On the Treatment of Scrambling and Adjunction in Minimalist Grammars[1]

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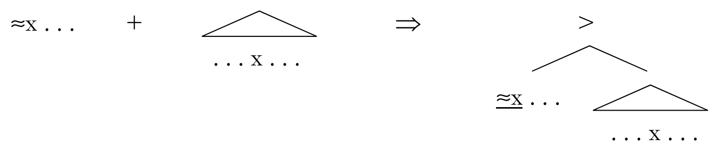
1 Introduction

Stabler (2001:258) suggested that ""asymmetric" feature checking" is among the mechanisms that "remain to be carefully explored" within his "minimalist grammars" framework. Our presentation will undertake exactly this kind of exploration. Concretely, we are going to extend the "minimalist grammars" framework of Stabler (1997) (see also Harkema 2001; Michaelis 2001) by adding the operations *adjoin* and *scramble*. These are "asymmetric" counterparts of *merge* and *move*, respectively (Section 2). Subsequently, we will formulate our views on the treatment of scrambling and adjunction in German within this extended formalism (Section 3). Finally, we are going to address various linguistically motivated formal constraints on the resulting grammar (Section 4). Formal definitions are given in the Appendix (Section 5).

2 *Adjoin* and *Scramble* in Minimalist Grammars

adjoin. There are three well-known properties of adjunction operations that have to be captured. Adjunction, whose primary task is the addition of adjuncts, should be optional, it should allow for iteration, and it should be "type-preserving." We thus adopt the "x/x-approach" from categorial grammar. In our minimalist grammar, adjuncts are going to be endowed with a categorially selective feature ≈x, a so-called *a(djoin)-selector* (to be distinguished from the conventional *m(erge)-selectors* denoted by =x). This feature will "trigger" the operation *adjoin* leading to unilateral cancelation (i.e. "asymmetric checking") as well as preservation of headedness. This is given in (1). [Canceled features are underlined. > = "right constituent projects over left one", < = "left constituent projects over right one".]

(1)


Given that *adjoin* leaves the head, x, unaffected, optionality and iteration are clearly permitted. The definition of *adjoin* is given in (2) (cf. Stabler 1997). [A tree τ "displays" a feature/category x iff x is the first uncanceled feature of τ.]

(2) a. *Dom*(*adjoin*) = $\{ \langle\tau_0,\tau_1\rangle \mid \tau_0$ displays feature ≈x and τ_1 displays category x $\}$
b. *adjoin*$(\tau_0,\tau_1) = [_> \tau_0', \tau_1']$ such that τ_0' is like τ_0 except that ≈x is canceled and $\tau_1' = \tau_1$.

Note that *adjoin* should not be confused with the much more general "adjoining operation" of "Tree Adjoining Grammar" (TAG) (e.g. Frank 1992).

scramble. Scrambling is a movement operation leading to the adjunction of an XP to a host YP. Like adjunction, scrambling should allow for iteration and be "type-preserving." Also, scrambling and adjunction operations should be able to intersperse wrt specific adjunction sites. Given these design objectives, we can assume that phrases that undergo scrambling come with a categorially selective feature ~x, a so-called *s(cramble)-licensee* (to be distinguished from the conventional *m(ove)-licensees* denoted by –x). This feature will "trigger" the operation *scramble*, leading to the adjunction of the constituent bearing ~x to the constituent headed by x. Again, there will be unilateral cancelation as well as preservation of headedness. This is given in (3). [λ indicates an empty leaf.]

[1] We have greatly profited from discussing the contents of this paper with Jens Michaelis. Thanks also to Gerhard Jäger for help with the lay-out. Common disclaimers apply.

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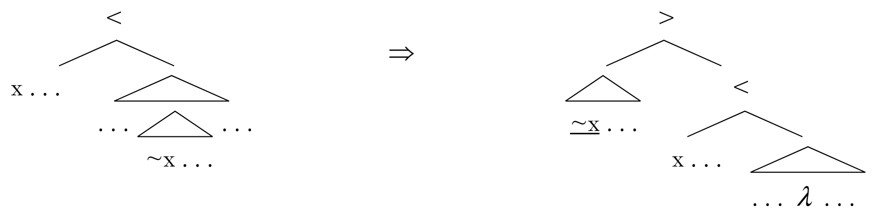
(3)



(4) is the definition of *scramble*.

(4) a. *Dom*(*scramble*) = { τ | τ displays category x and τ has exactly one maximal projection displaying feature ~x }
b. *scramble*(τ) = [$_>$ τ_0', τ'] where
τ displays category x,
τ_0 is a proper subtree of τ displaying feature ~x,
τ_0' is like τ_0 except that ~x is canceled, and
τ' = τ except that subtree τ_0 is replaced by an empty leaf.

An alternative approach to scrambling would be to rely on specific licensor/licensee structures. Phrases that scramble could be provided with a feature –Σ, an alternative *s(cramble)-licensee*, while the head of the scrambling target would carry +Σ, an *s(cramble)-licensor*. Since we don't want to rule out the possibility of there being an unbounded number of scrambling operations that could target each site, +Σ has to be a feature that never cancels.[2] Given this, and given the possibility of interspersing adjunction and scrambling, one would have to assume +Σ and categorial features to be unordered, i.e. equally "visible"/displayed for operations.

3 A Minimalist Treatment of German

We assume at least the following set of syntactic categories to be necessary for a minimalist treatment of (scrambling and adjunction in) German.

(5)
a. v, n, a
b. =v.(=pr.)cpr, =cpr.(=d.)(=d.)spr, =spr.=d.cs, =cs.c
c. ≈cpr, ≈spr, ≈cs
d. =n.d, =d.p
e. =p.≈spr
f. =d.d.~cs, =≈cpr.≈cpr.~spr
g. =n.pr, =a.pr

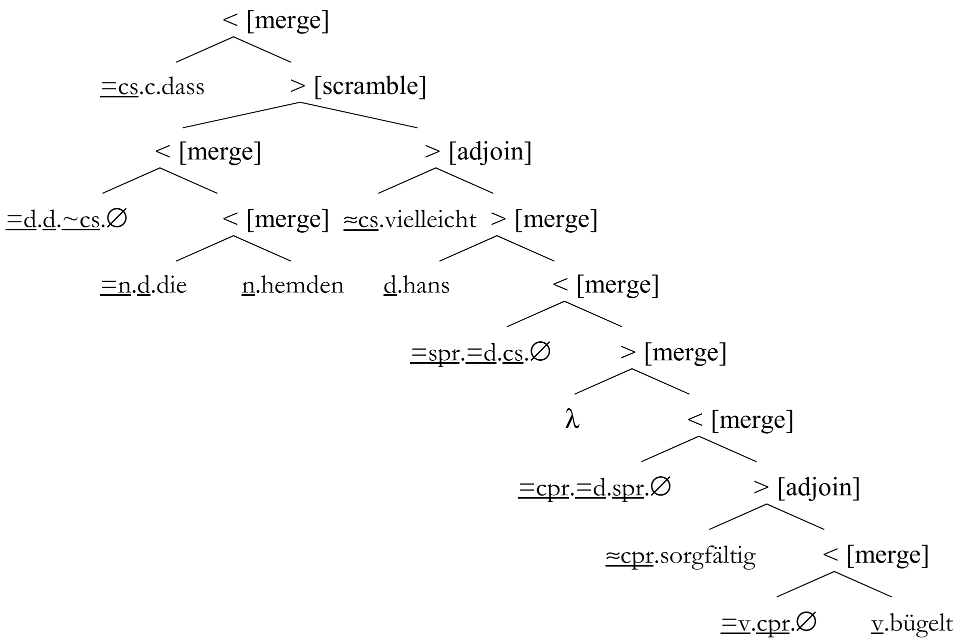
Simple basic categories are verbs (v), nouns (n), and adjectives (a) (5a). Standard clauses are projected on top of bare verbs by means of the four functional categories in (5b). First, there is a projection of the "core predicate" (cpr) of a clause, immediately m(erge)-selecting the bare verb and optionally adding a predicative element (pr). Secondly, there is a projection of the "sentential predicate" (spr) m-selecting cpr and adding non-subject (d-)arguments in accordance with the transitivity of the verb. Thirdly, there is the projection of the "core sentence" (cs), m-selecting the sentential predicate and adding the subject. Finally, standard subordinate clauses, which we restrict our attention to here, are closed off by a complementizer (c) that m-selects the core sentence. (5c) introduces three types of adjuncts, sorted according to the clausal layer at which they have their base positions. Thus, manner adverbs involve an a(djoin)-selector of type ≈cpr, event-related adverbs involve an a-selector of type ≈spr, and sentence and frame adverbs use an a-selector of type ≈cs. Note that in this system adjuncts are pure functors possessing no categorial feature of their own. (5d) shows the familiar categories that turn noun phrases into DPs as well as DPs into PPs. (5e) gives an example of a functor that turns a prepositional phrase into an spr-adjunct. (5f) shows how to turn a d-argument into a phrase that has to undergo scrambling to cs-level by introducing the relevant s(cramble)-licensee and likewise for a cpr-

[2] See Pollard&Sag (1987:chapter 6.3) for a formally similar approach to adjunction. See Sailer (1997) for a comprehensive HPSG-treatment of adjuncts in German.

adjunct that has to scramble to spr-level.[3] (5g) introduces functors that turn adjectives or nouns into predicative elements. The kinds of functor in (5e) and (5f) will have to be instantiated by all the categories that can become adjuncts or scramble, respectively.
(7) provides an explicit representation of (6), which puts to work most of these categories at the same time. [We indicate the structure-building operations at each non-terminal node.]

(6) a. dass die hemden vielleicht hans sorgfältig bügelt
that the shirts perhaps john carefully irons
'that perhaps john irons the shirts carefully'

(7)



Note that by allowing for optionality this approach to adjunct placement is in contrast with the one by Cinque (1999), which relies on an obligatory, universally fixed array of functional projections, whose specifiers may host adjuncts. Likewise, by classifying adjuncts wrt three adjunction sites, we differ from approaches like Haider (2000), which exclusively rely on relative scope.
The specifics of our approach to adjunct placement and scrambling have been motivated in Frey&Pittner (1998) and Frey (2000). At least two types of evidence for distinguishing our three structural domains (projected by cpr, spr, cs) can be given. First, existentially interpreted *w*-phrases in German resist scrambling under their non-specific reading. This is illustrated in (8).

(8) a. weil jemand was lesen will
because someone something read want
'because someone wants to read something'
b. * weil was jemand lesen will

When these phrases occur in the *Mittelfeld*, they are thus indicators of base-positions. Secondly, the scope of quantified expressions has been argued by Frey (1993) to follow the principle in (9).

(9) Scope Principle
A quantified expression α can have scope over a quantified expression β if the head of the local chain of α c-commands the base position of β.

Thus, scope ambiguities are indicators of chain-formation as is involved among other things in scrambling.

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[3] Our formalization in the appendix does not cover the latter case, where an a-selector directly gives rise to an m-selector.

Given these assumptions, the facts in (10) and (11) show that manner adjuncts must be attached below the base position of the (direct) object, i.e. they must be of type ≈cpr.[4]

(10) Peter will jetzt was konzentriert lesen
Peter wants now something carefully read

(11) a. Er HAT mindestens eine Kollegin auf jede Art und Weise umworben [∃∀]
He has at least one colleague in every way courted
b. Er HAT auf mindestens eine Art und Weise fast jede Kollegin umworben [∃∀/∀∃]
He has in at least one way nearly every colleague courted

Likewise, (12) indicates that instrumentals, belonging to the class of event-related adjuncts, must be base-generated between the base position of the direct object and the one of the subject.

(12) a. weil wer mit was den Tisch beschädigt hat
because someone with something the table damaged has
'because someone damaged the table with something'
b. * weil mit was wer den Tisch beschädigt hat
c. da Otto mit was wen am Kopf getroffen hat
since O. with something someone on the head hit has
d. ?? da Otto wen mit was am Kopf getroffen hat

(13) further shows that event-related adjuncts, in this case instrumentals and locatives, can be base-generated in any order within the same domain.[5] We take the relevant domain to be projected by spr.

(13) a. Er HAT mit mindestens einer Maschine in fast jedem Haus gearbeitet [∃∀]
He has with at least one machine in almost every house worked
b. Er HAT in mindestens einem Haus mit fast jeder Maschine gearbeitet [∃∀]
He has in at least one house with almost every machine worked

Finally, (14) and (15), involving sentence adjuncts and frame adjuncts, respectively, present evidence of the same kind wrt the cs-domain.

(14) a. * weil wer wahrscheinlich das Buch entleihen möchte
because someone probably the book borrow wants
b. weil wahrscheinlich wer das Buch entleihen möchte

(15) a. * dass wer in diesem Dorf weltberühmt ist
that someone in this village world-famous is
b. weil fast jeder Opernsänger in mindestens einem Land berühmt ist [∃∀/∀∃]
because nearly every opera singer in at least one country famous is

4 Some Conditions on Scrambling and Adjunction

One rather technical constraint on adjunction, going back at least to Chomsky (1986), is the ban on adjunction to X'-categories. From the perspective of minimalist grammars this translates into the requirement that the host of adjunction have "discharged" its m-selectional and m-licensor features. In the present system this is captured by making adjunction (and scrambling) categorially selective, while category features on host constituents are preceded by m-selector and m-licensor features.
Next, it is generally agreed that adjuncts constitute fairly strict islands for extraction.[6] This can be captured as follows (cf. Stabler 1999).

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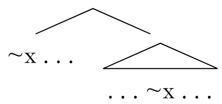
[4] Note that stress on the finite auxiliary in (11), i.e. so-called "Verum-focus", is meant to control for focus effects on scopal behavior.
[5] Facts like these are not expected under the approach in Cinque (1999).

(16) Adjunct Island Constraint (AIC)
*$adjoin(\tau_0,\tau_1)$, where there is a subtree τ_2 of τ_0 such that τ_2 displays –x or ~x.

The AIC takes care of extraction via *move* as well as via *scramble*.
Michaelis (2001) showed that the minimalist grammar defined in Stabler (1997) belongs to the class of mildly context-sensitive formalisms (cf. Stabler 2001). We conjecture that our extension of Stabler (1997) does not lead to greater complexity. The main property involved in showing this is finiteness of the set of (derived) categories. The uniqueness condition on unchecked s(cramble)-licensees incorporated in the definition of *scramble* (cf. appendix) is one way of achieving finiteness in the required sense. It guarantees that subtrees never contain an unbounded number of movable "components."
Empirically, however, this uniqueness condition faces at least the following two challenges. First, it has to be shown that scrambling out of constituents that themselves scramble is ruled out (or heavily restricted). Otherwise, configurations like (17), if cascaded out, would give rise to an unbounded number of movable components.

(17)



There are two orders of applying scrambling to such a configuration. If the larger constituent is scrambled first and the smaller one is extracted via scrambling afterwards, we arrive at what has been called a "freezing" configuration. Thus, the structures in question, e.g. (18), have often been considered degraded.

(18) ? weil [dieses Buch]$_i$ wohl [t$_i$ zu lesen]$_j$ keiner t$_j$ versucht hat
because this book Prt. to read noone tried has

Applying scrambling in the reverse order gives us a case of "remnant scrambling."

(19) ?? . . . Leute, die [t$_i$ gelesen]$_j$ [dieses Buch]$_i$ nicht t$_j$ haben
people who read this book not have

Müller (1996:269) has argued that configurations like (18) and (19) are ruled out by the following syntactic principle.

(20) Unambiguous Domination
An α-trace must not be α-dominated

In our case this would translate into a ban on a scrambling trace being dominated by the root of a scrambled constituent. To the extent that this can empirically be upheld, the uniqueness requirement on unchecked s-licensees would be vindicated.
The second challenge arises in the domain of adjuncts. Thus, note that we allow adjuncts themselves to undergo scrambling, (5f)/(11b). Now, first of all it cannot be ruled out that there is an unbounded number of adjuncts per clausal domain. This can be motivated on the basis of examples like (21).

(21) dass Hans ungeschickt geschickt ungeschickt den Tisch abräumte
that Hans clumsily skilfully clumsily the table cleared

Assume Hans is an actor whose assignment it is to clumsily clear the table. He will thus muster all his skills to skilfully clumsily clear the table. He may, however, fail in this effort. In this sense, he can be taken to have clumsily skilfully clumsily cleared the table. As long as our imagination doesn't fail us,

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[6] Exceptions to this are extractions from Swedish relative clauses (cf. Engdahl). Further exceptions may be constituted by "parasitic gaps" (cf. Chomsky 1986).

this stacking of "manners" can continue unboundedly. (22) would then indicate in addition that all of the relevant adjuncts can scramble at the same time, i.e. that there must be a substructure which contains multiple unchecked s-licensees.

(22) dass ungeschickt geschickt ungeschickt nur Hans den Tisch abräumte
that clumsily skilfully clumsily only Hans the table cleared

However, there is a method, suggested by Jens Michaelis (p.c.), to defuse this problem. Instead of inserting these adjuncts in their base position and applying scrambling afterwards, they could be adjoined in their surface position directly. This would require the assumption of "lifted" a-selectors of type ≈x[ρy] and the corresponding categories x[ρy]. The latter denote a category x on which it is "recorded" that x has m-selected a category y. For case (22), manner adjuncts would have to be of type ≈cs[ρcpr]. This way, appeal to unboundedly many "components" of the cpr-substructure can be avoided and complexity of our "minimalist grammar with adjunction and scrambling" will be unaffected.[7]

5 Appendix[8]

(1) A five-tuple $G^{a,s} = \langle \neg Syn, Syn, Lex, \Omega, \mathrm{c} \rangle$ that obeys (N1)-(N5) is called an *(unrestricted) minimalist grammar with adjunction and scrambling* ($MG^{a,s}$).

(N1) ¬*Syn* is a finite set of *non-syntactic features* partitioned into a set *Phon* of *phonetic features* and a set *Sem* of *semantic features*.

(N2) *Syn* is a finite set of syntactic features disjoint from ¬*Syn* and partitioned into a set *Base* of *(basic) categories*, a set *M-Select* of *m(erge)-selectors*, a set *A-Select* of *a(djoin)-selectors*, a set *M-Licensees* of *m(ove)-licensees*, a set *S-Licensees* of *s(cramble)-licensees*, and a set *M-Licensors* of *m(ove)-licensors*. For each $x \in Base$, the existence of an element =x in *M-Select*, an element ≈x in *A-Select*, and an element ~x in *S-Licensees* is possible. For each $x \in M$-*Licensees*, usually depicted in the form –x, the existence of an element +x in *M-Licensors* is possible.

(N3) c is a distinguished element from *Base*, the *completeness category*.

(N4) *Lex* is a *lexicon (over* ¬*Syn* ∪ *Syn)*, i.e. a finite set of simple expressions over ¬*Syn* ∪ *Syn* each of which is of the form $\tau = \langle N_\tau, \triangledown_\tau^*, \angle_\tau, label_\tau \rangle$ with $N_\tau = \{\varepsilon\}$ such that the unique node in τ, the empty string, is mapped onto an element from
(*M-Select* ∪ *M-Licensors*)* (*Base* ∪ *A-Selectors*) (*M-Licensees* ∪ *S-Licensees*)* *Phon** *Sem** under the leaf-labeling function $label_\tau$.

(N5) The set Ω consists of the structure building functions *merge*, *move*, *adjoin*, and *scramble* defined wrt ¬*Syn* ∪ *Syn* as in (me), (mo), (ad) and (sc) below, respectively.

For the following take *Feat* = ¬*Syn* ∪ *Syn*. Also, an expression $\tau \in Exp(Feat)$ is called *well-labeled* if the label of each leaf of τ is a string from *Syn** *Phon** *Sem**.

[7] The "recording" mechanism involves restrictions on "long-distance scrambling." Otherwise, an unbounded number of identical recorded categories (e.g. [ρcpr, ρcpr, . . .] would have to be allowed. Again,this would go against the crucial finiteness requirement. Further details of this issue are discussed in Frey et al. (in prep.).
[8] The following is an adaptation from Michaelis (2001:36ff). In particular, we ignore those properties of minimalist grammars that provide for head movement and covert movement. ∇ in (N4) denotes the dominance relation and ∠ denotes the precedence relation.

(2) The operator *merge*

(me) The function *merge* is defined as a partial mapping from *Exp*(*Feat*) × *Exp*(*Feat*) into *Exp*(*Feat*). A pair $\langle \upsilon, \phi \rangle$ of some expressions υ and ϕ over *Feat* belongs to *Dom*(*merge*) if υ and ϕ are well-labeled expressions, and if for some x ∈ *Base* conditions (i) and (ii) are fulfilled.

(i) υ has m-selector =x.
(ii) ϕ has category x.

Thus, there are $\kappa_\upsilon, \kappa_\phi \in Syn^*$, $\pi_\upsilon, \pi_\phi \in Phon^*$, and $\iota_\upsilon, \iota_\phi \in Sem^*$ such that $=\mathrm{x}\kappa_\upsilon\pi_\upsilon\iota_\upsilon$ and $\mathrm{x}\kappa_\phi\pi_\phi\iota_\phi$ are the head-labels of υ and ϕ, respectively. The value of $\langle \upsilon, \phi \rangle$ under *merge* is subject to two mutually distinct subcases.

(me.1) $merge(\langle \upsilon, \phi \rangle) = [_< \upsilon', \phi']$, if υ is simple,

where υ' and ϕ' are the expressions resulting from υ and ϕ, respectively, by replacing the head labels: the head label of υ becomes $\kappa_\upsilon\pi_\upsilon\iota_\upsilon$ in υ', that of ϕ becomes $\kappa_\phi\pi_\phi\iota_\phi$ in ϕ'.

(me.2) $merge(\langle \upsilon, \phi \rangle) = [_> \phi', \upsilon']$, if υ is complex,

where υ' and ϕ' are defined the same way as in (me.1).

(3) The operator *move*

(mo) The function *move* is a partial mapping from *Exp*(*Feat*) into *Exp*(*Feat*). An expression υ over *Feat* belongs to *Dom*(*move*) if it is well-labeled, and if for some feature −x ∈ *M-Licensees* conditions (i) and (ii) are fulfilled.

(i) υ has m-licensor +x.
(ii) there is exactly one maximal projection ϕ in υ that has feature −x.

Thus, there are $\kappa_\upsilon, \kappa_\phi \in Syn^*$, $\pi_\upsilon, \pi_\phi \in Phon^*$, and $\iota_\upsilon, \iota_\phi \in Sem^*$ such that $+\mathrm{x}\kappa_\upsilon\pi_\upsilon\iota_\upsilon$ and $-\mathrm{x}\kappa_\phi\pi_\phi\iota_\phi$ are the head-labels of υ and ϕ, respectively. The value of υ under *move* is

(mo.1) $move(\upsilon) = [_> \phi', \upsilon']$,

where υ' is the expression which results from υ by reducing the tree domain of υ' to all nodes not properly dominated by r_ϕ, the root of ϕ. Thus, r_ϕ is a leaf of υ'. The relation of projection in υ' and the leaf-labeling function of υ' are the corresponding restrictions of those defined in υ', except for the labeling of the head of υ' and r_ϕ. The head of υ' is labeled $\kappa_\upsilon\pi_\upsilon\iota_\upsilon$, r_ϕ is labeled ε. ϕ' is the expression that results from ϕ by changing the head-label to $\kappa_\phi\pi_\phi\iota_\phi$.

(4) The operator *adjoin*

(ad) The function *adjoin* is defined as a partial mapping from *Exp*(*Feat*) × *Exp*(*Feat*) into *Exp*(*Feat*). A pair $\langle \upsilon, \phi \rangle$ of some expressions υ and ϕ over *Feat* belongs to *Dom*(*adjoin*) if υ and ϕ are well-labeled expressions, and if for some x ∈ *Base* conditions (i) and (ii) are fulfilled.

(i) υ has a-selector ≈x.

(ii) ϕ has category x.

Thus, there are κ_υ, $\kappa_\phi \in Syn^*$, π_υ, $\pi_\phi \in Phon^*$, and ι_υ, $\iota_\phi \in Sem^*$ such that $\approx\mathrm{x}\kappa_\upsilon\pi_\upsilon\iota_\upsilon$ and $\mathrm{x}\kappa_\phi\pi_\phi\iota_\phi$ are the head-labels of υ and ϕ, respectively. The value of $\langle\upsilon, \phi\rangle$ under *adjoin* is

(ad.1) $adjoin(\langle\upsilon, \phi\rangle) = [_> \upsilon', \phi']$,

where υ' and ϕ' are the expressions resulting from υ and ϕ, respectively, such that the head label of υ becomes $\kappa_\upsilon\pi_\upsilon\iota_\upsilon$ in υ', and $\phi' = \phi$.

(5) The operator *scramble*

(sc) The function *scramble* is a partial mapping from *Exp*(*Feat*) into *Exp*(*Feat*). An expression υ over *Feat* belongs to *Dom*(*scramble*) if it is well-labeled, and if for some feature $\sim\mathrm{x} \in$ *S-Licensees* conditions (i) and (ii) are fulfilled.

(i) υ has category x.
(ii) there is exactly one maximal projection ϕ in υ that has feature $\sim$x.

Thus, there are κ_υ, $\kappa_\phi \in Syn^*$, π_υ, $\pi_\phi \in Phon^*$, and ι_υ, $\iota_\phi \in Sem^*$ such that $\mathrm{x}\kappa_\upsilon\pi_\upsilon\iota_\upsilon$ and $\sim\mathrm{x}\kappa_\phi\pi_\phi\iota_\phi$ are the head-labels of υ and ϕ, respectively. The value of υ under *scramble* is

(sc.1) $scramble(\upsilon) = [_> \phi', \upsilon']$,

where υ' is the expression which results from υ by reducing the tree domain of υ' to all nodes not properly dominated by r_ϕ, the root of ϕ. Thus, r_ϕ is a leaf of υ'. The relation of projection in υ' and the leaf-labeling function of υ' are the corresponding restrictions of those defined in υ', except for the labeling of r_ϕ. r_ϕ is labeled ε. ϕ' is the expression that results from ϕ by changing the head-label to $\kappa_\phi\pi_\phi\iota_\phi$.

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