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UNORDERED MERGE AND ITS LINEARIZATION

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Abstract. In the Minimalist Program (Chomsky 1995), Merge is a set operation that imposes no intrinsic ordering among its members. However, syntactic structures are linearized into strings of words at PF. This paper proposes that in order for a Merger set to be linearized, its members must be either hierarchically displaced or morphologically fused into a single terminal node.

The empirical study focuses on the structure of DP and its linearization in various constructions. It is shown that the Definiteness Effect (DE) can be attributed to the failure to linearize the DP in unaccusatives. The systematic lack of the DE in some languages (Arabic, Hebrew, and Romanian), unexpected in previous analyses, is due to the morphological N-to-D raising (fusion), therefore satisfying the linearization condition. Furthermore, cross-linguistic evidence is given to show that D can be attracted out of DP for feature checking, rendering transitive DP arguments well-formed.

1. Introduction

Linguistics is the study of Form and Meaning and their relations. Situated in a broad theory of mind, a linguistic theory aims to describe and explain the properties of the perceptual (Form) and conceptual (Meaning) interfaces, and the rules and representations employed to relate them.

The Minimalist Program (Chomsky 1995) outlines a research framework rooted in this conceptual necessity. It suggests that essential properties of human language are largely determined by the *Bare Output Conditions* at the external interfaces: Phonetic Form (PF) and Logical Form (LF). These conditions impose constraints on the possible structures of human language. The computational system of human language, C_{HL}, is a generative procedure that composes linguistic structures to satisfy interface conditions. Lexical items, essentially sets of feature bundles, are assembled by structure-building operations that apply recursively, in the Humboldtian sense of ''infinite use of finite means.'' The computation branches at the point of *Spell-out*, sending formed syntactic structures to PF and LF for interpretation. It is further conjectured that the C_{HL} exhibits a certain degree of economy, which avoids superfluous operations and extraneous representations in the course of syntactic composition.

To explore the consequence of the Minimalist approach, we must be precise about its theoretical assumptions in order for research problems to be

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formulated concretely. Most directly, one must address the following foundational issues:

(1) a. What is the nature of the external interface conditions? How are such conditions satisfied?
b. How do we quantify and evaluate complexity of the C_{HL} in this economy-based framework?

My chief concerns in this article are the questions in (1a), although issues of complexity (1b) do arise at various places.[1] Specifically I will consider the operation Merge which recursively combines syntactic objects. If taken seriously and literally, Merge is a set operation that imposes no ordering among its constituents (members); nonetheless, surface strings are linearized. This paper investigates the PF linearization procedure that interprets the product of Merge.

The paper is organized as follows. In section 2, I review some background assumptions in the Minimalist approach, along with some revisions. In section 3, I will propose the *Set Linearization Condition* (SLC) that restricts set structures produced by Merge, reminiscent of Kayne's (1995) Linear Correspondence Axiom, with some important differences. The SLC can be viewed as a Bare Output Condition that syntactic computation and morphological processes conspire to satisfy. The core case for the empirical study is the structure of DP in relation to the so-called Definiteness Effect in unaccusative constructions (section 4), and the implication of the linearization condition for feature checking (section 5).

2. Preliminaries

2.1 Features and Operations

Following Chomsky (1995, 1998), I assume the computation starts out with a *numeration* of lexical items. A lexical item is a set of features. Features most directly relevant to syntactic derivation are classified into two groups: those that are interpretable at the interfaces and those that are not. A *convergent* derivation is one in which uninterpretable features from the lexical items in the numeration are eliminated by the computation. Elimination of

[1] Some qualifications are immediate. To even start considering the questions in (1b), one must assume that computational complexity analysis plays a role in the evaluation of linguistic theories, a strong assumption that is perhaps not true for cognition studies in general. Furthermore, it raises the question whether the C_{HL} is a representational or derivational system. I will assume that a derivational view of syntax is correct, partially because such an approach allows us to formulate complexity most naturally and directly. For arguments in favor of the derivational approach, see Abraham et al (1996), Chomsky (1995, 1998), and Epstein et al (1998), among others. For discussion of complexity issues, see Collins (1997), Johnson & Lappin (1997), Yang (1997), and Chomsky (1998). The nature of interface conditions, (1a), is the focus of this article and is relevant to either approach.

uninterpretable features motivates syntactic operations. Such features are in turn divided into two kinds, selectional and checking, which require two kinds of operations for their elimination: *Merge* and *Attract*, together called the Generalized Transformations (GT).

The Generalized Transformations apply to *syntactic objects*, recursively defined:

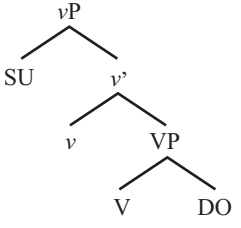
(2) Σ is a syntactic object if
  a. Σ is a lexical item (head) selected from the numeration, or
  b. Σ is formed by applying GT to syntactic objects.

In Chomsky's system, Merge takes two syntactic objects α and β and forms a compound {L, α, β}}, where L is its label, determined by which of α and β projects. In general, Merge satisfies the selectional properties of lexical items (e.g., the thematic grids). Attract eliminates the checking features, such as Case/agreement.[2] An uninterpretable feature *F* must be eliminated by attracting a matching feature *F′*. Failure to eliminate either kind of uninterpretable features leads the derivation to crash.

2.2 Merge as Set Union

Let's see Merge and Attract at work in the formation of a transitive VP structure. Assume the neo-Larsonian VP shell in Chomsky (1995): direct object (DO) is selected by V, subject (SU) is selected by *v*, and V raises to *v* to form a complex V-*v*. In Chomsky's system, the derivation proceeds as follows:

(3) a. Merge V and DO and project V to form VP = {V, {V, DO}}
  b. Merge *v* with VP to form *v′* = {*v*, {*v*, VP}}
  c. Merge SU with *v′* to form *v*P = {*v*, {SU, {*v*, VP}}}
  d.



A problem with the derivation in (3) concerns the ordering of Merge operations in (3). If the light verb *v* selects SU and VP, what forces the application of (3b) prior to that of (3c)? In pre-Minimalist theories, one

[2] It might be possible to subsume the Case requirement with agreement checking (Chomsky 1998), thus returning to some earlier proposals. In this paper, I will make no distinction between these two terms.

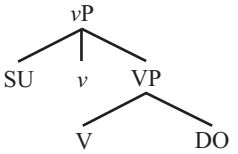
obtains this ordering by stipulating that SU only receives its θ-role in the *specifier* position of the verbal projection, and that the specifier is formed after the head (*v*) has merged with the complement (VP), by virtue of the X-bar theory. This technology is unavailable in the bare phrase system of the Minimalist Program (Chomsky 1995), where X-bar theoretic notions are not conceptual primitives. More generally, a crucial property of Merge that has been stated but commonly overlooked is: Merge is an *unordered set operation* (Chomsky 1995:296, Frampton & Gutmann this issue). That is, when α is merged with β, nothing intrinsically specifies the hierarchical or linear relations between α and β. Stipulating some sort of directionality or ordering would be the least desirable move under the Minimalist guidelines. In cases where α selects multiple elements, as in (3) where *v* selects SU and VP, we have no *a priori* reason to suppose that these elements are anything more than hierarchically and linearly unordered members of a set. Hence, the ordering of Merge operations in (3), where SU is higher than VP thus (3b) precedes (3c), is unmotivated.

If we take seriously the unordered nature of Merge, the following is virtually forced:

(4) If α selects $\beta_1, \beta_2, \ldots, \beta_n$, then the set $\alpha P = \{\alpha, \beta_1, \beta_2, \ldots, \beta_n\}$ is formed[3]

αP is formed by recursively applying Merge to α and β's. The order in which β's are Merged into αP is immaterial since the resulting set is unstructured. Hence, in the example of (3), *v*P is simply {*v*, {SU, *v*, VP}}:

(5)



Unordered Merge in (4) is essentially n-ary branching, going back to earliest formulations of generative grammar (Chomsky 1955/1975),[4] and entails the abandonment of the standard binary-branching view of phrase structure (e.g., Kayne 1984). Note that, firstly, the n-ary set operation in (4) is no less compatible than a binary operation, with the leading idea that syntactic operations deal only with hierarchical relations (dominance), linear ordering (precedence) only being relevant at PF. Secondly, as this

[3] I will continue to use αP to denote the set for which members are selected by α, and informally call this set αP projection of α. For visual convenience, I will also continue to use trees to illustrate grammatical structures, though sibling nodes are simply set members without intrinsic orderings.

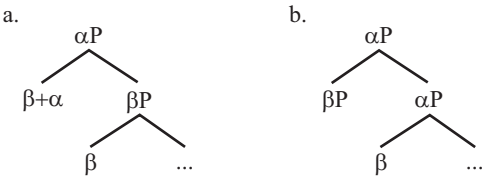
[4] Thanks to Howard Lasnik for pointing this out to me.

paper sets out to show, all but one element of αP must be displaced in order for the set to be interpretable at PF, and both n-ary and binary branching are subject to this constraint. Displaced surface strings in general do not suffice to determine the branching structure before movement takes place. Branching structure does not constitute a meaningful linguistic notion, but only serves as a convenient descriptive device.

Consider now the set αP = {α, β} where a lexical item α selects another lexical item β. If α and β are unordered members of a set, without stipulations for linearity such as the head parameter, the PF component cannot determine their linear ordering. This paper tries to answer this question: How does language make a merged set structure ''interpretable'' at PF? Section 3 proposes a solution to this question, and the rest of the paper explores its consequences.

For Attract, the operation that eliminates checking features, I will basically maintain Chomsky's formulation (1995, 1998). Checking of a feature *F* on a head α happens in two ways, which can be viewed as set operations as well. Suppose the matching feature *F′* is located in a head β; here ''matching'' is identified with locating *F′* (hence, the head β) that is the closest to *F* (α), directly incorporating the Minimal Link Condition (Chomsky & Lasnik 1993; Chomsky 1995). *Head attraction* refers to α attracting a head β to form a head adjunct β+α, a new head which is still a member of αP. If, on the other hand, α has some EPP-like property, then the set βP adjoins externally to the set αP via *set attraction* (cf. Frampton & Gutmann this issue) to form a set adjunct βP+αP — an operation that is some sort of generalized pied-piping (Chomsky 1998). Traditionally, the satisfaction of the EPP requirement is done through an XP substitution into the specifier position of αP. With the elimination of X-bar technologies, these structural relations are not definable. For this reason, and uniformity with head-attraction, we adopt the set-attraction approach to the satisfaction of the EPP requirement. This amounts to treating XP specifiers as adjuncts (cf. Kayne 1995), although nothing in this paper hinges on this technical formulation. In this sense, checking an uninterpretable feature results in the dislocation of the relevant syntactic object (be it an XP or a head), and hence captures the displacement property of human language. In (6a) and (6b), I provide a schematic representation of these two operations, respectively:

(6)



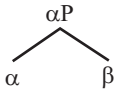
3. Linearization of Syntactic Structures

After the C_{HL} exhausts the numeration, the syntactic object formed by the derivation is sent to the interfaces for interpretation. For PF, the minimum functional requirement would be an algorithm that linearizes the terminal nodes of syntactic objects into a string of words. Some syntactic objects can be trivially linearized, for instance, a single lexical item, a head that is selected from the numeration. Problems arise when the entity to be linearized is a complex syntactic object formed by Generalized Transformations.

Consider first the case of Attract. There are two operations for feature checking: head adjunction (6a) and set (phrasal) adjunction (6b). In either case, the attracted element is attached *externally* to the attractor; hence in the complex syntactic object $\beta+\alpha$ formed by Attract, β is hierarchically ordered with respect to α. I assume that if α and β are hierarchically unambiguously ordered, then they are also linearly ordered. Hence, α and β are linearly ordered in $\beta+\alpha$.[5] This can be seen as a restatement of Kayne's LCA, which states that asymmetric c-command imposes a linear ordering of terminal nodes.

Merge, on the other hand, is problematic. Unlike Attract, no ordering, hierarchical or linear, is intrinsically available for members of a Merger set. Consider the following abstract structure, where two syntactic objects α and β are merged. Without loss of generality, suppose α selects β and α projects:

(7)



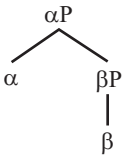
Consider the following cases:

(8) a. both α and β are heads
b. α is a head and β is a projection
c. both α and β are projections

In Kayne's system, (8a) is banned by the LCA; more precisely, it is corollary that a head *x* cannot be the complement of another head *y* for otherwise they would c-command each other. To resolve this, Kayne stipulates that β must be a *trivial* projection, by virtue of the X-bar theory he adopts:

[5] It is of course a logical as well as empirical question whether α precedes or follows β, as noted by Kayne (1995:36–38). In other words, is adjunction leftward or rightward? Conceptually, it is desirable one way or the other, but not both. Thus, the theory of grammar would be on the one hand more restrictive to facilitate language acquisition, and on the other in harmony with the Minimalist spirit to eliminate stipulations such as directionality parameters. See also Chomsky (1995: section 4.8). Throughout this paper, I will assume that adjunction is uniformly leftward, an assumption that is perhaps not too innocent in other contexts.

(9)



Trivial projections are systematically disallowed in the bare phrase theory (Chomsky 1994, 1995) assumed here. We must therefore seek alternatives. To provide a solution, I propose the *Set Linearization Condition* (SLC), given in (10):[6]

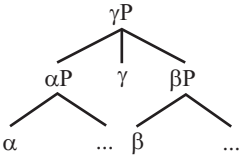
(10) a. force one or both of the heads out of αP, resulting in {α, t_β}, {t_α, β}, or {t_α, t_β}.
b. α attracts β to form {β+α, t_β}, or vice versa.

Recall that we have assumed an adjunct is ordered with respect to an attracting head. The structure in (10b) is therefore linearized.

In light of the SLC, consider (8b). Although α and β are not linearly ordered, α and β's terms are, β being a projection. Since α is higher — α precedes all of β's terms, by hypothesis. Hence, the PF linearization of (8b) recursively reduces to that of β.

(8c) presumably doesn't exist without a head selecting two such sets, if we assume that selectional properties are asymmetrically of heads, but not projections (Chomsky 1995, 1998). It is possible that two (or more) projections αP and βP are both selected by another head γ (which is allowed in the n-ary set Merge system assumed here):

(11)



A concrete example of (11) is conjunction, e.g., [[$_{DP1}$ the boy] and [$_{DP2}$ the girl]], where the conjunctor γ = *and* selects the two DPs (e.g., Munn 1992, among others). In accordance with the SLC (10), we propose that either DP_1 or DP_2 raises out of γP; this is reminiscent of Williams's (1978) proposal, which was based on set union of reduced P-markers in the sense of Lasnik & Kupin (1977). Naturally, both DP_1 and DP_2 must be internally linearized as well in order for (11) to be linearized at PF.

Briefly summarizing, we have examined the PF linearization problem caused by the unorderedness of the operation Merge, and proposed a solution,

[6] This implicitly adopts Chomsky's (1995:337) suggestion that LCA does not apply to traces.

the SLC (10), in the bare phrase structure framework. The rest of the paper explores its consequences.

4. Definiteness Effect and Morphological Linearization

In this section, I present a novel, structural account for the phenomenon known as the Definiteness Effect (DE), which supports the idea of unordered Merge and the Set Linearization Condition proposed in section 3.

4.1 Definiteness Effect Phenomena

It is well-established that in some languages, the existential construction requires an indefinite argument:

(12) a. There is a/*the man in the garden.
b. Il y a un/*l'homme dans le jardin.

Ever since the first systematic effort by Milsark (1977), various proposals have been put forth to explain this restriction. I will not give a comprehensive review, but only point out some obvious problems. It is of course tempting to construct a semantics-based explanation, given the ''existential'' nature of verbs such as *exist* and *be*, but it is less clear why DE should constrain arguments of unaccusative (13a) and passivized verbs (13b, from Lasnik 1995):

(13) a. There arrived three/*the girls.
b. There has been a/*the book put on the table.[7]
c. Il est arrivé trois/*les filles.

Some structurally oriented approaches are less than satisfactory as well. For instance, Belletti (1988) noted a correlation between the DE and the assignment of Case, but did not *explain* what causes this correlation. Even more problematic is the fact that there are languages which do *not* exhibit the Definiteness Effect in precisely the constructions shown in (12) and (13):

(14) Romanian[8]
a. a sosit voiniceste baiatul roscovan.
arrived in force boy-the red-haired
'(there) arrived the red-haired boy forcefully.'
b. a venit ieri vestea (cea) buna.
came yesterday the-news good
'the good news came yesterday.'

[7] An anonymous reviewer pointed out that the pattern *NP on the table* (13b) could also be interpreted as a reduced relative clause or the subject of a predicate, thus having nothing to do with passivized verbs. However, the very same problem remains: why does the reduced relative NP (or the subject of a predicate) have to be indefinite in such constructions?

[8] I thank Marina Meila-Predoviciu for these examples and judgments.

c. a sosit prompt raspunsul asteptat.
arrived promptly answer-the expected
'the expected answer arrived promptly.'

(15) Hebrew[9]

a. Hegia ha-ish ha-gadol derech ha-chalon.
arrived the-man the-big through the-window
'the big man arrived through the window.'

b. Makshive ha-yalda ha-yafa Le-Mozart.
Listens the-girl the-pretty to-Mozart
'the pretty girl listens to Mozart.'

c. nichnas bimhirut ha-sachkan ha-mechubad la mischak.
entered quickly the-player the-renowned in game
'the renowned player quickly entered the game.'

(16) Modern Arabic[10]

a. daxala rrazul-u mina nnafidat-i.
came-in the-man-NOM through the-window-OBL
'the man came in through the window.'

b. jaa?-a faz?at-an l-walad-u l-jamiil-u
came-in suddenly the-boy-NOM the-pretty-NOM
'the pretty boy suddenly came in.'

Even in languages such as English that regularly exhibit DE, we find instances where the "heaviness" of the post-verbal subject seems to relax the DE requirement, considerably improving acceptability:

(17) a. There came the knight that slaughtered the dragon into the castle.
b. There entered the room the man from England.

The improvement in acceptability in (17) has been attributed to the process Heavy NP Shift (HNPS) (Safir 1982), and/or rightward extraposition (Belletti 1988). However, this raises non-trivial questions, among which the most prominent is: why does rightward movement have anything to do with the Definiteness Effect? I will return to this in section 4.2 where a simple solution is proposed.

An important point must be addressed to establish the facts about DE in the examples cited above. There are languages that allow relatively free subject inversion, as shown in the following Italian example:[11]

[9] Despite Borer's (1984) claims that Hebrew exhibits the DE, all the speakers I consulted found the sentences in (15) very natural. I thank Danny Fox, Jeannie Frommer, Yael Gertner, Idan Landau, Tal Malkin, and Gideon Stein for the data reported here.

[10] I thank Diala Ezzeddine, Ayman Ismail, Mohammed Moubatssime, and Majd Sakr for examples and judgments.

[11] Traditional analysis for these patterns assumes rightward adjunction of the subject to TP/VP (Chomsky 1981; Rizzi 1982). This idea might have to be abandoned or reformulated, if we assume adjunction is uniformly leftward. See Kayne (1995:77) for a suggestion, which is built on Belletti (1990).

(18) È arrivato il ragazzo (Belletti 1988:7)
arrived the boy
'the boy arrived.'

It is worth noting that the languages in (14)–(16) have fairly free alternation between VS(O) and SV(O) orders as well; see, for example, Dobrovie-Sorin (1994) for Romanian, Shlonsky (1988) for Hebrew, and Fassi Fehri (1993) for Arabic. One possibility is that in those languages, subject inversion involves rightward extraposition of the subject, adjoining it to VP/TP — this is indeed Belletti's account for such cases in Italian (18). Apart from the technical difficulties posed by rightward movement in the current framework (see fn. 11), it is not clear why this operation (or the HNPS noted earlier) should supress the DE. Another possibility (Alec Marantz, p.c.) is that the subject is actually situated in TP, where definites are possible, and the verb is even higher. Note that in the languages under examination, the verb is quite high in the clausal structure. VP-adjoined adverbs and prepositions can be used to test the position of the subject, as Belletti (1988:9) shows for Italian:

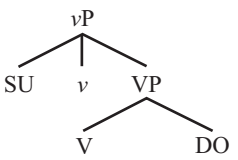
(19) a. All'improvviso è entrano un uomo dalla finestra.
Suddenly entered a man from the window.
b. *All'improvviso è entrano l'uomo dalla finestra.
Suddenly entered the man from the window.

In this minimal pair, the VP-adjoined PP shows that the subjects have not raised out of VP. Again, the Definiteness Effect is observed: the indefinite DP (*un uomo*) is possible, (19a), whereas the definite DP (*l'uomo*) is not (19b). This diagnosis was duplicated above in (14), (15), and (16), where PP and adverbial placement show that the subjects are indeed internal to VP. See Dobrovie-Sorin (1994), Shlonsky (1988), and Fassi Fehri (1993) for additional evidence that the subjects in constructions like (14), (15), and (16) are VP internal. Hence, the lack of the Definiteness Effect in these languages is genuine.

4.2 A Solution via the Linearization of DP

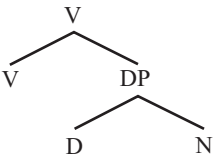
Having established the fact that the Definiteness Effect is manifest in some languages but not others, let's attempt to develop an analysis. Consider the transitive verb phrase in (5), repeated here as (20), with an object DP of the form {D, N}, both elements being simple heads:

(20)



Following Chomsky (1995), I assume that the light verb *v* is responsible for the checking of object Case. If unergatives are hidden accusatives (Hale & Keyser 1993), then the structure in (20) conveniently encodes Burzio's (1986:178) generalization that verbs lacking an external argument do not assign accusative Case. Unaccusatives have a reduced structure, in which *v* and SU are absent:

(21)



The structures in (20) and (21), if unaltered by further operations, can not be interpreted at PF, since D and N are unordered set members and hence not linearizable. According to the SLC, there are two ways of saving this structure:

(22) a. Raise at least one of the heads out of DP.
b. Adjoin one head to the other.

In both cases, movement must be the result of feature checking, the sole motivation for displacement in the Minimalist Program. Instantiating (22a), D could be attracted to *v*, presumably for Case/agreement checking. This option (extensively explored in section 5) is available for the transitive VP in (20), but is not available for the unaccusative VP in (21) where the Case-checking head *v* is absent. Hence the only mechanism to save (21) is (22b), overt N to D raising.[12]

If this much is true, then it is not a coincidence that the languages shown in section 4.1, which lack the Definiteness Effect in unaccusative constructions, are languages that allow overt N to D raising. Grosu (1988), Ritter (1991), and Fassi Fehri (1993), among others, have provided extensive arguments for the overt N-to-D raising operation in these languages. The following are representative examples:

(23) Romanian (Grosu 1988)
a. Printu-l viteaz
prince-*the* brave
b. Viteazu-l print[13]
brave-*the* prince
'the brave prince'

[12] See Chomsky (1995:337), as well as Longobardi (1994), who argues for this process on semantic grounds.

[13] Interestingly, both adjectives (23a) and nouns (23b) can raise to D and thus pick up *-l*. Either one of these two operations suffices to linearize NP = [A, N].

(24) Hebrew (Ritter 1991)
  a. ha-bayit sel ha-mora
     the-house of the-teacher's
  b. ha-yeladim
     the-boys

(25) Arabic (Fassi Fehri 1993: chapter 5)
  a. daxal-tu d-daar-a
     entered-I *the*-house-acc
     'I entered the house.'

The crucial point to notice about these examples is that the head noun has raised to form a phonological unit with the determiner. This operation is available and in fact obligatory in *all* contexts, regardless of whether DP is selected by unaccusative or transitive verbs.[14] If N to D raising is a universal process for all languages but not overtly manifested in some,[15] then it is the language-particular morphological processes that linearizes the DP in (21), hence saving it from crashing at PF.

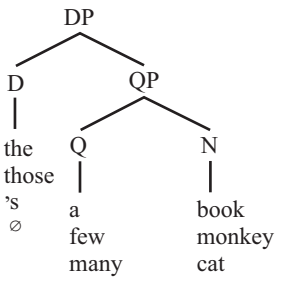
Compare this situation with that in English. In the ungrammatical (12a), *there was [$_{DP}$ the$_{D}$ man$_{N}$] in the garden, D and N can not be linearized, because N-to-D raising is not available in English, D being a separate phonological unit. Hence we obtain the Definiteness Effect in English.

One might wonder what explains the following contrast:

(26) a. There arrived [$_{DP}$ three men] yesterday.
  b. * There arrived [$_{DP}$ the three men] yesterday.

where the unaccusative DP object is more complex, taking the form [$_{DP}$ D [$_{QP}$ Q N]], Q a quantifier:

(27)



[14] See the references cited in (23)–(25) for extensive arguments for the process of N-to-D raising.

[15] In Chomsky (1993, 1995), N to D raising, if indeed a universal process, presumably happens at LF for languages such as English and are not overtly realized. In theories where features can move before Spell-out (Yang 1997; Chomsky 1998; Roberts 1998), the dichotomy between the two types of languages can then be attributed to differences in their morphologies.

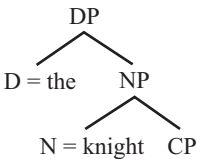
Following Stowell (1989), Longobardi (1994), and others, let's assume that only DPs (but not NPs) can be arguments. Hence, D head is present in DPs even when D is not phonologically realized. (Indeed, if *v* attracts D for Case or agreement, the postulation of an omnipresent D head is also justified.) Suppose QP is *three men* and DP is {D, {$_{QP}$ three men}}. Notice that now the QP is PF uninterpretable. Hence either Q = *three*, or N = *men* (or both) must raise out of QP. N raising out of base position (possible in Romanian, Hebrew, and Arabic, as discussed above) is not possible in English. N to Q raising, another logical possibility in the form of (22b), is also unavailable in English, as evidenced by the adjective-noun ordering.[16] The only possibility we are left with is Q raising out of QP. Let's suppose that Q's landing site is D, presumably as an adjunct.[17] Since English morphology does not allow Q+D to form a single phonological unit, it follows that Q to D raising is possible only if D is phonologically null.[18] This is necessary in order to save {Q, N} from crashing at PF. Q-to-D raising forms {Q, {t_Q, N}} — a PF interpretable structure (26a). When the position of D is not available, as in (26b), Q cannot raise to D, and the derivation crashes.

The PF linearization analysis yields a very simple account for the disappearance of DE in English when the post-verbal subject is "heavy," as shown in (17) and repeated below:

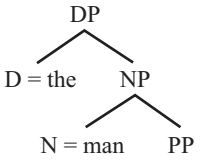
(28) a. There came [$_{DP}$ the knight that slaughtered the dragon] into the castle.
b. There entered the room [$_{DP}$ the man from England].

Under the standard analysis, the DPs in (28) have the following representations:

(29) a.



b.



[16] Cf. Irish, which does have N to Q raising:
i. mo chéad bhróga nua
my first shoe new
'my first new shoe' (Duffield 1995:307)

[17] This is based on Ritter (1991), where it is argued that numerals are based-generated in Num (Q here), and further raise to [Spec,D], as shown in *sney ha-yeladim* 'two the-boys' (24d). See also Reinhart (1997) for an application of this idea to issues of quantification.

[18] There are two possibilities for D to be phonologically null. D could be an empty head, as in *three men* or D could be a trace. Thus, for DPs like *the three men*, as I shall argue in section 5, D overtly raises out of DP, leaving behind a vacancy (because overt head-to-head adjunction is not possible in English), to which Q could raise.

In (29), regardless of the position of the DP relative to VP, D and N are linearly ordered because they are hierarchically ordered. N is merged with CP/PP, hence is ordered with respect to the terms of CP/PP.[19] Assuming CP and PP are PF interpretable themselves, the structures in (29) are interpretable. Therefore the DE disappears. The Heavy NP Shift analysis, as generally assumed, is not an explanation of the facts in (28) but an artifact: ''heavy'' NPs, shifted or not, generally have structures as depicted in (29) that are intrinsically linearizable without morphological operations such as N to D raising.

Summarizing, I have argued that syntactic derivations and language-particular morphological operations conspire to linearize Merger sets (DPs) to render them interpretable at PF, by satisfying the SLC (10). This approach provides a straightforward account for some cross-linguistic variations in the Definiteness Effect. Although certain semantic and pragmatic constraints are likely to play a role in the interpretation and licensing of certain constructions (e.g., donkey sentences), the linearization analysis offers an alternative perspective (perhaps more precisely, a necessary condition on the distribution of the DE). It explains a set of data that is not accounted for in previous analyses, and contributes to a better understanding of the overall phenomenon.

So far, all discussion has been mere advertisement — it raises as many questions as it answers. Most pressingly, I must address why, in languages like English where N-to-D raising is not available in morphology, DPs of the form = [D, N] are possible at all. Continuing to explore our linearization analysis, the option in (22a), D raising out of DP, is virtually forced. We now turn to establish this possibility.

5. Feature Checking and Syntactic Linearization

5.1 Cliticization

There is an assortment of evidence that D raises out of DP arguments of transitive verbs. The most transparent example comes from Galician. Uriagereka (1995) shows that in Galician, the determiner D of DP = [D, NP] adjoins to a Case-checking head via head adjunction, stranding the NP below, as shown in (30).[20]

[19] Consider the contrast between the following pair:

i. * There came the man by train.
ii. There came the man with the red hat.

The PP in (i) modifies the VP (*came*). Thus, the DP (*the man*) can not be linearized. On the other hand, the PP in (ii) unambiguously modifies the head noun, hence the complex DP is linearizable. This provides an account for the deviance of (i) and the grammaticality of (ii).

[20] Notice that only D is attracted, but not quantifiers (Uriagereka 1995):

i. Vimos *un* neno.
Saw.we a child
ii. * Vimos-un neno.
Saw.we -a child
'We saw a child.'

(30) a. Vimo-*lo* neno.
saw.we-*the* child
'We saw the child.'
b. Dixo que nosoutros nunca comimo-*lo* caldo.
said.he that we never ate.we-*the* soup
'He said that we never ate the soup.'
c. Po-*lo* traeres, heiche dar un garrido.
for-*it* bring-you will.I-to.you give a present
'Because of your bringing it, I'll give you a present.'

Further evidence can be found in other Romance languages. If we analyze clitics as affixal D heads which take an empty category as complement (cf. Postal 1966, Abney 1987, Kayne 1995), then cliticization patterns in Romance also show D raising out of DP (to V-*v*). Since V raises quite high in Romance (Emonds 1978, Pollock 1989), carrying the clitic D along the way as an adjunct, resulting in the familiar cliticization patterns in French and Italian:[21, 22]

(31) a. Jean *en* parle fort bien.
John *of-it* speaks strong well
b. Voi lo vedete.
You *it* see

D raising is also clearly manifested in non-Romance languages. In Irish, for example, Guilfoyle (1990) has argued extensively that determiners incorporate into the functional head governing them. When a D object raises to its preposition, a synthetic form results, as shown in (32a)–(32c). Given that Irish verbs raise above the subject (McCloskey 1996), when a D subject raises to the verb, a synthetic form can also result, as in (32d)–(32f):

(32) a. agat / *ag tú
at.2sg / at you
b. uaidh / *ó é
on.3sg / on him
c. orm / *ar mé
on.1sg / on me

[21] Note that in these languages, verb strands non-clitic determiners when it raises:
i. Jean vois la fille.
ii. *Jean la vois fille.
'John sees the girl.'

[22] For English, on the other hand,V is even lower than non-finite verbs in French. If pronouns are D's, as assumed here, we expect cliticization as in Romance, but fairly local ones, due to the lack of V raising higher. This suggestion is made by Chomsky (1995:338) to block "*look up it*" in particle constructions, if *it* is treated as a clitic-like D head.

d. mholamar / *mhol muid
praise.past.1pl / praise.past we
'we praised'
e. cuirim / *cuireann mé
put.pres.1sg / put.pres me
'I put'
f. chosnóidís / *chosnódh siad
defend.cond.3pl / defend.cond they
'they would defend' (Christian Brothers 1994)

The availability of synthetic verb forms in Irish varies paradigmatically according to verb class, person, and tense. However, even when a synthetic verb form is not available, the raising of D to V is evidenced by a phonological reflex in the 3rd person forms — the addition of [ʃ] to the pronoun, as shown in (33) (see Carnie 1995 for arguments and details).

(33) a. luífidh **s**í (cf. í 'she')
rest.pres she
'she rests'
b. ceannaíonn **s**é (cf. é 'he')
buy.pres he
'he buys'
c. bailíonn **s**iad (cf. iad 'they')
gather.pres they
'they gather' (Christian Brothers 1994)

Summarizing, D raising for feature checking can be instantiated as cliticization, stranding its NP complement, which could be lexical for Galician, and null for pronoun clitics in the other languages examined here. Hence, this process linearizes the argument DPs formed by set Merge.

5.2 The Linearization of English DP Object

In contrast to languages with cliticization considered in section 5.1, evidence for D raising in English is indirect. Consider first the structure of a direct object DP = [D NP]. Certain ellipsis tests show that D and its sister NP have distinct properties with respect to deletion. I use *e* to denote the ellided material intended for identity with its antecedent:

(34) a. * Felix sold [*this car*]$_1$ and Fido will buy e_1.
b. * John dated [*her*]$_1$ but Bill married e_1.
c. * Lenny recorded [*Mahler's*]$_1$ symphonies and Bruno did e_1 songs.

Compare with (35):

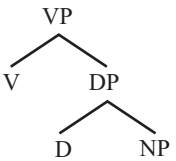
(35) a. I like John's [*car*]$_1$ more than Mary's e_1.
b. Lenny recorded Mahler's [*symphonies*]$_1$ and George recorded Brahms's e_1.
c. I read Jackendoff's [*paper on gapping*]$_1$ and you read Ross's e_1.

It appears that the D head of DP = [D NP] can not delete under identity (34), but deletion of D's NP sister (under identity) is fine (35). In fact, when DP (more specifically, D) is deleted, the entire VP must go with it – the standard VP ellipsis:

(36) John [ate the apple]$_1$ and Mary did e_1 too.

The asymmetry seems to be: if V is kept, then D is necessarily kept, but NP deletion is free. This is unexpected under the standard assumption of constituency for direct objects:

(37)

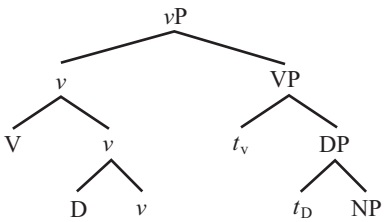


since successive deletion of XPs is in general possible, and, in fact, commonly used as a constituency test. The following is a textbook example (Radford 1997:110):

(38) a. She might have been [watching television]$_1$ more often than he might have been e_1.
b. She might have [been watching television]$_1$ more often than he might have [e_1].
c. She might [have been watching television]$_1$ more often than he might [e_1].
d. She [might have been watching television]$_1$ more often than he [e_1].

This puzzle is resolved if we can show that D *overtly* raises out of DP to adjoin to *v* to check Case. Since V moves into *v* as well, V and D are part of a complex head – if one is deleted, the whole head must be deleted as well:

(39)



The pattern of NP ellipsis in (35) is derived by deleting the NP or DP in (39). VP ellipsis deletes the *v*P altogether. On the contrary, D, being part of V+D+*v*, cannot delete without taking the rest of the complex head with it. This derives the facts in (34).

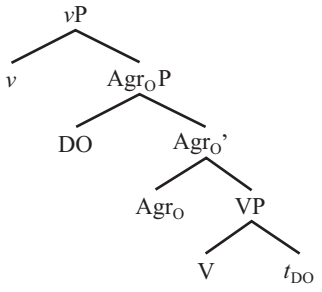
One might notice a technical complication in (39) concerning the adjunction ordering of V and D. The surface string shows V precedes D. If adjunction, which creates a ''higher'' element, is always leftward, then V raising must *follow* D raising to *v*; in other words, V raises to adjoin to the D-*v* complex, as depicted in (39). Note that *v* has [D-] and [V-] features — since V is closer to *v* than D, it should be attracted first, contrary to fact.

There is a solution, related to the phenomenon known as pseudogapping (Levin 1979/1986) where the verb is deleted with a remnant (usually an object) in the second conjunct:

(40) ? John will *select*$_1$ me and Bill will e_1 you.

I adopt a proposal by Lasnik (1998), which involves a modification of Jayaseelan (1990). Jayaseelan suggests that pseudogapping results from VP ellipsis with the remnant object having moved out of the VP by Heavy NP Shift (HNPS). This proposal is appealing because it allows an analysis that affects a constituent, namely, VP that contains the trace of the extraposed object. Otherwise, head deletion of V would have to be assumed, disrupting continuous constituency. Lasnik, noting several problems with the HNPS analysis, proposes that the direct object overtly raises to the spec position of Agr_OP, which is situated above VP but below *v*P (Koizumi 1995):

(41)

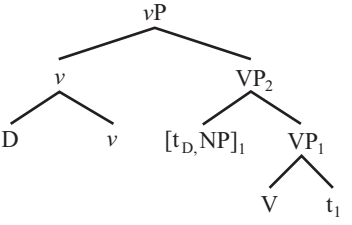


What is crucial here is that DO raises to [Spec, Agr_OP] to satisfy Agr_O EPP-like property, much like subject raising to [Spec,TP], rather than for Case. This is so because in earlier Minimalist formulations (Chomsky 1993), covert Case checking at LF suffices to satisfy the Case filter and is preferred by Procrastinate. Alternatively, in a model where features are allowed to move

prior to Spell-out,[23] feature raising to the relevant checking heads would presumably suffice. Thus, phrasal movement, triggered by EPP, is generalized pied-piping (see section 2.2, and Chomsky 1995, 1998). After DO raises to [Spec, Agr_O], V further raises to *v* to give the surface order of V DO. In pseudogapping, Lasnik proposes that VP deletes before V raises to *v*.[24]

In the system proposed here, Agr_O is not available. However, if we assume that V has a generalized EPP requirement,[25] which triggers the movement of DO to adjoin to VP, then Lasnik's analysis carries over:

(42)



In (42), D adjoins to *v* as usual. After satisfying EPP of V, DO is higher than V, hence D is attracted to *v* prior to V. VP_1 in (42) deletes for pseudogapping;[26] otherwise V is attracted to *v* to form V+D+*v*, deriving the correct V DO order.

5.3 The Linearization of English DP Subject

Let's move on to the structure of English subject DPs. Again, the goal is to show that D is higher than its complement NP in the surface order of D NP. Since English subject DP is pre-verbal, traditional analysis has assigned it the position of [Spec, TP]. I would like to propose that [D, NP] first raises to TP to satisfy the EPP requirement of T. Then, D overtly raises to a head above T, presumably for Case/agreement checking, paralleling the behavior of the object D shown in section 5.2.

[23] Even if not phonologically realized. See Yang (1997) for a variety of arguments, including considerations from computational complexity and integration with the late insertion models of Distributed Morphology (Halle & Marantz 1993).

[24] A question arises: if V is deleted before raising to *v*, does the derivation crash with *v* having an unchecked [V-] feature? I follow Lasnik's (1998) suggestion and assume that it is this unchecked feature that results in the marginality of pseudogapping. For details, see Lasnik's original paper, which has somewhat different assumptions from mine; his insights carry over to the present analysis.

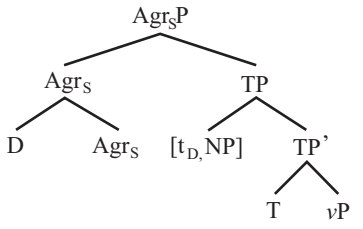
[25] See Chomsky (1998), where it is suggested *v*P also has an EPP requirement.

[26] One might wonder why VP_2 can not delete, taking [t_D, NP] along with it as in (ii):

i. You will call the cops and I will [$_{vP}$ the [$_{VP2}$ nurses [$_{VP1}$]]].
ii. * You will call the cops and I will [$_{vP}$ the [$_{VP2}$]].

I will return to this question at the end of section 5.3.

(43)



For convenience, we continue to call this head Agr_S, Case/agreement head (see fn. 2). I offer three pieces of evidence for the structure in (43).

The first piece of evidence is rather direct and is based on the grammaticality of (44):

(44) a. It was we ourselves that lost the game; there is no one else to blame.
b. I myself am solely responsible for the content of this paper.

Following Postal (1966) and Abney (1987), among others, we treat pronouns as D heads, which take optionally null complements:

(45) a. [We_D $chemists_N$] find [you_D $alchemists_N$] rather annoying.
b. [We_D *e*] find [you_D *e*] rather annoying.

Under the standard treatment of binding, an anaphor must be c-commanded by its antecedent. We can thus conclude that the pronominal D heads in (44) are higher[27] than their N complement, which, along with the ''trace'' (lower copy) of D, is situated in TP (43).

The second piece of evidence comes from auxiliary contraction:

(46) a. I've been bothered by Boston's funny weather ever since I moved here.
b. * John and you've got a lot in common. (Radford 1997:331)
c. ?* The boys've been causing a lot of troubles in class.

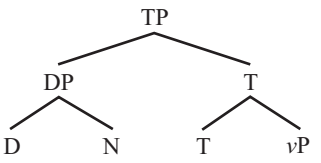
Note that D head (pronoun) in (46a) contracts with the auxiliary (presumably in T), but full DPs cannot, as in (46b) and (46c).[28]

[27] Sisterhood, which technically yields c-command under most definitions of c-command (e.g., Reinhart 1976), is not sufficient, as the ungrammaticality of '*[$Ourselves_N$ we_D] lost this game' indicates. In X-bar terms, D (*we*) is situated in spec position of N', thus it is able to c-command the N head and N's complement, whichever position *ourselves* assumes. This technology has long been abandoned in the DP analysis (Abney 1987) and is in any case not available in bare phrase structure theories.

[28] Some (e.g., Schachter 1984 and the references cited there) claim that full DP contraction is possible. However, Radford (1997:330–332) argues at length that a distinction must be made between syntactic contraction and the phonological processes that occur in informal speech.

In the standard analysis, the DP subject is uniformly situated in [Spec, TP], which makes no distinction between pronouns and full DPs. Under this approach, the contrast in (46) is not expected:

(47)



To explain the contraction patterns, we must first consider the nature of contraction in general, which has a checkered history in generative linguistics — witness the *wanna* contraction debate from 1977 to 1986 in *Linguistic Inquiry*. Here I update the proposal of Bouchard (1982, 1986), among others, into current theorizing. Bouchard suggests that the *wanna* contraction is possible if *want* governs *to*.[29] Of the many technical variations of government advanced over the years, consider (48) from (Chomsky & Lasnik 1993:79):

(48) α governs β if α c-commands β and there is no category γ that protects β from government by α.
γ protects β is α c-commands γ and γ is a barrier dominating β or γ intervenes between α and β.

(48), in combination with some ideas in Chomsky's (1986) *Barriers* framework and Rizzi's (1990) Relativized Minimality, roughly translates into a local relation between two heads, one of which is the closest c-commander of the other. This captures the well-known phenomenon that *wh*-traces block *wanna* contraction:[30]

(49) a. Who do you want [$_{TP}$ PRO to kiss]?
Who do you wanna kiss?
b. Who$_1$ do you want [$_{CP}$ t$_1$ [$_{TP}$ to kiss you]]?}
* Who do you wanna kiss you?

[29] Naturally, another condition is linear adjacency between contracting heads, going back to Chomsky (1957). The following textbook examples are taken from van Riemsdijk & Williams (1986:151):

i. I want John to drink this wine.
ii. * I wanna John drink this wine.

[30] This of course relies on the assumption that object extraction leaves no intermediate trace (copy) in the TP complement of bridge verbs such as *want* and *believe*. Hence (49a) does not have a *wh*-trace. Subject extraction, on the other hand, does leave an intermediate trace. See Bouchard (1982, 1986) and Kayne (1984) for defense of this position. Although it is currently an open question how to capture this asymmetry between subject and object *wh*-movements, let's nevertheless assume the correctness of this characterization.

The empty category in (49a) is a PRO, situated in T (adjoined to T or in [Spec,T]), so that no head intervenes between V = *want* and T = *to*; therefore contraction is possible. (49b) is bad because another head, namely C, is needed to host the *wh*-trace, and so that the local relation between *want* and *to* is disrupted.

If this characterization of contraction is correct, we can readily account for the auxiliary contraction pattern in (46) under the DP linearization analysis proposd in (43). Notice that crucially, contraction occurs between heads. When D is a pronoun, DP = [D, *e*] where *e* is an empty category. In the proposed structure (43), [D, *e*] first adjoins to TP for EPP reasons, and D raises higher to Agr_S. Hence, auxiliary contraction is possible for pronouns, as seen in (46a), since the relevant heads (D/Agr_S and T) obey the locality condition and are lexically adjacent. In (46b) and (46c), the lexical NP complement of D disrupts linear adjacency of D and T (see fn. 29), even though there is no intervening head — contraction is blocked.

Note that this analysis also explains why linear adjacency is not a sufficient condition for contraction. Notice that the negation marker in English (a head) cannot contract with the subject pronoun:

(50) * Is shen't smart?
'Is she not smart?'

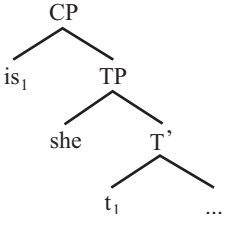
After *is* raises to C in (50), T intervenes between D = *she* in Agr_S and *n't* in Neg, although D and Neg are linearly adjacent. This shows that syntactic constraints such as (48) must be a licensing condition on contraction.

The last piece of evidence comes from tag questions. Again, we find an asymmetry between D and DP subjects that is unexpected under traditional analysis:

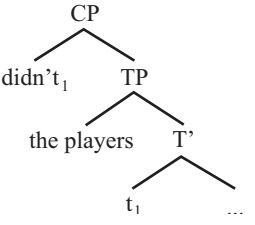
(51) a. She isn't late for class again, is she?
b. * The players tried their best, didn't the players?

Full DPs cannot be used to form tag questions (51b), but D heads can (51a). This receives no structural explanation if D and DP are in the same position:

(52) a.



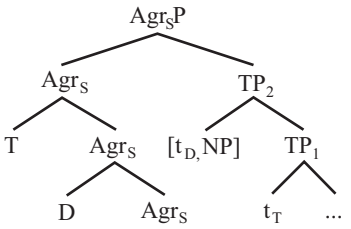
b.



if, following McCawley (1988:491), we assume tag question is formed by T′ deletion after T raising to C.

Instead, we assume D is in Agr_S hence higher than TP. On its way to C, T first adjoins to Agr_S, forming the structure in (53):

(53)



Here the entire TP = TP_2 deletes, taking the lower copy of D along with it, and we derive the patterns in (51a).

Let's now return to a problem noted in the discussion of pseudogapping (see fn. 26). One might ask what bans the following derivation:

(54) a. * The man tried his best, didn't the *e*? (*e* = *man*)
b. * You will call the cops and I will call the *e*, too. (*e* = *cops*)

In the tag question (54a), D = *the* is the remnant (in Agr_S), while its trace (lower copy) along with its complement N = *man* (in TP) are deleted. In pseudogapping (54b), the VP in (42) deletes, and the D head (*the*) is retained in *v*. The answer might lie in a theory combining the late insertion process of Distributed Morphology (Halle & Marantz 1993) and the possibility for features to move prior to Spell-out (Yang 1997, Chomsky 1998, Roberts 1998). Recall that we have assumed that N is categorially attracted to D: overtly for some languages, including the languages exempt from the Definiteness Effect examined in section 4; covertly (at LF) for other languages including English. Generalizing this to a model where there is no overt/covert distinction, enabled by the possibility of feature movement, it follows that the relevant features of N always raise to D before Spell-out, and languages differ only with respect to their morphologies. After Spell-out, vocabulary items compete for insertion, and the item that has the most relevant features and no conflicting ones wins out (Halle & Marantz 1993). Now consider the remnant D in (54a), which has the following feature specification:

(55) D: a. {[+nominative]}
b. {[+male], [+singular], [+3rd person], [+human], . . .}

The features in (55a) come from D, by virtue of being in Agr_S, a nominative Case position, and those in (55b) come from N = *man*, via feature raising.

Vocabulary items compete for insertion into D, and it is clear that *the* as in (54) is *not* the most specific entry, but rather *he*:

(56) a. *the*: [+definite]
b. *he*: [+definite], [+male], [+singular], ...

This correctly derives:

(57) The man did his best, didn't [$_D$ he]?

(57) is in fact the only valid insertion, since *he* contains more matching features with D in (55) than any other entry, e.g., *this*, *she*, *monkey*, *jump* etc., and does not contain any conflicting features.

To summarize, with the more direct evidence from cliticization in Irish and Romance, and somewhat less direct evidence from English subject and object, I have shown that for syntactic feature checking reasons (Case/agreement), D overtly raises out of its merger position. This helps to substantiate the general idea of set Merge and its linearization, and the particular analysis for the Definiteness Effect in section 4.

6. Concluding Remarks

To recapitulate, this paper has taken the unorderedness of set Merge seriously, and proposed a PF interface condition, the SLC (10), for linearization of terminal nodes. The SLC is a Bare Output Condition that syntactic feature checking and morphological operations conspire to satisfy. This condition is conceptually simple, virtually following directly from the definition of Merge. We have shown that the lack of the Definiteness Effect in some languages, unexpected in previous analyses, can be attributed to their morphological properties (N-to-D raising/fusion), and thus receives a straightforward explanation under the linearization condition. Furthermore, cross-linguistic evidence is given to show that D can be attracted out of its base position to linearize transitive DP arguments — even in a language like English where the impoverished morphology cannot linearize Merger sets directly. This has led us to challenge some traditionally-held positions on phrase structure and to reformulate them in the Minimalist framework, with both conceptual and empirical merits.

If the approach sketched here is on the right track, we have some encouraging evidence for the Minimalist approach. The results lend support to the conception that as a computational device of syntactic composition, the C_{HL} must find a way to satisfy interface conditions. If the computation of C_{HL} is uniform for all languages, then cross-linguistic variations must be instantiated at morpho-phonological levels — as this paper demonstrates.

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