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Obligatory Contour Principle and Minimalist Syntax

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ABSTRACT. This article argues that the Obligatory Contour Principle (OCP) in phonology works as an output condition on syntactic structure, which is assumed to be asymmetric in the minimalist syntax (Kayne 1994). I propose a phonological constraint OCP Stress and a stress assignment rule Set Stress, which filter out unacceptable symmetric structures. It is also argued that this analysis has interesting consequences for problems of First Merge and phases.[*]

Keywords: asymmetry, Linear Correspondence Axiom, First Merge, stress, phase

1. Syntactic OCP

In generative grammar, it has been argued that the Obligatory Contour Principle (OCP) has effects on syntax as well as on phonology. This line of research includes Ross (1972), Hoekstra (1984), Mohanan (1994), Yip (1998), Anttila and Fong (2000) and Richards (2001, 2010), who discuss various topics such as double-*ing*, doubling of homophonous morphemes, word order in Hindi and the partitive case in Finnish.

In this paper, I argue that the asymmetry of phrase structure, which has been assumed since Kayne (1994), can be derived from the OCP in phonology. In Section 2, I review the Linear Correspondence Axiom (LCA) proposed by Kayne (1994). In Section 3, I propose a constraint OCP Stress and a stress assignment rule Set Stress. As consequences of these rules, I discuss a problem with First Merge in Section 4 and problems with phases in Section 5. Section 6 concludes the discussion.

2. Linear Correspondence Axiom (LCA)

Kayne (1994) proposes the Linear Correspondence Axiom (LCA), which defines the relation between asymmetric c-command and the linear order of constituents. In order to keep the discussion simple, here I give a simplified definition of LCA by Roberts (2007: 189).

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[*] This is the English version of Tokizaki (2015a), which is based on my presentations at GLOW in Asia X (May 24, 2014, National Tsing Hua University) and the 25th Colloquium on Generative Grammar. (May 21, 2015, IKER Bayonne). I would like to thank the participants of these conferences. This work was supported by JSPS KAKENHI (Grant Number 15H03213).

(1) A terminal node α precedes another terminal node β, if and only if α asymmetrically c-commands β.

Assuming that constituents must be linearized, Kayne argues that LCA explains the acceptability of the structure in (2) and the unacceptability of the structures in (3).

(2) $[_{XP}$ X $[_{YP}$ .. Y ..]]

(3) a. * $[_{XP}$ $[_{YP}$ .. Y ..] X]

b. * [X Y]

c. * [[$_{XP}$ .. X ..] [$_{YP}$ .. Y ..]]

In (2), X asymmetrically c-commands and precedes Y, satisfying LCA in (1). In (3a), X asymmetrically c-commands Y but does not precede Y, violating LCA. In (3b), where X and Y c-command each other, the linear order of X and Y cannot be determined because there is no asymmetric c-command relation between X and Y. In (3c), where neither X nor Y c-commands the other, the linear order of X and Y cannot be determined because there is no asymmetric c-command relation between X and Y. Thus, LCA allows the right-branching structure in (2) as an acceptable structure but not the left-branching structure in (3a) nor the symmetric structures in (3b) and (3c).

3. OCP Stress and Set Stress

In this section, I argue that the asymmetry of phrase structure is derived from the Obligatory Contour Principle of stress (OCP Stress) in phonology. The original OCP is formulated as in (4) (Leben 1973, Goldsmith 1976).

(4) Obligatory Contour Principle (OCP):
At the melodic level of the grammar, any adjacent tonemes must be distinct.

Let us extend OCP to stress and consider the constraint OCP Stress in (5).

(5) OCP Stress:
Sisters of a constituent must have different degrees of stress.

I assume that this constraint applies to constituents in the sister relation at the syntax-phonology interface. Based on the metrical theory (Liberman and Prince 1977), I assume that stress is the relative strength between two adjacent constituents. I propose a general rule Set Stress (6) to assign relative strength to the sisters of a constituent.

(6) Set Stress:

Assign S (strong) to a set; assign W (weak) to a terminal.

I assume that this rule cyclically applies to a constituent at every Merge as is the case with the Nuclear Stress Rule (NSR) and the Compound Stress Rule (CSR) by Chomsky and Halle (1968) (cf. Szendrői 2001; Reinhart 2006).

OCP Stress is satisfied in a constituent whose sisters are a head and its branching complement, as shown schematically in (7a) and exemplified in (7b) where the word with the main stress is underscored.

(7) a. $[_{\alpha P}\ \alpha_{(W)}\ \beta P_{(S)}]$
b. $[_{VP}\ \text{love}_{(W)}\ [_{NP(S)}\ \text{white}\ \underline{\text{snow}}]]$

In (7a), where α merges with βP, Set Stress (6) assigns W to a terminal (a single word) α and S to a set βP.[1] Since the degrees of stress are different for α and βP, which are the sisters of αP, OCP Stress (5) is observed in (7a) and (7b).

OCP Stress is violated in the structures in (8), which are ruled out by LCA.

(8) a. * [α β]
b. * [αP βP]

(8a) is the result of merging two heads (terminals); (8b) is the result of merging two sets. Thus, Set Stress (6) applies to (8a) and (8b), and gives the representation in (9a) and (9b).

(9) a. * $[\alpha_{(W)}\ \beta_{(W)}]$
b. * $[\alpha P_{(S)}\ \beta P_{(S)}]$

In (9a) and (9b), the same strength, W or S, is assigned to the sisters violating OCP Stress.

To sum up, let us compare the structure compatible with LCA in (2) and the structures incompatible with LCA in (3). The right-branching structure in (2), which is compatible with LCA and acceptable, corresponds to the structure in (7), which observes OCP Stress. The symmetrical structures in (3b) and (3c), which are incompatible with LCA and unacceptable, correspond to the structures in (9a) and (9b), which violate OCP Stress. Thus,

[1] Following Cinque (1993), I assume that the main stress is assigned to the most deeply embedded element in βP. I will discuss the problem of First Merge in Section 4. I argue that in (7b) the noun *snow* is more deeply embedded than the adjective *white*. See Tokizaki (2015b) for the structure of noun phrases consisting of a noun and a modifier.

LCA and OCP Stress make the same prediction about the acceptability of structures. Then, we do not need to postulate LCA, which can be derived from OCP Stress in phonology.[2]

4. First Merge

The constraint OCP Stress has some consequences for problems other than LCA. First, let us consider the problem of First Merge. As shown in (3b) and (9a), merging a head with another head is prohibited by LCA and OCP Stress. However, merging two heads seems to be inevitable for the first merge in a derivation. For example, a verb merges with a noun to make a verb phrase in (10).

(10) $[_{VP}$ love music]

The generative syntax based on X-bar theory in the 1980s and early 1990s assumed the structure in (11) for a VP consisting of a verb and a noun.

(11) $[_{VP}$ love $[_{NP}$ $[_{N'}$ $[_{N}$ music]]]]

The structure in (11) cannot be assumed in the minimalist syntax based on bare phrase structure, which does not admit non-branching projections (N-N'-NP) (Chomsky 1995). Since LCA (or OCP Stress) requires a phrase structure to be asymmetric, Kayne (2009) suggests that in the case of head-to-head merge as in (10), a head α in fact merges with a one-membered set {ß} rather than a terminal ß, as shown in (12).[3]

(12) $[_{\alpha P}$ α {β}]

Set Stress (6) assigns W to the terminal α and S to the set {β} satisfying OCP Stress.

(13) $[_{\alpha P}$ $\alpha_{(W)}$ $\{\beta\}_{(S)}$]

This prediction is borne out in examples such as (10), where the main stress falls on the object as shown in (14).

(14) $[_{VP}$ $\text{love}_{(W)}$ $\{\text{music}\}_{(S)}$]

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[2] Whether or not (3a) should be ruled out of the grammar is a problem. Fukui and Takano (1998) and Haider (2000) argue that complement-head order is the basic order, contrary to Kayne (1994). If we follow the minimalist idea that linear order is determined at the PF (or SM) interface, there is no syntactic difference between (2) and (3a). Thus, we exclude (3a) from the discussion here.

[3] Guimarães (2000) argues that the first merge is self-merge. However, the notion of self-merge is not clear.

Note that the main stress may fall on the verb rather than on the object, especially in the case of contrastive focus on the verb, which I will discuss below.

Although Kayne's (2009) idea of one-membered sets goes well with our constraint Set Stress, Kayne does not explain why the last element in the first merge is a set. Let us consider the nature of one-membered sets. I argue that the head of a constituent is always a terminal, while its complement can be branching and can be modified by another phrase, as shown in (15).

(15) $[_{VP}$ love $[_{NP}$ music $[_{PP}$ by Bach]]]

Here, the object *music* is modified by a prepositional phrase *by Bach*. In other words, the set of *music* is restricted by the PP. Thus, I argue that the object *music* in (10) is restricted by a null modifier ø as shown in (16).

(16) $[_{VP}$ love $[_{NP}$ music ø]]

This represents *music* and ø making a set (i.e. NP). Thus, we can give support to the idea of one-membered sets by introducing a null phrase modifying the complement of a head at the first merge.[4]

The idea of null complements has an interesting consequence for the analysis of contrastive stress. For example, in (10), the main stress in the VP falls on the object *music* in the unmarked case, but it may fall on the verb *love* in some context, as shown in (17).

(17) (Do you like music?)
I $[_{VP}$ <u>love</u> music]!

Here, the speaker puts focus on the verb because (s)he emphasizes the degree of fondness; the object *music* is old information. The structure of (17) can be represented as in (18).

(18) I $[_{VP}$ $[_{V(S)}$ love (*not like*)] $\text{music}_{(W)}$]!

In (18), the verb is a set consisting of *love* and the unpronounced negative phrase *not like*. Then, Set Stress assigns S to the set $[_{V(S)}$ love (*not like*)] and W to the terminal *music* when they are merged. The main stress of VP falls on *love*, which is the only element with phonetic features in the set $[_{V(S)}$ love (*not like*)].

However, one might argue that *music* can take a null complement ø in this case, as

[4] Zwart (2004, 2011) and Fortuny (2008) also propose that ø is introduced into working space as the first operation. However, they do not discuss the nature of ø.

shown in (16).

(19) We [$_{VP}$ [$_{V}$ love (*not like*)] [$_{N}$ music ø]]!

In (19), both [$_{V}$ love (*not like*)] and [$_{N}$ music ø] are sets, to which Set Stress assigns S. Then, this structure violates OCP Stress. The same problem arises in the case of contrastive stress on the verb in a VP with a branching object, such as (20).

(20) (Do you like music by Bach?)
We [$_{VP}$ [$_{V}$ <u>love</u> (*not like*)] [$_{NP}$ music by Bach]]!

In (20), both the verb [$_{V}$ <u>love</u> (*not like*)] and its object [$_{NP}$ music by Bach] are sets.

This problem can be solved if we assume that the repeated object is old information for the hearer(s), and is in fact a terminal like the pronoun *it* (shown as N in (21)), rather than a set.

(21) We [$_{VP}$ [$_{V(S)}$ love (*not like*)] $N_{(W)}$]!

Then, the verb receives S as a set while its object receives W as a terminal. The VP in (21) observes OCP Stress.

We can extend this idea of contrastive stress to focal stress in general. Rooth (1985) claims that a focus constituent invokes an alternative set. This amounts to analyzing focal stress as the paradigmatic version of contrastive stress as in (22), which can be represented as syntagmatic as shown in (23).

(22) Mary <u>hates</u> chocolate.
not loves
not likes
not dislikes
...

(23) Mary [$_{VP}$ [$_{V}$ hates (neither loves, nor likes, nor dislikes, ...)] chocolate].

Here, the focused verb *hates* makes a set V with alternative verbal expressions *not loves, not likes, not dislikes, ...*, and receives stress assigned by Set Stress.

5. Spell Out and OCP

OCP Stress has another consequence for spell-out of syntactic structure to PF (or Transfer (Chomsky 2013)). Let us consider the case of merging two sets as shown in (24) (=(9b)), where Set Stress assigns S to αP and βP.

(24) * [$\alpha P_{(S)}$ $\beta P_{(S)}$]

As we have argued, this is ruled out by OCP Stress, which requires sisters to have different degrees of stress. However, merge of two sets is widely seen in languages. For example, a branching subject and a branching predicate are merged to make a legitimate structure such as (25).

(25) [$_{TP}$ [$_{DP}$ The girls] [$_{T'}$ T [$_{VP}$ love chocolate]]]

Both DP and T' are sets and are assigned S by Set Stress, violating OCP Stress, as shown in (26).

(26) * [$_{TP}$ [$_{DP(S)}$ The girls] [$_{T'(S)}$ T [$_{VP}$ love chocolate]]]

I argue that the example sentence in (25) can be derived by multiple Spell-Out.[5] If we adopt the VP-internal subject hypothesis, the subject DP *the girls* is merged with the v' before the subject DP is moved to the specifier position of T to derive (25) (cf. Chomsky 1995).

(27) [$_{vP}$ [$_{DP}$ The girls] [$_{v'}$ v [$_{VP}$ love chocolate]]]

If Set Stress applies to (27), it assigns S to both DP and v' as in (28).

(28) * [$_{vP}$ [$_{DP(S)}$ The girls] [$_{v'(S)}$ v [$_{VP}$ love chocolate]]]

This derivation violates OCP Stress. However, as an alternative derivation, it is possible to Spell Out VP to PF just before merging the subject DP *the girls* with v', as shown in (29a).[6] The remaining v in (29b) merges with the subject DP as in (29c).

(29) <u>working space</u> <u>PF</u>

a. [$_{v'}$ $v_{(W)}$ [$_{VP(S)}$ love chocolate]]] → [$_{VP(S)}$ love chocolate]

[5] An alternative to the multiple Spell-Out analysis presented here is to move either DP and T' to the specifier position of a head higher in the structure. See Moro (2000), Barrie (2006, 2011) and Bauke (2014).

[6] Here I follow the idea that the unit to be Spelled Out (or Transferred) is the complement of a phase head (v and C), i.e. VP and TP (Chomsky 2008, 2013). As an alternative, Otto (2011) argues that a phrase head is also Spelled Out together with its complement as long as it does not affect the interpretation. If we assume that v and C do not affect the interpretation at PF, the whole v' (and C') can be Transferred to PF. Then, only the subject remains in the working space and receives S without OCP Stress violation. See also footnote 7.

b. $v_{(W)}$

c. $[_{vP}\ [_{DP(S)}$ The girls] $v_{(W)}]$

Set Stress applies at every merge to assign S to a set without violating OCP Stress, as shown in (29a) and (29c).[7] Thus, we can avoid OCP violation by Transfer in the case of merging two phrases, i.e. two sets. Note that this is one of the two phases (CP and vP) that Chomsky (2008) proposes. In other words, we can derive Transfer from OCP in phonology. We do not need to stipulate that some heads are phase heads. In a derivation where two phrases merge, Set Stress assigns S to both of the phrases. Then the derivation is filtered out by OCP Stress. On the other hand, in a derivation where Transfer sends one of two phrases to PF before the second phrase is merged in the working space, no OCP violation occurs. Thus, Transfer is necessary for a derivation including merge of phrases to converge.

This is also the case with the CP phase. For example, consider the wh-movement of the branching object to the specifier position of C. The structure just before the wh-movement takes place is shown in (30).

(30) $[_{C'}$ will $[_{IP}$ you buy $[_{DP}$ which cake]]]

If the object moves to the specifier position of C, the resulting structure, which has two sets (DP and C') in a sister relationship, violates OCP Stress as shown in (31).

(31) $[_{CP}\ [_{DP(S)}$ which cake] $[_{C'(S)}$ will $[_{IP}$ you buy $[_{DP}$ *which cake*]]]]

Thus, it is necessary to have another derivation: Transfer sends the IP to PF when a copy of the wh-phrase is made at (30).

(32) working space PF

a. $[_{C'}$ will$_{(W)}$ $[_{IP(S)}$ you buy $[_{DP}$ which cake]]] → $[_{IP(S)}$ you buy $[_{DP}$ which cake]]

[7] Merge of two phrases occurs again when the subject DP moves to the specifier position of T as in (i), where T is merged with v moved from its base position in (29b) to give T'.

(i) $[_{TP}\ [_{DP}$ The girls] $[_{T'}$ v T]

It is possible to argue that T' is not different from a terminal T because v is invisible at PF. Then Set Stress assigns W to T' in (i) without violation of OCP Stress. Alternatively, as I argued in footnote 6, Transfer may send the whole v' to PF to leave only T in the working space. Then, T is internally merged with the subject DP to give (ii).

(ii) $[_{TP}\ [_{DP}$ The girls] T]

Set Stress successfully assigns S to a set DP and W to a terminal T, satisfying OCP Stress.

b. $will_{(W)}$

The constituent remaining in the working space is *will*, which the copy of the wh-phrase merges with to make CP. Set Stress assigns S to the branching wh-phrase and W to *will* in the C position, satisfying OCP Stress, as shown in (33).

(33) $[_{CP}\,[_{DP(S)}$ which cake]] $will_{(W)}]$

Thus, we can derive from OCP Stress the stipulation that vP and CP are phases (Chomsky 2008). Chomsky (2013) tries to derive phase from the C-I interface based on the asymmetry of labeling. It is interesting to pursue the parallelism between the C-I interface approach and the P-A interface approach developed here. However, I will leave this matter for my future research.

6. Conclusion

I have discussed the idea that the Obligatory Contour Principle in phonology has some important effects on syntax. I proposed a phonological constraint OCP Stress, which requires syntactic sisters to have different stress labels W and S, and a metrical stress rule Set Stress, which assigns S to a set and W to a terminal. I argued that we can derive the Linear Correspondence Axiom (Kayne 1994) from OCP Stress. I also argued that this OCP-based analysis has interesting consequences for the problems of the first merge and the phase units.

These discussions show that OCP in phonology works as an output condition on syntax. It seems well worth investigating the functions of OCP in the minimalist program of linguistic theory.

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