**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 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 (v₂), which requires integrity of the chain. Disrupting the integrity of a v₂-chain (a chain containing v₂) 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:

\[
\begin{align*}
\text{(2)} & \quad [\text{CP } C [\text{TP } T [\text{vP } v_s [\text{vP } V \ldots x]}} \\
\text{(3)} & \quad [\text{CP } C [\text{TP } T [\text{vP } v_s [\text{vP } V \ldots x}]
\end{align*}
\]

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 v₂-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 v₂ (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 v₂, depending on whether the clause is V2 (4) or not (5) (illustrated with Danish; Platzack 2008, Bjorkman 2011, Houser et al 2011):

\[
\begin{align*}
\text{(4)} & \quad \text{eller rettere } [\text{CP Mona gjorde } [\text{TP } [\text{vP } \Delta_{VP} ]]] \\
\text{(5)} & \quad \text{hvis } [\text{CP vi ikke } [\text{vP } gør } \Delta_{VP} ] [\text{]}]
\end{align*}
\]

The head chain is as in (1) (without C if non-V2), and VP deletion splits it as in (3). In MSc, v₂-chains are pronounced in C under V2, and in v₂ otherwise (Vikner 1995); since the orphan chain contains both C and v₂, 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):

\[
\begin{align*}
\text{(6)} & \quad [\text{CP Did } [\text{TP } \Delta_{VP} ]] \\
\text{(7)} & \quad [\text{TP She } \text{did not } \Delta_{VP} ]
\end{align*}
\]

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 (v₂), as the orphan chain does not contain that low position.
Unlike MSc, English also has Split-by-intervention. Specifically, the chain splits at $v_s$ if certain items such as negation intervene between elements in the chain:

(8) Mary did not leave.  
\[
\begin{array}{c}
\text{TP} \\
T \\
\not \text{vP} \\
\times \text{vP} \\
\times \text{VP} \\
\times . . .
\end{array}
\]

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?  
\[
\begin{array}{c}
\text{CP} \\
C \\
\not \text{TP} \\
\not \text{DP} \\
\times \text{T} \\
\times \not \text{not} \\
\times \text{vP} \\
\times \text{v} \\
\times \text{s} \\
\times \text{VP} \\
\times . . .
\end{array}
\]

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, . . .  
\[
\begin{array}{c}
\text{TP} \\
\left[\text{AuxP} \text{ Aux} \right] \\
\times \text{vP} \\
\times \text{v} \\
\times \text{s} \\
\times \text{VP} \\
\times . . .
\end{array}
\]

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.  
\[
\begin{array}{c}
\text{TP} \\
T \\
\not \text{vP} \\
\times \text{vP} \\
\times \text{v} \\
\times \text{s} \\
\times \text{VP} \\
\times . . .
\end{array}
\]

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 (Benincà & Poletto 2004). As a Northern Italian dialect, both auxiliaries (13) and lexical Vs (14) surface in T, preceding adverbs.

(13) l à semper tjakolà he has always spoken  
\[
\begin{array}{c}
\text{CP} \\
C \\
\not \text{TP} \\
\times \text{SCI} \\
\times \text{T} \\
\not \text{vP} \\
\times \text{v} \\
\times \text{s} \\
\times \text{VP} \\
\times . . .
\end{array}
\]

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 tjerkà fora? which have -you searched out  
\[
\begin{array}{c}
\text{TP} \\
T \\
\left[\text{AuxP} \text{ Aux} \right] \\
\times \text{vP} \\
\times \text{v} \\
\times \text{s} \\
\times \text{VP} \\
\times . . .
\end{array}
\]

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.