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Upward Inheritance of Phasehood¹

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1. Introduction

In general, syntactic operations such as IM (Internal Merge) proceed upward as well as cyclically in the computational system of human language (cf. Chomsky (2008: 140), Stroik and Putnam (2013: 96-99)).² However, Chomsky (2008: 143-144) proposed an operation referred to as Feature Inheritance, by which the phi and Tense features of phase heads (i.e. C and v^*) are transmitted downward to the heads of their complements.³ Recently, Chomsky (2015: 10-11) proposed another downward mechanism that enables T to inherit phasehood from C; this mechanism helps explain the contrast between (1) and (2).

(1) * *Who* do you think that *t* read the book?

(2) *Who* do you think *t* read the book?

In this paper, we point out several conceptual and empirical problems with Chomsky's (2015) downward inheritance of phasehood. We also propose two hypotheses: (i) the inheritance applies upward so that C can inherit phasehood from T; and (ii) T is strong enough to become a label once its phasehood is activated.

The organization of this paper is as follows. Section 2 outlines Chomsky's (2015) explanation of *that*-trace effects, as exemplified in (1), and reveals the difficulties associated with it.

Section 3 shows our alternative analysis of *that*-trace effects, which is immune from the problems discussed in Section 2. Based on the new analysis, Section 4 shows how exceptional cases of local subject extraction can be explained. Section 5 concludes the discussion and briefly reviews the remaining issues.

¹ This is a revision of my paper presented at the 7th International Conference on Formal Linguistics (ICFL-7), which was held at Nankai University, Tianjin, China, on December 2-4, 2016. I am grateful to the audience at the conference. Special thanks go to Kaneaki Arimura, Takeshi Furukawa, Diego Krivochen, Koichiro Nakamura, Tom Roeper, and Nicholas Sobin for their comments, help, and suggestions. The usual disclaimer applies. This work was supported by a Grant-in-Aid for Scientific Research (C) (No. 26370570).

² Zeijlstra (2012) argues that Agree also applies upward.

³ To simplify discussion in this paper, we will devote ourselves to the inheritance of phasehood and pay little attention to that of phi and Tense features.

2. Downward Inheritance

Recently, Chomsky (2015) has tried to account for *that*-trace effects by means of notions such as activation, inheritance, and phasehood. As the contrast between (1) and (2) indicates, subject extraction from a complement clause is allowed only when the complementizer *that* is missing.

Chomsky's (2015) analysis of the contrast can be summarized as follows. With regard to (2), when Feature Inheritance occurs, T inherits the phasehood of C along with phi and Tense features. If C is deleted, the phasehood of T is activated, and T becomes a new phase head, as illustrated in (3).⁴

$$(3) [_{CP} \epsilon [_{<phi, phi>} DP_{wh} [_{TP} T^{PH} [_{v^*P} \dots]]]]$$

Since v^*P is a complement of T, it is transferred. The subject DP_{wh} consequently remains in the derivation and is accessible to IM.⁵ In this way, subject extraction is allowed in (2).

On the other hand, if C is not deleted, it remains a phase head.⁶ Therefore, as illustrated in (4), its complement TP will be transferred together with the subject DP_{wh} , which is no longer accessible to IM. This explains why subject extraction is prohibited in (1).

$$(4) [_{CP} C^{PH} [_{<phi, phi>} DP_{wh} [_{TP} T [_{v^*P} \dots]]]]$$

However, there are at least four challenges associated with Chomsky's (2015) analysis. First, if the deletion of C is interpreted literally, it violates the No Tampering Condition (Chomsky (2008: 138)), which prevents the deletion or modification of any element introduced by the syntax during derivation.

Second, phasehood inheritance is assumed to apply downward or counter-cyclically. As Brody (2002: 22-23) argued, counter-cyclic or "look-back" properties of syntactic operations inevitably exploit both representations and

⁴ In what follows, the phase head and the transferred domain are indicated by the superscript " PH " and the half-tone dot meshing, respectively. The deleted C is crossed out.

⁵ This is a typical instance of PIC (Phase-Impenetrability Condition) effects. The PIC is defined by Chomsky (2000: 108) below in (i).

(i) In phase α with head H, the domain of H is not accessible to operations outside α , only H and its edge are accessible to such operations.

⁶ Chomsky (2015) was not as explicit about the derivation of (1) as that of (2). We tentatively assume that if C is not deleted, its phasehood is not inherited by T and remains on C.

derivations. This ultimately leads to a mixed theory with unwelcome redundancy.⁷ To avoid conceptual undesirability, it is naturally preferable to adopt cyclic operations rather than counter-cyclic ones.

A third problem occurs if we take account of adverb effects epitomized by (5).

(5) *Who* did Leslie say that, for all intents and purposes, *t* was the mayor of the city? (Browning (1996: 250))

Since the complementizer *that* is present in (5), Chomsky's (2015) analysis of (1) should predict that (5) is ungrammatical even though it is grammatical.

Lastly, let us examine the structure (6) derived by the application of subject extraction to (3). Here the status of α is at stake.

(6) $[DP_{wh} \dots [CP \in [_{\alpha} t [TP T^{PH} [v^*P \dots]]]]]$

Based on Chomsky's LA (Labeling Algorithm), the trace or copy of the DP_{wh} "is invisible to LA" (Chomsky (2013: 44)). In addition, Chomsky (2015: 9) claimed that T is intrinsically "too weak to serve as a label" in English. Thus, as pointed out by Abe (2016: 4-5), α cannot be labeled or interpreted at Interfaces, yet (2) is still grammatical.⁸

In order to circumvent this problem, Chomsky (2015: 11) suggested that "IM of *who* to the matrix clause doesn't de-label α ." In our context, α is $\langle \phi, \phi \rangle$ in (6), which leads to the following construction in (7).

(7) $[DP_{wh} \dots [CP \in [\langle \phi, \phi \rangle t [TP T^{PH} [v^*P \dots]]]]]$

Chomsky goes on to assume that once the label (i.e. $\langle \phi, \phi \rangle$ in (3)) is determined, it is temporarily stored in the "memory" until Transfer applies to the phase under consideration. Thus, "[f]or interpretation at CI, labels are computed at the phase level, with cyclic transfer" (Chomsky (2015: 11)).

However, his new concept of "memory" does not play any role in the derivation of (8) for reasons that are unclear to us.

(8) $*[_{\phi} \text{which dog do you wonder } [_{\alpha} t [_{\phi} C_Q \text{John likes } t']]]$ (Chomsky (2015: 8))

Chomsky (2015) argued that the unnaturalness of (8) is due to semantic anomaly

⁷ See also Stroik and Putnam (2013: 79-81) for criticism on the mainstream Minimalist Program in favor of a genuine derivational theory with no redundancy.

⁸ Whether labels are required for the SM (Sensorymotor) or the CI (Conceptual-intentional) interface is another interesting topic of inquiry. According to Chomsky (2015: 6), "LA simply determines a property of X for externalization and CI." Thus, he implies that labels are necessary for both interfaces.

rather than syntactic deviation. Since t is invisible to the LA, α is labeled Q “and is interpreted as a yes-no question, with Aux-raising and rising intonation. But this is gibberish, crashing at CI and solving the problem” (Chomsky (2015: 8)).

With regard to a similar construction in (9), Chomsky (2015: 13) argues that “at phase α , the lower copy of *which book* is invisible for the usual reason, so β is never labeled by $\langle Q, Q \rangle$.”

(9) *which book [_{α} they wonder [_{β} which book Q [he read]]]

Note that β is labeled $\langle Q, Q \rangle$ prior to the application of External Merge of β and *wonder*. Thus, if it is possible to utilize “memory” in the derivation of (9), the label $\langle Q, Q \rangle$ will be stored there for the CI interpretation. The same should hold true for (8). Consequently, in spite of Chomsky (2015: 8), there is no problem with respect to the labels or the selectional property of *wonder* that requires its complement to be $\langle Q, Q \rangle$, yet incorrect interpretations are given to (8) and (9). In other words, in order to distinguish (7) from (8) and (9), it must be assumed that “memory” is available in (7) but not in (8) or (9). Section 4 will address this discrepancy by providing an alternative analysis that does not require “memory.”

3. Upward Inheritance

Assuming that phasehood inheritance is independent of phi and Tense feature inheritance, we propose that phasehood is inherited upward (i.e. from T to C). Then, Chomsky’s (2015) explanation will be recast through the following assumptions and hypotheses.

First, we assume that T is introduced to the derivation along with inactivated phasehood.⁹ Note that we are not arguing that T is a phase head per se, but rather that it is rendered as a phase head if certain structural environments are established. Furthermore, the phasehood of T can be inherited by a functional head above T. Among the categories in the left peripheral domain above T (Rizzi (1997)), we would like to assume that a full-fledged category constitutes a phase, whereas other categories do not. To demonstrate this, we adopt Nakajima’s (2016) analysis and identify two types of categories constituting the left periphery above T: C and Top. Under our analysis, they differ with regard to phasehood inheritance. More

⁹ Chomsky (2000: 106) tried to refute the idea that TP is a phase, although Chomsky (2015) accepted it conditionally.

specifically, we propose that C is qualified as a phasehood inheritor, but Top is not.¹⁰

With regard to the status of CP, Chomsky (2015: 11) argued that CP can be “de-phased by disappearance of C” in the embedded clause. However, we assume that the disappearance of C is irrelevant to the phasehood of CP. We instead argue that the failure in phasehood inheritance from T to C results in the de-phased CP, regardless of whether its head C is overt or not.

We can now account for the typical cases of *that*-trace effects, such as in (1). When C merges with TP, it inherits the phasehood of T. The phasehood is then activated on C, and the TP is transferred together with the subject DP_{wh}; this is depicted in (10) and results in the same representation as (4). The subject DP_{wh} is thus no longer accessible to IM. This explains why subject extraction is precluded in (1).

$$(10) [_{CP} C^{PH} [_{<phi, phi>} DP_{wh} [_{TP} T [_{v^*P} \dots]]]]$$

Since the interrogative *whether* in (11), the prepositional *for* in (12), and the declarative *that* in (1) are assumed to occupy C (Nakajima (1996, 2016), Rizzi (1990)), the illicit subject extraction indicated in (11) and (12) as well as that in (1) is subsumed under our analysis.

(11) **Who* did you ask whether *t* would hate the soup?

(Sobin (2002: 528, fn. 2))

(12) **Who* would you prefer for *t* to win?

(Rizzi (1990: 45))

By contrast, with regard to sentences like (2), the *that*-less complement clause is identified as TopP (Nakajima (1996, 2016)). Thus, when its head Top is merged with TP, the phasehood of T is not inherited by Top. The phasehood is then activated in situ (i.e. on T). The *v**P is subsequently transferred because it is a complement of T, as illustrated in (13). The subject DP_{wh} remains in the derivation and is accessible to IM. Based on the above, it follows that subject extraction is allowed in (2).¹¹

$$(13) [_{TopP} Top [_{<phi, phi>} DP_{wh} [_{TP} T^{PH} [_{v^*P} \dots]]]]$$

¹⁰ Nakajima (2016: 38-39) also argued that CP is a phase, while TopP is not.

¹¹ According to Nakajima (1996, 2016), the *if*-complement clause is a TopP. Thus, (i) is expected to be as grammatical as (2). We leave this discussion open for future research.

(i) **Who* do you wonder if *t* went to school? (Di Sciullo (2000: 2, fn. 1))

The derivational procedures proposed above comply with the No Tampering Condition and does not employ downward or counter-cyclic operations. Thus, the first and second problems highlighted in Chapter 2 have been neatly evaded.

With respect to the adverb effects exemplified in (5), there are two derivational stages to consider based on the analysis of (2). First, (14) illustrates a stage in which TopP has been constructed. As argued in the discussion of (2), Top does not inherit phasehood, and T preserves it. Therefore, v^*P is transferred, with DP_{wh} left behind in Spec-TP.

(14) $[_{TopP} AdvP [_{Top} [_{<phi, phi>} DP_{wh} [_{TP} T^{PH} [_{v^*P} \dots]]]]]$

In the next stage, as seen in (15), C merges with TopP.

(15) $[_{CP} C [_{TopP} AdvP [_{Top} [_{<phi, phi>} DP_{wh} [_{TP} T^{PH} [_{v^*P} \dots]]]]]$

After the overt complementizer *that* is merged with TopP, it fails to inherit phasehood since Top has no phasehood for upward inheritance.¹² This means that neither C nor Top can serve as a phase head. Therefore, the subject DP_{wh} is still accessible to IM. In this way, adverb effects are accounted for in our analysis.

4. Strengthening by Activation

In this section, we attempt to resolve the fourth problem discussed in Section 2. Instead of employing “memory” to account for the possibility of subject extraction in (2), we propose that the activation of phasehood allows the “weak” T to be “strong” enough to become a label. Before discussing this proposal, let us first re-examine the derivational steps for (2), which is reproduced below as (16). The structure of its embedded clause is depicted in (17).

(16) *Who* do you think *t* read the book? (Chomsky (2015: 10))

(17) $[_{TopP} Top [_{<phi, phi>} DP_{wh} [_{TP} T^{PH} [_{v^*P} \dots]]]]$ (Cf. (13))

As discussed in Section 3, the subject DP_{wh} is outside the Transfer domain and is accessible to IM. Subsequently, (18) is derived. However, it is unclear what the label X is, as it cannot be $<phi, phi>$; this is because the trace or copy of the DP_{wh} does not participate in labeling.

(18) $[DP_{wh} \dots [_{TopP} Top [X t [_{TP} T^{PH} [_{v^*P} \dots]]]]]$

However, in our new proposal, once the phasehood of T is activated, T is able to

¹² We are implicitly assuming that the inheritance relation between the two heads must be local. Since the presence of another head between them mutilates the relation, C cannot inherit phasehood from T via Top.

serve as a label. Thus, X is labeled as TP, as shown in (19).¹³

(19) [DP_{wh} ... [TopP Top [TP t [TP T^{PH} [v*P ...]]]]]]

Although the fourth problem is overcome in this manner, it is still necessary to examine (1), replicated below as (20), once again to make sure that the correct prediction is obtainable.

(20) **Who* do you think that *t* read the book? (Chomsky (2015: 10))

Firstly, the embedded C *that* has the [-Q] feature, which neither attracts *who* nor allows it to merge with CP. Thus, *who* must stay in the embedded subject position. As argued in Section 3, *that* is a phase head, so *who* will be transferred, as shown in (21). This explains why subject extraction from the embedded clause is not possible.

(21) [CP that^{PH} [_{<phi, phi>} [DP *who*] [TP read the book]]]

However, given the simplest Merge (i.e. a completely free application of Merge (Chomsky (2015))), *who* can be internally merged with CP before applying Transfer. This results in the derivation in (22).

(22) [Y [DP *who*] [CP that^{PH} [_X t [TP read the book]]]]

Regarding the category Y, its label is undetermined because of the inverse value of [Q]: *who* has [+Q], while *that* has [-Q]. However, this does not cause any problem. This is because *who* can move out of Y at a later derivational stage, thus causing Y to become a CP with the [-Q] head. Consequently, the selectional property of *think*, which requires the complement head to be [-Q], will be fulfilled.

The genuine problem with (22) is the undermined label of X. Our proposal qualifies *that* to be a phase head, but T remains too “weak” to serve as a label. As a result, X will be transferred without being unlabeled and will not be interpreted at Interfaces. Therefore, no legitimate derivation is available to (1) for convergence.

Let us turn our attention to (8) and (9) again. Both our analysis and Chomsky’s (2015: 8) do not rely on “memory.” We thus agree that extracting the WH interrogative out of the complement clause of *wonder* gives rise to semantic anomaly.

However, our analysis deviates from the standard structural analysis of embedded clauses in (8) and (9). For example, let us examine (23), whose

¹³ The LA applies in a dynamic manner, so that the label <phi, phi> at a certain derivation stage can change into the one TP at a later stage.

embedded clause is generally analyzed as (24).

(23) I wonder which dog John likes.

(24) [_{CP} *which dog* C_[+Q] [_{TP} John T [_{likes} *t*]]]

A slightly more complicated situation needs to be reconciled here. The selectional property of *wonder* requires its complement clause to be <Q, Q>, which implies the presence of both the WH-phrase in Spec-CP and the [+Q] feature in the phonetically null C. However, in the discussion of (2), we assumed that the absence of an overt C signals that Top is present. To accommodate this situation, we suggest that (24) should be rephrased as (25), in which there are two projections above T: CP and TopP.

(25) [_{<Q, Q>} *which dog* C_[+Q] [_{TopP} Top [_{TP} John T^{PH} [_{likes} *t*]]]]

Not only are *who* and C_[+Q] successful in checking [+Q] in (25), but the selectional property of *wonder* will be satisfied by merging *wonder* and <Q, Q> at a later derivational stage. More importantly, the most embedded clause is labeled TP in (25). This is because the trace or copy of *which dog* cannot label categories, but the activated phase head T can serve as a label. Accordingly, (25) elicits the grammatical construction shown in (23).

The structural analysis suggested above can explicate the possibility of local subject extraction in (26), whose embedded clause is analyzed as (27).¹⁴

(26) I wonder who told you that.

(27) [_{<Q, Q>} *who* C_[+Q] [_{TopP} Top [_{TP} *t* T^{PH} [_{told you that}]]]]

The embedded subject *who* is outside the Transfer domain, so it can undergo IM. Although the trace or copy of *who* cannot label categories, the activated phase head T can label the most embedded TP clause. Again, “memory” is unnecessary here for convergence.

5. Concluding Remarks

In order to circumvent the four problems raised by Chomsky’s (2015) analysis, we have argued for an alternative ameliorated approach. However, a more detailed examination is required for further clarification. For example, we concentrated on English data, but an analysis of other languages may offer interesting observations.

¹⁴ This in turn suggests that Chomsky’s (1986) Vacuous Movement Hypothesis does not hold.

As pointed out to us by Diego Krivochen (personal communication), Spanish counterparts to (1) and (2) exhibit the opposite grammatical pattern. Rizzi (1990: 53-59) also observes a variety of complementizers that allow subject extraction across different languages. We would like to confine ourselves to the speculation that these facts could be identified as parametric variations, which are ascribed to the properties of certain sets of functional categories.¹⁵

We also need to examine the implications of our proposed analysis. For example, our new structural analysis of the embedded clauses in (5) and (23) leads to an unexpected but interesting prediction, which is that WH islands are not absolute barriers against IM. More specifically, (5) and the structure of its embedded clause (i.e. (15)) are repeated below as (28) and (29), respectively.

(28) *Who* did Leslie say that, for all intents and purposes, *t* was the mayor of the city? (= (5))

(29) [_{CP} C [_{TopP} AdvP [_{Top} [_{<phi, phi>} DP_{wh} [_{TP} T^{PH} [_{v*P} ...]]]]]] (= (15))

In Section 3, we have argued that the embedded subject DP_{wh} is outside the Transfer domain, and hence it can skip over non-phasal CP and TopP in (15). This implies that the movement of a WH interrogative out of the embedded clause is permissible (in principle) if the WH interrogative sidesteps Transfer and that the left periphery of the clause is composed of non-phasal categories. Since the left periphery of the embedded clause in (23), which constitutes a WH island, comprises two non-phasal categories (i.e. <Q, Q> and TopP in (25)), the movement of a WH interrogative from the embedded clause should be allowed as far as it is located in an edge (i.e. non-Transfer) position of the phasal TP.

It is true that this upshot goes against the traditional analysis regarding WH islands, which have been assumed to impede IM (cf. Chomsky (1986)). However, it is in line with Boeckx's (2012: Chapter 2) claim that weak islands (including WH islands) intrinsically are not syntactic obstacles to IM. We also leave this implication to future research.

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¹⁵ Chomsky's (2015: 10-11, fn. 10) speculation is also worth consideration.

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