Unattested Word Orders and Left-Branching Structure

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1. Introduction

In this chapter, we will argue that certain word-order patterns are unattested in human languages because they violate a principle of linearization, Cyclic Compounding. We will discuss three unattested word order patterns: (i) V-O-Aux, (ii) O-V and Aux-V-O and (iii) O-V in main clauses and V-O in subordinate clauses. In Section 2, we will show that each of these patterns is unattested. In Section 3, it is argued that in head-final languages, a complement moves to the specifier position of a higher functional head, thus making a left-branching structure. Section 4 discusses why the word order patterns (i) to (iii) are unattested, and the paper is concluded in Section 5.[*]

2. Unattested word orders

2.1. V-O-Aux

Biberauer, Holmberg and Roberts (2007, 2008) argue that of the possible permutations of V, O and Aux, only the V-O-Aux order is missing in Germanic, Basque and Finnish.[1] All the other possible permutations of Aux, V and O can be found, as shown in (1); the examples (1c), (1e) and (1f) are taken from Biberauer, Newton and Sheehan (2009: 5-6).

(1) a. Aux V O (English)
You can buy books.

b. Aux O V (German)
Anna hat Wasser getrunken
Anna has water drunk
'Anna has drunk water.'

c. V Aux O (Old English)
.. þæt ænig mon atellan mæge ealne þone demm
.. that any man relate can all the misery
".. that any man can relate all the misery" (Orosius 52.6-7; Pintzuk 2002: 283, (17b))

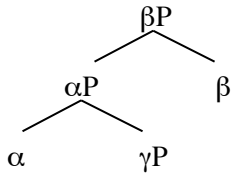
d. * V O Aux (Unattested)

e. O Aux V (Dutch)
.. dat Jan het boek wil lezen
that John the book wants to-read
'.. that John wants to read the book.'

f. O V Aux (Basque)
Jon-ek Miren-i egia esan dio
Jon-Erg Miren-Dat truth say-Perf Aux
"Jon has told Miren the truth."

Biberauer et al. (2008) argue that the word order V O Aux is impossible because it violates Holmberg's (2000: 124) Final-Over-Final Constraint (FOFC), which rules out structures like (2).

(2) $[_{\beta P}\ [_{\alpha P}\ \alpha\ \gamma P]\ \beta]$



FOFC can be formulated as in (3).

(3) If a phrase α is head-initial, then the phrase β immediately dominating α is head initial. If α is head-final, β can be head-final or head-initial.

V O Aux word order violates FOFC because it has the structure $[_{IP}\ [_{VP}$ V DP] I].[2]
Biberauer et al. (2008) try to formalize FOFC in terms of the following generalization (4):

(4) If a phase head PH has an EPP feature, then all the heads in its complement domain from which it is non-distinct in categorial features must have an EPP feature.

The EPP features that Biberauer et al. have in mind trigger movement purely for linearization and are not related to Agree. In this sense, their EPP features are different from those which trigger A-movement.

However, the generalization in (4) is no better than a description of the phenomena in terms of minimalist assumptions. It correctly describes the data in (1), but does not explain why the word order in (1d) (=(2)) is unattested. Biberauer et al. also have to assume that every head, including affix, N and P, is a head with an EPP feature, against the standard assumption that Tense and C have EPP features (Chomsky 1999). Furthermore, the generalization in (4) refers to categorial distinctness. This is necessary to deal with some cases of FOFC violation. First, German and Dutch may have the object-verb construction including DP or PP with the head-complement order.

(5) a. *Johann hat* $[_{VP}\ [_{DP}$ *den Mann*] *gesehen*]
John has the man seen
"John has seen the man."

b. *Johann ist* $[_{VP}\ [_{PP}$ *nach Berlin*] *gefahren*]
John is to Berlin gone
"John has gone to Berlin."

The examples in (5) violate FOFC for α=D/P, β=V in (2): $[_{VP}\ [_{DP/PP}$ D/P NP] V]. Second, particles are placed in clause-final position in some VO languages such as Chinese (6), making $[_{PrtP}\ [_{VP}$ V O] Prt] (α=V, β=Prt in (2)).

(6) a. *Xià yǔ le ma?*
fall rain PART Q
"Is it starting to rain?"

b. *Zhánmen kuài zǒ ba!*
1PL quick go Exclam
"Let's leave immediately!"

Thus, FOFC must be category-sensitive in that it prohibits the configuration (6) only if α and β have non-distinct categorial features. They argue that α and β have N and V features in (5), and V and N features in (6), respectively.[3]

The idea that FOFC is category-sensitive works well with the examples in (5) and (6), but it would make FOFC too weak to rule out rare constructions other than V O Aux. For example, if FOFC is not category sensitive, it can explain why certain word orders are rare in the languages of the world. The configuration violating FOFC (2) $[_{\beta P}\ [_{\alpha P}\ \alpha\ \gamma P]\ \beta]$ appears in various levels of constituents as shown in (7).

(7)
a. $[_{NP}\ [_{Genitive}$ Affix Stem] N] (α =Affix, β =N)
b. $[_{PP}\ [_{N}$ Affix Stem] P] (α =Affix, β =P)
c. $[_{VP}\ [_{N}$ Affix Stem] V] (α =Affix, β =V)
d. $[_{CP}$ .. $[_{X}$ Affix Stem] .. C] (α =Affix, β =C)
e. $[_{PP}\ [_{NP}$ N Genitive] P] (α =N, β =P)
f. $[_{VP}\ [_{NP}$ N Genitive] V] (α =N, β =V)
g. $[_{CP}$ .. $[_{NP}$ N Genitive] .. C] (α =N, β =C)
h. $[_{VP}\ [_{PP}$ P NP] V] (α =P, β =V)
i. $[_{VP}$ .. $[_{PP}$ P NP] .. C] (α =P, β =C)
j. $[_{CP}$ .. $[_{VP}$ V XP] .. C] (α =V, β =C)

Here we use the terms Affix and Stem to show syntactic categories under X^0 level (cf. prefix vs. suffix in Table 1 below). Note that we assume that an affix is the head of a derived word, while a stem is the complement of an affix, following Julien (2002). Then, the affix-stem combination is a head-initial 'phrase,' which could be described as an Affix Phrase. In (7a-d), a stem does not move into the Spec of an affix to make a derived word Stem-Affix, e.g. *form-ation*. Then, FOFC predicts that languages with the following word orders do not exist.

(8)
a. [[-*ation form*]*'s center*]
b. [[-*ation form*] *in*]
c. [[-*ation form*] *make*]
d. [[-*ation form*] .. *that*]
e. $[_{PP}\ [_{NP}$ *house Mary's*] *in*]
f. $[_{VP}\ [_{NP}$ *house Mary's*] *buy*]
g. $[_{CP}$ .. $[_{NP}$ *house Mary's*] .. *that*]
h. $[_{VP}\ [_{PP}$ *at a cafe*] *talk*]
i. $[_{VP}$ .. $[_{PP}$ *at a cafe*] .. *that*]
j. $[_{CP}$ .. $[_{VP}$ *see a doctor*] .. *that*].

The prediction that the word orders in (8) do not exist is, in part, borne out by typological data. Our examination of the data in Haspelmath et al. (eds.) (2005) (henceforth *WALS*) gives the word-order combinations shown in Table 1 and Table 2. Table 1 shows the number of languages with the given combination in the data. The percentages in Table 2 show the ratio of the number of languages with the given combination to that of all the languages in the data. The four combinations in each section (a) to (j) total 100 in each case. Dark shading represents the combination of word orders prohibited by FOFC, and light shading represents the other disharmonic word orders.

Table 1. Number of languages with respect to two order combinations (N=Noun, G=Genitive, P=Adposition, V=Verb, O=Object, Sb=Adverbial Subordinator)

a	N G	G N
prefix	74	44
suffix	98	275

b	P NP	NP P
prefix	82	28
suffix	95	134

c	V O	O V
prefix	105	28
suffix	128	307

d	Sb Cl	Cl Sb
prefix	103	8
suffix	124	45

e	P NP	NP P
N G	306	15
G N	46	373

f	V O	O V
N G	344	29
G N	104	418

g	Sb Cl	Cl Sb
N G	214	2
G N	84	76

h	V O	O V
P NP	417	10
NP P	38	427

i	Sb Cl	Cl Sb
P NP	254	4
NP P	45	114

j	Sb Cl	Cl Sb
V O	272	3
O V	55	80

Table 2. Percentages of languages with respect to two order combinations (N=Noun, G=Genitive, P=Adposition, V=Verb, O=Object, Sb=Adverbial Subordinator)[4]

a	N G	G N
prefix	15.1	9.0
suffix	20.0	56.0

b	P NP	NP P
prefix	24.2	8.3
suffix	28.0	39.5

c	V O	O V
prefix	18.5	4.9
suffix	22.5	54.0

d	Sb Cl	Cl Sb
prefix	36.8	2.9
suffix	44.3	16.1

e	P NP	NP P
N G	41.4	2.0
G N	6.2	50.4

f	V O	O V
N G	38.4	3.2
G N	11.6	46.7

g	Sb Cl	Cl Sb
N G	56.9	0.5
G N	22.3	20.2

h	V O	O V
P NP	46.7	1.1
NP P	4.3	47.9

i	Sb Cl	Cl Sb
P NP	60.9	1.0
NP P	10.8	27.3

j	Sb Cl	Cl Sb
V O	66.3	0.7
O V	13.4	19.5

The small percentages in the dark-shaded combinations show that FOFC applies to various levels of heads in languages, from affixes to adverbial clause subordinators. Adding category sensitivity to FOFC, as in (7), would lose an important generalization about possible word orders in languages. For example, if we allow $[_{VP}\ [_{PP}$ P NP] V] in order to account for German (5b), we cannot explain why P-NP & O-V is rare (1.1%), as shown in (h) in Table 1.

Note that the dark-shaded combinations of word orders can in fact be seen in a small number of languages. Interestingly, the percentages in the dark-shaded combinations generally decrease as one of the heads becomes a higher level category, from affix to adverbial subordinator, i.e. vertically from (a) 9.0% to (d) 2.9%, horizontally from (d) 2.9% to (j) 0.7%. This decreasing percentage in word-order combinations also needs to be explained. However, all these combinations are equally ruled out by FOFC.

In Section 3, we will propose an alternative analysis. We will argue that the effect of FOFC can be derived from the hypothesis that juncture in right-branching structure is longer than in left-branching structure. We will also point out that languages that show counterexamples to FOFC also allow phrasal compounds.

2.2. O-V and Aux-V-O

Let us turn to another word-order pattern that is unattested in the languages of the world. As far as we know, no language has the O-V order when an overt Aux is absent, and the V-O order if an overt Aux is present (*O-V & Aux-V-O). A hypothetical language of this type would be like (9).

(9) a. *Mary the piano plays*. (O-V)
'Mary plays the piano'
b. *Mary will play the piano*. (Aux-V-O)

The other permutations of these elements can be found, however: V-O & Aux-V-O (English (10)), O-V/O-V-Aux (Japanese (11)) and V-O & Aux-O-V (German (12), Kisi ((Atlantic, Niger-Congo, Guinea (13)), Nuer (Western Nilotic, Sudan), Dinka (Western Nilotic, Sudan: Nebel 1948), and Dongo (Ubangian, Niger-Congo, Democratic Republic of Congo: Tucker and Bryan 1966: 131).[5]

(10) a. Mary plays the piano. (V-O)
b. Mary can play the piano. (Aux-V-O)

(11) a. *Hanako-ga piano-o hiku* (O-V)
Hanako-Nom piano-Acc play
'Hanako plays the piano.'

b. *Hanako-ga piano-o hik-eru* (O-V-Aux)[6]
Hanako-Nom piano-Acc play-can
'Hanako can play the piano.'

(12) a. *Anna trink-t Wasser* (V-O)
Anna drink-3SG water
'Anna is drinking water.'

b. *Anna ha-t Wasser getrunken* (Aux-O-V)
Anna have-3Sg water drink.Pst.Ptcp
'Anna has drunk water.'

(13) a. *Kùwó lwá sàá* (V-O)
snake bite Saa
'The snake bit Saa.'

b. *Fàlà có lndó yìkpàá* (Aux-O-V)
Fallah Pres.Prog machete sharpen
'Fallah is sharpening the machete.'

First, languages with V-O and Aux-O-V orders such as German and Kisi cannot be explained by the assumption that some heads have the EPP-feature which triggers complement movement. Assuming Kayne's (1994) universal base hypothesis that basic order is universally SVO, we can derive Aux-O-V order from Aux-V-O by movement of O to the specifier of V. This movement is triggered by the EPP-feature of V. Then V must have an EPP-feature in these languages. However, we have to assu-

me that in the case of V-O, the EPP-feature of V does not trigger movement of V into its specifier. This is an implausible assumption.

Second, FOFC cannot rule out the O-V order in languages with the Aux-V-O order. Neither O-V nor Aux-V-O violates FOFC, which prohibits head-final over head-initial . The O-V order has the structure [$_{IP}$ … *I* [$_{VP}$ O V]] with no overt element in Infl, head-initial over head-final. The Aux-V-O order has [$_{IP}$ … I [$_{VP}$ V O]] with an overt element in Infl, head-initial over head-initial.

It has been argued that the order V-O is derived from the base [C .. [O V]], and the order Aux-O-V is derived from [C .. [Aux [O V]]], by movement of V or Aux into the head C position. This verb-second analysis can explain languages with V-O and Aux-O-V orders, but does not explain why languages with O-V and Aux-V-O orders do not exist.

One might argue that if we adopt Kayne's approach with VO as the base order, the OV and Aux-V-O combination cannot be derived syntactically.[7] OV order is derived by comp-to-spec movement from VO order. To get Aux-VO order in an OV language, then, comp-to-spec movement would have to be blocked when there is an auxiliary present. One could argue that this constraint on derivation seems implausible in syntactic terms. However, it is still logically possible for an auxiliary to block movement of O to the spec of V in some language. We need to know why this blocking does not occur in any languages. Thus, in Section 3 we would like to explore an interface explanation for this unattested combination of word orders.

2.3. O-V in main clauses and V-O in subordinate clauses

The third unattested word order pattern is similar to the second, in that object comes to the left of verb when a higher head is overt. No language has the OV order in main clauses and the VO order in subordinate clauses.[8] A hypothetical language of this type would be like (14).

(14) a. *Mary John loves*. (O-V)
'Mary loves John.'
b. *I think that Mary loves John*. (C..V-O)

The other three patterns are exemplified by English (VO in main and subordinate clauses), Japanese (OV in main and subordinate clauses), and German (VO in main clauses and OV in subordinate clauses), as shown in (15) to (17).

(15) a. Mary loves John. (V-O)
b. I think that Mary loves John. (C..V-O)

(16) a. *Hanako-ga Taro-o aisiteiru* (O-V)
Hanako-Nom Taro-Acc loves
'Hanako loves Taro.'

b. *Watashi-wa Hanako-ga Taro-o aisiteiru to omou* (..O-V-C)
I-Top Hanako-Nom Taro-Acc loves Comp think
'I think that Hanako loves Taro.'

(17) a. *Anna trink-t Wasser* (V-O)
Anna drink-3Sg water
'Anna is drinking water.'

b. *Hans sag-t, dass Anna Wasser trink-t* (C..O-V)
Hans say-3Sg that Anna water drink-3Sg
'Hans says that Anna is drinking water.'

The reverse of the German order, O-V in main clauses and V-O in subordinate clauses (O-V & C..V-O), does not exist in the languages of the world.

Syntax alone cannot explain the fact that no language has the OV order in main clauses and the VO order in subordinate clauses, just as we argued with regard to O-V and Aux-V-O in the previous section. One might argue again that if we adopt a Kayne's approach with VO as the base order, OV and C..V-O combination cannot be derived syntactically. To get C..VO order in an OV language, then, comp-to-spec movement would have to be blocked when C is present. One could argue that this constraint on derivation seems implausible in syntax. However, it is still logically possible for C to block movement of O to the spec of V. We need to know why this blocking does not occur in any language.

In this section, we have shown that there are three word-order combinations missing in the languages of the world. Given the wide variety of languages, to regard the absence of these word orders as merely accidental gaps could be to miss important generalizations. In the following sections, we will try to find possible reasons why these word orders are not derived in any language.

3. Complement movement deriving left-branching structure

3.1. Complement-movement to the specifier position

In this section, we argue that the rarity of the word orders (i)-(iii) is explained if we assume the universal base order Spec-Head-Complement, and the movement of the complement to the specifier position of its head (or a higher functional head) (cf. Kayne 1994). According to the universal base hypothesis, every language has [H [$_C$ …]] order in the base. Kayne (1984) argues that to have [[$_C$ …] H] order on the surface as in so-called OV languages, Complement moves across its head to a higher spec of some head. Here we assume Complement moves to the spec of the Head, as argued by Biberauer, et al. (2008) and Biberauer, et al. (2009). As Holmberg (2000) argues, this movement changes right-branching structure into left-branching structure. Consider the derivation in (18).

(18) a. [H [$_C$ …]]
b. [[$_C$ …] *[$_{H'}$* H *t]*]
c. [[$_C$ …] H]

The complement of a head H moves from its base position in (18a) to the specifier position of H as shown in (18b). The base structure in (18a) is right-branching because the complement C is branching while the head H is a non-branching X^0 category. In the derived structure in (18b), H' as well as C is branching because C leaves its trace in its base position. However, if we assume that phonologically null elements and the constituents made by merging them with other syntactic objects are invisible to phonological rules (cf. Tokizaki 1999, 2008a), the trace of C and H' are invisible at the syntax-PF interface, as shown by italics in (18b). Then, the structure in (18b) is interpreted as a left-branching structure at PF as shown in (18c).

Note that cyclic movements of complements in right-branching structure also derive left-branching structure, as shown in (19).

(19) a. [$_{XP}$ X [$_{YP}$ Y ZP]]
b. [$_{XP}$ X [$_{YP}$ ZP *[$_{Y'}$* Y *t$_{ZP}$]*]]
c. [$_{XP}$ [$_{YP}$ ZP *[$_{Y'}$* Y *t$_{ZP}$]*] *[*X *t$_{YP}$]*]
d. [$_{XP}$ [$_{YP}$ ZP Y] X]

First, ZP moves to the Spec of Y to derive (19b). Second, YP moves to the Spec of X to derive (19c). The italicized constituents and traces in (19c) are invisible at the syntax-PF interface. Then, the structure in (19c) is interpreted as a left-branching structure (19d).

Thus, complement-movement to Spec changes right-branching (i.e. head-initial) structure into left-branching (i.e. head-final) structure. Complement-movement changes V-O into O-V as in (18), and Aux-V-O into O-V-Aux as in (19). It also changes C..V-O into ..O-V-C as shown in (20).[9]

(20) a. $[_{CP}$ C $[_{IP}$ .. I $[_{VP}$ V O]]]
b. $[_{CP}$ C $[_{IP}$ .. $[_{I'}$ I $[_{VP}$ O V t_O]]]
c. $[_{CP}$ $[_{IP}$ .. $[_{I'}$ I $[_{VP}$ O V t_O]] C t_{IP}]
d. $[_{CP}$ $[_{IP}$ .. $[_{I'}$ I $[_{VP}$ O V]] C]

The derived structure (20c) is interpreted as (20d) at PF-interface. The structure in (20d) is not entirely left-branching, in that CP contains a right-branching IP with I. However, the topmost CP in (20d) is left-branching because IP is branching while its sister C is a non-branching X^0 category.[10]

Thus, constituents in the orders O-V, O-V-Aux and ..O-V-C have left-branching structure derived from V-O, Aux-V-O and C..V-O by complement-movement to Spec.

3.2. Motivation for complement-movement

A natural question to ask is: what triggers complement movement into a Spec? Svenonius (1994), Holmberg (2000) and Julien (2002) assume that every head taking a complement needs to check that its complement is of the right category. This need can be formally expressed as an uninterpretable c-feature, which is checked (i) by attracting the head of its complement, (ii) by attracting the whole complement or (iii) by attracting just the categorial feature of its complement (Holmberg 2000: 137; Julien 2002: 120). Holmberg illustrates (i) and (ii) with Finnish examples shown in (21)-(23), where Prc and t_O stand for participle and the trace of the object.

(21) a. *Milloin Jussi olisi kirjoittanut romaanin?*
when Jussi would-have written a novel

b. *Milloin Jussi olisi romaanin kirjoittanut?*
when Jussi would-have a novel written

(22) $[_{PrcP}$ *-nut* $[_{VP}$ *romaanin kirjoitta-* t_O]]
Prc novel write

(23) a. $[_{PrcP}$ $[_{Prc}$ *kirjoitta-nut*] $[_{VP}$ *romaanin* t_V t_O]]
b. $[_{PrcP}$ $[_{VP}$ *romaanin kirjoitta-* t_O] $[_{Prc'}$ *-nut* t_{VP}]]

In (22), the participle head *–nut* is merged with the VP. Then, the participle head can be licensed either by V-movement as in (23a) or by VP-movement as in (23b).

This analysis in terms of a c-feature offers a good perspective for word-order typology. However, it does not give any principled explanation of why certain languages are head-initial or head-final. If feature movement is enough to trigger the head to check the relation between a head and its complement, as in head-initial languages such as English, then something must require a complement to move to the Spec of the head in head-final languages such as Japanese. However, the c-feature analysis does not tell us what the requirement is.

Instead of assuming c-feature checking, we propose that all languages have the same LF, where complements are combined with their heads in complement-head order. We call this idea the universal LF hypothesis. It is reasonable to think that meanings are represented in the same form and order in LF in all languages, even if they are represented in different forms and orders in PF. What the English sentence *the cat chases the rat* means is the same in other languages even though the words and their order are different. Huang (1982) argues that Operator-movement applies in overt syntax in English but in covert syntax in Chinese. The structure Spelled-Out as the PF representation is (24a) in

Chinese and (24b) in English. However, the LF-representation is the same (24b) for Chinese and English.

(24) a. [$_{IP}$ … Op …]
[$_{IP}$ *ni* *xihuan* *shei*] (PF)
you like who
'Who do you like?'

b. [$_{CP}$ Op [$_{C'}$ C [$_{IP}$ … *t* …]]]
[$_{CP}$ *shei* [$_{C'}$ C [$_{IP}$ *ni xihuan*]]] (LF)
[$_{CP}$ who [$_{C'}$ do [$_{IP}$ you like]]] (PF and LF)

English derives (24b) in overt syntax while Chinese does it in covert syntax so that both languages have the operator in the Spec of C position. The universal LF hypothesis claims that this overt/covert movement also applies to complements to derive the complement-head order in LF. In other words, all complements are raised to specifier positions for checking the semantic relation between head and complement.

The universal LF hypothesis can stand if we assume that only features move in LF. In head-final languages, complements move to the spec position by c-feature pied-piping the phonological features of complements. However, it is not necessary for c-feature to pied-pipe the semantic features of complements. In other words, semantic features stay in their base position even if overt movement takes place. In head-initial languages, c-feature of complement moves to the spec of head without pied-piping phonological features and semantic features. Again, semantic features of complement stay in their base position. That is, feature movement analysis leads to universal LF where semantic features of complement stay in their base position.

Why do some languages have comp-to-spec movement in overt syntax? Why do other languages move complement only at LF? Here we briefly sketch our explanation of this difference between languages (cf. Tokizaki and Kuwana 2009; Tokizaki 2011). We assume that the form in PF should be as close as possible to the one in LF (cf. Bobaljik 2002). Then, complements move to the Spec of the head before Spell-Out, unless the resulting structure violates some PF condition in the language. We argue in the next section that comp-to-spec movement derives left-branching, compound-like structure. The resulting structure has stress on the moved complement. This left-hand stress in the derived compound is not allowed in right-hand stress languages such as English. Thus, comp-to-spec movement does not occur in overt syntax in right-hand stress languages. Left-hand stress languages allow comp-to-spec movement in overt syntax because left-hand stress in derived compounds matches the stress pattern of words in the language. Languages with no stress, such as Japanese, also allow comp-to-spec movement because the resulting compounds do not have stress. Thus, we can explain the difference across languages between overt and covert comp-to-spec movement .

3.3. Short juncture in left-branching structure

In this section, we argue that left-branching structure, which can be made by comp-to-spec movement, has the nature of compounds because the juncture between its constituents is short. We define juncture as the length of silence or pause duration between words. In Tokizaki (2008b), it is argued that left-branching structure has short juncture between its constituents so that it behaves like a word or a compound. Here, short juncture means that the pause between two words is short and that the two words are closely connected to each other. This argument is supported by the fact that phonological changes such as Japanese Voicing and Korean *n*-Insertion occur in left-branching constituents as in (25a) and (26a), but not in right-branching constituents as in (25b) and (26b) (cf. Otsu 1980; Han 1994).

(25) a. [[*nise* *tanuki*] *shiru*] → *nise danuki jiru*
mock badger soup 'mock-badger soup'

b. [*nise* [*tanuki shiru*]] → *nise tanuki jiru*/**nise danuki jiru*
mock badger soup 'mock badger-soup'

(26) a. [[*on chən*] *yok*] → *on chən nyok*
hot spring bathe 'bathing in a hot spring'

b. [*kyəŋ* [*yaŋ sik*]] → *kyəŋ yaŋ sik*/**kyəŋ nyaŋ sik* (OK in Kyungsan)
light Western food 'a light Western meal'

Voicing changes *sh* into *j* in left-branching (25a) but it does not change *t* into *d* in right-branching (25b). Similarly, *n*-Insertion changes *yok* into *nyok* in (26a) but it does not change *yaŋ* into *nyaŋ* in left-branching (26b). Assuming that phonological change is blocked by long juncture between words, the left bracket in right-branching structure in (25b) and (26b) shows long juncture. The juncture at the right bracket in left-branching structure (25a) and (26a) must be short because it does not block phonological change.

Moreover, the idea of left-branching structure as a compound fits nicely with the observation that head-final languages tend to be agglutinative and have simple syllable structure (CV) (Lehmann 1973; Plank 1998; Tokizaki and Kuwana 2012a).[11] For example, Japanese is a head-final language with agglutinative morphology, as shown in (27).

(27) Kono hon-wa amari yom-are-nai.
this book-Top very read-Pass-Neg
'This book is not read very often.'

Japanese syllable structure is simple in that its template is CV(*n*). Thus, words can be connected to each other to form compounds without making consonant clusters between words. These facts contrast with head-initial languages such as English, which is isolating in morphology, as shown in the gloss in (27). English has complex syllable structure with the maximal template CCCVCCCC (*strengths /streŋk θ s/*). However, even these languages do not allow long consonant clusters. If complement-movement to spec occurred, the resulting compounds would have long consonant clusters made of the word-final (coda) consonants of the complement and the word-initial (onset) consonants of the head: [[$_C$ .. CCCV<u>CCCC]</u> [$_H$ <u>CCC</u>VCCCC ..]]. This would violate the phonotactics of the language.

Furthermore, left-branching structure behaves like a word or a compound in that it does not allow extraction of its constituent (Left Branch Condition (Ross 1967)).

(28) a. The boy [[whose guardian's] employer] we elected *t* president ratted on us.
b. * The boy [whose guardian's] we elected [*t* employer] president ratted on us.

In (28a, b), *whose guardian's employer* is a left-branching structure whose constituents cannot be extracted as shown in (28b). This contrasts with the fact that extraction from right-branching structure is possible, as shown in (29).

(29) Who did you see [a [picture [of *t*]]]?

Thus, we have phonological, morphological and syntactic evidence for the claim that left-branching structure has shorter juncture than right-branching structure.

These arguments give support to Julien's (2002) idea that complement-movement makes heads adjacent to each other and agglutinative (cf. Kayne 1994). However, adjacency is not a sufficient condition for agglutination because heads can be adjacent in right-branching structure as well. Right-branching languages, i.e. head-initial languages, tend to be inflectional and isolating, not agglutinative and polysynthetic, as pointed out by Lehmann 1973 (cf. Plank 1998 and the references cited therein). Thus, both adjacency and left-branching structure are necessary conditions for agglutination.

3.4. Complement-movement as compression

We have argued that complement-movement makes left-branching structure, which has short juncture between words. Thus complement-movement has the effect of compressing phrases into compounds.[12] The term 'compounds' is used here to mean head-final constituents that have short juncture between their daughters.[13] The process of compression may turn a phrase into a single phonological word. Compression should be cyclic from the innermost cycle to the outermost cycle, i.e. from root-affix to IP-C, in order to rule out the word orders that violate FOFC, shown in Tables 1 and 2 in Section 2. The numbers and the percentages of languages in Tables 1 and 2 show that complement-head order at a given level is possible if all the lower levels have complement-head order. This corresponds to what FOFC represents in the minimalist framework. Let us consider an example of cyclic complement-movement to Spec, as shown in (30).

(30) a. $[_{AffP}$ Aff $[_{Root}$ …]]
b. $[_{NP}$ N $[_{AffP}$ $[_{Root}$ …]-Aff]]
c. $[_{DP}$ D $[_{NP}$ $[_{AffP}$ $[_{Root}$ …]-Aff]-N]]
d. $[_{PP}$ P $[_{DP}$ $[_{NP}$ $[_{AffP}$ $[_{Root}$ …]-Aff]-N]-D]]
e. $[_{VP}$ V $[_{PP}$ $[_{DP}$ $[_{NP}$ $[_{AffP}$ $[_{Root}$ …]-Aff]-N]-D]-P]]
f. $[_{IP}$ I $[_{VP}$ $[_{PP}$ $[_{DP}$ $[_{NP}$ $[_{AffP}$ $[_{Root}$ …]-Aff]-N]-D]-P]-V]]
g. $[_{CP}$ C $[_{IP}$ $[_{VP}$ $[_{PP}$ $[_{DP}$ $[_{NP}$ $[_{AffP}$ $[_{Root}$ …]-Aff]-N]-D]-P]-V]-I]]
h. $[_{CP}$ $[_{IP}$ $[_{VP}$ $[_{PP}$ $[_{DP}$ $[_{NP}$ $[_{AffP}$ $[_{Root}$ …]-Aff]-N]-D]-P]-V]-I]-C]

The stages in (30) represent the derivational process of consistent head-final orders. In (30a), Affix, merged with Root, makes AffixP(hrase). The complement Root moves to the Spec of the head Affix to give complement-head order and then it is merged with a head N in (30b). Next, AffixP moves to the Spec of N and is merged with D in (30c). Similarly, complement cyclically moves to the Spec of the head to make higher constituents with complement-head orders. The constituents with complement-head orders behave like compounds because of the short juncture between their constituents. Then, in the final structure in (30h), the whole CP is left-branching and is like a giant compound.

To sum up the discussion in Section 3, we have argued that complement-movement to Spec applies to right-branching structure in the base to derive left-branching structure, which has short juncture between its constituents. This movement is motivated by a universal condition on LF-representation, which requires complements and their head to be interpreted as a unit.

4. Why are certain word-order patterns unattested?

4.1. V-O-Aux

As we have seen in Section 2.1, Biberauer et al. (2008) try to explain the first unattested word order, V-O-Aux, in terms of Holmberg's (2000) Final-over-Final Constraint (FOFC), which bans $[_{\beta P}$ $[_{\alpha P}$ α γ P] β]. They claim that FOFC violation occurs in $[_{IP}$ $[_{VP}$ V O] Aux], where V= α , O= γ P, and β =Aux. However, as we have argued, their explanation has both conceptual and empirical problems in deciding phase heads, explaining counterexamples and assuming categorial distinctness. In this section, we will consider an alternative analysis based on the arguments in Section 3. The discussion will also give a new possible explanation of why FOFC makes a correct prediction in most cases.

Let us consider the word orders involving Aux, V and O derived by cyclic complement-movement to Spec.

(31) a. $[_{IP}$ Aux $[_{VP}$ V O]]
b. $[_{IP}$ Aux $[_{VP}$ O-V]]
c. $[_{IP}$ $[_{VP}$ O-V]-Aux]

The base structure Aux-V-O in (31a) may be changed into Aux-O-V in (31b) by movement of O to the Spec of V. Movement of VP to the Spec of Aux gives O-V-Aux in (31c). The unattested order V-O-Aux (32) could be derived if the VP in (31a) was moved to the Spec of Aux without moving O to the Spec of V, i.e. skipping the intermediate stage (31b).

(32) $[_{IP}\ [_{VP}$ V O]-Aux]

However, this derivation violates the morphological constraint banning phrasal compounds (cf. Allen 1978). Botha (1981: 18) formulates this idea as the No Phrase Constraint, as in (33).

(33) Morphologically complex words cannot be formed (by Word Formation Rules) on the basis of syntactic phrases.

This amounts to saying that no phrase may appear within complex words. In (31), the IP is a compound word with VP phonologically incorporated into Aux. However, the incorporated VP is a syntactic phrase because O is not incorporated into V. Thus, the structure in (31) is prohibited by the No Phrase Constraint. Note that the existent orders (31a) to (31c) do not violate the No Phrase Constraint because O is incorporated into V to make a compound O-V. Thus, we can explain why the V-O-Aux order is unattested without assuming FOFC.[14]

This analysis is supported by the fact that the languages allowing FOFC violation also allow the No Phrase Constraint violation. As we saw in Section 2.1, German has $[_{VP}\ [_{DP/PP}$ D/P NP] V] and Chinese has $[_{PrtP}\ [_{VP}$ V O] Prt], violating FOFC. These languages also have phrasal compounds violating the No Phrase Constraint as shown in (34a) and (34b).

(34) a. $[_{NP}\ [_{PP}$ *Vor* *Ort*] *Tarif*]
before place tariff
'local tariff'

b. $[_{N}\ [_{VP}$ *qie cai*] *tao*]
cut vegetable knife
'vegetable-cutting knife'

We need to show that all languages that allow FOFC violations (of any morphological or syntactic category) allow No Phrase Constraint violations. Dutch and Afrikaans as well as German allow FOFC violation in $[_{VP}\ [_{DP/PP}$ D/P NP] V] as shown in (34a). These languages also allow No Phrase Constrain violation (cf. Botha 1981). English may violate FOFC in genitive construction $[_{GenP}\ [_{DP}$ D NP] 's] (e.g. *the girl's*) and may violate No Phrase Constraint in phrasal compounds such as *over the fence gossip*.

We will not discuss here what features of these languages allow violations of FOFC and the No Phrase Constraint. However, this interesting correlation between the two constraints supports our analysis based on the compression effect of complement-movement.[15]

The analysis in terms of No Phrase Constraint can explain why the percentage of languages violating FOFC decreases as the categories get larger, as we saw in Table 2 in Section 2.1. Comp-to-spec movement derives compounds different in sizes according to the sizes of head and complement. Here we have some Complement-Head constructions: Root-Suffix, Genitive-Noun, DP-postposition, Object-Verb and Clause-Adverbial Subordinator. As the complement gets larger, the more difficult it becomes to violate No Phrase Constraint. For example, it is far more difficult to allow head-initial clause compounded with a head, than head-initial word-root compounded with a head.

4.2. O-V and Aux-V-O

The second unattested order, O-V/Aux-V-O, could be derived if O was incorporated into V only when Aux was not present: O-V/Aux $[_{VP}$ V O]. There seem to be three possible explanations for the non-existence of this order. Let us consider each of them in turn. First, O-V/Aux-V-O is impossible be-

cause there is no way to make O stay in the complement position only when Aux is present. The reverse pattern, V-O/Aux-O-V is possible (and exemplified by German and some African languages) because Aux, a higher head, triggers comp-to-spec movement of O to make Aux-O-V.

Second, we can explain the non-existence of the O-V/Aux-V-O pattern in terms of economy. If a language allows objects to move into the Spec position to make a left-branching structure in VP when Aux is not merged, it can allow object movement when Aux is merged. Suppose that there is an economy condition that requires a construction to have the fewest number of (compound) words as a whole (the Fewest Words). Then, [O V] is a 'compound' because it is a left-branching structure. [Aux [V O]] has three words, Aux, V, and O, which are a part of right-branching structure. These words could be [Aux [O V]], which has two words because [O V] is a left-branching "compound." In fact, this pattern, O-V/Aux-O-V, can be seen in Bantu languages such as Supyire (Senufo, Gur, Niger-Congo: Heine and Nurse 2000: 199).

(35) a. *u màha suro shwɔhɔ*
she Hab mush cook
'She cooks mush.'

Verb-second languages such as German and Dutch have the V O/Aux O V pattern. [V O] has two words, and [Aux [O V]] also has two words because [O V] is a left-branching compound. Thus, these languages do not violate the Fewest Words condition.[16]

The third possible explanation, more plausible than the other two, is to assume that PF-representation should be as close to LF-representation as possible. Given that the universal base order is Specifier-Head-Complement, as Kayne (1994) argues, OV languages move O to the Spec of V in overt-syntax by the time of Spell-Out. Recall the discussion in Section 3.2 of what motivates complement-movement. We could assume that some strong EPP-feature of the head V triggers the complement-movement to check off the uninterpretable feature, as Biberauer et al. (2008) argue. This idea conforms to minimalist assumptions, but it does not give us any principled answer to the question why verbs in some languages have a strong EPP-feature. We could also assume that selectional features of V need to be checked by the moved complement in its Specifier position, as Holmberg (2000) argues. This seems to be a plausible approach, but we go a step further to propose that languages have the same representation in LF.

Assuming that all languages have the same LF compound O-V, let us consider the complexity of covert complement-movement in LF. Suppose that a language has O-V and Aux-V-O orders at the Spell-Out and PF. Then, the language must have two complement movements to make the O-V-Aux compound in LF, as shown in (36).

(36) a. Aux V O
b. Aux O-V
c. O-V-Aux

However, these iterative LF-movements are too much and should be avoided in this language, where overt complement-movement can make O-V order in overt syntax. Thus, languages with O-V and Aux-V-O orders do not exist. The idea that overt movement should be preferred over LF-movement is similar to Bobaljik's (1995, 2002) Minimize PF-LF Mismatch, which explains scope and word order. On the other hand, languages with V-O and Aux-O-V orders exist because they use complement-movement once in LF to make O-V and O-V-Aux compounds in LF. O-V-Aux is made by one movement of the O-V compound in overt syntax. Languages with V-O and Aux-V-O orders are also possible because they do not have complement-movement in the cases of V-O. They do not have complement-movement in cases when Aux is merged with VP to make Aux-V-O. Iterative LF-movement of complements has to apply to Aux-V-O to make legitimate LF O-V-Aux.

The preference of overt movement to LF-movement also explains why some languages, such as Japanese, are consistently head-final. Those languages move every complement to the spec of the head to make PF similar to LF. Then, there remains a question as to why head-initial languages such as English do not move complements to the spec of heads overtly to minimize PF-LF mismatch. We

argue that if right-hand stress languages, such as English, move complements to the spec of heads, the resulting compounds would have non-canonical stress on left-hand constituents. This result is filtered out at PF. Left-hand stress languages and stressless languages, such as Japanese, do not make a stress mismatch between compounds and words. Thus, these languages move complements to the spec of heads to minimize PF-LF mismatch. This idea has a lot of interesting consequences for disharmonic word orders. We will not go into detail here, however (See Tokizaki 2011; Tokizaki and Kuwana 2012b).

Thus, without assuming FOFC, we can explain why there is no language with the O-V/Aux-V-O order. The three possible explanations we have shown above are based on the idea of asymmetric juncture in left/right-branching and complement-movement to the Spec.

4.3. O-V in main clauses and V-O in subordinate clauses

Lastly, let us consider the third case of unattested word orders, O-V in main clauses and V-O in subordinate clauses. This combination of word orders could appear in a language that allows the incorporation of the object into V in the main clause and leaves the object in the complement position of V in the subordinate clause. There are two ways to explain why this pattern does not exist in the languages of the world. First, this language would have the structure (37), where the verb in the main clause has a subordinate clause as its object.

(37) .. $[_{VP1}\ [_{CP}$ .. $[_{VP2}$ V O]]-V]

However, this structure violates FOFC and the No Phrase Constraint. The left-branching VP_1 in the main clause contains the right-branching VP_2 in the subordinate clause. In other words, the VP_1 in (37) is a kind of phrasal compound in that the compound-like VP_1 contains a phrasal category VP_2.

However, there is a problem with this explanation. It would predict that languages allowing the No Phrase Constraint violations, such as German and Chinese, may allow this word-order combination as phrasal compounds. As this combination is not found in any language, we cannot rely on the explanation based on the No Phrase Constraint.

Alternatively, we can apply the same analysis used in the previous case (*O-V & Aux-V-O) to this case, *O-V & C..V-O. In LF, all the complements must be in the Spec of their head to make interpretable compounds O-V and ..O-V-C. However, Spell-Out of O-V and C..V-O is impossible because C..V-O must be changed into ..O-V-C by two cyclic complement-movements, as shown in (38).

(38) a. $[_{CP}$ C $[_{IP}$ .. $[_{VP}$ V O]]]
b. $[_{CP}$ C $[_{IP}$ .. $[_{VP}$ O-V]]]
c. $[_{CP}\ [_{IP}$ .. $[_{VP}$ O-V]]-C]

The object O moves to the Spec of V to derive (38b), which is changed into (38c) by movement of IP to the Spec of C. However, the language could move O into the Spec of V in overt syntax in a subordinate clause C..V-O, because it can do so in a main clause to derive O-V. Overt movement of O to the Spec of V must take place in subordinate clauses in order to have fewer LF-movements as long as the overt movement is possible in main clauses. Thus, we can explain why there is no language with OV order in main clauses and VO order in subordinate clauses. Again, we can correctly predict that the reverse order combination, V-O and C..OV can be found in some languages. Both V-O and C..O-V can be changed into O-V and ..O-V-C by a movement of O and ..O-V in LF, respectively. That is, in the latter case, an LF-movement changes (38b) into (38c). Languages may have O-V and ..O-V-C orders at Spell-Out, which are the same orders in LF as well. Languages may also have V-O and C..V-O orders, which are changed into O-V and ..O-V-C in LF. The LF-derivation from C..V-O to ..O-V-C needs two covert complement-movements as shown in (38). However, this cannot be avoided because this type of language does not have overt object movement to the Spec of V.

To sum up the discussion in this section, we have argued that the compound nature of left-branching structure together with the No Phrase Constraint and a constraint on cyclic LF-movement explain why the word orders (i) V-O-Aux, (ii) O-V and Aux-V-O and (iii) O-V and C..V-O are unattested.

5. Conclusion

Thus we can give principled answers to the question why certain word-order patterns are missing from the world's languages. The unattested word orders involve left-branching structure, which behaves like a compound-word and cannot contain phrasal categories. The universal LF hypothesis has also been proposed to explain complement-movement to the Spec position in overt and covert syntax. It has also been argued that iterative complement-movement in LF should be avoided as far as possible.

The fact that this analysis can explain unattested word-orders gives support to the universal base order Spec-H-C (Kayne 1994) which this analysis is based on. This study represents a challenge to the Spec-C-H hypothesis (Fukui and Takano 1998; Haider 2000).

Notes

* We would like to thank Theresa Biberauer and two anonymous reviewers for their valuable comments on an earlier version of this paper. This work is supported by Sapporo University and Grant-in-Aid for Scientific Research 2008.

[1] As noted by Biberauer, Holmberg and Roberts (2007: 17), the VOAux order is found in A'-movement constructions or when the auxiliary is an uninflected particle. In Tokizaki and Kuwana (2009), we argue that particles can be moved in PF. Assuming that this PF-movement analysis applies to VOAux orders, we will deal with VOAux ordering as unattested.

[2] A reviewer pointed out that some auxiliaries can be analyzed as light v or as articulated heads of v and/or I.

[3] In Tokizaki and Kuwana (2009) we argue that question particles are moved from the clause-initial position to clause-final position in PF. This PF-movement analysis of particles can keep the FOFC (4) intact.

[4] The *WALS* features we combined are as follows:

26 Prefixing vs. Suffixing in Inflectional Morphology; here we combined 'strongly prefixing' and 'weakly' prefixing as 'prefix', and 'strongly suffixing' and 'weakly suffixing' as 'suffix')
83 Order of Object and Verb
85 Order of Adposition and Noun Phrase
86 Order of Genitive and Noun
94 Order of Adverbial Subordinator and Clause

WALS generally uses dominant order as the criterion for categorizing languages into a word-order type. For example, English is categorized as a suffixing language, although it has both prefixes and suffixes. See each chapter or description of *WALS* for the criteria.

[5] The languages with V-O & Aux-O-V order are listed in Dryer (2005).

[6] Here, we treat *-eru* as an Aux suffixing to the verb *hik-u*.

[7] We would like to thank a reviewer who pointed out this possibility.

[8] Here we are discussing unmarked word orders in a language. In Basque, where OV is the unmarked order in main clauses, VO order is possible in subordinate clauses. However, this VO order is not obligatory nor unmarked, as shown by the unmarked OV order in subordinate clause.

[9] In (20), the complement of I, i.e. VP, does not move to the spec of I because the spec position is filled with the subject. A reviewer pointed out that (20c) could be ruled out by FOFC

[10] Note that (20c) is ruled out by FOFC with head-initial IP dominated by head-final CP. However, this is not a problem in our analysis in terms of compression at PF if Infl does not contain an overt element.

[11] See also The Universals Archive (http://typo.uni-konstanz.de/archive/intro/).

[12] We would like to thank Theo Vennemann for the term 'compression'.

[13] We argue that the juncture between head and its complement moved into spec is short. This is different from Uriagereka's idea that specifiers are rendered "words" by Spell-out for LCA purposes, which is intended to explain some island effects.

[14] A reviewer pointed out that the relationship between V and O could be argued as being tighter in V-O order than in O-V order. Adverbs can occur in between O and V in languages like German, but generally not in between V and O in languages like English. However, it is also possible to assume that the base order is [$_{VP}$ O [$_{VP}$ Spec [V Adv]] (cf. Larson 1988), where an adverb moves from the complement position to the inner spec of verb to make Adv-V. V-Adv-O is ruled out by adjacency requirement for Case checking.

[15] As for the other type of FOFC violation caused by clause-final particles, we argue that these particles are grammaticalized tag questions meaning 'yes/no', or moved in PF as clitics. We will not go into detail here, however (cf. Tokizaki and Kuwana 2009).

[16] The Fewest Words condition applies at the PF interface. As the anonymous reviewers have pointed out, this analysis has a problem in comparing two different derivations.

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