Head movement as External Merge

Diego Gabriel Krivochen

diegokrivochen@hotmail.com

1. Introduction

In this brief note we sketch an implementation of the idea that head movement, which Chomsky has recently insisted is unformulable under strict set-theoretic Merge (Chomsky, 2020, 2021), is not an instance of Internal Merge (IM) but rather of External Merge (EM) given certain assumptions about the monotonic nature of derivational currents and the composition of complex heads. This would leave only phrasal movement as an instance of IM.

It is important to point out that the problem posed by head movement (which is legitimate under Chomskyan assumptions) can, we think, be scrapped altogether if set theory is abandoned as the foundation of syntax in favour of directed graphs, but the purpose of this note is to propose a solution to the problem within the framework in which it arose. This note, importantly, should not be interpreted as an endorsement of that framework.

Chomsky (2020, 2021) does not provide a very precise formulation of the problems with head movement under Merge/MERGE, but it is not difficult to see what those problems may be. Suppose that we have a structure like (1):

1) {comprar {un, libro}}

(1) corresponds to what we would call the 'VP'[1] in a Spanish sentence like *Juan compró un libro* (lit. 'Juan bought a book'). The next step, then, is to merge T, to deliver

2) {T, {comprar, {un, libro}}}

Under relatively standard assumptions that in Spanish V raises to T, there should be an instance of head movement. Furthermore, under, again, relatively standard assumptions, the result of raising V to T is a two-segment category, a complex head: {T, comprar}. The crucial point is that Internal Merge cannot deliver such an object (explicitly said, e.g., in Collins, 2017: 52). The best it can do, under the definitions of Internal Merge currently available (Collins & Stabler, 2016; Epstein et al., 2015: 14; Chomsky, 2020, among others) is (3), by copying and re-Merging *comprar*:

3) {comprar, {T, {comprar, {un, libro}}}}

[1] Note, incidentally, that VP is not an element of any set formed by Merge. As such, at best, VP and all other phrasal labels are names of sets (see e.g. Seely, 2015: 124). This stands in stark contrast to any graph-theoretic approach, where all nodes (terminal and nonterminal) are part of the structural description.

which is not what we wanted. The challenge is then to see if the only other allowed operation, External Merge, can deliver the desired structure.

2. The proposal

The proposal has two ingredients.
The first ingredient is Sola's (1996) approach to the syntactic introduction of words that contain features of several types (e.g.: T, C, …), so-called *multicategorial words* (an approach also used in Gallego's 2010 argument for *phase sliding*):

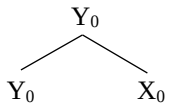
> *In order to insert a multicategorial word in a syntactic structure...*
> *a. Insert a copy of this word in each of the positions it contains features of.*
> *b. In each copy, read only the relevant features, and ignore the other features.*
> *c. Pronounce only the highest copy.* (Sola 1996: 223)

For example, the following options are available for the relations between V and T:

> *a. V is inflected for tense, and there is overt movement (a copy of the verb is inserted in both T and V).*
> *b. V is not inflected for tense because the tense morpheme is a free particle; there will be no movement of the verb to T; the free particle itself will be inserted under T.*
> *c. There is no tense morpheme in the language, and there will be no movement either (possibly a null tense morpheme will be inserted in T).*
> (Sola 1996: 229)

If they are syntactically complex objects, then multicategorial words must be formed by Merge, under the (controversial) assumption that Merge is all there is in terms of structure building. In traditional terms, a head that raises and forms a complex segment with two categories (e.g., Chomsky, 2015 [1995]: 123):

4)



Under most contemporary approaches to decomposition (Distributed Morphology, Nanosyntax, etc.), words are not simply bundles of features, but structured syntactic objects (see also Matushansky, 2006; Bruening, 2019). If Merge is the only structure building operation, it is Merge that is responsible for delivering structures such as the above. This entails not only a rejection of Lexical Integrity (at least insofar as words are the output of syntactic operations, although whether syntactic operations can probe inside words may be construed as a different matter), but also of any syntactic exceptionality at the level of words. Needless to say, this is a highly controversial position.

The second ingredient is Uriagereka's (2002, 2012) approach to Multiple Spell-Out (MSO), which is triggered by the impossibility of linearising symmetry points under the Linear Correspondence Axiom (LCA; Kayne, 1994). MSO capitalises on the order imposed by monotonic Merge for purposes of linearisation; it is reasonable to assume that the same order can be exploited for MS. The strongly cyclic character of MSO comes to the forefront when we consider the derivation of complex specifiers. Suppose that we have a phrase YP which needs to merge as the specifier of XP: a symmetry point between XP and YP does not allow an LCA-based linearisation algorithm to apply. Uriagereka's solution is to restrict the application of the LCA to local units where asymmetric c-command relations are unambiguous: these are called *command units* or *derivational currents* (Uriagereka, 2012: 86). A command unit is a syntactic object generated by monotonic applications of Merge such that the structure grows one terminal node at a time:

5) a. Merge(D, books) = {D, books}
   b. Merge(read, {D, books}) = {read, {D, books}}
   c. Merge(John, {read, {D, books}]) = {John, {read, {D, books}}}

Crucial to Uriagereka's argument is the so-called 'Finite State limit on phrase structure':

> *The FS Limit on Phrase Structure*
> *An exhaustively binary phrase-marker, none of whose branches symmetrically bifurcates, can be expressed in FS fashion.* (Uriagereka, 2012: 57)

This is a restatement of an equivalence formulated by Sheila Greibach in 1965:

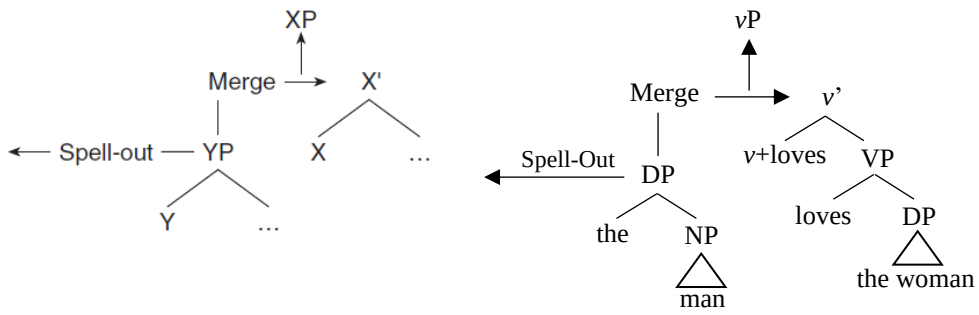
> *a given finite-state language L can be generated either by a psg* [Phrase Structure Grammar] *containing only left-linear rules: Z → aY, Z → a, or by a psg containing only right-linear rules: Z → Ya, Z → a, and a psg containing either only left-linear rules or only right-linear rules will generate a finite state language* (Greibach, 1965: 44)

Crucial to this approach is the idea that linearisation of terminals in terms of precedence can be done by an FSA. The solution to symmetry points is to separate the phrase marker into individual units, each a command unit, within which the LCA works as intended. Let us briefly illustrate how the system works. An adequate structural description for a sentence like *the man loves the woman* is not (6a), but (6b):

6) a. {the, {man, {loves, {the, {woman}}}}}
   b. {{the, man}, {loves, {the, woman}}}

In (6a) we would be dealing with a single command unit: relations of asymmetric c-command are established such that each derivational step introduces a single terminal node, and no symmetry point arises. However, such a description fails to capture the fact that the sequence *the man* is a constituent that excludes the rest of the string. (6b) manages to solve the constituency problem, but introduces a symmetry point between {the, man} and {loves, {the, woman}}: this is a problem for the application of the LCA, which is based on a total order of terminals (Kayne, 1994). Uriagereka's solution to this conundrum is to Spell-Out the command unit {the, man} separately from the command unit {loves, {the, woman}}, such that Spell-Out of a command unit feeds Merge of that command unit in a wider phrasal context. Crucially, the two command units are derived in parallel: each parallel cascade is a workspace WS. We can diagram the order of operations in (7) (Uriagereka, 2002: 51):

7)



In Uriagereka's system, Spell-Out 'collapses' a phrase marker (here, YP) into something 'akin to a word' (Uriagereka, 2002: 49), an atom without accessible internal syntactic complexity. Terms introduced in this way are opaque for any operation: this derived the syntactic opacity of specifiers and adjuncts for extraction (both of which are derived in parallel with respect to the derivational current to which they are merged). A collapsed phrase marker can be merged to another syntactic term, derived in parallel or not, once the linearisation paradox has been solved.

At this point we can spell out the proposal. The basic idea is that head movement can be recast as External Merge if (a) the relevant syntactic objects are multicategorial words, (b) multicategorial words are derived syntactically, and (c) the syntax is strongly cyclic and subjected to the conditions of MSO[2].

[2] After the first version of this note was completed, David Medeiros (p.c.) called to my attention the work Bruening (2019), where a version of Head Movement as EM is defended. Interestingly, the only shared assumption is that word formation is syntactic. Bruening's work puts much more emphasis on word order, which we do not consider, and assumes a more traditional feature-rich Minimalist machinery where adjunction to a head is an available operation. The common point, and certainly not a minor one, is that complex words are derived in parallel, with morphemes attaching before the insertion of the complex word in a wider clausal environment. In the present context, due to our reliance on MSO, the notion of *head* could well be dispensed with (note that it does not come into play at any point in the argument: we need a definition of syntactic object, and that is pretty much it): all we need to know is that an object is a command unit in and of itself and it will have its own derivational space. The contribution from Solá's work pertains to the kind of information that is

Let us see how the idea works in practice. Suppose that we have a polar interrogative in a language like Spanish, as in:

8) ¿Compró Juan un libro? (Spanish)
Buy$_{3Sg.Past.Perf}$ J. a book
'Did Juan buy a book?'

Under traditional head movement, we have V-to-T-to-C raising. This means that *compró* is a multicategorial word with V, T, and C features. Because each of these is a complex syntactic object, we would have, *in principle*, three distinct syntactic objects (we will return to this point shortly):

9) a. {*v*, √compr-}
b. {T, {*v*, √compr-}}
c. {C, {T, {*v*, √compr-}}}

Because each of these are branching nodes (thus, complex syntactic objects generated by Merge), they should be derived in parallel under Uriagereka's assumptions. So they do: assuming *for the time being* that each is derived as a distinct object, {*v*, √compr-} is the result of Merge(*v*, √compr-), which maps WS_1 to WS'_1; {T, √compr-} is the result of Merge(T, {*v*, √compr-}) (because the object in T must have V features), which maps WS_2 to WS_2', and {C, {T, {*v*, √compr-}}} is the result of Merge(C, {T, {*v*, √compr-}}), which maps WS_3 to WS_3'.
Then, they get externally Merged in their respective positions. The derivation would go as follows:

10) Merge(un, libro) = {un, libro}

At this point, we can insert the simplest of the syntactic objects we have in storage: {*v*, √compr-}, with label *v* if roots are invisible for labelling (Chomksy, 2013):

11) Merge({*v*, √compr-}, {un, libro}) = {{*v*, √compr-}, {un, libro}}

Because, under Chomsky's assumption about the invisibility of roots, the label of {*v*, √compr-} is *v*, Minimal Search finds this label and identifies the whole object as *v*. There is an alternative available, however, based on the notion of *extended projection*: it is the root that contributes lexical content, and functional material on top of the root is part of the extended projection of that root. The label of {*v*, √compr-} would then be *comprar*, identified at the relevant interface(s) as the head of the extended projection. Only this latter option solves the problem, noted in Chomsky (2020: 55) that

encoded in a syntactic object that is spelled out as a single word (no equivalence is drawn in this note between 'word' and 'head'). In Bruening's approach, complex words 'move through' T, C, etc., but do not occupy the position of 'head' of TP or CP (these would be T and C, which have their own, distinct properties). Crucially, in this process, no complex word is *formed* by 'head movement'. This point is common to our own view. Bruening's approach is, needless to say, much more developed than ours.

> *If a verb raises to inflection, say to T, it's always described as if the T-V complex becomes a T; but it's not, it's a V—the outcome of the adjunction is really verbal, not inflectional. And the further move of V to C is kind of V-second phenomenon, not a T-second phenomenon. So there are all kinds of problems with head movement.*

Note that, as in Uriagereka's MSO, syntactic objects merged from parallel derivations are atomic for purposes of operations at the target: once we introduce {*v*, √compr-} in a wider syntactic context, its internal structure is not visible or accessible. All the syntax sees is an atom, a 'terminal' in more classical FLT terminology[3]. Thus, no operation can probe inside {*v*, √compr-} because, strictly speaking, there is no 'inside'.

We continue by inserting the external argument:

12) Merge(Juan, {{*v*, √compr-}, {un, libro}}) = {Juan, {√compr- {un, libro}}}

Now we have again a complex object to insert, whose featural composition properly contains that of the previously stored object: {T, {*v*, √compr-}}. The same considerations about labelling apply (T under the traditional view, *comprar* under extended projection). We can introduce this object in the previous derivation directly by EM:

13) Merge({T, {*v*, √compr-}}, {Juan, {{*v*, √compr-}, {un, libro}}}) = {{T, {*v*, √compr-}}, {Juan, {{*v*, √compr-}, {un, libro}}}}

Then, {Juan} gets IM-ed as usual, delivering

14) {Juan, {{T, {*v*, √compr-}}, {Juan, {{*v*, √compr-}, {un, libro}}}}}

At this point we also have {C, {T, {*v*, √compr-}}} assembled in parallel, and that also gets EM to the root, respecting all relevant conditions.

15) {{C, {T, {*v*, √compr-}}}, {Juan, {{T, {*v*, √compr-}}, {Juan, {{*v*, √compr-}, {un, libro}}}}}}

We can do some spring cleaning now. Instead of multiplying the workspaces for multicategorial words, we may have only one (in this particular case). In this case, we would *not* have three distinct syntactic objects, but rather distinct derivational stages of a single object:

16) a. Merge(*v*, √compr-) = {*v*, √compr-} (this maps WS_2 to WS_2')
b. Merge(T, {*v*, √compr-}) = {T, {*v*, √compr-}} (this maps WS_2' to WS_2")
c. Merge(C, {T, {*v*, √compr-}}) = {C, {T, {*v*, √compr-}}} (this maps WS_2" to WS_2'")

What gets EM, then, is the output of Merge in WS_2 to WS_1 (the command unit that corresponds to the main clause). As has been extensively argued for phrasal movement (see e.g. Nunes, 2011), the most

[3] Note that there is no correspondence between 'terminal symbol' and 'orthographical word': a grammar must contain some notion of *multi-word basic expression* to be descriptively adequate.

feature-rich object gets materialised *ceteris paribus*. The apparent 'cyclicity' of head movement follows from the sequence of functional heads that constitute the extended projection of the verbal root, under the view that a 'copy' of the 'word' will be inserted in each position it contains features of: because the object derived in parallel is the extended projection of the root, and this extended projection contains, in order of semantic composition, *v* (event), then T (or rather, TAM anchoring), and then C (illocutionary force), EM of this object cannot target *v* and C but not T. At each step in the derivation (12) EM can be applied, with 'cyclicity' being an emergent property.
Some languages provide morphological exponents for all the features we have considered here (in our case, Spanish materialises T and Agreement, but not C or *v*), for example, Turkish:

17) Merve kitabı aldı mı?
M. book$_{Acc}$ buy$_{3Sg.Past.Perf}$ Q
'Did Merve buy the book?'

Here, -mı is a question particle which corresponds to the materialisation of an interrogative (non *wh*) C, with -dı a materialisation of T (past, perfective).

18) Merve buna elledi mi?
M. this$_{Dat}$ touch$_{3Sg.Past.Perf}$ Q
'Did Merve touch this?'

Here, *elledi mi* can be analysed as *el-* (root, meaning 'hand'), *-le-* (verbaliser, spell out of *v*), *-di-* (T) and *-mi* (spell out of C)[4].

3. Conclusions (sort of) and promissory notes

This brief note attempted to show that what has been called 'head movement' can be rephrased as external Merge if we incorporate some relatively well-established assumptions about the lexicon and the conditions under which parallel derivations are allowed. Being an instance of EM, 'head movement' would be firmly planted in the syntax, not being delegated to 'externalisation'. In the view sketched in this note, there is no 'chain' involved in 'head movement', as there is no movement. Thus, the conditions on what has been called 'head movement' cannot be those imposed by the theory of movement: there should be changes in interpretation as well as the locality conditions that restrict the operation. But -apparently- there are not. This has some implications.

There is no need to (a) define workspaces to include the lexicon (which seems to defeat the purpose of workspaces to be local derivational spaces) or (b) mix set- and pair-Merge. Both of these

[4] The fact that the C is orthographically detached from the rest of the verbal base is a historical rather than a syntactic fact. Kornfilt (1997: 5) characterises the question particle as a morpheme that cliticises to the main predicate (in which case it has sentence scope) or to a smaller constituent (in which case a contrastive focus interpretation arises).

assumptions are necessary in Kitahara's proposal as sketched in Chomsky (2020: 56), but the problem of multiplying objects remains: for T-to-C movement, the structure is {<C, T>, {T, VP}}, with C pair-Merged to T and the result of this pair-Merge in turn set-Merged to {T, VP}. Additional stipulations on opacity are required to shield the lower T from interpretation. But, even then, the issue with copies arises due to the set-theoretical commitments of contemporary Minimalism.

Should one want to keep set theory, given the tools that current Minimalism offers, there are few options so far as we can see. One is to leave the work to the interfaces: Merge applies to lexical item tokens which are uniquely indexed, assigned category types in the lexicon. In other words, when merging, say, *read* and *books*, we are actually merging two expressions which are uniquely indexed by a set of addresses. These addresses serve the same purpose of Gorn addresses (Gorn, 1967), which have been used in Tree Adjoining Grammars to great effect (Sarkar & Joshi, 1997): they identify expressions regardless of context as they point to memory locations (in the present case, these memory locations would contain semantic values; here, ⟦read⟧ and ⟦books⟧, using notation from Heim & Kratzer, 1998). Their application in the present context is straightforward, but their consequences are far-reaching. Evidently, we want to say that there is one and only one object √compr- in all positions: that is what Chomsky captures with the idea of *copies*, to an extent. But if basic expressions are uniquely indexed, identity is not an emergent property of syntax (as with Chomsky's Form Copy); rather, it is a property of the lexicon. The distinction between copies and repetitions can be reformulated in the following terms: for any X, Y (of arbitrary complexity), X and Y are copies *iff* X and Y have the same address. Because addresses may be computed for complex objects (again, see Gorn, 1967), there is no need to specify that X or Y are 'heads' or 'non-heads': they are syntactic objects, and (if categorematic) they will be assigned an address. No 'illegitimate' operations have been invoked (as a matter of fact, we didn't even need pair-Merge) in this process, and nothing additional is required of the syntax. Some work has been shifted to the lexicon, yes, but no complication arises from that so far as we can see.

There are some bad news, however. A direct consequence of the approach sketched above is that we have a single object in more than one position, which is unsurprisingly problematic for set-theoretic approaches. In 'standard set theory' (the term is Chomsky et al.'s 2019), there is no easy way to say that in {a, {b, {{c, d}, a}}}, for instance, there is only one *a*. It has proven difficult for Minimalism even to define what it means to have 'one' *a* or 'several' in the syntax and/or the interfaces. Additional mechanisms or diacritics must be invoked (and indeed they have been). Consider, following Chomsky (2020, 2021), that some distinction between *copies* and *repetitions* is invoked such that *copies* are only produced by IM. It is worth pointing out that the processes involved in IM are far from unproblematic, and Form Copy is not an innocent operation (see Stroik & Putnam, 2013; Gärtner, 2021 for useful discussion). The problem can be illustrated as follows:

19) a. {b}

b. {a, b}

c. {b_1, {a, b_2}}

Here, b_1 is Internally Merged to the set {*a*, *b*}. According to Chomsky (2020), Minimal Search (the proper formulation of which has its own problems under set theoretic assumptions) renders b_2 inaccessible to further operations because b_1 is found first. This entails, however, that the system knows (i) that it is looking for an object of category *b*, and (ii) that b_1 and b_2 are copies of each other (or 'occurrences' of *b*; see Collins & Stabler, 2016: 51), neither of which follow from either Merge or Minimal Search[5]. Given the informal characterisation of Minimal Search as a sequential search algorithm in Chomsky's works, some order needs to be imposed over objects in a structure, such that a search sequence may be defined. Here, an order based on containment seems sufficient: there is a set that contains b_2 and excludes b_1, but there is no set that contains b_1 and excludes b_2 (so (19c) must be a multiset; see Gärtner, 2021 for discussion. Chomsky, 2021 must introduce a new principle, *stability*, which determines that we are dealing with 'occurrences' of *b*). This entails putting the weight of distinguishing between copies and repetitions to the syntax, at the cost of yet another principle. Note, however, that Chomsky (2021: 17) says that copies need not be marked as such in the derivation, presumably because the status of an object as a copy or a repetition matters at the interfaces. Our addressing system delivers this result without needing either an additional stipulation (marking copies or not), operation (Form Copy), or relation (*Copy*<X, Y>). As a matter of fact, under the assumption that lexical item tokens are assigned addresses and that several of those lexical item tokens in a structure may be assigned addresses that point to the same semantic value, the distinction between copies and repetitions becomes somewhat artificial, being delivered for free by the addressing system.

If we do admit multisets, the whole point of copies is missed, as we now explicitly multiply the elements. There are conceivable ways around this problem within set theory, widely conceived. But the cost in auxiliary hypotheses may just be too high. Alternatively, the entire burden may be shifted to the lexicon and the interpretative systems: the syntax operates with lexical item tokens, each of which has an address. If two or more tokens have the same address, they have the same semantic value, as semantic values are the content of the memory locations pointed to by the addresses. In this case, whenever interpretation applies and √compr- is read, *the same semantic value* ⟦comprar⟧ *will be accessed*. Thus, three objects are read, but only one memory location is accessed for the lexical root, as desired. The alleged lack of semantic effect of head movement (Chomsky, 2020: 55; 2021: 30)

[5] David Medeiros (p.c.) has -correctly in our opinion- observed that the copy-repetition can be captured in (some kind of) set-theoretic approach only if the system has access to previous stages of the derivation. This brings up the problem of derivational conditions (i.e., conditions that make reference to more than one derivational step) and whether the kind of removal operation that Chomsky (2019, 2020) has claimed is part of MERGE allows for the storage of derivational information. So far as we can see, this is yet another complication that is ultimately an artefact of Minimalism's commitment to set theory.

follows at once, given the unique indexing system: it is literally the same semantic value what is being accessed in all instances.

As a final promissory note, this view can help in other areas of the grammar, too: for example, the classical Lees-Klima view on reflexivisation can be directly recast in these terms. In traditional Minimalist terms, an anaphor and its antecedent are two distinct nodes related by coindexation; there are, however, some approaches that handle reflexivisation via the same mechanisms as displacement (e.g., Hornstein, 2001: Chapter 5 uses movement; Gärtner, 2014 and Krivochen, 2022b, multidominance). In this context, what we have in *John shaves himself* is simply the semantic value ⟦John⟧ accessed twice, which means that *John* and *himself* must have the same address (and co-occur within a local domain, as co-arguments)[6, 7]. In a sentence like *John shaved John*, in contrast, the semantic values of subject *John* and object *John* are different, and thus they are assigned different addresses. Their identical phonological exponent (what would make them 'repetitions' in Chomsky's terms) is a mere accident of the fact that the name *John* can be assigned to more than a single entity in the phenomenological world. The derivation would not necessarily change with respect to Minimalist tradition (although it may, of course, under graph-theoretic assumptions as those outlined in fn. 6 and references cited there), but the interpretation of the resulting structure does.

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[6] In our opinion, there is a degree of clumsiness derived from sticking to 'standard' set theory at this point, considering the difficulties it raises not only for movement (Gärtner, 2021), but also for argument structure (Langendoen, 2003) and Minimal Search (Krivochen, 2022a). A readily available alternative is to replace Merge(X, Y) = {X, Y} with a graph-theoretic counterpart: Merge(X, Y) = *e*<X, Y> (a directed edge from X to Y), again with X and Y uniquely indexed expressions (see McKinney-Bock & Vergnaud, 2014 for a related proposal, although much closer to traditional Minimalist assumptions than ours). If we also dispense with the Single Mother Condition, such that a single node may be the tail of more than one edge, we are at the gates of the rich landscape of multidominance approaches (some of which are Minimalist and derivational, such as Citko & Gračanin-Yuksek, 2021; Johnson, 2016, 2020 and whose connections to graph theory are somewhat weak; some of which are constraint-based and explicitly couched on graph theory, such as Postal, 2010; Krivochen, 2022b), which current Minimalism rejects by principle. For the case of 'head movement' under consideration, there would be a graph G with a single node corresponding to the basic expression √compr-, which is immediately dominated by *v*, T, and C. The same object is accessed from distinct (immediate dominance) contexts, because the objects that are being interpreted all contain a common address. Once uniquely identifying addresses are accepted (regardless of their content), the road to graph theoretic structural descriptions has started to be paved. The consequences of following this path are explored in our recent work, but far exceed the scope and purpose of this note.

[7] The next logical step is to do the same for *wh*-movement and other non-local dependencies (as in Krivochen & Padovan, 2021; Krivochen, 2022b), but that is a story for another day.

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