***Do*-support as spellout of split head chains**

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Existent analyses of *do*-support share one basic feature: *do* is required by a particular head (typically T) due to some special requirement of that head (e.g. its affixal nature). We argue that this characterization of *do*-support is incorrect and instead propose that *do*-support arises as spellout of lexical verb chains when their integrity is disrupted. The analysis correctly predicts that *do* can surface in a variety of positions (sections 2–3) and is not due to failure to satisfy affixal properties of a particular head (section 4).

1. Split chains and *do*-support In a sentence without an auxiliary, a lexical verb enters into a head-chain relation with multiple

(1) $[_{CP}$ C $[_{TP}$ T $[_{vP}$ v $[_{VP}$ V . . .

heads, including v, T, and C (in cases of V2/inversion), as in (1). We abstract away from the precise mechanism behind head-chain formation: it can be head movement, lowering, or feature checking (i.a. Chomsky 1957, Pollock 1989, Bobaljik 1995, Bjorkman 2011). The resulting inflected verb can surface in any position in the chain, subject to language-particular conditions (height of V movement, etc.). A crosslinguistically uniform aspect of *do*-support is that it's triggered by lexical verbs (not auxiliaries). We assume that in languages with *do*-support, lexical Vs are associated with a special *strong v* head (v_s), which requires integrity of the chain. Disrupting the integrity of a v_s-chain (a chain containing v_s) causes *do*-support. Under some circumstances (e.g. VP ellipsis, negation in some languages), the chain is split at various positions, resulting in a higher portion of the chain that's no longer associated with the lexical V; such chains are *orphan chains*:

(2) $[_{CP}$ C $[_{TP}$ T $[_{vP}$ v_s $[_{VP}$ V . . . (3) $[_{CP}$ C $[_{TP}$ T $[_{vP}$ v_s $[_{VP}$ V . . .

Our central claim is that ***do* is inserted in orphan chains**, e.g. in C-T in (2), and in C-T-v in (3). Under this analysis, the site of insertion is not linked to any property of particular functional heads, such as the affixal requirement of T or its equivalent present in all previous accounts (i.a. Lasnik 1981, Embick & Noyer 2001, Bjorkman 2011). Instead, *do* can surface in any position in the orphan chain, as determined by the same language-particular conditions on V movement mentioned above.

2. Variable positions of *do* The integrity of a v_s-chain can be disrupted for two reasons, causing a split. (i) **Split-by-deletion**: If part of the head chain is deleted (e.g. by predicate ellipsis), the chain is split at the deletion site (e.g. (2) if vP is elided; the same occurs under XP movement). (ii) **Split-by-intervention**: In some languages, the chain is split at v_s (as in (2)) if certain items disrupt adjacency between elements in the chain. As in all other accounts, the list of interveners must be stipulated (negation, verum focus *so* and *too*, Chomsky's (1957) contrastive A, and overt subjects, but not adverbials; see Bobaljik 1995).

Under ellipsis, *do* can surface in different positions depending on the particular language and construction. Previous analyses must stipulate affixal requirements on separate heads to account for this variation. Under the present account, the surface position of *do* follows directly from the size of the deleted consituent and language-particular conditions on V movement. In Mainland Scandinavian (MSc), deletion of VP results in *do* surfacing in C or v_s, depending on whether the clause is V2 (4) or not (5) (illustrated with Danish; Platzack 2008, Bjorkman 2011, Houser et al 2011):

(4) . . . eller rettere $[_{CP}$ Mona gjorde $[_{TP}$ $[_{vP}$ Δ_{VP}]]] (5) . . . $[_{CP}$ hvis $[_{TP}$ vi ikke $[_{vP}$ gør Δ_{VP}]]]
     or rather Mona did   if we not do

The head chain is as in (1) (without C if non-V2), and VP deletion splits it as in (3). In MSc, v_s-chains are pronounced in C under V2, and in v_s otherwise (Vikner 1995); since the orphan chain contains both C and v_s, *do* surfaces in either position, according to clause type. Similarly, the spellout positions of English *do* under predicate ellipsis are C in matrix questions (6) and T otherwise (7):

(6) $[_{CP}$ Did $[_{TP}$ she Δ_{vP}]] (7) $[_{TP}$ She did not Δ_{vP}]

This is due to vP deletion, which splits the head chain as in (2). This gives rise to *do* in C in matrix questions, and in T otherwise (where C is not part of the chain). *Do* can't surface in the typical low position of English lexical verbs (v_s), as the orphan chain does not contain that low position.

Unlike MSc, English also has Split-by-intervention. Specfically, the chain splits at v_s if certain items such as negation intervene between elements in the chain:

(8) Mary did not leave. $[_{TP}$ T not $[_{vP}$ v_s $[_{VP}$ V ...

As in cases of vP deletion, *do* surfaces in T, the only element in the orphan chain. In matrix questions (*Did Mary leave?*), the head chain includes—and is pronounced in—C. An overt subject triggers Split-by-intervention, resulting in *do* at the top of the C-T orphan chain. Since Split-by-intervention always splits the chain at v_s, two interveners will cause splits in the same position, giving the appearance of a single split:

(9) Did Mary not leave? $[_{CP}$ C $[_{TP}$ DP T not $[_{vP}$ v_s $[_{VP}$ V ...

3. Double *do* VP deletion in MSc also accounts for *do*-support under auxiliaries, in which the head chain doesn't extend above v_s, so the orphan chain only contains v_s, which is where *do* surfaces (Platzack 2008):

(10) Men hvis jeg havde gjort, ... $[_{TP}$ T $[_{AuxP}$ Aux $[_{vP}$ v_s $[_{VP}$ V ...
      but if I   had   done (Danish)

Some varieties of British English also allow VP deletion (i.a. Thoms 2011, Baltin 2012):

(11) Morag has done, too.

Since English also has Split-by-intervention, the analysis also correctly predicts sentences with two instances of *do*-support in these varieties (Chalcraft 2006), one due to VP deletion and the other due to an intervener:

(12) He doesn't usually do. $[_{TP}$ T not $[_{vP}$ v_s $[_{VP}$ V ...

Double *do* sentences of this sort are notoriously hard to account for in previous analyses that attempt to unify all uses of English *do* in terms of a requirement by a single head (see Thoms 2011, whose sketched solution potentially predicts double *do* even in other dialects). In the present analysis, it follows automatically from the independently motivated existence of VP deletion and Split-by-intervention in these dialects.

4. *Do* doesn't rescue stranded heads *Do*-support is standardly assumed to occur only in languages in which finite lexical verbs surface low: some head (typically, T) is 'stranded' because the verb doesn't raise to it, causing insertion of *do* by Last Resort. This assumption is disconfirmed by Monnese (Benincá & Poletto 2004). As a Northern Italian dialect, both auxiliaries (13) and lexical Vs (14) surface in T, preceding adverbs.

(13) l **à**   semper tʃakolà   (14) l **tʃakola** semper
      he **has** always spoken   he **speaks** always 'He always speaks.'

However, in contexts that require inversion with a subject clitic (matrix questions), auxiliaries surface in C (15), but lexical verbs trigger *do*-support in that position (16):

(15) kwal **è**   -t tʃerkà   fora?   (16) ke **fe** -t   majá?
      which **have** -you searched out   what **do** -you eat.INF
      'What have you chosen?'   'What do you eat?'

(17) $[_{CP}$ C $[_{TP}$ SCl T $[_{vP}$ v_s $[_{VP}$ V ...   This is due to Split-by-intervention, as the subject clitic disrupts adjacency in v_s-chains (17). Monnese thus shows that *do*-support is not triggered by a failure to attach T to a verb to satisfy a requirement of T, as the requirement *can* be met by verb movement. Our analysis correctly predicts that *do*-support and v-to-T movement can coexist, as well as the asymmetry between auxiliaries and lexical verbs, as only the latter involve v_s.

5. Consequences for the theory of verb movement The analysis based on v_s-chain integrity accounts for crosslinguistic variation in the surface position of *do*, including double occurrences of *do*, and for its appearance in a language in which the affixal properties of T can be satisfied by lexical verb movement. The head chains used in this account are neutral between verb raising and lowering of functional heads, which provides evidence that head raising and lowering are surface manifestations of the same underlying syntactic mechanism, as in e.g. in Brody 2000 and Arregi & Pietraszko 2018.