A RE-EXAMINATION OF HARRIS'S SYNTACTIC THEORY:

CONSTRAINTS ON TRANSFORMATIONS[1]

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1. <u>Introduction</u>. Zellig Harris's pioneering work has played an important role in the development of linguistics in this century. His descriptive studies have been highly influential, as has his development of both string analysis and transformational theory. With the advent of generative transformational grammar, much of importance in Harris's work was lost sight of. More recently, however, with an increasing sensitivity to its intellectual antecedents, linguistics has begun to rediscover Harris and to find that many of the syntactic "innovations" claimed by generative grammarians were overtly present in Harris's earlier work (Prideaux 1971). A couple of examples will serve to illustrate the point. In his 1955 presidential address to the LSA, Harris raised the issue of whether transformations (or a subset of them) should be meaning preserving, yet no reference of any sort is made to Harris in Katz and Postal 1964, where the meaning preservation hypothesis is also advanced. In the same paper, Harris proposed that prenominal adjectives be derived from full copula sentences containing the adjective in the predicate, that possessive structures be derived from full copula sentences containing the adjective in the predicate, that possessive structures be derived from full sentences containing <u>have</u>, and that <u>wh</u> and <u>pro</u> forms be included in a grammatical description. Yet in her paper on "Determiners and relative clauses in a generative grammar of English," Carlotta Smith (1964) failed to mention Harris either in the body of the paper or in the references, even though several of her proposals mirror those of Harris. Ignoring the history of one's discipline might be excused under some conditions, but it hardly seems excusable when we remember that the 1955 presidential address was later published in <u>Language</u> (Harris 1957), and that Harris was one of the world's foremost linguists. More recently, however, with some mellowing and more attention being paid to our intellectual progenitors, it is becoming more widely recognized that many of Harris's insights were indeed profound, regardless of the particular theory or version of a theory that one might espouse (cf. Kac 1973).

The purpose of the present paper is to examine another of Harris's insights, namely that an important class of transformations (Harrisian transformations, of course,) preserve grammatical structure and semantic information in an important way. Harris's notion of the kernel serves a far more important role than simply being the set of basic, "normalized" syntactic forms from which other, more complex sentences are derived. Specifically, Harris's kernel also provides a set of syntactic and semantic constraints on transformations and delimits just what sentential forms are allowable in a given language. Before the particulars of this

claim can be explored, however, it is useful to review briefly just what Harris's conception of a grammar involves.

2.   Harris's Transformational Model.   In numerous papers dealing with transformational theory and discourse analysis, Harris has presented a detailed transformational approach to linguistic structure.   All of Harris's works referenced here are collected and reprinted in Harris 1970, to which all page references are made.   Although details vary slightly depending on the source cited, his basic view is as follows.   A grammar—the linguistic description of a language—can be formally represented as consisting of a kernel of basic syntactic forms, plus a set of transformations which operate on either the kernel structures or on structures derived from the kernel.   The kernel is a very small set of structures which, according to Harris, are selected on the basis of overall descriptive simplicity.   In fact, the kernel corresponds more or less to what Harris's predecessors often called basic sentence types.   The kernel for English, taken from Harris (1964), is represented below, with Harris's notation to the left. To the right, the structures are recast in the more familiar constituent structure notation, where X represents a possibly null variable ranging over optional PPs.

Harris's Notation	Kernel	Constituent Structure Notation
N t V	K_1	NP AUX V X
N t V N	K_2	NP AUX V NP X
N t V P N	K_3	NP AUX V PP X
N t V N P N	K_4	NP AUX V NP PP X
N t V N N	K_5	NP AUX V NP NP X
N t be N	K_6	NP AUX be NP X
N t be P N	K_7	NP AUX be AP X
N t be De	K_9	NP AUX be Adv X

In addition to these nine kernel structures, Harris at times includes two more: it-structures, as in It rained and there-structures, as in There is hope.   Following Harris 1956, we shall not treat these two problematical sentence forms as kernels since the former can be subsumed under the already existing K_1 and the latter can be given a transformational treatment, as Harris does elsewhere.   Each of the kernel types is labelled here merely for convenience of reference.   The subscripts on the verbs are, of course, indications of specific subclasses, and the particular

details of determiners are ignored. Since Harris's notation is not widely known or used, the more familiar constituent structure notation will be employed throughout this paper.

It is useful to pause at this point and notice that given the kernel for English, it is a short step to reformulate the entire set in terms of phrase structure rules. Once higher level categories such as VP and PRED are introduced and once abbreviatory devices such as parentheses and curly braces are permitted, the kernel can be represented by the following simple set of phrase structure rules:

$$S \rightarrow NP \quad VP$$

$$VP \rightarrow AUX \begin{Bmatrix} V(NP) \ (\begin{Bmatrix} NP \\ PP \end{Bmatrix}) \\ \underline{be} \ PRED \end{Bmatrix}$$

$$PRED \rightarrow AP, \ NP, \ PP, \ Adv$$

It appears that Chomsky 1957 took just this step and converted Harris's kernel set into a generative component of phrase structure rules. But that little episode is beside the point of the present paper, even though it does illustrate in an interesting way the transition from Harris's approach to syntax to Chomsky's.

In describing the nature of the kernel, Harris noted:

> Those constructional features of grammar which are well known from descriptive linguistics are in general limited to the kernel. In the kernel, the constructions are built up as concatenations of various included constructions, down to morpheme classes; various classes or sequences of classes (and their members) are substitutable for each other in particular positions of those constructions (1970:447).

Harris realized, or course, that the specification of the kernel alone was quite inadequate for the description of a language. While describing the basic sentence types of a language, the kernel itself by no means exhausts the totality of syntactic forms, and, even more importantly, it does not provide any means for representing relationships among grammatical structures. To remedy this inadequacy, Harris introduced the notion of grammatical transformation. While the kernel represents the basic constructional types for sentences in a language,

> Transformations cannot be viewed as a continuation of this constructional process. They are based on a new relation, which satisfies the conditions for being an equivalence relation and which does not occur in descriptive linguistics (1970:447-448).

Thus, for Harris, transformations "...can be viewed as an equivalence relation among sentences or certain constituents of sentences" (1970:384).

Transformations are classified as either <u>unary</u> or <u>binary</u> (1970:540-546). Unary transformations are rules which either pair one sentence form with another sentence form (such as the PASSIVE or CLEFT transformations) or which pair one sentence form with a constituent (usually a NP), such as various types of nominalizations. Binary transformations are rules which serve to combine two sentences in various ways: some involve the embedding of (part of) a full sentence into another sentence, as in the derivation of nominal modifiers from full sentences, while others combine two sentences into a single sentence, as in conjuction and subordination. By and large, Harris treats the unary transformations as <u>bidirectional</u>. That is, each such rule defines an equivalence class such that if one member of the class is well-formed, then so is the other member. He seems not to view such unary transformations as taking one member of the pair as basic in principle, although in practice he seems to view the unary transformations as mapping kernel structures into non-kernel structures. The binary rules are generally unidirectional. It should be noted also that Harris did not employ the notion of transformation to account for such grammatical phenomena as subject-verb agreement, verbal suffixation, or nominalization affixation. Rather, he handled these phenomena by the use of morphological analysis, sometimes employing discontinuous morphemes, so that the morphology appears to be a kind of overlay on top of the syntactic structures.

In what follows, attention will be directed exclusively to unary transformations, and more specifically to those unary transformations which pair sentence forms with other sentence forms.

We shall ignore binary transformations altogether, as well as those unary transformations which convert a sentence into a sentential constituent which is less than a full sentence. Thus, only rules of the form $S_i \longleftrightarrow S_j$ shall be considered here.

3.   <u>Unary Sentential Transformations</u>.   Unary sentential transformations pair one sentential form with another, and Harris spent considerable effort in formulating such rules for English. When these rules are viewed in <u>derivational</u> terms, a given sentence form is, under the application of a particular transformation, converted into another, <u>derived</u>, sentence form. Such a way of viewing transformations is familiar from the practice of the generative grammarians who succeeded Harris. However, there is an important difference between Harris's notion of derivation and Chomsky's. For Harris, both the input and the output of such transformations are <u>sentences</u>, while in generative transforma-

tional theory the input to a transformation is an <u>abstract</u> syntactic representation which does not flesh out into a fully developed sentence until all the transformations have applied and the structure surfaces. This distinction is important, and ignoring it has led to considerable confusion in the understanding of both theories. When the unary sentential transformations are understood in Harris's derivational sense, for example, a full active sentence is converted into a passive sentence under the operation of the PASSIVE transformation. The unary rules can also be viewed as a means for extending the syntactic types of a language beyond the kernel set, and there is some indication that Harris views the unary rules in just that way--as a means for expanding the syntactic types by taking the kernel as input and deriving other sentential forms by application of the unaries.

In order to move from this fairly general discussion to a more detailed analysis, it is necessary to examine some of Harris's rules. The basic $S_i \leftrightarrow S_j$ unary transformations, the original formulation for which can be found in Harris's 1956 paper "Introduction to transformations," are discussed below. Both Harris's notation and the more familiar constituent structure notation are provided for each rule, as was done with the kernel set discussed above.

The best known and essentially archetypical rule in all theories of transformational grammar is PASSIVE, which Harris formulated as follows:

$$N_1 \; t \; V \; N_2 \; \leftrightarrow \; N_2 \; t \; \underline{be} \; \underline{Ven} \; \underline{by} \; N_1$$

where <u>t</u> represents the tense or tense plus auxiliary such as <u>will</u>, <u>can</u>, etc. When formulated in constituent structure terms, PASSIVE is roughly:

$$NP_1 \; AUX \; V \; NP_2 \; \leftrightarrow \; NP_2 \; AUX \; \underline{be} \; \underline{Ven} \; \underline{by} \; NP_1$$

This rule, like all those to be discussed below, is bidirectional, which means that if a particular passive (or active) sentence is well-formed, then its corresponding active (or passive) is also well-formed.

Harris also treated sentences with the existential <u>there</u> as derived by transformation. His formulation of THERE FORMATION is:

$$N \; t \; V \; \leftrightarrow \; \underline{there} \; t \; V \; N$$

This rule is designed to account for such pairings as <u>A girl appeared</u> $\leftrightarrow$ <u>There appeared a girl</u>. However, as is well-known, THERE FORMATION is notoriously difficult to formulate within any theory. Recast, in constituent structure terms, the rule can be stated as:

$$NP \; AUX \; V \; X \; \leftrightarrow \; \underset{NP}{[\underline{there}]} \; AUX \; V \; NP \; X$$

Again, the rule must be constrained such that the NP is indefinite
and the verb is either <u>be</u> or one of a small set of verbs including
<u>appear</u>, <u>seem</u>, and the like.

A third unary rule is DATIVE MOVEMENT which Harris formulates
as:

$$N_1 \ t \ Vg \ N_2 \ P \ N_3 \ \longleftrightarrow N_1 \ t \ Vg \ N_3 \ N_2$$

where the class Vg contains such double object verbs as <u>give</u> and
<u>show</u>. Reformulated in constituent structure terms, the rule is:

$$NP_1 \ AUX \ V \ NP_2 \ P \ NP_3 \ \longleftrightarrow NP_1 \ AUX \ V \ NP_3 \ NP_2$$

and of course the rule must also be constrained such that it
applies only in the case of the double object verbs, and the prep-
osition must be either <u>to</u> or <u>for</u>.

The transformations which have come to be known as CLEFT
FORMATION and REVERSE PSEUDOCLEFT FORMATION were also included
among the unary rules. Harris ignored PSEUDOCLEFT FORMATION, but
we shall formulate it later, in the spirit of Harris's approach.
His treatment of CLEFT FORMATION required two different rules, one
for subject clefting, which would pair such sentences as <u>He saw</u>
<u>the supervisors</u> ⟷ <u>It was he who saw the supervisors</u>, and another
for direct object clefting, to handle such pairs as <u>He saw the</u>
<u>supervisors</u> --- <u>It was the supervisors whom he saw</u>. His subject
clefting formulation is:

$$N_1 \ t \ V \ N_2 \ \longleftrightarrow \ \underline{it} \ t \ \underline{be} \ N_1 \ \underline{wh\text{-}pro}\text{-}N_1 \ t \ V \ N_2$$

where <u>wh-pro-N₁</u> is the <u>wh</u>-form of N_1. His formation of object
clefting is similar:

$$N_1 \ t \ V \ N_2 \ \longleftrightarrow \ \underline{It} \ t \ \underline{be} \ N_2 \ \underline{wh\text{-}pro}\text{-}N_2 \ N_1 \ t \ V.$$

Harris realized that the two rules could be generalized, and he
introduced notation S which stood for the entire clause following
the <u>wh</u>-form, but minus the relativized noun. Of course, clefting,
like pseudoclefting and reverse pseudoclefting, can be carried out
on almost any NP in a sentence. A generalized statement of the
rule, in constituent structure terms, is:

$$[\ X \ NP_1 \ Y \ ]_S \ \longleftrightarrow [\ \underline{it} \ ]_{NP} \ AUX \ \underline{be} \ NP_1 \ [\underline{wh\text{-}pro}\text{-}NP_1 \ X \ Y \ ]_S$$

and in fact, the NP_1 and the following clause on the right-hand
side of the rule can also be bracketed together as a NP, yielding
a formulation of the rule as:

$$[\ X \ NP_1 \ Y \ ]_S \ \longleftrightarrow [\ \underline{it} \ ]_{NP} \ AUX \ \underline{be} \ [\ NP_1 \ [\underline{wh\text{-}pro}\text{-}NP_1 \ X \ Y \ ]]_{NP \ S}$$

Such a formulation will account for clefting on the subject and
object NPs as well as on the indirect object NP. The use of
labelled bracketing simplifies the formulation of such rules
greatly and at the same time allows them to be given in a very
general form when variables are exploited.

Harris formulated REVERSE PSEUDOCLEFT FORMATION only for the
direct object NP, accounting for such pairs as <u>They sought fame</u>
←→ <u>Fame is what they sought</u>. The formulation given by Harris for
this rule is:

$$N_1 \ t \ V \ N_2 \ \leftrightarrow \ N_2 \ is \ \underline{wh\text{-}pro\text{-}N_2} \ N_1 \ t \ V$$

A reformulation of this rule in our notation, again generalized to
all NPs in a given sentence, is:

$$[\ X \ NP_1 \ Y] \ \text{---} \ NP_1 \ AUX \ \underline{be} \ [(\underline{pro\text{-}NP}_1) \ [\underline{wh\text{-}pro\text{-}NP}_1 \ X \ Y]$$
$$\text{S} \qquad\qquad\qquad\qquad\qquad\qquad \text{NP} \qquad \text{S}$$

where <u>pro-NP$_1$</u> is the optional <u>pro</u>-form for a NP, such as <u>the one</u>,
<u>the place</u>, <u>the thing</u>, etc. Such a formulation accounts for
reverse pseudoclefting on all NPs; for example, it can relate the
following pair of sentences, where reverse pseudoclefting is
carried out on the indirect object NP: <u>Sam gave the book to Fred</u>
--- <u>Fred was the one whom Sam gave the book to.</u>

Finally, even though Harris did not formulate a rule of
PSEUDOCLEFT FORMATION, one can be readily constructed which
parallels the REVERSE PSEUDOCLEFT rule:

$$[\ X \ NP_1 \ Y \ ] \ \leftrightarrow \ (\underline{pro\text{-}NP}_1) \ [\ \underline{wh\text{-}pro\text{-}NP}_1 \ X \ Y]] AUX \ \underline{be} \ NP_1$$
$$\text{S} \qquad\qquad\qquad\quad \text{NP} \qquad \text{S}$$

Such a rule accounts for pseudoclefting on all NPs in a given sen-
tence, and will relate the following pair, for example, where
pseudoclefting is done on the indirect object: <u>Sam gave the book</u>
<u>to Fred</u> ←→ <u>The one whom Sam gave the book to was Fred.</u> It is
interesting to notice, as many linguists have done, that the
pseudocleft and the reverse pseudocleft forms can also be directly
related to each other by a simple rule of pivoting the two matrix
NPs around the copula. Thus, while there exists a transforma-
tional relation between simple sentences and the pseudocleft and
reverse pseudocleft forms, there also exists a direct transforma-
tional relation between these two members of the cleft family.

Once these unary transformations are represented in terms of
hierarchical constituent structure, an interesting fact emerges:
<u>the right-hand side of each rule is in fact a kernel structure.</u>
To demonstrate this, let us consider each of the above rules,
starting with PASSIVE. The left-hand side of PASSIVE is clearly a
kernel structure, namely K_2, while the right-hand side is of the
form NP AUX <u>be</u> Ven <u>by</u> NP. However, once it is remembered that
Harris treats affixation morphologically, the above structure

reduces to the form NP AUX V P NP, which is a case of kernel type K_3. Thus, PASSIVE does not convert a kernel structure into a non-kernel structure, but rather maps one kernel form onto another kernel form.

The rule of THERE FORMATION is a similar case; the left-hand side of the rule is a kernel structure, while the right-hand side satisfies K_6 when the verb is be and satisfies K_2 when V is some other verb. The rule of DATIVE MOVEMENT likewise maps one kernel type into another, since the right-hand side of this rule corresponds to K_4. These three rules therefore do not expand the available syntactic structures for English but rather convert one kernel form into another.

Turning to the cleft family of rules, we notice that all share certain properties. First, any of the clefting rules can be applied to just about any NP in a simplex sentence. Consequently, the left-hand side of each of these rules, when stated in the most general form, simply selects an arbitrary NP in a simplex sentence and pairs that sentence with another structure in which the selected NP is placed in prominence. The specific manner of highlighting or focusing the selected NP is of course a function of the individual rule. Secondly, the right-hand side of each of these rules is quite complex, involving two clauses, with one embedded within another much in the manner of a relative clause embedding. However, if we direct attention to the main or upper clause, we notice in each case that it fits the general structure of kernel type K_6, the copula structures, linking two NPs. However, for each of these cleft structures, one or the other of the higher level NPs is syntactically complex, involving as it does an embedding. There thus appears to be a kind of trade-off in terms of syntactic complexity at work here; the main clause structure is of a simple sort, but this simplicity seems to be compensated for by the syntactic complexity in one or the other of the NPs. Nevertheless, each member of the cleft family of transformations, like the other unary rules discussed above, actually maps sentences back into kernel structures. Furthermore, if the two nominalization rules which Harris included among his unary transformations are closely examined, exactly the same result is found. The generalization to be drawn about unary transformations is that each such rule pairs one kernel structure with another kernel structure. Put another way, the kernel, which was originally selected in terms of overall descriptive simplicity, also functions as a powerful constraint on transformations. Such a "structure-preservation" constraint predates the work of Emonds (1970, 1976) by many years.

A second interesting generalization also emerges from a close examination of the unary transformations: they are all meaning-preserving in the sense that the logical relations such as subject-of and object-of are maintained under transformation. The only real kind of semantic change involved in the unary transformations is of a change in emphasis, highlighting, or focus,

call it what you will. For example, the REVERSE PSEUDOCLEFT transformation operating on the direct object NP of <u>Sam gave the book to Fred</u> yields <u>The book was what Sam gave to Fred</u>. In both (semantic donor), logical direct object (semantic patient), and logical indirect object (semantic recipient) are maintained. The only semantic difference in the two forms of the sentence is that in the reverse pseudocleft form, the NP <u>the book</u> is placed in prominence. In fact, in one place, Harris (1964) actually formulates rules in terms of grammatical relations.

In summary, the unary transformations are syntactically constrained by the form of the kernel, and the kinds of semantic changes permitted by such rules are also tightly constrained. Consequently, the concept of the kernel has important implications extending well beyond its original motivation as the set of basic or normalized sentence types for a language.

4. <u>Conclusions and Implications</u>. The conclusions drawn here concerning the importance of the kernel in Harris's theory of grammar are more important, I feel, than mere historical observations about a relatively neglected linguistic theory. The reason is that a number of general trends and concerns in current linguistic theorizing focus on much the same issues as those discussed above.

For example, over the past several years, there has been a persistent concern for establishing some means to limit the expressive power of transformations and for discovering viable general conditions on the form of transformations. A second, superficially unrelated, issue is the recent emergence of trace theory which has even led to the proposal that all semantic information be read off the surface (e.g., Chomsky 1975; Chomsky & Lasnik 1977). A third area of contemporary interest centers on the importance of grammatical relations grammar (cf. Cole & Saddock 1977). These three general research areas all seem to converge in Harris's notion of grammar. The importance accorded to surface structure, to conditions and constraints on transformations, to structure preservation, and to grammatical relations all converge under the aegis of a single theoretical framework. It seems to me that the theory of transformational grammar as developed originally by Harris and modified over the years is a natural place to bring these different concerns together.

Finally, an entirely different area of linguistic research can also benefit from the view of grammar developed by Harris. Here I am referring to the sentence comprehension studies as carried out in experimental psycholinguistics. For example, much of the work of Bever 1970; Fodor, Bever & Garrett 1974, and others dealing with so-called "perceptual strategies" seems to cry out for some sort of coherent syntactic theory, as do the many studies dealing with the perceptual complexity of clausal structures and

syntactic closure. In fact, a great deal of psycholinguistic research yields up vast arrays of data but often invokes an utterly implausible or obsolete view of linguistic theory, as found, for example, in the continual resurrection of the derivational theory of complexity as an interpretation of generative grammars. More recently, however, functionally oriented grammars seem to be moving in new directions, incorporating functional notions while at the same time attempting to hug the syntactic surface (cf. Prideaux 1979).

In summary, I suggest that within linguistic theory the issues of the centrality of surface structure, grammatical relations, and tight constraints on rules can all be seen to converge in the kind of theory developed by Harris. Furthermore, his theory provides a more constrained set of options for interpreting experimental results than does any version of generative grammar currently available. This is not to say that Harris's work is perfected, but at least it provides, to my mind at least, a valuable starting place, and one not laden with elusive abstract structures and pseudo-issues of innateness.

FOOTNOTE

1. An earlier version of the paper was read at the annual meeting of the Alberta Conference on Language, Banff, Alberta, October, 1977.

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