# Cyclic remnant-internal copy deletion

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## 1 Gärtner's (1998) problem

The copy theory of movement (Chomsky 1995) has it that movement of a syntactic element leaves a copy in the base position. In the majority of cases, however, only one of the copies in a movement chain is pronounced. Canonically, this is the highest one. Various proposals have been put forward as to how this can be achieved (see Brody 1995; Groat and O'Neill 1996; Bobaljik 1995; Pesetsky 1997, 1998; Nunes 1995, 2004). Assuming that movement always proceeds into c-commanding positions, all these approaches suggest in some way or another that a category $\alpha$ is PF-deleted if c-commanded by a (higher) copy of $\alpha$, thereby accounting for the fact that it is the highest copy that is pronounced (1).

(1) $\underset{\curvearrowleft}{\alpha} \ldots\ [_{\beta} \ldots\ \underset{\curvearrowright}{\cancel{\alpha}} \ldots\ ]$

This is both simple and well-motivated for the majority of instances of movement. As Gärtner (1998: 20) – discussing Nunes' (1995) *Chain Reduction* – points out, however, this procedure is unable to handle remnant movement configurations such as (2), where the remnant

category $\alpha_1$ contains a "lower" copy of $\gamma_1$ (2) (indices for expository use only).

(2) $[\ [_{\alpha_1} \ldots \ \gamma_1 \ldots\ ] \ldots\ [_{\beta} \ldots\ \gamma_2 \ldots\ [_{\alpha_2} \ldots\ \gamma_3 \ldots\ ]\ ]\ ]$

Since $\gamma_1$ is not c-commanded by another copy of $\gamma$ it should be pronounced. This is, however, not what we find in constructions that have been argued to involve remnant movement, such as the English verb phrase topicalization in (3) (Thiersch 1985; Höhle 1991). Similar remnant VP configurations have been proposed for other languages, including German (Thiersch 1985; den Besten and Webelhuth 1987; Müller 1998), Brazilian Portuguese (Bastos-Gee 2009) and Polish (Bondaruk 2009, 2012).

(3) $[_{\text{VP}}$ Criticized ~~John$_1$~~ (by his boss) $]_1$ John$_2$ has never been $[_{\text{VP}}$ ~~criticized John$_3$~~ $]_2$.

In what follows, we refer to this unexpected non-pronunciation as *Gärtner's Problem*, which presents itself for any copy deletion mechanism formulated solely on c-command.

# 2 Previous solutions

## 2.1 Nunes (2004)

Nunes (2004), as a reaction to Gärtner (1998), suggests that a chain not only contains information about the content of the chain links, CH = ($\alpha$,$\alpha$), but also about their structural environment, i.e. their respective sisters, CH = (($\alpha$,K),($\alpha$,L)). In a remnant movement configuration, such as (4), the copy in the remnant (*John*$_1$) is a sister of the same element (*criticized*) as the copy (*John*$_3$) left by the movement step creating the remnant. As the latter is c-commanded by a higher copy (*John*$_2$) *Chain Reduction* applies and deletes occurrences of *John* that are sisters of *criticized* including the remnant-internal copy *John*$_1$.

(4) a. [$_{\text{VP}}$ criticized ~~John$_{\text{I}}$~~ ] John$_2$ has never been ~~[$_{\text{VP}}$ criticized John$_3$ ]~~

b. CH$_1$ = ((John,T′),(criticized,John))

c. CH$_2$ = (([criticized John],C′),(been,[criticized John]))

There is one crucial issue with this analysis. As remnant $\overline{\text{A}}$-movement is in principle unbounded, *Chain Reduction* must be able to inspect an arbitrarily large representation. This was not required in Nunes' original formulation of *Chain Reduction*, where (every two-membered part of) a chain contains all the relevant information in order for deletion to apply correctly. Thus, the information about the lower copy

being c-commanded and the information about its sister must be kept throughout the derivation until the remnant reaches its final landing site. This is incompatible with the idea that syntactic derivations proceed phase by phase (Chomsky 2000, 2001), which is standardly assumed to result from cyclic spell-out thereby effectively letting the derivation 'forget' information contained in the representations of previous phases. Derivation by phase, in turn, is well motivated by a huge body of evidence suggesting that long syntactic dependencies are actually composed of a series of local dependencies, an idea going back at least as far as Chomsky (1973).

### 2.2 Collins and Stabler (2016)

Collins and Stabler (2016) implement copy deletion as a part of the formal operation $\text{Transfer}_{\text{PF}}$ applying to phases. Phonetic features of non-final copies (i.e. those which are not in their final landing site) are not transferred to PF, where "[a] syntactic object A $\in$ {A,B} is final in a phase P, if {A,B} is not c-commanded by A in P" (Collins and Stabler 2016: 71). On a first formulation, $\text{Transfer}_{\text{PF}}$ renders the complement of a (strong) phase head opaque by spelling it out only retaining its label. This derives the Phase Impenetrability Condition (PIC, Chomsky 2001) as a theorem. In a regular example of remnant movement, like (5), when the phase (CP) undergoes Transfer, there is a copy of *John* that c-commands a copy of *John* $\in$ {John, to win},

namely *John*$_2$ c-commands *John*$_3$. Hence, *John* $\in$ {John, to win} counts as non-final. As there is no distinction between both instances of {John, to win}, *John* is deleted in both.

(5) [How likely {~~John$_1$~~ to win}] is [$_{\text{TP}}$ John$_2$ ~~how likely {John$_3$ to win}~~ ]?

As Collins and Stabler (2016: 73) point out, however, this mechanism fails when remnant movement spans more than one phase. The structure of the lower TP will have become opaque at the point when the remnant in its final landing site is transferred to PF. The remnant-internal copy can thus not be identified as non-final and evades deletion. To overcome this problem, Collins and Stabler (2016) modify their theory to the effect that transferred structure, i.e. the foot of the remnant movement chain remains accessible throughout the whole derivation, as was the case for Nunes (2004). In turn, the PIC, i.e. non-mobility of phase domain material, can no longer follow from spell-out rendering structure opaque. Instead, an additional (arbitrary) stipulation about invisibility of spelled-out material to later syntactic operations is required, which is a considerable drawback of this approach.

## 3 Cyclic copy deletion

We propose to appraoch Gärtner's problem by means of the theory of cyclic spell-out (Bresnan 1971; Uriagereka 1999), in which small chunks

of syntactic structure are sent to the interfaces before the derivation is complete. The idea is that the remnant-internal copy is deleted when it is still c-commanded by its antecedent, i.e. before remnant movement takes place.[1] Cyclic spell-out is nowadays intimately related to the theory of phases and assumed to derive the effects of Chomsky's (2000, 2001) Phase Impenetrability Condition. As we will illustrate, such an approach, in contrast to previous proposals, allows for a very local formulation of copy deletion (applying to phases) as well as for the PIC to follow from cyclic spell-out.

Under standard assumptions, completion of a phase $\beta$ with head H triggers Spell-Out of H's complement (Chomsky 2001). This derives the escape hatch property of phases: a category $\alpha$ that is supposed to leave the phase $\beta$ must first move to the edge of $\beta$ in order to not undergo spell-out and become inaccessible for further syntactic processes (6).

(6) $[_\beta\ \alpha\ \mathrm{H}\ [_\gamma\ \ldots\ \alpha\ \ldots\ ]]$

It is also common to take copy deletion to be computed at the PF interface. However, combining both assumptions leads to a problem hitherto undocumented in the literature: if only the phase head's complement ($\gamma$) is shipped to PF (deriving the PIC), then a copy of $\alpha$ at the phase edge cannot trigger deletion of a copy of $\alpha$ within the phase domain $\gamma$ as the former is simply not visible at PF (7).

(7) $\overbrace{[_{\beta}\ \alpha\ \mathrm{H}}^{\text{not sent to PF}}\ \underbrace{[_{\gamma}\ \ldots\ \alpha\ \ldots\ ]}_{\text{sent to PF}}]]$

In order to be able to combine the PF-approach to copy deletion with the derivation of the PIC from cyclic spell-out, we make three additional assumptions.[2] First, spell-out is preceded by the operation Transfer, which translates a complete phase P (comprising its edge domain) into a hierarchically organized PF-representation $\mathcal{P}$ (8) (Selkirk 2006, 2011). In contrast to Collins and Stabler (2016), who assume that Transfer applies to the whole phase only in root CPs but to the complement of the phase head in embedded clauses, we take it to apply to whole phases in all cases.

(8) a. $[_{\mathrm{XP}}$ WP $[_{\mathrm{X'}}$ X $[_{\mathrm{YP}}$ Y $[_{\mathrm{ZP}}$ Z UP $]]]]$ (Transfer of phase XP)

b. $[_{\phi}\ \phi\ \omega\ [_{\phi}\ \omega\ [_{\phi}\ \omega\ \phi\ ]]]$

Conserving the general insight that c-command is crucial for computing copy deletion, we take it that at PF, a copy $\kappa$ within a PF-representation $\mathcal{P}$ is deleted (here indicated as $\not{\kappa}$) if $\kappa$ is c-commanded by a copy $\kappa'$ within $\mathcal{P}$. Second, following Transfer, the operation Spell-Out applies to the complement domain $\Delta$ of $\mathcal{P}$ and hands it over to phonology proper. In this process, the terminals of $\Delta$ are linearized. This leads to the atomization of $\Delta$ at PF (indicated as $\langle\Delta\rangle$), which retains $\Delta$'s root while rendering its internal structure syntactically opaque (9) (Uriagereka 1999, Nunes and Uriagereka 2000, Fowlie 2013). The atomized $\langle\Delta\rangle$ thus

behaves as a single lexical item, much "like a giant lexical compound" (256 Uriagereka 1999).

(9) $[_{\phi}\ \phi\ \omega\ \langle_{\phi}\ \omega \prec \omega \prec \phi\rangle\ ]$ (Atomization of phase domain)

Third, the hierarchical PF-representation $\mathcal{P}$, including the atomized $\langle\Delta\rangle$, is re-matched against the syntax (cf. Dobashi 2003, Sato and Dobashi 2016 for a related idea) where the edge, the head, and the domain as a unit are accessible to further syntactic operations (10).

(10) $[_{\mathrm{XP}}\ \mathrm{WP}\ [_{\mathrm{X'}}\ \mathrm{X}\ \langle_{\mathrm{YP}}\ \ldots\rangle\ ]]$ (Re-match against syntax)

Under these assumptions, it now follows that a copy $\kappa'$ at the edge of the phase XP can induce cyclic PF-deletion of a lower copy $\kappa$ without $\kappa'$ becoming syntactically inaccessible (thus preserving XP's escape hatch property) (11).

(11) a. $[_{\mathrm{XP}}\ \mathrm{ZP}\ [_{\mathrm{X'}}\ \mathrm{X}\ [_{\mathrm{YP}}\ \mathrm{Y}\ \ldots \mathrm{ZP} \ldots\ ]]]$ (Transfer of XP)

b. $[_{\phi}\ \phi\ \omega\ [_{\phi}\ \omega \ldots \phi \ldots\ ]]$ (Deletion of lower copy)

c. $[_{\phi}\ \phi\ \omega\ [_{\phi}\ \omega \ldots \cancel{\phi} \ldots\ ]]$ (Atomization of phase domain)

d. $[_{\phi}\ \phi\ \omega\ \langle_{\phi}\omega \ldots\rangle\ ]$ (Re-match against syntax)

e. $[_{\mathrm{XP}}\ \mathrm{ZP}\ [_{\mathrm{X'}}\ \mathrm{X}\ \langle_{\mathrm{YP}}/\mathrm{Y} \ldots /\rangle\ ]]$

It also follows that the phase domain $\langle\Delta\rangle$ as a unit may undergo movement out of the phase.

With this in mind, consider again the remnant movement example (3), repeated in (12). Assuming that both $v$P and CP are phases, the solution to Gärtner's problem that now becomes possible is that the remnant-internal copy of *John* in (12) is deleted after Transfer of $v$P, when it is still c-commanded by the copy of *John* in Spec$v$P, which has been created by cyclic movement to the phase edge. Later in the derivation the atomized VP with the deleted copy of *John* undergoes movement to SpecCP.

(12) [$_{\text{VP}}$ Criticized ~~John~~ (by his boss) ] [$_{\text{TP}}$ John has [$_{v\text{P}}$ never ~~John~~ been ~~[$_{\text{VP}}$ criticized John ]~~ ]]

The derivation of (12) is given in (13) (abstracting away from the difference between syntactic and PF representations).

(13)
a. [$_{\text{VP}}$ criticized John ] (build $v$P)
b. [$_{v\text{P}}$ $v$ [$_{\text{VP}}$ criticized John ] (cyclic movement)
c. [$_{v\text{P}}$ John $v$ [$_{\text{VP}}$ criticized John ]] (Transfer $v$P)
d. [$_{v\text{P}}$ John $v$ [$_{\text{VP}}$ criticized ~~John~~ ]] (Spell-Out VP)
e. [$_{v\text{P}}$ John $v$ ⟨[$_{\text{VP}}$ criticized ~~John~~ ]⟩ ] (build TP)
f. [$_{\text{TP}}$ T [$_{v\text{P}}$ John $v$ ⟨[$_{\text{VP}}$ criticized ~~John~~ ]⟩ ]] (raise *John*)
g. [$_{\text{TP}}$ John T [$_{v\text{P}}$ John $v$ ⟨[$_{\text{VP}}$ criticized ~~John~~ ]⟩ ]] (build CP)
h. [$_{\text{CP}}$ C [$_{\text{TP}}$ John T [$_{v\text{P}}$ John $v$ ⟨[$_{\text{VP}}$ criticized ~~John~~ ]⟩ ]]] (topicalize VP)

i. $[_{\text{CP}}\ \langle[_{\text{VP}}\ \ldots\ \sout{\text{John}}\ ]\rangle\ \text{C}\ [_{\text{TP}}\ \text{John}\ \text{T}\ [_{v\text{P}}\ \text{John}\ v\ \langle[_{\text{VP}}\ \ldots\ ]\rangle\ ]]]$

(Transfer CP)

j. $[_{\text{CP}}\ \langle[_{\text{VP}}\ \ldots\ \sout{\text{John}}\ ]\rangle\ \text{C}\ [_{\text{TP}}\ \text{John}\ \text{T}\ [_{v\text{P}}\ \sout{\text{John}}\ \sout{\langle[_{\text{VP}}\ \ldots\ ]\rangle}\ ]]]$

$(\ldots)$

(13b-c) involves cyclic movement of *John* to the edge of the $v$P-phase. Transfer of $v$P in (13c-d) leads to deletion of the remnant-internal copy of *John* as it is c-commanded by the higher copy in the outer Spec$v$P at PF. By assumption, Spell-Out of VP (13d-e) retains VP's root node (Uriagereka 1999; Nunes and Uriagereka 2000; Fowlie 2013), which thus remains accessible without having moved to the edge of $v$P. Next, the higher copy of *John* raises to SpecTP (13f-g) and the remnant VP moves to SpecCP (13h-i). Finally, Transfer of CP involves deletion of the copy of *John* at the $v$P-phase edge and of the (atomized) copy of VP (13i-j).[3]

This solution is local, as copy deletion only needs to inspect the current phase, not the whole representation. It also allows the PIC to be derived from cyclic spell-out, as any element inside the phase domain will become inaccessible to operations outside the phase once the phase head's complement has been atomized. The proposal thus offers a way to make the idea that copy deletion is a PF process compatible with phase theory, in particular with the derivation of the PIC from cyclic spell-out, while avoiding the drawbacks of Nunes (2004) and Collins

and Stabler (2016). It does so at the cost of introducing an additional operation Transfer that makes the whole phase PF-accessible. However, it has been argued on independent grounds that more than just the phase domain has to be visible at PF (cf. Simpson and Wu 2002 on tone sandhi and Dobashi 2003; Sato and Dobashi 2016 on linearization).

## 4 Consequences

The account crucially relies on the existence of a spell-out domain, i.e. a phase level, below CP, be that $v$P or VoiceP. Although there is a considerable amount of arguments in favour of such a phase (Clements et al. 1983; Chung 1994; Fox 1999; Legate 2003; Manetta 2010; van Urk and Richards 2015; Heck and Himmelreich 2016; Ingason and Wood 2017; Korsah and Murphy 2020) some of these have lately been called into question (Dikken 2006; Keine 2016, 2020; Dayal 2017). In particular, it has been claimed that while arguments are compatible with $v$P being a phase, they do not actually require it (Keine 2016: 404ff.) and therefore do not constitute compelling evidence for the phase status of $v$P. To the extent that the present paper might serve as a further argument for the $v$P phase it is worth pointing out that this criticism does not pertain to it.

The proposal further entails that unaccusative and passive $v$Ps, which do not select an external argument, must also constitute phases

(Legate 2003, Sauerland 2003; pace Chomsky 2001). In the sentence (12), the VP containing the passivized verb *criticize* has undergone remnant VP topicalization. The remnant-internal copy of *John* must thus have been deleted prior to VP-topicalization, which is only possible, if the passive $v$P in (13) is a phase that has undergone Transfer.

It follows from this implementation that only phrases that are complements of phase heads (i.e. only phase domains) may act as remnants in a remnant movement derivation. Why? There is no way to delete the remnant internal copy and then move the remnant if both the higher and the lower copy are properly contained inside the phase domain $\Delta$.

## 5 Conclusion

We have presented a solution to Gärtner's problem, that is, the problem of remnant-internal copy deletion, which is based on the idea that deletion applies cyclically, at the phase level. The analysis assumes that the whole phase, including the edge, is transferred to PF. This is motivated by the general need of cyclically moved categories to be able to induce PF-deletion of their own copy. After PF-computation has taken place, the phase is returned to syntax with the phase domain atomized but still present. This makes remnant-internal copy deletion possible at an intermediate stage in the derivation where it is still

c-commanded by a higher copy. Crucially, this presupposes that there is a domain of cyclic spell-out below CP, which in turn requires there to be a phase, namely $v$P. In contrast to previous approaches (Nunes 2004; Collins and Stabler 2016), this allows for a very local determination of remnant-internal copy deletion while at the same time retaining the PIC to follow from cyclic spell-out.

## Notes

[1]The idea of cyclic deletion is already briefly mentioned in Bošković and Nunes (2007) and in Collins and Sabel (2015). In both cases, the details of the analysis are not worked out, though. Moreover, Collins and Sabel (2015) do not relate it to the theory of phases.

[2]Bošković and Nunes (2007: 66f.) also briefly sketch a phase-based proposal for copy deletion (where CP is the only phase). In their approach, however, the antecedent and remnant-internal copy are both contained in the phase domain (TP in their case). While this makes Transfer of the head and edge unnecessary, it requires PIC-violating movement of the remnant to its final landing site. If the remnant would move to the phase edge before Spell-Out in order to avoid a PIC violation, the remnant-internal copy could be deleted in the remnant copy in the base position at Spell-Out, but not in the remnant copy in SpecCP, which is exactly *Gärtner's problem* again.

[3]V-to-$v$ movement can be incorporated by assuming that (12) involves $v$P-topicalization, $v$P being the complement of Voice and VoiceP being the relevant phase (Collins 2005, Merchant 2013, Legate 2014).

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