

# Morphological Phases

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## 1. Purpose

The phase-based approach to derivations (Chomsky 2000, 2001) allows for a deeper understanding of syntactic (Adger 2003, Holmberg 2001) as well as semantic (Chierchia 2001, Nissenbaum 2000) phenomena. We bring evidence that it also contributes to our understanding of morphological phenomena, in particular local asymmetric selection and opacity.

Local asymmetric selection is typical of derivation, viz., a derivational affix selects on the basis of the relational properties of its complement, as evidenced in Di Sciullo (1996), and it can be used to identify the size of a morphological phase. Opacity is typical of morphological expressions as demonstrated in Di Sciullo and Williams (1987), and it can be viewed as an instance of impenetrability of the morphological phase. We show that morphological phases share basic properties with syntactic phases. Notwithstanding their similarities, we demonstrate that morphological and syntactic phases are not coextensive. More specifically, we show that i) a morpho-functional affix identifies a morphological phase, and that ii) the Phase Impenetrability Condition (Chomsky 2001) applies restrictively in a morphological phase.

Firstly, we show that morphological phases are subject to asymmetric selection. Secondly, we discuss the boundedness effects observed therein, and offer an explanation for the restrictions on AGREE observed therein. We conclude on the role of morphological phases for the reduction of derivational complexity.

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## 2. Phases

The notion of cyclic domain has been recently discussed in terms of Chomsky's (2000b, 2001) notion of phase, Uriagereka's (1999, 2003) notion of Multiple Spell-Out, and Collins's (2001) notion of phase as a saturated constituent. See Adger (2003) and Holmberg (2000) for phonology, and Chierchia (2001), Nissenbaum (2000) for semantics. A phase has the following properties:

- (1) **Diagnostics for the phase** (Chomsky 2001, Legate 2003, Adger 2003, Matushansky 2003, Svenonius 2003)
- a. F-XP configuration
  - b. Subject to Impenetrability
  - c. Independence at the interfaces

According to Chomsky (2000b, 2001), a phase is a propositional category (vP, CP). v\*P is a strong phase and thus opaque to extraction at the CP level. The only position from which extraction can take place is from the Head and the 'edge' (the specifier, and the adjoined positions) of the vP. Chomsky (2000) provides evidence that syntactic phases are propositional on the basis of examples such as (2a,b) in which the lower propositional domain constitutes a domain of cyclic interpretation and spell-out.

- (2) a. [ John [ t thinks [ Tom will [ t win the prize]]]]  
 b. [which article is there some hope [ $\alpha$  that John will read  $t_{wh}$ ]]

It has been shown that other categories than propositions are syntactic phases, see Adger (2003) for DPs and Legate (2003) for VP. The syntactic properties of phases have been shown to be related to semantic properties, see McGinnis (2001) and Pylkkänen (2002) for the distribution and semantic properties of high and low applicatives.

We assume that phases are not limited to propositions, and that their syntactic properties are related to semantic properties. We take morphological phases to be units of computation that start with a morphological numeration and end with spell-out. A morphological phase is thus a domain for cyclic interpretation and spell-out. It is a sub-section of a morphological derivation.

A morphological phase like a syntactic phase exhibits independence at interfaces (it can be sent to spell-out and to LF). However, morphological and syntactic phases are not subject to the same interface operations and interpretations. For example, at the PF interface, a syntactic phase is

assigned phrasal stress by the Nuclear Stress Rule (Cinque 1993, Zubizarreta 1998, Arregi 2003), while a morphological phase is assigned stress by word-internal stress rules, including the Compound Stress Rule (Cinque 1993, Arregi 2003). At the LF interface, syntactic constituents which are interpretable at LF translate as saturated functions with bound variables, and the uninterpretable ones are either unsaturated or contain unbound variables; morphological constituents, however, are interpreted as unsaturated functions. Morphological objects are opaque with respect to the bare output conditions applying at the sentence level. Notwithstanding their differences, the similarities between syntactic and morphological phases is expected in a parallel model in which generic operations, including TRANSFER, must apply as early as possible, taking Pesetsky's (1989) Earliness Principle to contribute to the optimality of the language design.

We show that a morphological phase satisfies the phasehood diagnostics in a restricted way, focussing on the first two properties of the phase, viz., F-XP and Impenetrability. A morphological phase includes a head selecting a complement projection (see also Harley and Noyer 2000, Embick and Noyer 2001, Marantz 2003 for related views). However, the selection relation that holds between an affix and its complement is more restricted than the one that holds between a syntactic head and its complement. Moreover, we show that a morphological phase constitutes a more restricted domain with respect to agreement. We start by defining the canonical form of a morphological phase.

### **2.1 The canonical form of a morphological phase: the morphological unit**

We propose that the canonical form of a morphological phase is (3), where  $x$  and  $y$  are heads, and  $\alpha$ ,  $\beta$ ,  $\delta$  are dependent positions, the locus of morpho-functional features. Morphological phases are thus bipartite configurations, they are formed of two layers of asymmetric (sister-contain) relations.<sup>1</sup> The head of the phase  $x$  is an affix and it takes the  $y$  projection

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1. Asymmetry is part of the definition of the relations derived by the grammar, such as the precede, dominate, asymmetric c-command (Chomsky 1981) and sister-contain relations (Chomsky 2000a).

In set theory, asymmetry is a property of a relation. A relation is a set of ordered pairs. Asymmetry is the property of a relation such that there is no pair in which the same coordinates are in the inverse order. Thus, for example, in the set  $A = \{ a, b, c \}$ , the following relation  $R$  is asymmetric:  $R1 = \{ \langle a, b \rangle, \langle b, c \rangle, \langle a, c \rangle \}$ . A symmetric relation includes pairs in which the same coordinates

as its complement. Linking relations hold within a morphological phase and from a position in a given phase to another position in the next phase up.

$$(3) \ [{}_x \ \alpha \ x \ [{}_y \ \beta \ [{}_y \ y \ \delta \ ]]]$$

A morphological phase is derived by the operations of the grammar and is subject to strict locality conditions. We will assume Asymmetry Theory (Di Sciullo 2003), a model of grammar where asymmetry is central, given (4).<sup>2</sup>

- (4) *The Asymmetry Hypothesis*: Asymmetry is a core relation of the language faculty.

In Asymmetry Theory, the derivation of linguistic expressions proceeds in parallel dimensions of the computational space, morphological objects, hereafter M-objects, are derived in the morphological dimension, and N-objects are derived in narrow syntax. M-objects are not derived in N-syntax, which is the ‘computation of LF’ (Chomsky 2000). In M-syntax, structures are merged and the elements therein are linked in order to derive complex asymmetric feature structures on the basis of more elementary ones. N-structure is built in order to check/delete uninterpretable features.

A morphological phase is a unit for morphological computation (M, ADV, D, Q, A, v, n; V, N). It is derived by the operation SHIFT, that merges two elementary trees  $x$  and  $y$ , by substituting the tree  $y$  to the complement of the tree  $x$ . The derivation in (5) illustrates the application of this operation. Furthermore, parts of morphological phases are related by the operation LINK, whether phase-internally (6a) or across phases (6b). Both SHIFT and LINK apply in the derivation of morphological objects and syntactic objects in a relativized way. Linearization occurs in the PF dimension of the grammar and is performed by the operation FLIP, which derives a mirror image of a minimal tree. See Di Sciullo (2003) for the definitions of the primitives and the operations of this theory.

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occur in the inverse order. So for example, given the set  $A$ , the following relation  $R_2$  is symmetric:  $R_2 = \{ \langle a, b \rangle, \langle b, c \rangle, \langle b, a \rangle \}$ . Finally, an antisymmetric relation is an asymmetric relation which may include a pair in which the first and the second coordinates are the same. Thus, given the set  $A$ , the relation  $R_3$  is antisymmetric:  $R_3 = \{ \langle a, b \rangle, \langle b, c \rangle, \langle a, a \rangle \}$ .

2. By asymmetric relations we mean configurational asymmetries, and in particular the sister-contains relation, in the sense of Chomsky (2000). In a tree  $t$ , a node  $\alpha$  sister-contains a node  $\beta$ , iff  $\beta$  is included in the sister-contains domain of  $\alpha$ .

- (5) a. [x ... x ...]
- b. [y ... y ...]
- c. [x ... x ... [y... y ... ]]

- (6) a. [x α x [y β [y y δ ]]]
- |\_\_\_\_\_ |
- |\_\_\_\_\_ |

- b. [w ε w [z φ z [x α x [y β [y y δ ]]]]]
- |\_\_\_\_\_ |
- |\_\_\_\_\_ |

The elements of a morphological numeration are dependent morphemes including affixes and roots with their interpretable and uninterpretable features attached. Thus, functional words such as wh-words, e.g. *who*, *what*, *where*, etc., and determiners, e.g. *the*, *this*, *that*, etc., are M-objects, they have the canonical form of a morphological phase. They include an operator (Op) in the highest specifier position, a variable (x) in the highest head position, the restrictor (R) projection is the complement of the variable, thus we have: [x Op x [y β [y R δ ]]]. Empirical evidence for this bipartite structure comes from the fact that generally wh-words and determiners are formed of two morphemes cross-linguistically. Furthermore, the fact that clitic *wh-* and *th-* are observed in languages such as French, as in *Qu'a-t-il fait?* 'What did he do?', brings additional empirical support to our analysis which also covers determiners, as well as inflectional and derivational structures, as discussed in Di Sciullo (2003).

- (7) a. [x wh-[α [y β [y -at δ ]]]]
- b. [x th- [α [y β [y -at δ ]]]]

- (8) a. [x α [-s [y β [y cat δ ]]]]
- b. [x α [-ed [y β [y like δ ]]]]

- (9) a. [x re-[ x [y β [y load δ ]]]]
- b. [x en [ x [y β [y chain δ ]]]]

- (10) a. [x α [ ness- [y β [y happy δ ]]]]
- b. [x α [ able [y β [y write δ ]]]]
- c. [x α [ en- [y β [y white δ ]]]]

Given the Universal Base Hypothesis (Kayne 1994), according to which the specifier precedes the head, and the head precedes the complement universally, an affix precedes the root it selects before PF linearization, the affix being a head and the root being its complement. Both the affix and the root have an internal structure. An affixal head projects a specifier and a complement position, which may either be the locus of an argument feature [+a] or a non-argument feature [-a], see (10). Other affixes, see (9), sit in the specifier of projections headed by functional features, such as the Aspect terminus [+t] or the non-terminus [-t] features, as defined in Di Sciullo (1997). Yet, other affixes are associated with operator features. This is the case for inflectional features, such as the  $\phi$  features of verbs and nouns, as in (8), as well as other morpho-functional features, such as the [+Q] and [-Q] features of quantifier-like affixes, such as the *wh*- affix and the *th*- affix in *wh*-words and determiners, as in (7).

## 2.2 Asymmetric selection

Facts from different languages show that asymmetric selection holds from a derivational affix to a given position in its complement domain. It has been shown in Di Sciullo (1996) that the severe and apparently idiosyncratic restrictions on the combination of affixes and roots follow from the fact that an affix imposes restrictions on the feature structure of a root. This can be expressed in a unified way in terms of asymmetric agreement of [a], [t], and [Q] features, as discussed in Di Sciullo (2003).

For example, the fact that the nominal *-ee* affix is less productive than the nominal *-er* affix is a consequence of the fact that *-ee* imposes stricter restriction on the [+a] positions of a root. Both affixes project a [-a] specifier; however, they differ with respect to the asymmetric argument structure properties of the roots with which they can merge. Both affixes require that the root project a [+a] specifier, the nominal affix *-ee* requires the complement of the root to be [+a]; this is not the case for *-er*, consequently, both affixes may not merge with unaccusatives (e.g. *\*arriver*, *\*arrive*), only *-er* may merge with unergatives (e.g. *dreamer*, *\*dreamee*); both may merge with transitives (e.g. *adviser*, *advisee*).

Asymmetric agreement also covers the cases where the affix may affect the aspect features of a verbal projection. Thus, while the iterative affix *re-* applies to a projection denoting a bounded [+t] event, the prepositional affix *en-* applies to verbal projections denoting activities, that is, unbounded [-t] events, and changes predicates denoting activities into predicates denoting accomplishments. Likewise, an inflectional affix imposes asymmetric selection on the feature structure of its complement. For example, the plural

affix *-s* asymmetrically selects a nominal complement which is [+count]; the past tense morpheme *-ed* asymmetrically selects a verbal projection which is not defective. The structures in (11)-(13) illustrate the three cases of asymmetric selection. The asymmetric relation between an affixal head and the feature structure of its root complement is illustrated in (11) with the deverbal noun *dreamer* vs. #*departer*, in (12) with the prefixed verbs *encode* vs. #*enknow*, and in (13) with the plural noun *cats* vs. #*cated*.

- (11) a.  $[_N \text{ [-a] -er } [_{+a} \text{ dream } \delta ]]$   
           |\_\_\_\_\_ |  
       b. # $[_N \text{ [-a] -er } [_{-a} \text{ depart } [+a ]]]$   
           |\_\_\_\_\_ X \_\_\_\_\_|

- (12) a.  $[_v \text{ en- } F_I \text{ } [_{\beta} \text{ code } \delta ]]$   
           |\_\_\_\_\_ |  
           |\_\_\_\_\_ |  
           |\_\_\_\_\_ |  
       b. # $[_v \text{ en- } F_I \text{ } [_{\beta} \text{ know } \delta ]]$   
           |\_\_\_\_\_ |  
           |\_\_\_\_\_ |  
           |\_\_\_\_\_ X \_\_\_\_\_|

- (13) a.  $[_N \text{ } \alpha \text{ -s } [_{\beta} \text{ cat } \delta ]]$   
           |\_\_\_\_\_ |  
           |\_\_\_\_\_ |  
           |\_\_\_\_\_ |  
       b. # $[_N \text{ } \alpha \text{ -ed } [_{\beta} \text{ cat } \delta ]]$   
           |\_\_\_\_\_ |  
           |\_\_\_\_\_ |  
           |\_\_\_\_\_ X \_\_\_\_\_|

The asymmetric selection accounts for the fact that the composition of an affix and a root is more restricted than the composition of a syntactic head with its complement. Syntactic selection is a symmetric relation holding between a syntactic head and its XP sister. A syntactic head selects an XP category irrespective of its internal feature structure; this is not the case for a morphological head. If the morphological unit is the morphological phase, as defined in (3) above, local configurational selection is expected as the search space of a morphological head is the configuration of its local complement.

Thus, a morphological phase shares properties with a syntactic phase. Like a syntactic phase, it includes a functional head selecting a complement projection. Thus, as the functional small *v* selects a complement VP projection, a morpho-functional affix is a morphological head selecting a root projection. However, asymmetric selection (sister-contain relation)

holds in the derivation of morphological phases, while symmetric selection (sister of relation) holds in the derivation of syntactic phases, as a syntactic Head selects its complement XP. Moreover, a morphological phase does not have the internal articulation of CP, it is not a vericonditional expression in a domain of interpretation, and it does not have an associated Force. This core difference between the two sorts of phases can be observed in considering the properties of Japanese affixal operators and particles in questions and indefinites.

- (14) a. *John-wa nani-o tabe-masi-ta ka?*  
 John –Top what-Acc eat-Past Q-part  
 ‘What did John eat?’  
 b. *Dare-mo ga nani-ka o tabe-te-iru*  
 Everyone Nom something Acc eating  
 ‘Everyone is eating something’.

Cases such as (14) have been discussed, among other works, in Nishigauchi (1990). He observed that in Japanese, elements which function as wh-phases can also act as universal and existential quantifiers. Cheng (1991) also develops the idea that wh-words, in addition to their interrogative reading, also function as existential or universal quantifiers. (See also Kiss (1991), Dornish (1998) and Gil (2001) for the properties of wh-expressions and indefinites). The indefinite *nani* and the Q-particle *ka* have a quantificational feature when they are part of a proposition, a CP phase. They do not have a Q-feature (with a semantically related choice function operator) when they are adjacent and part of the derivation of an M-object, as morphological phases are not propositional units. The difference in the legibility of the Q-feature cannot follow from a syntactic derivation; as the Q-feature is interpretable, it could not be checked under AGREE. However, if they are part of the derivation of a morphological phase, they can preserve their indefinite feature as being the head of the construct. These facts above provide evidence of the presence of the two sorts of phases in the derivation of linguistic expressions.

### 2.3 Summary

A morphological phase is a configuration of the type F-XP, where F is the head of the phase and XP is its complement. Contrary to a syntactic phase, a morphological phase is not propositional. Moreover, asymmetric selection holds between the head of the phase and elements in its complement domain, while symmetric selection holds between the head of a

syntactic phase and its complement. Morphological and Syntactic phases are not coextensive; they are subsections of parallel derivations.

### 3. Local domains for cyclic interpretation and spell-out

#### 3.1 The Phase Impenetrability Condition

The Phase Impenetrability Condition applies in the derivation of M-objects. In a morphological phase, the domain of H is not accessible to operations outside HP; only H and its edge are.

$$(15) [_{ZP} Z \dots [_{HP} \alpha [H [ YP ]]]$$

The complement YP is immune to agreement with something in the next phase up. Once a morphological phase is derived, only the edge of the phase is accessible to further operations. The edge of a morphological phase is immune to agreement with something in the next phase up.

$$(16) [_{Ph3} \varepsilon w [_{Ph2} \varphi z [_{Ph1} \alpha y [ \beta x \delta ]]]]$$

$\begin{array}{c} \text{--- X ---} \\ \text{--- X ---} \end{array}$

Evidence that morphological phases are local domains of cyclic interpretation and spell-out comes from the relation between argument features [+a] and non-argument features [-a], that are associated with items that are part of the numeration. Assuming that [+a] features are interpretable, while [-a] features are not, and must be eliminated in the derivation of morphological objects, the facts in (17) are parallel to those noted by Chomsky (2000), in (1) above. While the examples in (1) show that syntactic phases are propositional (CP, vP), the examples in (17) show that morphological phases are predicative (A, V, N).

- (17) a. formalizer  
 $[N [-a] -er [V [+a] -e [V [-a] -i- [A [-a] -al [ [-a] form [+a] ]]]]$
- $\begin{array}{c} \text{---} \\ \text{---} \end{array}$
- b. formalize  
 $[V [+a] -e [V [-a] -i- [A [-a] -al [ [-a] form [+a] ]]]]$
- $\begin{array}{c} \text{---} \\ \text{---} \end{array}$
- \*  $\text{---}$

The lower phase (Ph1) in (17a) is adjectival (A), it is headed by an adjectival affix that selects a nominal (N) complement. Ph1 is independent from the upper verbal (V) phase. This can be seen by the fact that the linking between the [+a] and the [-a] features does not extend to the upper nominal phase, while only the edge of Ph1 is accessible to operations outside Ph1. In (17b), the lower phases Ph1 and Ph2 are independent from the upper phase, the difference with (17a) being that linking does not obtain in the upper phase. Evidence supporting the boundedness effect of morphological phases can also be seen with inflected denominal and deadjectival verbs such as *unionizes* and *formalizes*, see (18). Assuming, as in Carstens (2003), that any head with agreement paradigms has uninterpretable  $\varphi$  features attached to it when it leaves the lexicon, Matching of  $\varphi$  features between the inflectional head and the features of the complement of the verbal affix does not obtain. The inflectional head may only enter into a MATCH relation with the verbal head.

- (18) a. union ize s  
 $[\varphi \ \varepsilon \ -s \ [{}_V \ \varphi \ \text{ize} \ [ \alpha \ [ \beta \ \text{union} \ \delta \ ]]]]$   
 \*  $\begin{array}{|l} \hline \phantom{[ \alpha \ [ \beta \ \text{union} \ \delta \ ]]} \\ \hline \end{array}$
- b. form al ize s  
 $[\varphi \ \varepsilon \ -s \ [{}_V \ \varphi \ \text{ize} \ [{}_A \ \alpha \ \text{al} \ [ \beta \ \text{form} \ \delta \ ]]]]$   
 \*  $\begin{array}{|l} \hline \phantom{[ \beta \ \text{form} \ \delta \ ]} \\ \hline \end{array}$

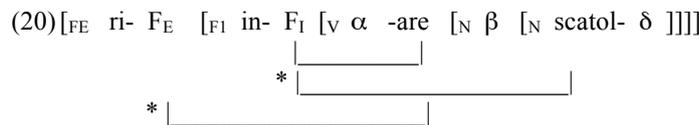
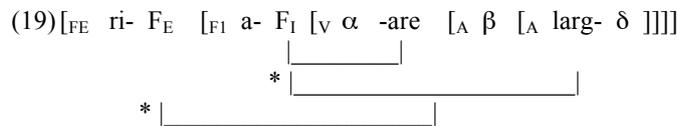
This fact, which can be seen as following from the Phase Impenetrability Condition, provides supplementary evidence that phases are part of the derivation of morphological objects. In the structures in (18), the *-s* morpheme, which is part of Ph2, cannot be related to the noun in Ph1, and thus it cannot be interpreted as a plural morpheme on the noun. The only possible interpretation for the *-s* morpheme is as a tense morpheme on the verb in Ph3. This follows from the fact that once a morphological phase is derived, the complement of the Head of the phase is no longer accessible.

In both cases, (17) and (18), the minimal size of a morphological phase is limited to two layers of asymmetric [Spec [H-Compl]] relations. In effect, in the example in (17) the Ph1 is limited to the domain of the adjectival affix projection and its complement, and it excludes the projection of the verbal affix. In the example in (18) Ph1 is limited to the domain of the verbal affix projection and its complement. The examples in (17) and (18) show that the Spec or the head of a morphological phase are the only transparent positions to the next phase up. The edge of a morphological phase is not however

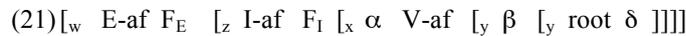
transparent to a syntactic phase. Syntactic atomicity follows if morphological and syntactic phases are derived in parallel.

Further evidence that the Phase Impenetrability Condition applies in the derivation of morphological objects comes from the properties of aspectual affixes in denominal and deadjectival verbs. In languages such as Italian, it is possible to identify two sorts of affixes that contribute to determine the aspectual features of a verbal projection. The first sort of affixes, spatial (directional and locational affixes, e.g. *a-*, *in-*), is more closely related to the verbal projection than the second sort of affixes (iterative and inverse affixes, e.g. *ri-*, *di-*), as discussed in Di Sciullo (1997). There is an asymmetry between external and internal affixes which is evidenced by the strict ordering of the affixes, i.e. the External affix must precede the Internal affix, e.g. from Italian *riallargere* ‘to reenlarge’, *riinscatolare* ‘to reembox’ ‘to put in a box again’ and, in a deadjectival or a denominal verb, the Internal affix must occur between the External affix and the base noun or adjective, e.g. *\*rilargare*, ‘to relarge’, *\*riscatolare* ‘to rebox’.

The asymmetry between External sequential affixes (F<sub>E</sub>) and Internal spatial affixes (F<sub>I</sub>) follows from the locality of the phase-based derivation of morphological objects. This is illustrated in (19) and (20).



In a morphological phase, only the head of the phase is accessible to the next higher phase. Thus, in (21), F<sub>E</sub> has access to F<sub>I</sub> and has access to V-af, neither F<sub>E</sub> nor F<sub>I</sub> has access to the root.



Here again, structural differences are coupled with semantic differences pertaining to whether or not the affix may affect the aspect and the argument structure of the verbal predicate, as well as whether or not it applies to an entire event or to a sub-part of an event denoted by the verbal predicate. This can be seen in cases where the external and the internal

affixes modify a verb, as in the following examples, where  $F_E$  may affect the telicity ([t]) of a verbal predicate, and the argument structure of the projection to which they are adjoined,  $F_I$ , cannot. The examples in (22) illustrate this point.

- (22) a. Ha (ri)dormito (per ore/?in un ora). (Italian)  
 ‘He slept again (for hours/?in an hour).’  
 b. Ha addormentato Gianni (subbito/?per ore).  
 ‘(S/He) made Gianni sleep (right away/?for hours).’

The difference in the appropriateness of a punctual or a durative adverbial modification indicates whether the event denoted by the verbal predicate has or not a natural end point or Terminus [t].

Once  $F_I$  has applied to a V-phase, superior functional  $F_E$  (sequential and temporal) which may affect the telicity or boundedness of the event denoted by the verbal predicate may no longer affect the internal aspectual structure [t] of the V-phase.

- (23) a. Gianni ha corso (per cinque minuti/#in cinque minuti). (Italian)  
 ‘Gianni ran (for five minutes/#in five minutes).’  
 correre ‘to run’ (activity)  
 b. Gianni e accorso (#per cinque minuti/in cinque minuti.)  
 ‘Gianni ran up (#for five minutes/in five minutes).’  
 a-correre ‘to run up’ (accomplishment)  
 c. Gianni e riaccorso (#per cinque minuti?in cinque minuti).  
 ‘Gianni ran up again (#for five minutes/in five minutes).’  
 Ri-a-correre ‘to run up again’ (accomplishment)

As  $F_I$  may change the telicity of the verbal predicate to which it is adjoined, we predict that  $F_I$  may not adjoin to telic predicates, whereas  $F_E$  may do so. This prediction is borne out, e.g. from Italian \**anascere* ‘to be born at’ \**aexplodere* ‘to explode at’, \**avincere* ‘to win at’ vs. *rinascere* ‘to be born again’, *riesplodere* ‘to explode again’, *rivingere* ‘to win again’.

The facts show that a morphological phase is in effect a domain of cyclic interpretation and spell-out. The  $F_I$  domain is distinct from the  $F_E$  domain.

### 3.2 Agreement

Agreement relations occur within a phase and across phases. AGREE is only possible if the probe and the goal are in the same phase or if the goal is

at the edge of the phase immediately contained in the phase which includes the probe.

Morphological phases include active elements, i.e. elements that have uninterpretable features. This is the case of  $\phi$  features, as well as [-a] and [-t] features. The  $\phi$  features on N and V are uninterpretable on the probe, and interpretable on the goal. [-a] features are uninterpretable on the probe, and interpretable on the goal. [-t] features are interpretable on the probe, and uninterpretable on the goal.

Matching is between an uninterpretable feature and an interpretable feature of the same type (the features that enter a matching relation are uninterpretable only on the probe and interpretable on the goal. Both the probe and the goal must be active for AGREE to apply. Agreement leads to checking/deletion of uninterpretable features. AGREE is based on MATCH, i.e. feature identity between the probe and the goal. MATCH and AGREE occur within a phase as well as between phases.

**MATCH and AGREE occur within a morphological phase.**

Accessibility of the edge and the head of the complement of:

- (24)a. N phase  
 $[_N [-a] \text{-er} \ [ [+a] \text{advise} \ [+a] \ ]]$   
|  
|
- b. A phase  
 $[_A [-a] \text{-ive} \ [ [+a] \text{impress} \ [+a] \ ]]$   
|  
|
- c. V phase  
 $[_\phi \ \epsilon \ \text{-s} \ [ [+a] \text{write} \ [+a] \ ]]$   
|  
|

**Accessibility of the non-edge** of the complement of:

- (25)a. N phase  
 $[_N [-a] \text{-ee} \ [ [+a] \text{advise} \ [+a] \ ]]$   
|  
|
- b. A phase  
 $[_N [-a] \text{-able} \ [ [+a] \text{read} \ [+a] \ ]]$   
|  
|
- c. V phase  
 $[_V [-a] \text{-e n} \ [ [+a] \text{red} \ [+a] \ ]]$   
| |  
| |

**MATCH and AGREE occur across morphological phases**

AGREE occurs from the edge of a morphological phase with something in the next phase up. The complement of the head of a phase is immune to agreement with something in the next phase up.

An inflectional affix imposes asymmetric selection on its closest head. This can be seen in (26) as for nominal inflection and in (27) as for verbal inflection. The inflectional affixes *-s* and *-ed* must be linked to their closest heads, which are the nominal affixes *-er* and *-ion* in the first case, and the verbal affixes *-ize*, *-ify* in the second case.

**Accessibility of the edge, and non-accessibility of the non-edge****-N-phase**

(26) a.  $[\varphi \ \varepsilon \ -s \ [N \ \alpha \ er- \ [y \ \beta \ [y \ read \ \delta \ ]]]]$

\_\_\_\_\_ |  
\* |\_\_\_\_\_ |

b.  $[\varphi \ \varepsilon \ -s \ [N \ \alpha \ ion- \ [y \ \beta \ [y \ destruct \ \delta \ ]]]]$

\_\_\_\_\_ |  
\* |\_\_\_\_\_ |

**-V-phase**

(27) a. union ize s

$[\varphi \ \varepsilon \ -s \ [v \ \alpha \ ize \ [ \beta \ union \ \delta \ ]]]]$

\_\_\_\_\_ |  
\* |\_\_\_\_\_ |

b. form al ize s

$[\varphi \ \varepsilon \ -s \ [v \ \alpha \ ize \ [A \ \alpha \ al \ [ \beta \ form \ \delta \ ]]]]$

\_\_\_\_\_ |  
\* |\_\_\_\_\_ |

The facts above show that AGREE and MATCH occur within and across morphological phases.

However, morphological phases are more restricted than syntactic phases with respect to boundedness effects. Evidence comes from the properties of AGREE. AGREE-Check, but not AGREE-Concord, occurs in Morphological phases.

Two types of AGREE are distinguished in Di Sciullo and Isac (2003): Agree-Check and Agree-Concord.

- (28) AGREE-Check : a matching relation under which feature checking takes place  
 AGREE-Concord: a matching relation under which no feature checking takes place

AGREE-Check is similar to Move, but Agree-Concord has different properties. Agree-Check and Move can be ‘collapsed’ as regards both the locality domains that are relevant for their application (phases), and their effect (i.e. they both lead to the checking of uninterpretable features).<sup>3</sup>

AGREE-Concord is subject to different locality restrictions, and it does not lead to the checking of uninterpretable features. AGREE-Concord is observed in a variety of constructions including Multiple ECM (Hiraiwa 2001), Multiple NOM (Hiraiwa 2001), Negative concord (Przepiorkowski and Kupsc 1997), Definite spread (Borer 1999; Hazout 1991, 2000), Multiple Case and  $\phi$  agreement, Multiple Case and clitic doubling (Kalluli 1965), multiple wh-questions, etc.

Thus, Japanese allows optional ECM across a CP boundary

- (29) a. #*John-ga* [<sub>CP</sub> [<sub>TP</sub> *Mary-wo* *me-wo* *waru-i*] *to*] *omoikondei-ta*  
 John-Nom Mary-Acc eyes-Acc bad-Pres C believe  
 ‘John believed Mary’s eye to be bad.’  
 b. \**John-ga* [<sub>CP</sub> [<sub>TP</sub> *Mary-ga* *me-wo* *waru-i*] *to*] *omoikondei-ta*  
 John-Nom Mary-Nom eyes-Acc bad-Pres C believe-past  
 ‘John thinks that Mary has a bad eyesight.’ (Japanese; Hiraiwa 2001)

The  $v$  probe has uninterpretable  $\phi$ -features and the goal DP has uninterpretable structural case. Once the uninterpretable  $\phi$ -features of the  $v$  probe are determined,  $v$  should no longer be able to enter into agreement relations and should be “frozen”. However, the second DP in the embedded CP also has uninterpretable Case features that need to be valued.

Furthermore, infinitives in Japanese cannot check structural nominative case. The nominative case of the embedded subject in (30) below is checked via AGREE with the matrix T. Multiple Nominative DPs can appear within an infinitival embedded clause. The fact that these DPs are lower than the embedded adverbial phrase indicates that there is no overt raising of these DPs out of the embedded clause.

3. For the view that AGREE and MOVE are distinct and independent operations, which are not parasitic upon each other, see Wumbrandt (2002), Guasti and Rizzi (1999), and Chung (1998). For the view that AGREE and MOVE are indeed related, see Chomsky (2000).

- (30) *John-ga* [*yosouijouni* *nihonjin-ga* *eigo-ga* *hido-ku*] *kanji-ta*.  
 John-Nom than-expected the-Japanese-Nom English Nom bad-inf think-past.  
 'It seemed to John that the Japanese are worse at speaking English than he expected.'  
 (Japanese; Hiraiwa 2001)<sup>4</sup>

AGREE-concord does not occur in morphological derivations. It is not observed either with uninterpretable features, such as Case features, or with interpretable features, such as the terminus aspectual feature. Thus, in languages with rich morphological Case, such as Modern Greek and Slavic languages, Agree-Concord takes place in compounds, the internal structure of which excludes morphological Case, as discussed in Di Sciullo (1999).

However, there are compound-like expressions where Case is PF visible on both constituents of the compound.

- (31) a. *anthropos. NOM*      *mihani. NOM*      (MG)  
          man                    machine  
          'a man like a machine' / an entity which is a man and a machine  
       b. *aftokinito. NOM*      *privavlos. NOM*  
          car                        rocket  
          'a car like a rocket' / an entity which is a car and a rocket

There are reasons to believe that these constructs are not compounds. The constructs are neither genitive constructions, as it is the case for the expressions in (32), including the genitive Case, nor compounds, as they do not include a linking vowel.

- (32) a.                              *anthroupu.GEN*      *mihani. ACC* (MG)  
          'a man's                    machine'  
       b. *aftokinitu. GEN*      *piravlos. ACC*  
          'a car's                        rocket'

The constructs in (31) have the syntactic properties of conjuncts:

4. Hiraiwa (2001) analysis, i.e. Multiple AGREE (i) (multiple feature checking) with a single probe as a single simultaneous syntactic operation, increases computational complexity, as features can be [+multiple] or [-multiple]. It runs counter the Earliness Principle (Chomsky 2000, 2001) and PIC. See Di Sciullo and Isac (2003) for discussion.

- (i) MULTIPLE AGREE as a single simultaneous operation

$$\alpha > \beta > \gamma$$

$$\begin{array}{|c|c|} \hline \alpha & \beta & \gamma \\ \hline \end{array}$$

AGREE ( $\alpha, \beta, \gamma$ ), where  $\alpha$  is a probe and both  $\beta$  and  $\gamma$  are matching goals for  $\alpha$

they can be separated by other constituents.

- (33) *O misos [anthropos misos mihani] perpatai aton thromo.*  
 The half.M man.M half machine.F is walking in the street  
 'The half-man half-machine is walking in the street.'

In (33), the adjective *misos* 'half' agrees with the masculine *anthropos* but not with the feminine *mihani*, indicating that they are separate constituents. Furthermore, the parts of the constructs have their own independent stress. These expressions clearly differ from deverbal compounds such as the ones in (34) with no morphological case, a linking vowel, and a unique stress.

- (34) *katsik-o-kleftis* (MG)  
 goat-LV-stealer  
 'goat-stealer'

The fact that AGREE-Concord does not obtain in M-objects can be seen as a consequence of the fact that morphological relations are asymmetric only. Thus antisymmetric relations, that is, relations that are asymmetric but may also include reflexive relations, are not possible morphological relations.

Morphological relations can be defined in terms of ordered pairs of features in Spec positions or in Head positions. In the case of the Asp-phase, repeated here in (35), the relevant ordered pairs are the functional heads  $F_E$  and  $F_I$ , the affixes are spelled out in the Specifier of the functional Heads. The ordered pair in (36) can be identified, the Aspectual features  $F_E$  and  $F_I$  are subject to strict ordering and strict scope. Given (37), ordered pairs such as (38), where two affixes have the same [t] feature, cannot be part of a morphological object. This is illustrated in (39) with Italian, where two instances of the [+t] affix *a-* are merged with the verbs *correre* 'to run' and *dormire* 'to sleep'.

- (35) [ $F_E$  E-Asp  $F_E$  [ $F_I$  I-Asp  $F_I$   $\delta$  ]  
 (36)  $\langle F_E, F_I \rangle$   
 (37) *Strict Asymmetry of Morphology*: Morphological relations are asymmetric only.  
 (38)  $\ast \langle F_I, F_I \rangle$   
 (39) a.  $\ast$ Mario e aaccorso a casa. (Italian)  
 Mario is up-up-ran to home  
 'Mario ran up home.'



requires asymmetric agreement, M-objects being asymmetric but not antisymmetric relations.

#### **4. Morphological phases and derivational complexity**

If there were no distinction between the derivation of morphological and syntactic objects, computational complexity would arise. At the initial point of the derivation, choices between analyzed and unanalyzed elements and between asymmetric and symmetric selections would arise. Moreover, two different locality conditions would be required at the phase evaluation level. Computational complexity does not arise however if the two sorts of objects are derived in parallel.

The computational system limits the size of morphological phases, i.e. the number of projections that may combine to form a minimal morphological phase. Evidence from a variety of languages suggests that the size of a phase is limited to two layers of asymmetric relations, which constitutes the minimal domain where Strict Asymmetry is obtained. The reduction of the size of a morphological phase limits computational complexity, as it reduces the search space in the derivation of morphological objects.

Computational complexity may arise in the derivation of syntactic objects, and phase theory is a way to reduce the search space and eliminate backtracking and look-ahead. Computational complexity may arise in the derivation of morphological objects in situations in which the derivation leads to decision points with respect to possible mergers and attractions of morphological features.

If there were no distinction between the derivation of M-objects and N-objects, computational complexity would arise. Decision points would occur, and the grammar would have to choose between more than one path in the course of the derivation. Thus, at the initial point of the derivation, choices between analyzed and unanalyzed elements, and between asymmetric and symmetric selection would arise. Computational complexity does not arise however if M-objects are derived in M-syntax, where primitives are minimal trees, and where selection is couched in terms of sister-containment. Furthermore, boundedness effects are stricter in morphological phases than in syntactic phases, thus two different locality conditions would be required at the phase evaluation level, and thus another choice point would arise if M-objects were derived in N-syntax. Moreover, a morphological phase like a syntactic phase exhibits independence at interfaces (it can be sent to spell-out and to LF). However, morphological and syntactic phases are not subject to the same interface operations and

interpretations. For example, at the PF interface, a syntactic phase is assigned phrasal stress through the Nuclear Stress Rule, while a morphological phase is assigned stress by word-internal stress rules, including the Compound Stress Rule. At the LF interface, syntactic constituents which are interpretable at LF translate as saturated functions with bound variables and the uninterpretable ones are either unsaturated or contain unbound variables; morphological constituents, however, are interpreted as unsaturated functions.

Given parallel M and N derivations, the asymmetric selection, restricted boundedness effects, and interpretation of M-objects are tractable without look-ahead or backtracking if the morphological derivations proceed phase by phase, and only a part of a phase is accessible to further operations.

Notwithstanding their differences, the parallelism between syntactic and morphological phases is expected in a model in which generic operations, including TRANSFER, must apply as early as possible, taking Pesetsky's (1989) Earliness Principle to contribute to the optimality of the language design.

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