-tuple can occur in a particular form, e.g. Despite the Ving of N by N, as a part of a sentence structure, there will be some //TSL 32// sentence structure in which this form occurs with only one additional n-tuple: there is no need to seek longer structures containing three n-tuples. We can therefore say either that the elementary sentence structures relate to single elementary n-tuples or to pairs of them: or else that an elementary n-tuple occurs either in a primitive sentence-structure (which contains only one n-tuple that can occur by itself in a sentence) or in an adjunct form (like Despite the Ving of N by N).[20]

The table suggests, in addition to the elementary sentence structures and n-tuples, also the possibility of defining within each battery $S_i \rightarrow S_j$ a directed transformation $S_i \rightarrow S_j$, such that if the set of n-tuples in S_i includes as a proper part the set in S_j, then either $S_j \rightarrow S_i$ (the n-tuples of S_j are sent into S_i, which also contains other n-tuples) or $S_i \rightarrow S_j$ (a distinguished proper part of the n-tuples of S_i are sent into S_j, whereas the others are not). In addition, we may define $S_i \rightarrow S_j$ even if all n-tuples of one are found in the other, on grounds of convenience of description. The conditions for the direct transformation will be discussed below.

The availability of a directed transformation usable for deriving A → B, as against a pure equivalence relation A ↔ B, permits two descriptions for the two views mentioned above (at fn. 20). If we want to point out the existence of a relation on the set of sentences of a language, in terms of which we can show a decomposition of sentences into sentences (ultimately into elementary sentences), then we define unary transformations which relates sentence structure A to sentence structure B (by B having a permutation of the n-tuple members of A, a changing of its constants, possibly a dropping some of its n-tuple members, or an adding of primitive adjuncts or of new verbs //TSL 33// or subjects at particular points of A), and binary transformations which relate the pair of sentence structures A, B to sentence structure C (by adding connections, or by adding constants usually to only one of the sentences or dropping some of the categories or constants of one of them). If, however, we want to point out the application of this relation to the way each sentence can be constructed or derived from sentences and non-sentential parts (ultimately from kernels and primitive operations), then we define a transferral transformation which transfers the n-tuples of one sentence structure to the category positions of some (the same or another) sentence structure (by permuting or dropping n-tuple members, changing constants, inserting primitive adjuncts or deformed sentences or new verbs or subjects), and a deformation which changes a sentence into a deformed sentence available for being inserted in some other sentence (by permuting or dropping n-tuple members, changing constants or adding a connective, but such that the resultant is not a sentence that can stand by itself).

The second is a more specific description, in that it restricts a sentence C which contains two sentences A and B to consisting of A, or some S → S transform of A, plus an S → I deformation of B into non-sentence forms (the insertion of the deformed B into A being considered itself an S → S transform of A). This is indeed the case for the great bulk of combinings of two sentences into one. In contrast, the first formulation makes no restriction on what happens to the component sentence A and B. The transformation that combines them could simply add a connective between them, or could change either or both. In the few cases in which both participants change (or, we might say, in which the process of adjoining B to A requires some //TSL 34// changes in A, to A') it may be convenient to use this description (e.g. in the comparative). In most cases in which this happens in English, the changed A can occur by itself as a sentence, so that we can say that B is deformed and then adjoined not to arbitrary sentences but only to sentences of the form A which have been obtained by an S → S transformation from A. (Hence, just as there are cases of particular transformations φ_2 which occur only on sentences that have already undergone a particular transformation φ_1, so we would say here that the insertion of a particular type δ_2 of deformed sentence occurs only in sentences that have already undergone a particular insertion of type δ_1.) In the few remaining English cases we have an A B sentence in which neither part can occur by itself as a sentence, so that neither part can be considered a sentence to which something has been adjoined. These are the few real binary sentential operations of English.[21]

For the comparison of the two descriptions it should be noted that the transferral operations of the second are only a slight extension of the unary operations of the first. For the unaries include the insertion of primitive adjuncts into sentences, between certain categories of the sentence structure, and the transferrals add to this the possibility of inserting, at the same points of a sentence structure, certain types of deformation of other sentences. //TSL 35//

The great limitation on the universe of linguistic data makes it possible to arrive at a transformational description while using a very small theoretical apparatus. The only features of speech which have been successfully incorporated into linguistic science have been the discrete features, and these are in each language simply successive in time, or have such limited simultaneities that they can be organized into a linear description. Each different sentence is thus a different sequence of discrete elements. In such a restricted and simple type of data it becomes interesting to ask whether a stronger demand can be made than is possible in other sciences: namely, whether it is possible to determine from the nature of the data the kind of the analysis that would organize it into theoretical descriptions. In particular, we have two added facts characteristic of language: that words (morphemes) can be grouped into categories in such a way that sentence structures (as sequences of categories) have different modes of acceptance for different n-tuples of members of their categories; and that the same n-tuples have the same or similarly changed modes of acceptance in several sentence structures. Any description which can specify the modes of acceptance of n-tuples for one structure in terms of those for another will be far more compact than the one which has to give the same data separately for each structure. Hence there is indicated a search for transformational equivalences among sentence structures, and also for a canonical transformational equivalent each of whose component sentences would be in a selected elementary form: this would be a decomposition of sentences into elementary sentences. //TSL 36//

Once we are lead to this question, the discovery of the transformation of a language can perhaps be planned. However, it should be noted that the problem is more complicated than if there were simply two modes of acceptance: occurs or doesn't occur. If the latter was the case, then all n-tuple choices in each structure would be divided into two classes, those which occur in that structure and those which do not. A theory would simply have to be able to distinguish these classes for each structure. However, if each n-tuple may have any one or more of several modes of acceptance (some of which perhaps have continuous grading) in each structure, then the procedures of investigation become more complex, the task of the theory more intricate; and if a particular theory proves adequate the likelihood that a different theory would also prove adequate to the data is smaller.

In discovering transformations, the question that is asked follows from the definition given above: Do two sentence forms (initially, preferably not overly long ones) have the property of being satisfied by the same n-tuples (or by distinguished parts of them).[22] Or rather, can we divide the satisfying n-tuples of one structure into families, such that each family is the same as some one of the families of some other structure? To take a special case, for example, we can show that for N_1 t V N_2, the apparent similar N_2 t V N_1 is not a transform, while the passive N_2 t be V en by N_1 is. For if we consider any large set of N_1, N_2 pairs for a particular V (even for V whose subject and object are both animate, both human, etc.), we find the same modes of acceptance //TSL 37// for them in active and passive (often less comfortable in passive): <u>The judge sentenced the prisoner</u>, <u>The prisoner was sentenced by the judge</u>; <u>The wind fanned the flowers</u>, <u>The flowers were fanned by the wind</u>. But some of these n-tuples (as the above) will not occur with the same acceptance in N_2 t V N_1.

Footnotes
9. [left blank]
10. This insertion process could be repeated, but all the transformations will be obtained if we have just one depth of insertion, i.e. if we analyse sentences containing the n-tuples of at most two short sentences. The transformations which a

sentence undergoes when it is inserted into an adjunct are the same as the ones it undergoes when it is inserted (as an adjunct) into an elementary sentences.

11. Not counting P or t. This bound is in order to catch any sentence that includes up to two quadruples plus their operators (<u>some of which contain two categories</u>), or adjuncts. Of course, this bound will include many sentence structures containing three or four tuples, etc.

12. $\check{N}_i$ indicates the pronoun of N_i: e.g. man...he, woman...she; after wh, man...who, woman...who, book...which.

13. If we expect intercalation in a sentence we may have each of two n-tuples interrupting the other once (X_1 X_2 and Y_1 Y_2 appearing as X_1 Y_1 X_2 Y_2), or we may have to broaden the condition so that an n-tuple may be interrupted twice by another, but in some regular fashion.

14. Even a pair lacking one member may be identified in sentences if the remaining member occurs only in a particular type of n-tuple (e.g. $V_{n,}$ occur only in N $V_{n,}$ pairs) or if the identification parallels the identification of other n-tuples in a set of sentence structure (see Imperative, below). Such considerations can serve to identify in a sentence structures n-tuples from which more than one word is lacking, as when we locate in <u>This attribution is doubtful</u> the quadruple of <u>He attributed the fresco to Masaccio</u>.

15. The occurrence of <u>the</u>, <u>a</u> or, plural with many nouns will be considered below.

* Aside from this, a sentence structure which contain [sic.] <u>X</u> and a constant affix <u>y</u> characteristic of that sentence structure will be similar in string analysis to a sentence structure which contains <u>Y</u> in the position of <u>Xy</u>: <u>N2 t be $V_{n,n}$en by N1</u> (<u>Mount Blanc was climbed by deSaussure</u> [sic.]) is thus similar to <u>N t be A P N</u> (<u>Mount Blanc was blue by moonlight</u>), because <u>$V_{n,n}$en</u> has the properties of <u>A</u>.

16. Compare the acceptable forms: <u>There is a man coming</u>, <u>The room is in order</u>, <u>With the room in order, we left</u>, <u>The room in order, we left</u>.

17. Certain departures from normal acceptability will be expressed as correlations of n-tuples with (elementary) sentence structures. Others are due to restrictions on transformations; such are the completely unacceptable and borderline cases, and in a different way the n-tuples which occur in one structure but in the sense of another structure.

18. The term is from Henry Hiż [left blank] who stresses this approach to transformations.

19. Except in the presence of an intercalation marker: <u>He and she played violin and piano respectively</u>.

20. These alternative descriptions are noted toward the end of 1.2.

21. In [left blank] below it will be seen, somewhat similarly, that while the great bulk of English transformations operate on elementary sentences or on transformations, there are a few which operate on arbitrary sentences. Certain other features of these arbitrary sentence operations and of the pure binary operations permit us to separate them from ordinary transformations as a special group of morphophonemic operations on sentences or sentence pairs.

22. We recall here that an n-tuple satisfies a structure if it occurs in it in a stated mode of acceptance, and that two structures have the same satisfaction (i.e. the same n-tuples satisfy both structures) if the difference in mode of acceptance between any two n-tuples is the same in both structures.

What exactly is the role of this tabular representation of n-tuples of words and sentence structures? Hypothetically, setting up this type of table (considering the infinity of n-tuples in a language – “some hundred of varied n-tuples and with some scores of sentence-structures,” as Harris mentions) implies that a set of n-tuples of words would appear along with their “mode of acceptance,” or set of acceptable sentences structures, which are considered to be transformationally related. Apart from this manuscript, the same methodology of discovering transformations was also mentioned, even if building a table is not clearly suggested, in Harris (1957 [1970]):

> To establish the transformations in any given language we need methods, and if possible an organized procedure, for seeking (§1.41) what constructions may contain identical co-occurrences; these methods should if possible be general, but additional ones may be based on special features of the language. And we need methods of checking (§§1.42-3) the co-occurrences in each construction, so as to see if they are indeed identical.

Harris (1957 [1970: 400-401]) also uses the term "chart," rather than "table" :

> We may say, then, that to determine transformations we need to find same-class constructions which seem relevant, collect and compare the co-occurrences in each, and test to see if differences between them are upheld. (…)
>
> The results can often be summarized in a chart of same co-occurrence, which organizes all the different constructions that exist for a given set of classes keeping constant the same co-occurrences, where the set is satisfied in all the constructions by the same set of members.

6.2. Harris' table (part 2)

In the next section of his manuscript, Harris discusses another slightly different type of table. The description is more explicit here, with a sample table inserted in the text. We cite the entire section:

> 1.4 The satisfaction sets of elementary structures
>
> The correlation of n-tuples with sentence structures in the table described above can be summarized into a second table which sets up *objects useful for our later discussion: We consider n-tuples which satisfy elementary sentence structures, i.e. structures not satisfied by two or more independently occurring n-tuples. All n-tuples which occur in the same structures, preserving any difference between them in mode of acceptance, are collected into an n-tuple set: e.g. <u>man, read, book</u>; <u>man, read, story</u>; <u>child, find, book</u>; <u>man, eat, shadow</u> (bizarre);... . If two n-tuples do not occur in the same range of structures, or if they occur in the same structures but without preserving the difference in their mode of acceptance, they are not in the same n-tuple set. Each set of n-tuples is assigned a row in the table. Each n-tuple set plus the n-tuple set for a single adjunct (provided they are not independently occurring n-tuples) will also be assigned a row, e.g. the set illustrated above plus the set <u>quickly</u>; <u>hungrily</u>; <u>hurriedly</u>;... . If a set of n-tuples satisfies a certain range of structures, and a subset of it satisfies (preserving mode-of-acceptance differences) some additional structures, we may assign it a subsection of the row, for those additional structures. The different columns will be assigned to elementary sentence forms or to sentence segments, i.e. sequences of categories and constants which are not sentence forms but may //TSL 38// be found inserted into all non-elementary sentence-forms: and which are satisfied, like the elementary sentence forms, by a set of n-tuples (more exactly, a distinguished m ≤ n of the words of a set if n-tuples) plus possibly a single adjunct or other non-independently occurring n-tuples, but not by two or more independently occurring n-tuples. Each row then satisfies a certain range of columns, and the intersection shows how the members of the satisfying n-tuple occupy the category positions of the elementary structure. For example:

Sample member of n-tuple set	N t V	N t V N	N t V N P N	N t V N N	N t be A	N t be A P N	Nt Vt to V Ω	N's Ving Ω
man, walk	1,2	(1, V_M, 2) (N, 2, 1) 1, 2, N_m	β		(2, V_M en) (1, 2 en)	(2, V_M en, by 1) (1, 2 en, by N) β	1,2 α	1,2 α
man, read, book	(1,2) *(3,2)	1,2,3 (1,2,N_m) (3,2,N_m)	β (1,V_M, 2,3)		3,2 en (2P3, $V_m$en)	3,2 en, by 1 (2P3, $V_m$en, by 1) β	1,2,3 α	1,2,3 α
man, give, candy, boy		1,2,3	β 1,2,3,4	(1,2,4,3)	3,2 en	β 3,2 en, by 4 3,2 en, by 1	α 1,2,3,4 1,2,3,4	α 1,2,3,4 1,2,3,4
man, fool		1,be,2		1,be,2,N_m	(1,2)	β	1,be,2 α	1,be,2 α

The numbers of each intersection show the order in which the words of the n-tuples (plus others) fill the categories of the structure. Parenthesis refer to the subsets of the n-tuples in the row, and thus constitute sub-rows; i.e., parenthesized ways of filling the categories are satisfied by only a subset of the n-tuple set, in most cases all those having particular verbs (second member of n-tuple). β in row i column j indicates that the satisfaction of the row i column j-1 plus P N adjunct satisfy the structure of the column j. In row 1, for (1, V_M, 2) with //TSL 39// an inserted modal verb we have, e.g. The man will take a walk, The man is a walker, for (N, 2, 1) with a new causative subject The nurse walked the man, and for 1, 2, N_m with an added noun of measure The man walked an hour. In row 2, we have for (1,2) The man will read, for (3,2) The book reads well, for (1,2,N_m) The man read an hour, for (3,2,N_m) The book sold a thousand copies,[23] for (1,V_M,2,3) The man attempted a reading of the book, The man gave a kick to the table, for 3,2,1 (with the passive Ven taking the properties of A) The book was read by the man and The book was read. In row 3, N t V N N is satisfied by 1,2,4,3 for certain verbs in the n-tuple, e.g. The man gave the boy candy; but when the verb is deprive, as in The boy deprived the boy of candy, this structure is not satisfied. In the structure N t be A P N we have both Candy was given to the boy and Candy was given by me; there is also N t be A P N P N Candy was given to the boy by me, and other forms. In row 4, we have The man is a fool, The man is foolish. In the last two columns, α in row i and column j indicates that all satisfactions in row i also satisfy the structure in column j. V_t indicates a set of verbs plus to which operate on the verb of the n-tuple: The man began to walk. The man tried to walk. The man began to read a book. By α, we have also (1,V_M,2) The man began to take a walk, etc. Some of the columns add a mode of acceptance to their satisfactions in a particular row, which could be marked, e.g. as the asterisk was here. For example, the (3,2) //TSL 40// case in the first column gives the words of the second row rather clearly in the sense of the second column: The book reads well in the sense of Someone reads the book. This effect is added to all the n-tuples, and does not affect the difference in modes of acceptance between the various n-tuples, which should remain constant. In the present table, the mode of acceptance shown in the first table is separated into two parts: the difference between n-tuples, which is part of the property of the n-tuple set here; and the effect on all n-tuples of a set (row) due to particular structure (column), which has to be marked at the row-column intersection.

The category symbols, N, V, etc., in the structures indicate positions in the structures which may be filled by n-tuple members. Those symbols may therefore be looked upon as variables taking n-tuple members (hence, words) as values. An n-tuple member may occur in various category-symbols: e.g. read occurs in V and A. But most n-tuple members satisfy only one category symbol when affix-less, and satisfy others only by carrying an affix (even if of zero phonemes). The category-symbol which n-tuple members satisfy without affixes may be considered the general name of the category in which those n-tuple members belong. For transformational analysis it would have sufficed if the successive word positions (not counting constants) in a structure have been simply marked by members. They are marked by N, V, etc., for string analysis reasons, and because the words which satisfy N in one structure are the same (except for differences of subcategory) as the words which satisfy positions marked N in other structures (except, of course, that the remaining words in the n-tuple will in general be different for the occurrence of these N-words in different N positions). A category X of words, then, is a set of words X which occur in X position of structures, or which with affix y //TSL 41// occurs in Y positions of structures when the n-tuple of which X_i is part satisfied the structures containing X or Y. If those n-tuples which contain particular members X_i of some category X satisfy certain additional structures, we will call X_i a sub-category of X. Then the only categories and sub-categories of words which have to be recognized in a transformational grammar are just those which are necessary in order to indicate which n-tuple members satisfy which positions of which structures.

Some subcategories are sharply distinguishable. For example, different members of the V category occur in the N t V, N t V P N, etc. structures: V <u>exist</u>, <u>sleep</u>; V_n <u>take</u>, <u>pick</u>; V_{pn} <u>rely</u>. Also, there are certain members of N, called N_s, which operate on all assertion sentences in a set of structures <u>That S t be N_s</u>, <u>the N_s that S</u>, etc.: <u>fact</u>, <u>theorem</u>. No other N occurs in these N_s positions, and many N_s do not occur in N positions (i.e. some N_s occur only as operators), though operators on N also operate on N_s. Similarly, there are certain members of V, called V_M, which operate on regular V in structures N t V_M a V_n, etc.: <u>give</u>, <u>take</u> in <u>He gave a jump</u>, <u>He took a walk</u>; members of V_M also occur in V positions. A different situation is presented by those members V_m of V which are such that n-tuples containing V_m satisfy structures containing V_M: e.g. <u>jump</u>, <u>walk</u>, <u>nap</u> are in V_m, but <u>exist</u> is not. Similarly, there are members, V_α, of V such that n-tuples containing V_α satisfy structures which lack the last part of the indicated object of the V_α: <u>sell</u>, <u>read</u>, in V_α, occur in N t V N <u>He sells things</u>, <u>He reads things</u> and also in N t V <u>He sells</u>, <u>He reads</u>; but <u>wear</u>, <u>make</u>, not in V_α, occur in N t V N <u>He wears clothes</u>, <u>He makes things</u> and not in N t V. In some case [sic] more indirect considerations for //TSL 42// subcategorizing arise. The forming of subcategories, however, is the other side of the coin of determining transformations. Therefore the specific kinds of sub-categories and the considerations used in each case can only be seen in the course of presenting each transformation of the language, below. In terms of the distinction (to be made below) between kernel structures and transformations, it may be said that certain kinds of sub-categories (N_s, V_M, V_*, V_n, V_{pn} above) indicate the occurrence of certain category-members in particular kernel structures or operators while other kinds of sub-categories (V_m, V_α) indicates the fact that particular transformations can operate on certain category members. It will be seen that the S → I transformations, and certain operators on kernel structures, which only change some constants in the sentence structures on which they operate, do not require any subcategorizing.

It will be seen that the subcategories (i.e. the operands of transformations) do not form a simple hierarchy of inclusions. However, the detailed transformations that continue to be found in a language, after the main ones have been established, usually involve the formation of only very small new subcategories. //TSL 43//

The table above reveals an equivalence relation among the entries under the various columns: all the entries, for each column, within any one row contain the same n-tuples (or a distinguished n-tuple out of each n-tuple) with the same differences between them in mode of acceptance. That is, the satisfactions of each structure (recalling that a given n-tuple may satisfy a structure more than once, in more than one mode of acceptance) can be grouped into disjoint n-tuple sets (for subsets) such that each set is identical with one or another of the n-tuple sets of at least one other structure.

From the equivalence relation we can proceed to ask what are the differences among the ways in which the n-tuple members fill the positions of the different structures of one n-tuple set, i.e. the positions of the structures which have entries participating in an equivalence relation. Thus, for the entries in the first row the structure N t V N is satisfied by adding a new element in any one of the three category positions with various particular restrictions on how the n-tuple words occur. In row 2, the first column is filled by dropping one of the N of the first entry in column 2, but keeping the verb member of the n-tuple in second position; the remaining entries in column 2 relate to column 1 in some but not all the ways seen in row 1. In the last two columns the entries throughout can be summarized if we use Ω to indicate whatever follows the first V (in each entry of the row). We can then reach all the entries in the last column by taking each entry in a structure which has the form N t V Ω and adding ‘s to N, dropping t, adding -ing to V. The column before it can be similarly //TSL 44// summarized by insertion of V_t to after the t of N t V Ω entries, including the entries of this very column (hence He tried to begin to do it). Another kind of summary is possible if we consider all entries containing V_M, and say that whenever the verb of an n-tuple is a member of V_m, then V_M a may be inserted before the V_m with nominalizing suffix m, usually zero, after the V_m; the insertion is not permitted in certain entries where permutation has taken place.

We see, then, that an n-tuple occurs in various structures by having its members arranged in a particular way into the positions of the structure, with possibly some of its members dropped, and constants added. The n-tuples of different rows may receive different treatment in satisfying a particular structure. For example, the man, walk pairs satisfy (in that order) N t V by inserting t; the triples man, read, book by in addition dropping the last member, or dropping the first member and permuting; the pairs of the forms man, sick (not in the table) by adding (to only a few of the second members) a suffix v_* which permits words of adjective category to occur in the position of V_*: The man sickened (but in N t be A: The man is sick). In some cases, the n-tuples of various sets are treated in the same way in getting them to satisfy a particular structure or a class of similar structures. For example, all n-tuples containing a V_m verb insert V_M a...n, obtaining from man, walk an N t V N structure; from man, kick, door an N t V N P N (The man gave a kick to the door), or, with last member dropped, an N t V N (The man gave a kick); from critic, attribute, fresco, Masaccio an N t V N P N P N (The critic made an attribution of the fresco to Masaccio). //TSL 45// In many cases, an n-tuple set satisfies one structure by including some of the change it underwent in satisfying another structure. For example, the man, walk set satisfies N t be A with the aid of changes it received in satisfying N t V N (The walk was taken from The man took a walk from The man walked; The man was walked from The nurse walked the man). Indeed, some structures are satisfied in a particular way (i.e. by means of particular changes) by all the entries in certain other structures, or by a distinguished subclass of these entries, even though these entries in turn may have been obtained from different n-tuple subsets. For example, N t be A P N and N t be A are satisfied, by means of the same changes, by all entries in the N t V N structure unless the V position is filled by be (or the be-class) or the second N is filled by N_m (or certain other N). Finally, some structures are satisfied, with the aid of a single set of changes, by all entries in all the N t V Ω structures, or by all those in particular structures (independently of their n-tuple set): e.g. the N t V_t to V Ω and N's Ving Ω in the table. As an example of the changes being somewhat different for different structures, note the structure N's Ving Ω which adds of in almost all structures in which Ω begins with N, but not otherwise. As an example of restriction to the entries of particular structures, note N's A_n, which is satisfied (with the same changes) by all entries in N t be A (provided the word in the A position can take an n affix) no matter whether from noun-adjective pairs (man, sick: The man is sick, The man's sickness), or from noun-noun pairs (man, fool, The man is foolish, The man's foolishness), etc. //TSL 46//

All this can be described by saying: either that the various structures are obtained from the n-tuple sets by operations of arrangement (ordering), dropping of n-tuple members, or adding of constants or of categories (as adjuncts or an operators; the latter as in the case of V_t to, V_M a...n); or that some structures are obtained from other structures by permuting or dropping categories, or by adding constants or categories. The main consideration here is to express the differences between the various structures having the same satisfactions in terms of a number of operations either on n-tuple sets or on other structures. The satisfactions of the various structures can be given in part by operations on particular sets of ordered n-tuples (or "home" structures containing the least addition to them): e.g. N t V is satisfied by one assignment of each n-tuples of row 1, by other assignments of each n-tuple in row 2; and in part by operations on all the satisfactions (or on all having certain structural properties) in particular other structures: e.g. the satisfactions indicated by α in the last columns of the table. Each operation consists: first, in forming an elementary structure by a particular arranging of categories and particular constants; and second, in a particular assigning, to these category-positions, of the words of the n-tuple (identified as its V, its subject N, and its object Ω or either part of a two-part object containing N, A, P, or P N) or of the specified category-position fillers of the home structure or of any other structures.

The table shows that each (or almost all) of the elementary structures is satisfied by several n-tuple sets and that each (or almost all) of the n-tuple sets satisfies several elementary structures. It is clear, then, that the various operations which send an n-tuple set into various structures, or //TSL 47// which take n-tuples from one structure into another are not arbitrary changes of constants and positioning of categories and assignments of the n-tuple member or the category fillers of the prior structure. Rather, the operations are in almost all cases such that their resultants are the same structure (i.e. the same sequence of categories and constants) as the resultants of some other operations. The major transformational operations, then, take n-tuples of a set to various ones of a class of elementary structures. We will see later that most of these structures are similar to the home structures of particular n-tuple sets (so that the difference between transformations operating on n-tuples and transformations operating on structures becomes academic). And we will see that most of the remaining transformations, or the marginal transformations which are felt as extensions of the grammar rather than as parts of it, yield structures which while not identical with the existing class of elementary structures nonetheless preserve certain properties of this class.

To see more exactly how transformations are restricted to yielding a certain class of structures we consider first the similarities among the elementary structures, that is, without regard to how the category positions are filled. Almost all the sentence-forms consist of N (subject), followed by a verb-word which takes t as affix (or tense-auxiliaries before them), followed by a category-sequence (object, Ω) which is determined by the particular subcategory of verb. This even though the occupant of any of these positions may be a constant of the structure rather than an n-tuple-member: //TSL 46// e.g. V_t or be in the V position, or it in the N position, of certain structures. A few rarely-occurring sentence-forms present a partially different arrangement of these same parts: Ω N t V (The fugue I liked), D t V_* N (Nearby rose a tower; only for certain D, V_*), D t N V Ω (Little did I believe it; only for certain D), Ω t N V (Two hours have we waited). A very few sentence-forms are even more different: The more they think for themselves, the better. (ch. [left blank]). Some departures from the major form are only apparent, are due to morphophonemic zeroing. This is the case for all structures occurring only before or after conjunctions: The non-elementary sentence from N t V and t V (He went and returned) has an apparent unique structure t V after and; but it can be shown to be the full major structure N t V with zero phonemes constituting the morphophonemic shape of the second occurrence of he in subject position. Certain departures from the major forms occur as the result of transformations which are members of a family of transformations whose other members yield the usual major structures. For example N_2 t be N_1's Ving is a sentence form of the N t V N structure with adjunct before the second N; it is satisfied by certain N_1 V N_2 triples (The chef cooked the meal. The meal is the chef's cooking); the occupant of the last N position is the V of the n-tuple with ing affix. Similarly N_2 t be what N_1 t V, N_1 t be what t V N_2, (The regime is what the revolt overthrew; The revolt is what overthrew the regime) and other related forms, are satisfied (with certain adjustments) by all N_1 V N_2 triples; but the occupant of the last N position in the N t V N structure is here a wh-pronoun plus the whole n-tuple with one N omitted from it. Finally, we have P N t be where N t V (At the corner is where it occurred), A t be what N t be (Henry is //TSL 49// what it is), satisfied by N V (with P N adjunct) and N A pairs, which differ from the major form in not having N as subject.

Some word forms are resultants of particular functional operations, such as the deleting of the reconstructible words of performative sentences: Will he come? ← I wonder, will he come? ← I wonder whether he will come. And Please come! ← I request (that) you please come.

In the sentential segments, which are the resultants of S → I transformations, the structure is of course not of the sentential N t V Ω form. However, in one way or another, these structures are similar to the primitive adjunct forms; and their insertions into other sentences are like the insertion of primitive adjuncts. Thus Ving of N_2 by N_1 (chopping of trees by settlers) which is satisfied by all N V N triples has the structure of an N position (filled by verb member of the triple plus -ing) to which have been added two P N adjuncts. Similarly, in (or after, upon, etc.) Ving Ω (in seeking peace), satisfied by all N V Ω n-tuples, has the structure of a P N adjunct (with V Ω filling the N position by addition of -ing).

A general statement of what the common properties of the sentence forms, and of the primitive adjuncts, and to what extent and in what ways these are preserved under transformation, will not be attempted until the transformations of English have been presented in detail in the following chapters.

Not only do the structures show certain common properties, but the transformational operations do too. These are distinguished from their resultant structures in that the operations include specific assignment of words of the n-tuple to positions of the structure. Thus the words of N V N //TSL 50// triples appear twice in the N t V structure. It is of interest that most triples which occur normally with the last noun as subject of N t V do not have the first noun as subject (He shattered the meter. The meter shattered. But *He shattered.); however some verbs occur normally with both assignment of N (He cooked the meat. The meat cooked.

He cooked.)

If we consider the constants in each structure, or in the transformational operations that enable an n-tuple not to satisfy a structure, we will see that only a small number of morphemes provide the constants for all the structure, each structure using one or more of them, whether as an affix y added to n-tuple words of category X to enable them to occupy a Y-category position in the structure, or otherwise. In the case of the affixes, some can occur on all members of a category. Others occur only on particular members: in this case only n-tuples whose relevant member can take the necessary affix can satisfy the structure in question.

Certain characteristics of the way of operating on sentences affect some properties of the resultant structures. For example, since transformations operate on a single n-tuple or elementary sentence structures, any insertion that takes place is whole nesting, so that intercalation does not normally arise (to intercalate two structures, one would have to interrupt, hence operate on, both of them); and thus, too, no more than binary compounding occurs. Also, there are in several cases families of transformations whose members are identical except for a parameter, e.g. extracting any one word from an elementary sentence to make it the subject (The book is what I want from I want the book); The transformations differ only in what word they extract. In such cases unusual //TSL 51// structures may result from particular members of the family (e.g. Henry is what it is).

The operations are limited by being constrained to a small set of elementary structures, and by being restricted to available constants. Furthermore, the transformations have only particular effects and not others on elementary structures: such effects being the features common to the operand-resultant differences in each transformation.

1. As to the difference in structure between operand and resultant: transformation can change a kernel sentence (or an n-tuple) into the form of a shorter or larger or different kernel structure, or of a kernel structure with adjunct; they can change a kernel with adjunct into the shape of a larger kernel, or a different kernel plus adjunct, or two kernels. And a combination of two kernels can be changed into the form of one plus adjunct.

2. As to the functional effect that transformations have on sentences: Aside from arranging the n-tuple members with various constants, they can add primitive adjuncts to particular parts of the kernel; they can add metalinguistic operators to the whole kernel; they can adjoin a sentence that begins with a particular N to an occurrence of that N in an elementary structure; they can add primitive adjuncts or deformed sentence structures between various parts of a kernel; they can conjoin two sentences either absolutely or in respect to a particular word in the first of them. Within these kinds of transformations there are sub-types: e.g. there are different conjoining-words depending on whether the minimal difference between the conjoined sentences is 0, 1, or 2; //TSL 52// there are different morphemes that connect a metalinguistic operator to the sentences on which it operates, depending on whether the latter is a disjunction of sentences, or a single sentence, or a sentence lacking its t. It is thus clear that transformations are not all the possible rearrangements of n-tuple members within a set of structures, but rather those which yield particular type of difference between operand structure and resultant structure.

The fact that transformations have such systemic properties helps in many cases to decide whether a given set of sentences is a resultant of some transformation. The problem is, given some sentences having a particular sentence form, to see if the n-tuples satisfying these sentences or a subset of them are the same as (some subset of) those satisfying some other structure, and if the difference between the two structures, i.e. the transformational operation necessary to send the n-tuples from one to the other, is some succession of known operations or has the general properties of the transformations of the language. In a more general sense, this criterion can be used for such problems as the following: In English, a P N adjunct of N is analyzed as coming from a second sentence, but a P N adjunct of V or A is not. Thus (1) The mark on the rock disappeared is a transform of (2) The mark disappeared. (2') The mark was on the rock; and A man with green hair appeared from A man appeared: A man has green hair (disregarding certain problems concerning the article). But (3) He walked near the rock. is not a transform of two sentences. True, there is (4) The walk (or The walking) was near the rock. But there also exists (5) His walk (or His walking) was near the rock and known transformations would connect //TSL 53// (4) with (5), but (5) is obviously satisfied by the full n-tuples of (3) and is a transform of (3). Hence (3) does not contain another independent sentence over and above (4), as (1) does over and above (2), namely (2').

The fact that there are families of transformations, the members of which differ only by a parameter, makes it possible to recognize transformations even when only one word of the n-tuple is left.[24] For example, in Writing is not easy we can show that the first word is a transform of N_1 write N_2, with each of the N-portions omittable. In contrast, exclamations N! are not transformations of any other n-tuple: John! or Fire! cannot be derived in accordance with known kinds of transformation from any other structure.

There are cases in which a structure F_j can be considered a transform of F_i only for a small part of the n-tuples of F_i, even only for those n-tuples containing some particular verb, or the like. Usually this problem will arise where some n-tuples of F_i satisfy a structure F_j: others satisfy $F_{j'}$, others $F_{j''}$, etc., the primes indicating slight differences among F_j-like structures. For example, the pairs N walk, N ride, N look, etc., satisfy N took a V_n (He took a walk); the pairs N smile, N look, N think, etc. satisfy N gave a V_n (He had a fall [sic]); N sleep occurs in N had some sleep, N got some sleep. First we can form a structure F_j for this family of transformations, whose constant is V_M a...n (n usually zero; V_M: take, give, have, etc.). Then we can admit, for sleep and possibly other verbs, some in place of a, an [sic] get in V_M. These are in any case transformations, if all N V pairs whose second member in [sic] sleep satisfy N t get some V. A more difficult problem arises in He vacationed, He spent a vacation; He weekended, He passed a weekend; He died, He suffered death. //TSL 54// Each of these can be taken as a transformation for all N V pairs with the given V. Together they form a family for N V pairs having certain V; and the family is of the type of the N V_M a V_n family.[25]

If a unique (frozen) word-sequence A_1 B_1 occurs (or a few such), it is impossible to test to what n-tuple set the sequence belongs, since we cannot see if the difference is in mode of acceptance of the sequence for different second words A_1 B_i (or for different first words A_i B_1) are the same as in a particular n-tuple set. Nevertheless, if the sequence is identical (with the same mode of acceptance) with one of the n-tuples (or part of one) in an n-tuple set, and if there exists a transformation which takes certain n-tuples of that set to sequences of this general kind, then the unique word-sequence can be considered a transform. For example, the V N pairs in compound-nouns stress pick-pocket, do-nothing, even ne'er-do-well are identical with the latter protions of particular N_1 V N triples. There are several transformations which take these triples into N_1 t be φ (V N) or N t be φ (N_1 V), where φ (X Y) indicates some constants plus X and Y: from cat, kill, bird we have The cat is a bird-killer, The cas is what killed the bird, The bird is what the cat killed. The latter portion of these structures can then replace its N_i subject in almost all occurrences of N_i (as an adjunct to a zeroed N_i): I don't like this cat, I don't like this bird-killer. This transformational course fits the compounds above: (1) The //TSL 55// fellow picks pockets (2) The fellow is a pick-pocket, The fellow got a lot of money, The pick-pocket got a lot of money. The operations that involve pick-pocket are thus not unique. The only unusual feature is that the first operation, the particular form φ in (2) occurs only for a few particular V N, not even for all pairs having the same V.

There are various special tests and criteria which are relevant to particular transformational problems. For example, the difference between V_* (run) which have no object and $V_{,n:d}$ (drink) which have N object but can delete it can be tested by asking for the object: He drank. What did he drink? But after He ran there is no What-question. (And indeed, to the question What did he run best?, the answer He ran the dance evening best is taken as containing a $V_{,n}$: ran different from V_*: ran.) This semantically natural test is not so obvious transformationally, for transformations deal with structures that are equivalent in a certain respect, not with successive sentences of a discourse. However, (1) it can be shown that a question is a particular transformational operation on the sentences which are its answers (so that What did he drink? includes a transform of He drank N. [ )] But (2) it can be shown that when an assertion is put into question form, the same operation is carried out on that assertion. Then What did he drink?, which by (1) is a transform of He drank N, is also the same transform by (2) of He drank, and it follows (transformations being an equivalence relation) that He drank is a transform of He drank N. //TSL 56//

There are quite a few cases in which the transformational character or standing of a structure is uncertain and can be established only by complicated reference to the n-tuple involved or to the other transformations of the language. The problems are too variegated to be summarized here, and the individual cases have to be discussed below, each in its place, where all the relevant data can be reviewed.

Footnotes

23. It will be noted that 3,2,1 is not considered a satisfaction of N t V N for row 2 (but only for a small group of reciprocal verbs: met). One might think of John saw Bill and Bill saw John, and say that 3,2,1 is also a satisfaction of N t V N, but only for a subset of row 2 containing animate subjects and objects. However any differences within this proposed subset in mode of acceptance in the 1,2,3 satisfaction are not preserved in the proposed 3,2,1 satisfaction: John saw the blind man is normal, The blind man saw John is bizarre. If we propose just personal names to be the subset, there is a question whether all personal names are not simply variant forms of one morpheme, in language structure.

24. This would be impossible without special considerations. For ordinarily, if F_i is to be a transform of F_j each n-tuple which is common to both must have at least two of its members present in each structure. If only one member of the n-tuple remains in the structure, it is difficult to say what n-tuple it is that is thereby satisfying the structure, i.e. from which n-tuple the word has come.

25. But see the problems discussed in [left blank].

The table explained in this section is oriented to show equivalence relations between "elementary sentence structures" satisfied by a set of n-tuples. Transformations relate structures represented by columns, sometimes with an n-tuple augmented by a special type of verb like V_M. The role the latter (here called "modal verb") plays, is precisely the one played by a U operator or Verb-operator in later works by Harris (e.g. Harris 1964 [1970], 1965 [1970]): it is “a new *V* of certain special subcategories”, which “change[s] the original *V* into what might be called the object of the new *V* (V_n, V_a, etc.)”. It “also add[s] or change[s] a preposition before the N_2 object of the old *V*.” (Harris 1965 [1970: 544]).

7. **Harris’ and Gross’ tables**

Given the fact that Gross had read this manuscript in 1963, years before the publication of his first work, it is highly possible that it gave him some insight on how to represent his own results while developing his transformational analysis of French sentence structures.

As it was seen above, the columns of lexicon-grammar tables are equivalent sentence structures, related to a definitional elementary sentence structure. As for the entries in the rows, Gross focused on verbs, as a central unit of sentence structure, and not on n-tuples of words. In terms of lexicon-grammar, Harris’ second table could be reorganized into at least four different tables: one for the intransitive structure *N V*, one for the transitive structure *N V N*, another for the transitive-dative structure *N V N P N*, and the last one for the copulative sentence *N be N*. Other structures, for example *N t be A (P N)*, which describes a passive transformation, would appear in tables describing transitive verbs. The *N t Vt to V Ω* structure, on the contrary, would receive a treatment apart, its own syntactic class, in fact. Gross considered V_t operators, which are not reducible from a sentence operator, some kind of “(semi-)auxiliary” verb and assigned it a separate class (table 1). As to the structures with V_M, Gross decided not to treat them within a table of verbs, but to dedicate a set of tables based on a particular V_M (*faire, avoir, prendre,* etc.) and on forms of elementary structures defined by complement structures required by sets of V_n.

8. **Conclusions**

In this brief report, the main focus is on the presentation of recently found historical documents, which appear to shed some new light on the possible origin of Maurice Gross’ lexicon-grammar tables, and their connection to Harris’ work. A more detailed examination of the manuscript attributed to Harris, and first presented here, will be necessary for its critical edition.

References

Boons, Jean-Paul, Guillet, Alain and Leclère, Christian, 1976a, *La structure des phrases simples en français 1 : constructions intransitives*, Genève-Paris: Droz, 377 p.

Boons, Jean-Paul, Guillet, Alain and Leclère, Christian, 1976b, *La structure des phrases simples en français 2 : classes de constructions transitives*, Rapport de recherches 6, Paris: Laboratoire d’Automatique Documentaire et Linguistique, 143 p.

Danlos, Laurence, Pradet, Quintin, Barque, Lucie, Nakamura, Takuya and Constant, Matthieu, to appear, Un VerbeNet du français, *TAL* 57.

Gross, Maurice, 1968, *Grammaire transformationnelle du français 1: syntaxe du verbe*, Paris: Larousse, 181 p.

Gross, Maurice, 1975, *Méthodes en syntaxe*, Paris: Hermann, 414 p.

Guillet, Alain and Leclère, Christian, 1992, *La structure des phrases simples en français 2 : constructions transitives locatives*, Genève-Paris: Droz, 445 p.

Harris, Zellig S., 1957, Co-occurrence and transformation in linguistic structure, *Language* 33, 283-340, reprinted in Harris 1970, 390-457.

Harris, Zellig S., 1965, Transformational theory, *Language* 41, 363-401, reprinted in Harris 1970, 533-577.

Harris, Zellig S., 1970, *Papers in Structural and Transformational Linguistics*, Dordrecht-Holland: D. Reidel Publishing Company, 850 p.

Kipper-Schuler, Karin, 2005, *VerbNet : A broad-coverage, comprehensive verb lexicon*, PhD thesis, University of Pennsylvania, 146 p.

Koerner, Ernst Frideryk Konrad, 2002, Zellig Sabbettai Harris: A comprehensive bibliography of his writings, 1932-2002, *The Legacy of Zellig Harris: Language and Information into the 21st Century*, Vol. 1, (Bruce E. Nevin ed.), Amsterdam-Philadelphia: John Benjamins, 305-316.

Levin, Beth, 1993, *English Verb Classes and Alternations*, Chicago-London: University of Chicago Press, 348 p.