SOME EXAMPLES OF MOTIVATION IN TRANSFORMATIONAL GRAMMAR

Irena Kałuża

The Jagellonian University of Cracow

The considerations that must be taken into account in writing an adequate transformational grammar go well beyond the minimal requirements of consistency and observational adequacy in the presentation of the data observed. In general they concern properties which a grammar must have in order to reach at least some degree of generalization and explanatory power. These properties may conveniently be discussed as motivated by three goals, namely that of (A) formal adequacy, (B) descriptive adequacy, and (C) explanatory adequacy [1]. The need for formal adequacy is pragmatically motivated, that is formal adequacy is not a goal in itself, but only a necessary condition for the higher levels of adequacy to be reached. Motivation on the level of descriptive adequacy is of empirical character, while motivation on the level of explanatory adequacy usually involves an empirical choice from among the competing hypotheses. The stress on empirical and pragmatical issues should be borne in mind, particularly in view of occasional criticisms of transformational grammar for its alleged disregard of linguistic fact, together with its reliance on an a priori system taken over from the science of logic.

To make the presentation of some examples of motivation more concrete, here is a small fragment of an English grammar [2].

Phrase Structure Rules

$$S \rightarrow (PreS) \ NP \ Aux \ VP$$

$$PreS \rightarrow \left(\left\{ \begin{matrix} Q \\ Imp \end{matrix} \right\} \right) (Neg) \ (Emp)$$

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[1] From a theoretical point of view these concepts have been presented in Chomsky 1957: Chapter 6; Chomsky 1964: Chapter 2; Chomsky 1965: Chapter 1 § 4, § 6, § 7.

[2] PS-rules and T-rules as given by John Ross at Course No 387 of the 1968 Linguistic Institute at the University of Illinois, Urbana. Generally, they are of the same type as the rules in Rosenbaum 1967. For present purposes the rules have been simplified at some points which have no relevance for the ensuing discussion. Observe also that NP is rewritten as a recursive symbol, which was not allowed in earlier transformational grammars, for instance in Bach (1964: 35, 39) and Koutsoudas (1966: 19). The subcategorization rules are given after Chomsky (1965: 82).

Aux → Tense (Modal) (Perf) (Prog) (Pass)

$$NP \rightarrow \left\{ \begin{array}{l} NP \ S \\ (Det) \ N \ (S) \end{array} \right\}$$

$$VP \rightarrow V \ (NP) \left\{ \begin{array}{l} (NP) \\ (S) \end{array} \right\}$$

$$Tense \rightarrow \left\{ \begin{array}{l} Pres \\ Past \end{array} \right\}$$

Context-free Subcategorization Rules

1. N → [+N, ±Common]

2. [+Common] → [±Count]

3. [+Count] → [±Animate]

4. [−Common] → [±Animate]

5. [+Animate] → [±Human]

6. [−Count] → [±Abstract]

Transformational Rules

1. Dative

SD : XV — NP — NP — Y
    1   2   3   4

          OPT
           ⇒

SC : 1   3   *to*   2   4

2. Passive

SD : # # (PreS) — NP —[X Passive] V — NP — Y
                     Aux   Aux
       1   2   3   4   5

                            OBLIG
                             ⇒

SC : 1   4   3   5   *by*   2

3. Agent Deletion

SD : X Passive V — *by* NP — Y
      1   2   3

          OPT
           ⇒

SC : 1   3

Condition: $2 = by + some \left\{ \begin{array}{l} one \\ thing \end{array} \right\}$

4. Reflexive

SD : Z — NP — X — NP — Y
     1   2   3   4   5

                       OBLIG
                       ⇒

$$SC : 1 \ 2 \ 3 \left[\begin{array}{c} 4 \\ Refl \end{array} \right] 5$$

Condition: 2=4, and 2 and 4 are in the same simplex sentence
....

11. Imperative

SD : # # Imp — *you* — Pres — *will* — X
        1   2   3   4   5

                     OBLIG
                     ⇒

SC : 1   3   5

(A) A grammar must have formal adequacy[3], that is a maximum uniformity in formalism and explicitness. A standard formalism is necessary to make it possible for us to compare two (or more) grammars, each compatible with linguistic facts, and choose the better, i.e. that which expresses more insightful generalizations. The explicitness of the proposed formalism is meant to ensure detailed coverage, so that no step in the generation of a sentence may be omitted and left out to be supplied by the intelligence of the reader. For these reasons a grammar consists of a set of symbols interrelated by an (ordered) set of rules. Every rule is of the form

$$A \rightarrow B$$

and may be interpreted as an instruction to rewrite A as B. Among the symbols there is one initial symbol (S for "sentence") which is understood as given by the theory, in the fashion of an axiom initiating a deductive chain. The constraints placed upon the formalism of the rules, e.g. "one symbol only may be expanded at a time", are meant to ensure an automatic assignment of structural analyses at each step in the derivation. Finally, the abbreviatory notations, such as for instance parentheses to indicate optionality:

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[3] For a more detailed discussion see Bach 1964: Chapter 2; and Koutsoudas 1966: Chapter 1, Chapter 2.

$$A \to B(C) = A \to B$$
$$A \to BC$$

and braces to indicate alternative replacements:

$$A \to \begin{Bmatrix} B \\ C \end{Bmatrix} = A \to B, \text{ or } A \to C$$

are used to merge several rules into a single rule, thus contributing directly to the simplicity of grammar in the measurable sense of the number of symbols needed to state the rules.

(B) Next, a grammar must have descriptive adequacy, that is, it must take account of the linguistic facts, stating whether these belong to the surface or to the underlying structure. Or as Chomsky (1965 : 24) has it: "A grammar can be regarded as a theory of language; it is *descriptively adequate* to the extent that it correctly describes the intrinsic competence of the idealized native speaker. The structural descriptions assigned to sentences by the grammar, the distinctions that it makes between well-formed and deviant, and so on, must, for descriptive adequacy, correspond to the linguistic intuition of the native speaker (whether or not he may be immediately aware of this) in a substantial and significant class of crucial cases."

An empirical justification for the postulation of an individual node in the deep structure will provide a very simple example of descriptive adequacy. Suppose, for instance, that intuition has led a grammarian to postulate the existence of *you* as the deep structure subject of an imperative sentence (see, for instance, Katz and Postal 1964 : 74 - 9), just as traditional grammar regarded *you* as the "understood" subject of these sentences (see, for instance, Curme 1947, reprint 1966 : 249 - 50). The imperative transformation (T-rule 11 of our grammar) then deletes the subject, so that it does not appear in the surface structure. To justify the postulation of *you* empirically, the grammarian must look for structures with identity requirements for subjects (subject=NP immediately dominated by S) and objects (object=NP immediately dominated by VP) in the same simplex sentence, so that the object form remaining in the surface structure may serve as evidence of the form of the deleted subject. Such structures are found in reflexives with deep structure postulated as
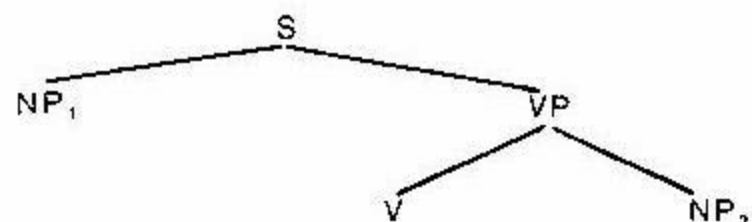
where $NP_1 = NP_2$

and in possessive reflexives, where NP_1 refers to the modifier of NP_2[4].

The surface structures of the imperative sentences are respectively:

1. in the reflexive paradigm: *wash yourself/ves*, since

    *wash myself
    *wash himself
    *wash herself
    *wash themselves, etc.

are ungrammatical.

Conclusion: the deep subject must have been *you*.

2. in the reflexive possessive paradigm: *wash your own car*, since

    *wash my own car
    *wash his own car
    *wash Mary's own car, etc.

are ungrammatical.

Conclusion: the deep subject must have been *you*.

Other evidence is supplied by:

3. various expressions with the identity requirement for NP_1 and the modifier of NP_2, e.g.

    I crane my neck,   he holds his breath

but:

    *I crane his neck,   *he holds your tongue

Again the only possible surface imperative is that with *your*:

    crane your neck
    hold your tongue

Conclusion: the deep subject must have been *you*.

4. sentences with tag questions, which have person-agreement requirement, e.g.

    he will leave, won't he?

have as the only possible imperative sentences those with *you, your*:

[4] The reflexive transformation (T-rule 4 of our grammar) then operates on the deep structure of a sentence with two identical noun phrases, changing the second NP appropriately:

    *I washed I ⇒ I washed myself
    *you washed you ⇒ you washed yourself/ves

In the reflexive possessive the modifier of NP_2 is postulated as referring to NP_1 because the only possible surface structures are witnessed in the paradigm:

    I washed my own car, you washed your own car, he washed his own car, etc.

whereas the following are not possible English sentences:

    *I washed your own car, *I washed his own car, *I washed Jack's own car, *I washed their own car, etc.

turn around, will you

wash your car, won't you

since

*turn around, will Bill

*wash your car, won't she

*wash your car, won't they, etc.

are ungrammatical.

Conclusion: the deep subject must have been *you*.

5. collocations with *you* present in surface structure, in obsolete, fixed, and emphatic expressions, e.g.

never you mind

mark you

Mary, you go

To sum up, the facts revealed by the paradigms presented above, and supported by some fixed expressions may be considered as conclusive evidence for the existence of *you* in the deep structure of imperative sentences. The argument has been presented as an illustration of descriptive adequacy; on this level 'the grammar is justified on *external* grounds, on grounds of correspondence to linguistic fact" (Chomsky 1965 : 27).

(C) We now come to the much more complex level of explanatory adequacy. On this level "a grammar is justified to the extent that it is a *principled* descriptively adequate system, in that the linguistic theory with which it is associated selects this grammar over others, given primary linguistic data with which all are compatible. In this sense, the grammar is justified on *internal* grounds, on grounds of its relation to a linguistic theory that constitutes an explanatory hypothesis about the form of language as such" (Chomsky 1965: : 27). In other words, what must be given motivation is the choice of the best grammar, while on the level of descriptive adequacy justification has to be given to the postulation of a structure within one grammar. Grammars must then be evaluated before one is selected as the best, that is before choice is made on the level of explanatory adequacy. The concept of *simplicity* has been suggested by Chomsky as an evaluation measure for grammars which have achieved some degree of explanatory adequacy. As is well known, the rationale underlying evaluation is presented in Chomsky 1957, Chapter 6, and in Chomsky 1965, Chapter 1 § 7. Chomsky (1965 : 42) mentions length in the sense of the number of symbols employed, as an obvious numerical measure, hence, as has already been observed, the importance of the abbreviatory notation which serves to merge several similar rules into a single one (Chomsky 1965 : 39; see also Halle 1962 and Halle 1964, where concrete examples of simplicity in generative phonology are given). However, if the reduction in the specification

of symbols in one part of grammar leads to making another part of the same grammar more complicated, then simplicity is not achieved, since it must involve the whole of a grammar. Ultimately then, a concrete choice of simplicity measure cannot be given a priori. "Rather any proposal concerning such a measure is an empirical hypothesis about the nature of language," which "can be justified empirically by ... [its] success in other cases" (Chomsky 1965 : : 37, 41). Consequently, an example of explanatory adequacy may take the shape of a proof of one particular descriptive construct as useful in a number of ways, in various parts of grammar. Thus, for instance, to justify the existence of the passive transformation (T-rule 2 of our grammar), it is not enough to demonstrate that it is needed to map the surface structure of sentences like "the film was praised by the critics". It must also be demonstrated that without the passive transformations the grammar would have to be made considerably more complex and less general. In other words it must be demonstrated that the transformation in question is needed in various parts of the grammar.

Thus it may be shown that the passive transformation may be used as a reliable test for isolating noun phrases in sentences which meet the required structural description (e.g. not a sentence like "the bird sings"). This is so because the constituents interchanged by the passive transformation are by definition regarded as noun phrases, irrespective of their internal structure, always providing that the resulting sentence is a grammatical one. Thus both "Charles", "everybody", as well as "the fact that Charles was promoted to the senior class of the best public school in that part of the country" are noun phrases.
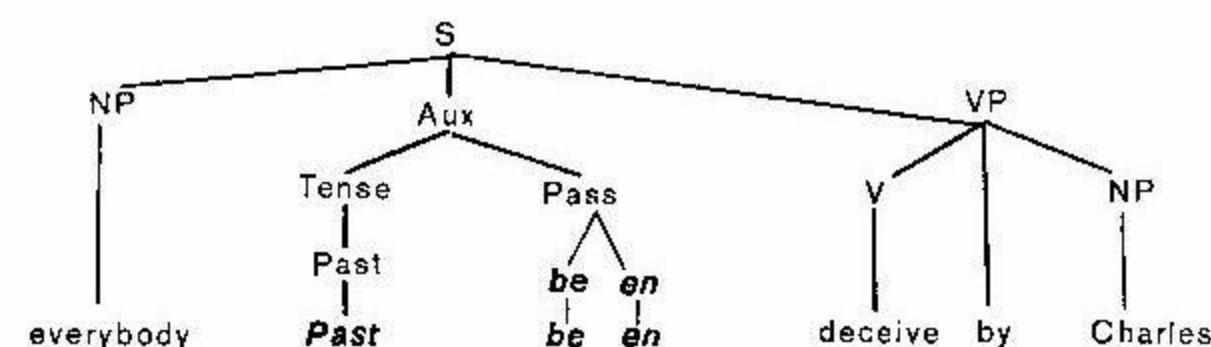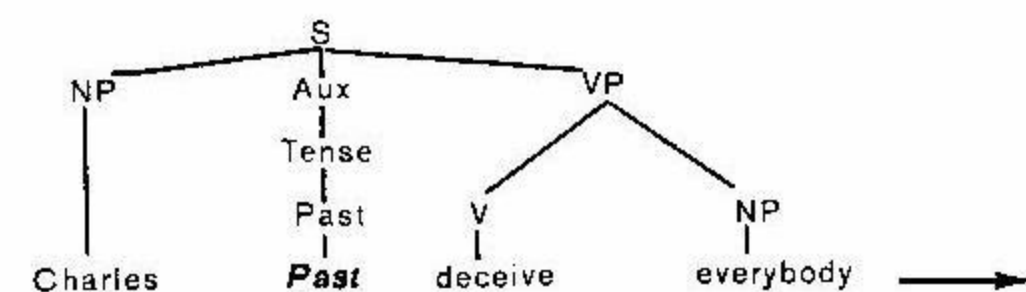
And similarly:

The fact that Charles was promoted

to the senior class of the best

public school in that part of the country   astonished everybody
                                                            ⇒
Everybody was astonished by the fact that Charles was promoted
                              to the senior class of the best
                              public school in that part of the country.

More important, the passive transformation helps us to avoid duplicating information, thus making grammar simpler and more general. Consider the following pair of active sentences, the first of which is both fully grammatical and semantically well formed:

(1) the tourists admired the scenery
(2) *the scenery admired the tourists.

In terms of the selectional restrictions on the verb, the verb *admire* requires a subject noun specified as ⟨+human⟩, which may be presented in the lexicon as:

$$admire\ [+V, +⟨+hum⟩\_\_]$$

Since the noun *scenery* is ⟨−hum⟩, it follows that the introduction of such a noun as subject of *admire* will result in an anomalous string. Now consider that in the passive version of (1) and (2):

(3) the scenery was admired by the tourists
(4) *the tourists were admired by the scenery

sentence (4) is peculiar in exactly the same way as sentence (2). Now if the active and passive sentences did not have common deep structures (except for the Pass included in the Aux of the latter), it would be necessary to state the selectional restrictions twice, once for the active sentence and then the same restriction for the passive sentence, only in reverse. In this way information would be needlessly duplicated. Now on the assumption that the passive transformation exists and generates passive sentences from deep structures, the restrictions may be stated solely for the deep structure. "Thus, we can predict that if the deep structure violates this restriction, the passive sentence will also violate this restriction because it is based upon the same deep structure. Thus, assuming the existence of the passive transformation, the grammar can be considerably simplified" (Jacobs and Rosenbaum 1968: 225).

What is more, the argument presented here to justify the postulation of the passive transformation can also be extended to quite a number of other descriptive constructs which are bound in a similar way to their deep structures by the identity of selectional restrictions. A detailed discussion of these matters cannot be included in the present paper (but see Jacobs and Rosenbaum 1968, Chapter 27), only a few examples can be given of the structures involved. Thus we have:

the nominalization

Peter refused the offer ⇒ Peter's refusal of the offer
*Peter refused consternation ⇒ Peter's refusal of consternation

with the selectional restrictions identical for the deep structure and its nominalizing transform. The same is true of the genitive and the comparative transforms:

the genitive
                    Mary has blue eyes ⇒ Mary's blue eyes
                    *radiation has blue eyes ⇒ radiation's blue eyes

the comparative

my cat is hungry
your dog is hungry ⇒ My cat is hungrier than your dog

*my rheumatism is hungry
*the *New York Times* is hungry ⇒ My rheumatism is hungrier than the *New York Times*.

Now observe that the facts (in the sense of grammaticalness or ungrammaticalness of sentences) quoted above could also be used to justify:

(a) the postulation of the existence of deep structure — on the assumption that transformations exist;

(b) the postulation of the existence of selectional restrictions — on the assumption that deep structures exist.

Observe furthermore that selectional features as such also lead to the simplification of lexicon, since only one set of features is needed for a word and all its derivatives. In all these examples a grammar is justified by the interconnections within the system, which make the grammar simpler and at the same time more general.

Our final examples of justification of a grammar will be provided by some standard cases of rule ordering [5]. Only very few transformational rules are intrinsically ordered, that is rule B operates on a constituent that has been introduced only by the preceding rule A, otherwise this constituent would not be present in the structural description. Obviously the order of the rules cannot be reversed, since if rule B had come as rule 1 (instead of 2), it would have had nothing to operate on; it would not apply, since the structural description would not be met. A standard example is provided by T-rules 2 and 3 of our grammar, Passive (2), and Agent Deletion (3). It is only through the operation of the passive transformation that agents are introduced, therefore, if T-rule 3, Agent Deletion, had been applied first, it would have had nothing to delete and simply would not apply. Strictly speaking, the

[5] In the general trend of rule ordering arguments I follow John Ross's Course No. 387, *The structure of English*, at the 1968 Linguistic Institute, University of Illinois, Urbana.

intrinsic order of rules is not concerned with simplicity, but rather with the most primitive requirement for consistency.

Most transformational rules, however, are not intrinsically ordered. They are only indirectly ordered, so that again considerations for simplicity of grammar are involved. That is, to put it briefly, another ordering would have been technically possible, but it would make the grammar longer (in the terms of the number of symbols used) and more complicated. The proofs for indirect ordering are carried out by assuming the reverse order and checking results. If (a) a non-sentence is derived, or if (b) the derivation of a structure we know to exist[6] is blocked, then the order is incorrect. To illustrate (a) we shall make use of the reflexive (T-rule 4) and the imperative (T-rule 11, in our grammar) transformations. If the order were reversed, the non-sentence *Behave you!* will be generated, instead of the grammatical *Behave yourself!* This would happen because the imperative transformation would delete the subject *you*, so that the reflexive transformation would be blocked, since it requires two identical noun phrases.

To illustrate (b) we shall make use of T-rule 1, dative, and T-rule 2, passive. This ordering is the only way to derive two passive sentences:

Mary was given a book by John

a book was given to Mary by John.
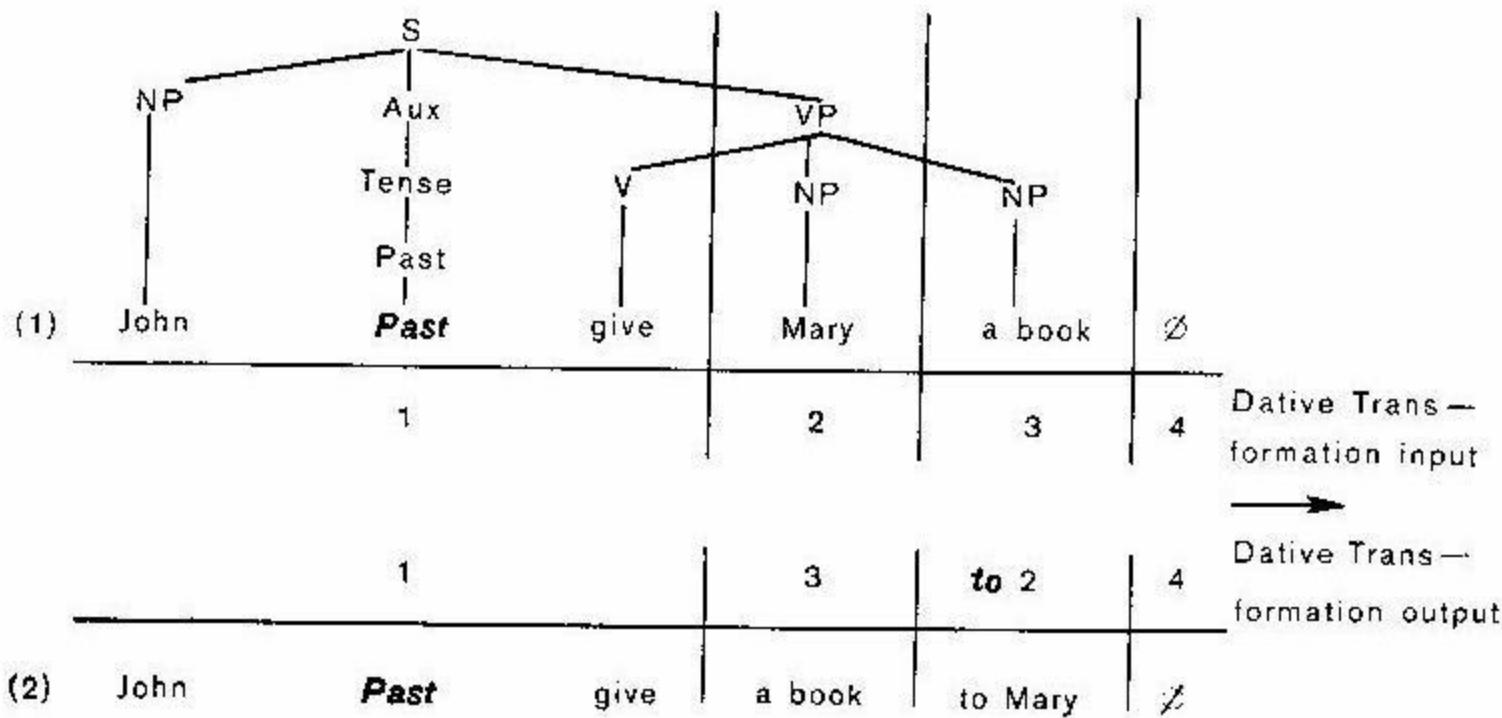
With 2–1 ordering, only the first would be derivable. Here is the proof in some detail. The ordering dative—passive makes it possible to derive two different passive constructions because the passive transformation can be applied to two different structures, that specified in the structural description (input), and that specified in the structural change (output) of the dative

[6] We know of its existence through synonimity of meaning, e. g.:
John gave Mary a book, Mary was given a book by John, a book was given to Mary by John.

transformation. This is so because the dative transformation is optional. The technical requirement would only be to add the symbol *Pass* to the specification of Aux of both the input and output structures of the dative transformation. Here is a greatly simplified version of these operations (operations not relevant to the argument, such as expansion of NP, affix hopping transformation, agreement, etc. have been omitted) (c. f. diagram p. 46.)

Now after adding Pass in the Aux (Aux → Tense Pass), sentence (1) and sentence (2) both meet the structural description of passive transformation which yields respectively:

Sentence (1)

ø	John	*Past Pass* give	Mary	a book
1	2	3	4	5

Passive Transformation input (1) ⇒

1	4	3	5	*by* 2
ø	Mary	*Past Pass* give	a book	by John

Passive Transformation output (1)

Sentence (2)

ø	John	*Past Pass* give	a book	to Mary
1	2	3	4	5

Passive Transformation input (2) ⇒

1	4	3	5	*by* 2
ø	a book	*Past Pass* give	to Mary	by John

Passive Transformation output (2)

If, however, the order of transformations were reversed to passive—dative, only output (1) of the passive transformation would be derivable. To prove it, consider the following facts: if we tried to apply dative transformation to output (1) of the passive transformation in order to obtain another passive construction:
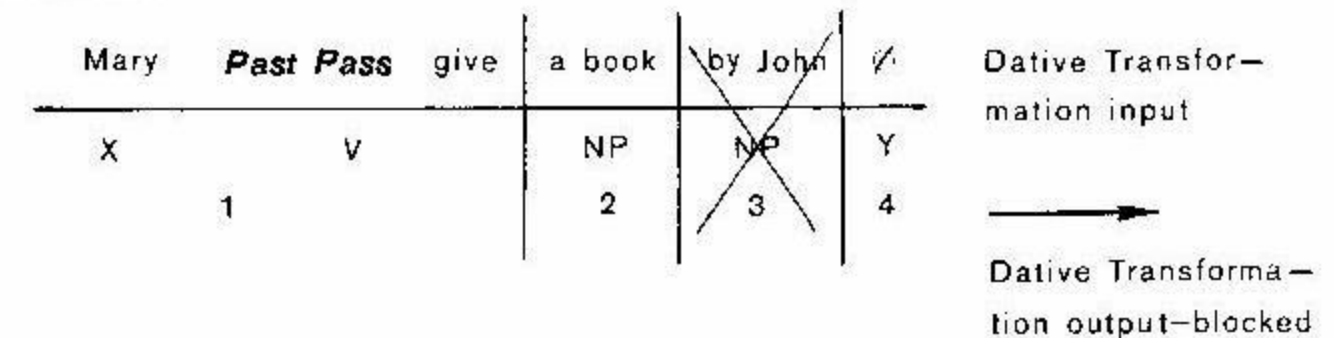
the structural description for the dative transformation would not be met, since *by John* is not an NP, that is it is not the constituent required as the

third symbol in the structural description in question; and there is no way to assign the symbols so that the structural description would be met (*by John* could only come under the variable Y, but it cannot be accommodated in that position). In effect the dative transformation is blocked. Furthermore, even if we accepted *by John* as a noun phrase and allowed the transformation to operate, the result would be an ungrammatical sentence:

Mary	*Past Pass* give	a book	by John	ø	Dative Transformation
	1	2	3	4	input

$\Rightarrow$

	1	3	to 2	4	Dative Transformation
Mary	*Past Pass* give	by John	to a book	ø	output

= *Mary was given by John to a book

In short, if the order of transformations is reversed to passive—dative, only one passive construction (passive transformation output 1) is produced. Consequently, in this argument the order dative—passive has been proved to be the only correct one for the grammar proposed here. A change of this order would entail an addition of one more transformation to produce passive constructions like *a book was given to Mary*. In other words such an addition would detract from the simplicity of the grammar, so that the requirements for generalization and explanatory adequacy would not be met.

It should be very clearly understood that all that has been said in this paper has nothing to do with mechanical procedures for the discovery of a grammar. The formulation of such procedures is the main goal of structural linguistics (see Harris 1951). Transformational-generative grammar, on the other hand, is not interested in discovery procedures, on the assumption that such a goal is unrealistic and cannot be achieved since there are no mechanical methods by which insights about the structure of language may be obtained. In fact "one may arrive at a grammar by intuition, guess-work, all sorts of partial methodological hints, reliance on past experience, etc." (Chomsky 1957: 56). Thus what has been presented in this paper is a discussion and exemplification of measures of correctness of an already existing grammar. Of such grammars, the one that is most successful in fulfilling the adequacy requirements may be selected as the "best".

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