Delayed Linearization and Haider's Paradox

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1 Introduction

This paper aims to offer a solution to a linearization puzzle known as the Haider's Paradox (Haider 1994). The puzzle is shown in (1). It concerns two right dislocated (i.e. post-verbal in German) constituents — a restrictive relative clause (RC) and a finite sentential complement (CP). In (1-a) the matrix object pronoun *ihr* and a full DP *Ida* inside RC can be co-indexed without creating a Condition C violation. It suggests that RC is not c-commanded by *ihr*. In (1-b) the co-indexation of *ihr* and a full DP inside CP triggers a Condition C Effect, signaling that CP is in the c-command domain of the pre-verbal argument.

(1) *Haider's Paradox*

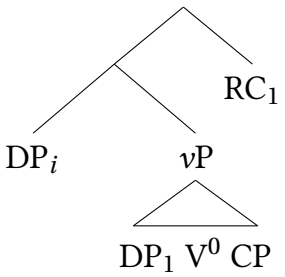
a. Es hat [$_{vP}$ ihr$_i$ jemand$_1$ gesagt [$_{RC}$ dem Ida/sie$_i$ blind
EXPL has her someone said whom Ida/she blindly
vertraut]$_1$ [$_{CP}$ dass sie$_i$ sehr alt wird]]
trusts that she very old becomes
'Someone who Ida blindly trusts told her that she is getting very old'

b. *Es hat [$_{vP}$ ihr$_i$ jemand$_1$ gesagt [$_{RC}$ dem Ida/sie$_i$ blind
EXPL has her someone said whom Ida/she blindly
vertraut]$_1$ [$_{CP}$ dass Ida$_i$ sehr alt wird]]
trusts that she very old becomes
(Haider 1994, cited by Büring and Hartmann 1997, p. 11, ex. 19)

The tree in (2) reflects these facts — DP$_i$ c-commands CP and does not c-command

RC.[1] Under standard assumptions about how dominance (c-command) is translated into precedence, CP in (2) is expected to precede RC, contrary to fact.

(2)



Furthermore, as noted in Haider (2010), the only possible order of the two constituents in the right field in German is RC $\prec$ CP, not CP $\prec$ RC:

(3) a. Es fiel im vergangenen Jahrhundert einem Grammatiker$_1$ auf
EXPL stand in past century a grammarian out
[**RC** der das untersuchte]$_1$ [**CP** dass dieser Satz grammatisch ist]
who this investigated that this sentence grammatical is
'It struck a grammarian from the last century who analyzed it that this sentence is grammatical'

b. *Es fiel im vergangenen Jahrhundert einem Grammatiker$_1$ auf [**CP**
EXPL stand in past century a grammarian out
dass dieser Satz grammatisch ist] [**RC** der das untersuchte]$_1$
that this sentence grammatical is who this investigated
(Haider 2010, p. 198, exx. 6iv.a-b)

If RC precedes CP and CP is situated in the c-command domain of DP$_i$ as we concluded above, RC is expected to appear in its c-command domain too, yet the lack of Condition C Effect in (1-a) suggests otherwise.

In this paper I argue that RC and CP take two different routes moving to the right field. RC moves rightward in the narrow syntax, but in German it cannot cross another DP and thus it does not affect binding. For the right dislocation of CP I propose a new mechanism of *Delayed Linearization* that pushes CP to the right edge of an utterance during Spell-Out without changing its c-command relationships. In what follows I show how this proposal accounts for the discrepancy between structural and linear facts in (1) and a wider range of properties of RC and CP.

The rest of the paper is organized as follows: in Section 2 I discuss the analysis of Haider's Paradox in Inaba (2013). In Section 3 I argue that Inaba's (2013) assumption that CP stays in-situ as a sister of V is inconsistent with two linear effects

[1] DP$_1$ is the host of RC, the in-situ subject *jemand* in (1).

of the post-verbal CP. Section 4 introduces my proposal for Haider's Paradox and the mechanism of Delayed Linearization for the right dislocation of CP. Section 5 contains a new proposal about the extraposition of RC. Section 6 concludes the paper.

2 A previous analysis — Inaba (2013)

Inaba (2013) offers an interesting solution to Haider's Paradox. Unfortunately, the scope of his paper (it is a review of Haider 2010) prevents him from spelling out all of the details of his proposal. I will do my best here to fill in the details, while adhering to the spirit of Inaba's analysis. I first consider the binding facts and then discuss the linear order part of Haider's Paradox.

There are two binding facts pertaining to the paradox according to Haider (1994). The first is that a pre-verbal argument can bind into CP and trigger the Condition C Effect. The second is that a pre-verbal argument does not bind into an extraposed RC resulting in no Condition C violation.

For binding into CP Inaba (2013) posits that CP is base-generated and spelled out as a sister of V (Barbiers 2000; Cardinaletti 1990; Haider 1994, 1997, 2000; Inaba 2007; Kayne 1994; Koster 2016; Webelhuth 1989; Zwart 1993). This analysis is corroborated by two kinds of facts. The first is that pre-verbal arguments can bind into CP as demonstrated by the variable binding in (4) and the violation of Condition C in (5).

(4) ...weil der Direktor jeder Putzfrau$_i$ persönlich mitteilte [$_{CP}$ dass sie$_i$ entlassen sei]
because the director each cleaning.lady personally told that she fired was
'...because the director told each cleaning lady personally that she was fired'
(Bayer 1995, p. 56, ex. 17a)

(5) *...weil der Direktor ihr$_i$ persönlich mitteilte] [$_{CP}$ dass die Putzfrau$_i$ entlassen sei]
because the director her personally told that the cleaning.lady fired was
int. '...because the director told her personally that the cleaning lady was fired'
(Bayer 1995, p. 56, ex. 17b)

The second is the possibility of extraction from the post-verbal CP in (6-a) and (7-a), but not from the pre-verbal CP in (6-b) and (7-b). If the post-verbal CP appears in

its base position and the pre-verbal CP reaches its surface position via movement, the extraction asymmetry between (6-a) and (7-a) and between (6-b) and (7-b) can be attributed to a ban on movement out of a moved constituent (Ross 1967; Wexler and Culicover 1980), see Bošković (2018) and Corver (2017) for a recent overview and discussion.

(6) Ich weiss nicht ...
I know not

a. *wen*$_1$ er gesagt hat [$_{CP}$ dass Claudia ~~*wen*~~$_1$ geküsst hat]
whom he said has that Claudia kissed has
'I don't know who he said that Claudia kissed' (Müller 2011, p. 166, ex. 58b)

b. **wen*$_1$ er [$_{CP}$ dass Claudia ~~*wen*~~$_1$ geküsst hat] gesagt hat
whom he that Claudia kissed has said has
(Müller 2011, p. 166, ex. 58a)

(7) a. *Wen*$_1$ hat er gesagt [$_{CP}$ dass Claudia ~~*wen*~~$_1$ geküsst hat]
whom has he said that Claudia kissed has
'Who did he say that Claudia kissed?' (Müller 2011, p. 166, ex. 58b)

b. **wen*$_1$ hat er [$_{CP}$ dass Claudia ~~*wen*~~$_1$ geküsst hat] gesagt
whom has he that Claudia kissed has said
(Müller 2011, p. 166, ex. 58b)

For binding into RC Inaba (2013) claims that its interpretation in Haider (1994) is misconstrued. What has to be explained in relation to the paradox instead is that the operation of RC extraposition in German does not affect binding. To support this claim Inaba shows the minimal pair in (8) where the co-indexation of a pre-verbal argument with an R-expression inside RC does not trigger the Condition C Effect irrespective of whether RC is extraposed or not.

(8) a. Es hat ihr$_i$ jemand$_1$ prophezeit [dem Ida$_i$ blind vertraut]$_1$ [dass
EXPL has her someone predicted who Ida blindly trusts that
Ida$*_i$ uralt werde]
Ida very.old would.become

b. Es hat ihr$_i$ jemand$_1$ [dem Ida$_i$ blind vertraut]$_1$ prophezeit
EXPL has her someone predicted who Ida blindly trusts
[dass Ida$*_i$ uralt werde]
that Ida very.old would.become
(Inaba 2013, p. 110, exx. 37–38)

Inaba (2013) interprets the binding insensitivity as an indication that RC extrapo-

sition in German is post-syntactic. He posits that RC is born together with its host and is extraposed at PF.

This proposal that RC extraposition in German is post-syntactic is based on Inaba (2005, 2007) where he shows that RC extraposition in German is different from English with respect to semantic effects. In English RC extraposition has a range of semantic effects, e.g. it escapes the Condition C Effect (9) and it can save a superlative by evacuating it from the scope of negation in (10).

(9) a. *I sent her$_i$ many gifts [that Mary$_i$ didn't like] last year
b. I sent her$_i$ many gifts last year [that Mary$_i$ didn't like]
(Culicover and Rochemont 1990, p. 29, exx. 13a-b)

(10) a. *M. thinks that the extraposition transformation [which has *the slightest* effect on LF] has*n't* been found yet
b. M. thinks that the extraposition transformation has*n't* been found yet [which has *the slightest* effect on LF]
(Guéron 1980, p. 650, exx. 44a-b)

In contrast, RC extraposition in German does not change binding relations. (8) shows that if a pre-verbal argument does not bind into extraposed RC, it is not going to bind into RC that appears in-situ either. Similarly, if a pre-verbal argument binds into the in-situ RC, it is going to bind into the extraposed RC too (11).

(11) a. *Ich habe ihr$_i$ mit Absicht viele Geschenke [die Maria$_i$ nicht mag]
I have her with intent many gifts that Maria not like
geschickt
sent
int. 'I intentionally sent her many gifts that Maria didn't like'
b. *Ich habe ihr$_i$ mit Absicht viele Geschenke geschickt [die Maria$_i$
I have her with intent many gifts that Maria not
nicht mag]
like sent
(Inaba 2007, p. 112, ex. 36)

The difference in semantic effects between RC extraposition in German and English reported in Inaba (2005, 2007) can be attributed to the difference in timing of RC extraposition within the derivation. In English RC extraposition is a syntactic operation which creates a new configuration interpreted by both LF and PF, while in German RC extraposition is post-syntactic and therefore leads to no consequences for LF. This line of reasoning is adopted in Inaba (2013).

Turning to the linear order part of Haider's Paradox, there are also two facts that

need to be explained: that the linear order V $\prec$ RC $\prec$ CP is allowed and that the linear order V $\prec$ CP $\prec$ RC is prohibited. Recall that CP stays in-situ as a sister of V; it does not undergo movement. It follows that the word order facts must be created either by verb movement or by RC extraposition or their combination.

Inaba (2013) does not discuss verb movement as a part of his analysis of Haider's Paradox, but since the analysis is formulated in terms of Haider (2010), I assume that Inaba adopts the approach to verb movement defended in Haider (2010, Ch. 2), namely, that the clause-final verb stays in its base position inside VP. If V does not move, the linear order facts must be created by RC extraposition alone.

For RC extraposition Inaba (2013) suggests that RC moves at PF from its host-adjacent base position according to the following rule:

(12) Extraposition places the relative clause into the nearest postfield.
(Inaba 2013, p. 108, ex. 32)

The notion of "postfield" (*Nachfeld*) is a common descriptive term of German syntax reserved for phrases appearing post-verbally. Importantly, it does not have a specific grammatical mechanism associated with it. Inaba (2013, p. 110, fn. 20) suggests that the rule in (12) "might be considered a specific version of a more general constraint proposed by Truckenbrodt (1995, p. 503)". Truckenbrodt (1995) introduces the prosodic restriction on the extraposition of RC and PP that is shown in (13). Note that Truckenbrodt (1995) develops this constraint for the extraposition of both RC and PP. RC is matched with an intonational phrase, PP is matched with a phonological phrase (see Section 4 for details).

(13) a. Let XP be a prosodic category that is canonically mapped into the prosodic category π upon extraposition (where π is either a phonological phrase or the intonational phrase in the following). Then extraposition from NP will take XP as far as out of a prosodic constituent of the same category π.

b. $(\ldots \text{XP} \ldots) \rightarrow (\ldots \text{t}_i \ldots)_\pi \, (\text{XP}_i)_\pi$ (Truckenbrodt 1995, p. 503)

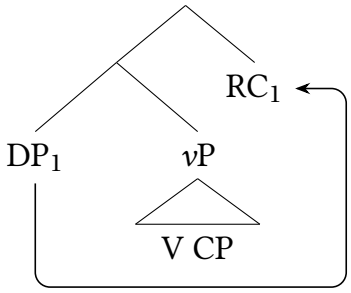
Truckenbrodt (1995) introduces (13) as a prosodic constraint restricting a *syntactic* operation of extraposition. Its purpose is to filter out syntactic trees in which the extraposition movement is either too long or too short.

If RC extraposition is created by a movement operation in a syntactic tree, there are two existing proposals for how the movement operation works that Inaba could have in mind. One is introduced in Inaba (2005). It claims that RC extraposition in German is a special kind of syntactic movement that targets only phonological features and moves them to a new position leaving the semantic features behind.[2]

[2]Jonathan Bobaljik (personal communication) notes that if the requirement to move to a c-

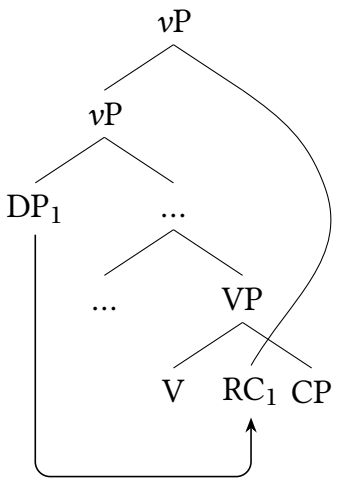
The problem with this mechanism is that, all else equal, as a movement operation it should move RC to a c-commanding position, which would be higher in the tree than CP as shown in (14). And with the usual assumptions about how dominance is translated into precedence, the only word order following from (14) is V $\prec$ CP $\prec$ RC, which is ungrammatical as we observed in (3).

(14)



To save this, one possibility would be to alter the usual linearization algorithm to allow RC to appear between V and CP as in (15). What this means in practice is to relax the Non-Tangling Condition in (16) (Chomsky 1993; Wall 1972).[3]

(15)



(16) *Non-Tangling Condition (informal version)*
If one node X precedes another node Y then all nodes dominated by X must precede Y and all nodes dominated by Y.

commanding position follows from a restriction on traces it may apply to syntactic/semantic features, but not necessarily to the movement of phonological features only. Under this view, the movement of RC could potentially lower it to a position between V and CP. This account is . also erases all restrictions on possible positions to which RC could move, so we would expect the extraposed RC to appear outside of the right field, including a position between parts of a complex verb. Another potential problem for the lowering analysis of RC extraposition is its ordering with complex verbal of multiple instances of RC extraposition in (20) (19).

[3]In (15) X is *v*P and Y is RC_1.

(Carnie 2008, p. 43, fn. 30, ex. ii)

Another possibility is that Inaba could postulate a new kind of lowering movement that directly "tucks in" RC between the two sisters V and CP. Both proposals would be novel, and therefore if Inaba intended them, they would likely be explicitly mentioned in the paper. Since neither is, it seems fair to say that Inaba does not intend either proposal. As such, it seems unlikely that Inaba's (2013) analysis could rely on the phonological feature movement operation from Inaba (2005), as it would not generate the correct word order.

A second syntactic mechanism is described in Sauerland and Elbourne (2002). They propose that PF-movement can be seen as syntactic movement that occurs after Spell-Out. This proposal can be applied directly to RC extraposition in German. At LF, RC didn't move at all, hence the lack of semantic effects; while at PF, RC moves, which creates a new word order. However, this proposal suffers from the same problems as the first mechanism. If RC extraposition in German is a type of syntactic movement operation, then, all else being equal, we expect RC to move to a c-commanding position. This would require relaxing the Non-Tangling Condition for RC to appear between V and CP. The other option is to reformulate the movement as a lowering operation. Neither modification is mentioned by Inaba (2013). As such, it seems unlikely that Inaba's (2013) analysis could rely on the Sauerland and Elbourne (2002) mechanism either, as it would not generate the correct word order.

As it stands, the analysis offered in Inaba (2013) derives the structural part of Haider's Paradox. If the post-verbal CP is a sister of V, it is in the c-command domain of pre-verbal arguments. The fact that the extraposition of RC does not affect its binding follows from the assumption that RC extraposition in German is a PF-movement. However, in its current form Inaba's account does not seem to be able to derive the correct linear order without fairly extreme modifications: either a lowering movement operation or the relaxation of the Non-Tangling Condition.

In the next three sections I offer a new analysis that solves these problems. In Section 3, I show that Inaba's (2013) assumption that CP stays in-situ as a sister of V is inconsistent with linear effects of the post-verbal CP and that the processes targeting RC and CP are principally different based on their effect on the prosodic structure of the utterance. In Section 4, I propose that the post-verbal CP in German is subject to a PF operation that temporarily excludes CP from the process of linearization. I call this operation *Delayed Linearization*. In Section 5, I propose that in German RC is extraposed in narrow syntax, similar to English. I argue that the differences in semantic effects of RC extraposition in English and German (Inaba 2005, 2007) can be deduced from independently motivated locality restrictions on movement in the two languages. In German RC extraposition is shorter than

in English. Because of that it does not change the scope of RC and does not cause any semantic effects. I show that these two proposals capture both the linear and structural parts of Haider's Paradox.

3 CP does not stay in-situ, nor does it move

One important assumption in Inaba (2013) is that CP stays in-situ as a sister of V. In the previous section we saw two kinds of effects that support this assumption. Binding into CP by pre-verbal arguments in (4) and (5) suggests that CP appears lower in the structure than pre-verbal arguments. Extraction asymmetries between the pre-verbal and the post-verbal positions of CP in (6) and (7) suggest that the post-verbal CP appears in its base position (and pre-verbal CP appears in a displaced position). Note that both of these effects are structural and require that CP appears in-situ in narrow syntax or at LF. But it is possible that CP moves at PF.

In this section I introduce two linear effects of CP. The first effect, as I argue, cannot be deduced from the assumption that CP and V are structural sisters alone. Instead, I propose that in German CP is targeted by an additional PF process that alters its linear position without changing its structural position. Therefore I adopt the structural assumption from Inaba (2013) that CP is the sister of V, but argue that there is an additional PF process that applies to CP.

I further consider extending the PF-movement account of Inaba (2013) from RC extraposition to the right dislocation of CP. Under this view, the additional PF process that targets CP is the syntactic movement operation that happens during Spell-Out. I show that this hypothetical analysis where both RC and CP move at PF can potentially derive the linear part of Haider's Paradox. However, the second linear effect of CP that emerges from considering a larger class of constructions with multiple right dislocation of RC and CP shows that this account significantly overgenerates and thus requires adopting an ad-hoc surface restriction on the linear order of RC and CP. Because of that I argue that this account has to be rejected. My own non-movement proposal for the PF mechanism targeting CP is discussed in Section 4.

The first linear effect of CP is the possibility of disrupting linear adjacency between V and CP. If V and CP are sisters and both remain in-situ as proposed in Inaba (2013), we would expect them to always be linearly adjacent. This is not the case. One example of this is Haider's Paradox in (1-a) where an extraposed RC is inserted between V and CP. But RC is not the only item that can intervene between V and CP. Parts of a complex verb can separate V and CP as in (17).[4] Wurmbrand (2007) argues that complex verbs in German do not form a single complex head in

[4]This, of course, requires that the base order is V $\prec$ CP.

syntax, i.e. they do not undergo head movement.[5] She suggests instead that the German complex verb is created via syntactic complementation only. If CP and V-1 are sisters, V-2 selects VP-1, and V-1 and V-2 do not form a complex head, then we expect to see the word order V-1 $\prec$ CP $\prec$ V-2, but instead in (17) we find V-1 $\prec$ V-2 $\prec$ CP as the only option.

(17) a. Wenn dir jemand **sagen will**, [$_{\mathbf{CP}}$ dass du etwas nicht
if to.you someone to.tell wants that you something not
kannst oder etwas nicht bist], dann halte etwas Distanz und
can or something not are then keep some distance and
gebe extra viel Dampf.
give extra much steam
'If someone wants to tell you that you are not capable of something or you are not it, keep a distance and chill' (Befeni.Club, 13.02.2018)

b. *Wenn dir jemand **sagen**, [$_{\mathbf{CP}}$ dass du etwas nicht kannst
if to.you someone to.tell that you something not can
oder etwas nicht bist], **will**, dann halte etwas Distanz und
or something not are wants then keep some distance and
gebe extra viel Dampf.
give extra much steam

In order to create this linear effect we may want the following to happen during Spell-Out: V-1 and V-2 (and extraposed RC) are added to the linear sequence first and CP is added later. A standard way to implement this intuition is to postulate a rightward movement operation for CP in narrow syntax. But this is not compatible with the two structural effects of CP mentioned in the beginning of this section (extraction asymmetries between pre- and post-verbal CPs and binding by pre-verbal arguments) that suggest that CP stays in-situ in the post-verbal position in narrow syntax and at LF.

Another way to do it is to postulate that CP moves to a new syntactic position at PF (following Sauerland and Elbourne 2002). This way, within the purview of narrow syntax and LF, CP remains in-situ, while at PF the linear adjacency between V and CP is disrupted. Recall that, according to Inaba (2013), RC also moves at PF, so it seems reasonable to expect that CP and RC are targeted by the same operation of PF-movement.

This hypothetical analysis that assumes that both RC and CP move to the right via PF-movement can derive the linear part of Haider's Paradox. The paradox is

[5]The claim in Wurmbrand (2007) is, in fact, more general. She argues that there are no complex heads at all in syntax. See also Wurmbrand and Bobaljik (2005) for a proposal that the impossibility of splitting of a complex verb is a PF effect.

repeated in (18). Since both RC and CP undergo movement, only two derivational restrictions are necessary: that CP moves after RC and that the PF-movement of CP is obligatory. These restrictions rule out the word order CP $\prec$ RC in (18-b), which cannot satisfy both of them simultaneously. CP could precede RC either if RC moved across CP that stayed in-situ thus violating the first restriction or if CP moved first and RC moved across it later which violates the second restriction. This leaves RC $\prec$ CP in (18-a) as the only possible word order.

(18) a. Es hat [$_{vP}$ ihr$_i$ jemand$_1$ gesagt [$_{RC}$ dem Ida/sie$_i$ blind
EXPL has her someone said whom Ida/she blindly
vertraut]$_1$ [$_{CP}$ dass sie$_i$ sehr alt wird]]
trusts that she very old becomes
'Someone who Ida blindly trusts told her that she is getting very old'

b. *Es hat [$_{vP}$ ihr$_i$ jemand$_1$ gesagt [$_{RC}$ dem Ida/sie$_i$ blind
EXPL has her someone said whom Ida/she blindly
vertraut]$_1$ [$_{CP}$ dass Ida$_i$ sehr alt wird]]
trusts that she very old becomes

However, in what follows I argue that this account does not fare well with respect to a larger class of constructions with multiple right dislocation of CP and RC. Specifically, it overgenerates with respect to the second linear effect of CP, the alignment of CP with the right edge of the utterance that blocks any rightward displacement across it. In what follows I show that the only way to restrict the overgeneration within the account where both RC and CP move requires an ad-hoc representational (surface) restriction on the word order of RC and CP.

The class of multiple right dislocation constructions under consideration is organized along two parameters[6], each has two values — the right edge that functions as the target for RC_1 extraposition (RC_1 at the edge of *v*P vs. RC_1 at the edge of CP) and the label of the second constituent in addition to the extraposed RC_1 (CP_{ARG} vs. RC_2). I make two assumptions about the origination site of the movement of CP and RC. The PF-movement of CP starts from its base position of a sister of V, in what follows I consider both local and successive-cyclic options for it. The PF-movement of RC starts from the final position of its host and proceeds as far as the right edge of the next phase (*v*P or CP). All four logical possibilities are shown in Table 1.

[6]One may have expected to see three parameters here — label of the first constituent (RC vs. CP_{ARG}), label of the second constituent (RC vs. CP_{ARG}), and the surface position of the first constituent (the right edge of *v*P vs. the right edge of CP). However, to the best of my knowledge, there are no verbs that take two CP complements. It reduces the number of logical possibilities from eight (2x2x2) to four (2x2).

	RC_1 at the edge of *v*P	RC_1 at the edge of CP
CP_{ARG}	$[_{CP}\ [_{vP}\ t_1\ t_{ARG}$ ...$RC_1\ CP_{ARG}\ ]\ ]$	$[_{CP}\ t_1\ [_{vP}\ t_{ARG}$ ...$CP_{ARG}\ ]\ RC_1\ ]$
RC	$[_{CP}\ [_{vP}\ t_1\ t_2$ ...$RC_1\ RC_2\ ]\ ]$	$[_{CP}\ t_1\ [_{vP}\ t_2$ ...$RC_2\ ]\ RC_1\ ]$

Table 1: Multiple right dislocation of CP and RC

In Haider's Paradox sentences in (18) both CP_{ARG} and RC originate inside *v*P. This is the top left cell in Table 1 (CP_{ARG} and RC; both are at the edge of *v*P). I assume that the subject in (18) appears in Spec;*v*P and the transitive expletive *es* appears outside *v*P. CP_{ARG} is the sister of V. Above we saw that the account that postulates PF-movement for both CP_{ARG} and RC could derive the linear part of Haider's Paradox by making the PF-movement of CP_{ARG} obligatory and scheduling the movement of RC to precede the movement of CP_{ARG}.

(19) shows that there is no such restriction for two RCs at the edge of *v*P, both orders of RCs are possible there. This is the bottom left cell in Table 1 (two RCs in the same Spell-Out Domain). The observation in (19) is new to my knowledge. I consulted 11 speakers of German, they all agreed with the judgments shown in (19) and reported a sharp contrast between within-pair differences in acceptability of (19) and (20).

(19) a. ?weil sie keinem$_1$ etwas$_2$ gesagt hat [was ihm nützte]$_2$
because she nobody something said has what to.him be.useful
[der ihr begegnete]$_1$
who her encountered

b. ?weil sie keinem$_1$ etwas$_2$ gesagt hat [der ihr begegnete]$_1$
because she nobody something said has what to.him be.useful
[was ihm nützte]$_2$
who her encountered

Wiltschko (1995) reports that the ordering of RCs becomes obligatory when their hosts are separated by a phase boundary, cf. (20) and (19).[7] In (20) the order of RCs must be the mirror image of the order of their hosts. This is the bottom right cell in Table 1 (two RCs in different Spell-Out Domains).

[7]As Susi Wurmbrand and Jonathan Bobaljik (personal communication) point out, (19-b) requires that the subject DP must move outside *v*P. This requirement seems to be at odds with Wurmbrand (2006) who argues that indefinite subjects in German can stay inside *v*P/VP. One way to reconcile my analysis with Wurmbrand (2006) is to suppose that indefinite subjects that can license relative clauses are different from indefinite subjects appearing without relative clauses in German. This, of course, requires further research.

(20) a. weil [ein Mann]$_1$ [die Party]$_2$ langweilig finden wird [die
because a man the party boring consider will which
Maria veranstaltet]$_2$ [der nur Bier trinkt]$_1$
Maria organizes who only drinks beer
'because a man who only drinks beer will consider the party boring which Maria organizes'

b. *weil [ein Mann]$_1$ [die Party]$_2$ langweilig finden wird [der nur
because a man the party boring consider will who only
Bier trinkt]$_1$ [die Maria veranstaltet]$_2$
drinks beer which Maria organizes

(Wiltschko 1995, p. 163, ex. 34a-b)

The interpretation I offer for the contrast between (19) and (20) is based on the assumption that the Spell-Out is cyclic and phase-based (Chomsky 2001, 2008; Epstein et al. 1998; Richards 2006; Uriagereka 1999). After Lee-Schoenfeld (2008) I also assume that in German at least *v*P and CP are phases and therefore they are separate Spell-Out Domains. It is also necessary that an extraposed RC appears in the same phase as its host, see Section 5 for the deduction of this restriction. With these assumptions, the strict ordering in (20) results from RCs appearing on the right edges of two different Spell-Out Domains (*v*P and CP). The object-linked RC moves to the edge of *v*P and stops there, while the subject-linked RC is extraposed to the right edge of CP. In contrast, in (19) both RCs appear at the right edge of the same Spell-Out Domain (*v*P) and, assuming after Chomsky 2001; Richards 2006 that there is no imposed schedule for two instances of PF-movement within the same Spell-Out Domain, there is no restrictions on the order of RCs and both orders are possible.

Finally, consider the last, top right cell of Table 1 (CP_{ARG} and RC in different Spell-Out Domains). (21) provides a modified version of Haider's Paradox sentences. In the original Haider's Paradox sentences both CP_{ARG} and RC appear inside *v*P, since CP_{ARG} is a sister of V and the host of RC remains in Spec;*v*P. The modification of those sentences in (21) places the subject outside *v*P thus RC is now extraposed to the edge of a different Spell-Out Domain, CP. Similar to (18), CP_{ARG} is the sister of V and moves to the edge of *v*P. Therefore in (21) RC and CP_{ARG} are separated by the phasal boundary in contrast to (18) and similar to (20). However, unlike (20), both word orders in (21) are banned. The observation in (21) is new to my knowledge, I consulted 11 speakers of German and they all agreed with the judgments in (21) and contrasted them with Haider's Paradox sentences in (18).

(21) a. *Jemand$_1$ hat [$_{vP}$ ihr$_i$ gesagt [$_{RC}$ dem Ida/sie$_i$ blind vertraut]$_1$ [$_{CP}$
someone has her said whom Ida/she blindly trusts

dass sie$_i$ sehr alt wird]]
that she very old becomes

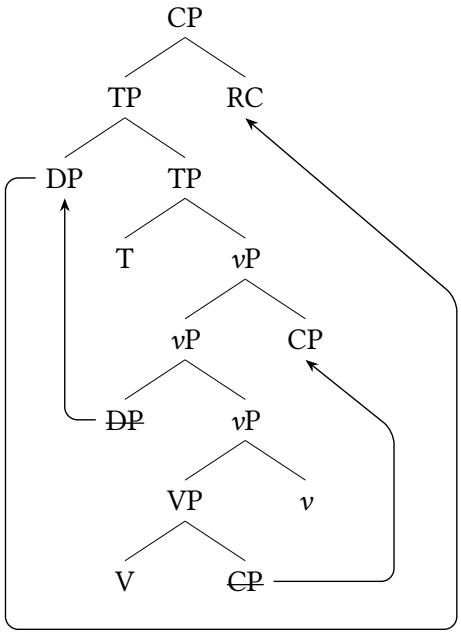
b. *Jemand$_1$ hat [$_{vP}$ ihr$_i$ gesagt [$_{CP}$ dass sie$_i$ sehr alt wird]] [$_{RC}$
someone has her said that she very old becomes
dem Ida/sie$_i$ blind vertraut]$_1$
whom Ida/she blindly trusts

(21) illustrates the second linear effect of CP. In a nutshell, the rightward movement across CP_{ARG} (i.e. a movement that positions its target linearly to the right of CP_{ARG}) must be prohibited, even if this movement happens in a different, higher Spell-Out Domain. The only exception to this generalization that I know of is result clauses, which can follow CP_{ARG}, cf. (22) and see Haider (2010, p. 189) for many more examples (also Manetta 2013, p. 66 mentions in fn. 26 that an anonymous reviewer offered a similar observation about the order of CP_{ARG} and result clauses in Hindi). I have nothing to say about the syntax of result clauses or other adjuncts at the moment and leave it for future research.

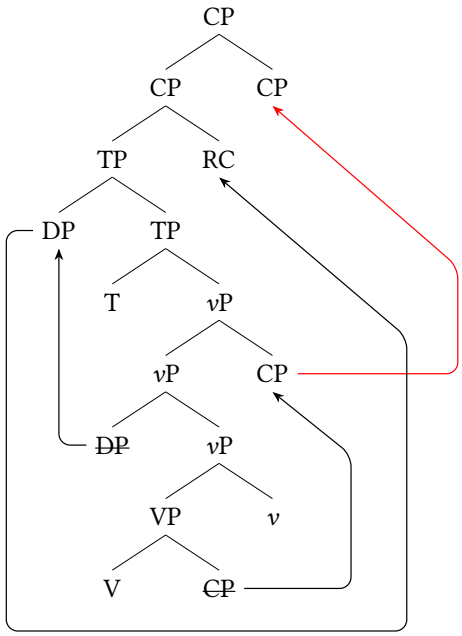
(22) Mir haben soviele Leute versichert, [$_{CP}$ dass es so sei], [$_{ResultCP}$
me have so.many people assured that it so would.be
dass ich es selbst auch schon glaube]
that I it myself also already believe
'So many people have assured me that it would be so, that I myself believed it too' (Haider 2010, p. 189, ex. 2a)

The hypothetical PF-movement account of CP and RC offers two options for how to analyze (21), depending on whether PF-movement of CP_{ARG} is successive-cyclic or not. Trees for these options are shown in (23) and (24). In both trees the subject DP raises from Spec;*v*P to Spec;TP, CP_{ARG} moves via PF-movement to the edge of *v*P, the subject-linked RC PF-moves from DP-adjoined position in Spec;TP to the edge of CP. In (24) CP_{ARG} further moves from the edge of *v*P to the edge of CP.

(23) *Option 1*



(24) *Option 2*



In (23) the only word order that is expected to be possible (incorrectly) is V $\prec$ CP_{ARG} $\prec$ RC. The inverse word order V $\prec$ RC $\prec$ CP_{ARG} is (correctly) prohibited by the Non-Tangling Condition (16). Note that the same word order V $\prec$ CP_{ARG} $\prec$ RC must be banned both in the derivation of (3-b) (which shows the inverse word order for the Haider's Paradox sentences in (18)) and in the derivation of the modified version of Haider's Paradox sentences in (21-b), but the derivational timing solution we offered for (3-b) and (18-b) (CP_{ARG} moves obligatorily and it must move after RC moves) cannot be extended to (21-b), since RC and CP_{ARG} there appear in different Spell-Out Domains (CP and *v*P respectively) and so the relative timing of their PF-movements is irrelevant. The only other alternative to rule out (21-b) is to propose an ad-hoc representational restriction that bans the word order CP $\prec$ RC altogether. This way, the derivational proposal we have made for the linear part of Haider's Paradox in (18) becomes redundant.[8] Therefore this account is untenable

[8]Susi Wurmbrand (personal communication) notes that this argument can potentially be undermined by the possibility that in German the RC extraposition from the subject in Spec;CP constitutes an island effect violation (i).

(i) *Jemand$_1$ hat ihr eine Geschichte erzählt, [$_{RC}$ dem Ida blind vertraut]$_1$.
someone has her a story told who Ida blindly trusts

Out of 11 speakers of German I consulted 7 did not agree with the judgment in (i) and found it more acceptable (? to ??). Therefore, at least for speakers who find (i) more acceptable than (21-b)

for any strictly derivational syntactic theory.

In (24) the starting situation is inverse. Everything else being equal, CP_{ARG} moves successive-cyclically to the edge of CP. In order to still account for the linear part of Haider's Paradox we maintain that CP moves after RC and its movement is obligatory. The obligatory PF-movement of CP and its timing with respect to RC exclude (correctly) the word order V $\prec$ CP_{ARG} $\prec$ RC in (21-b), since CP_{ARG} must move to the edge of CP after RC moves there. However, in order to rule out the order V $\prec$ RC $\prec$ CP_{ARG} in (21-a) and at the same time retain the same word order in (18-a), the restriction on RC $\prec$ CP_{ARG} must somehow distinguish between RC and CP_{ARG} that started in the same Spell-Out Domain (18-a) and those that move successive-cyclically (21-a). This sort of restriction that needs to take the "derivational memory" into account is also undesirable.

To sum up, in this section we saw two linear effects of CP. I argued that the first effect, the disruption of linear adjacency between CP and V, is incompatible with any account that keeps CP in-situ as a sister of V throughout the entire derivation. The solution that I proposed is that CP remains in-situ in narrow syntax and at LF, but it is targeted by an additional PF-process. We have also considered one candidate for this PF-process, the mechanism of PF-movement that is independently offered for the RC extraposition in Inaba (2013). We saw that the second linear effect of CP, the right edge alignment of CP that results in a ban on any rightward displacement across it, presents a serious problem for the PF-movement account of CP and either requires adopting ad-hoc representational restrictions on the word order or postulating restrictions that refer to the derivational history of phrases. Both options appear theoretically undesirable. In the next section I introduce my own non-movement proposal for CP.

4 Delayed Linearization of CP

In the previous section I argued that the claim from Inaba (2013) that CP stays in-situ as a sister of V can be reconciled with the fact that the linear adjacency between V and CP can be disrupted (the first linear effect of CP) if there is a PF process that alters the linear properties of CP without affecting its structural position. We also concluded that this PF process cannot be an instance of PF-movement (i.e. a syntactic movement taking place during Spell-Out), because it cannot account for the right edge alignment of CP (the second linear effect of CP). Recall also that the structural effects of CP (extraction and binding asymmetries) discussed in Section 2 are incompatible with the syntactic movement of CP prior to Spell-Out. Summa-

the grammatical mechanisms along the lines I propose below must be at work, while for others it appears to be impossible to say because the inner mechanism is shadowed by the island effect.

rizing, CP does not stay in-situ, it does not move in the narrow syntax, and it does not move at PF. So what does CP do?

In this section I propose a new non-movement PF operation that targets CP. I argue that CP can be temporarily excluded from the linearization algorithm and re-introduced into it later. I call this process *Delayed Linearization*. In what follows I show how this mechanism derives both linear effects of CP as well as the linear part of Haider's Paradox. My proposal does not require any changes to the structural assumption from Inaba (2013) that CP stays in-situ as a sister of V. I also maintain the assumptions about cyclic phasal Spell-Out and *v*P and CP being phases in German that we made before (see Section 3 for references).

Intuitively, Delayed Linearization can be seen as a two-step operation. In the first step CP is excluded from the regular linearization algorithm. In the second step the linearization algorithm makes a second attempt to linearize CP *after* everything else in the same Spell-Out Domain was already linearized. Below I make a detailed proposal about the interior architecture of the linearization algorithm within Spell-Out, but before turning to the inner workings of Spell-Out, it is important to discuss why CP is targeted by Delayed Linearization in the first place. CP undergoes Delayed Linearization only when it appears as a sister of V. It is easy to check that the linear effects do not follow CP to other positions. For example, in (25) CP is fronted. If CP were to undergo Delayed Linearization, we'd expect RC extraposition across the base position of CP to be blocked (the second linear effect of CP). But RC extraposition in (25) is grammatical[9], which suggests that a fronted CP does not undergo Delayed Linearization.

(25) [$_{CP}$ dass er wem ihr Kleid gezeigt hat], hat dem Mädchen ~~RC~~
that he to.someone her dress shown has has the girl
nicht gefallen ~~CP~~, [$_{RC}$ das er gern hat]
not liked that he liked has
'The girl that he liked wasn't happy that he had shown her dress to someone'

My proposal about why CP becomes the target of Delayed Linearization is based on the notion of "prosodic monsters" (Féry 2015; Hartmann 2013). Informally, a "prosodic monster" is a combination of two prosodic units, one is extremely "light" (e.g. a prosodic word) and another is extremely "heavy" (e.g. a clause). Féry (2015) and Hartmann (2013) show a wide range of constructions in German where prosodic monsters occur and either require a readjustment or affect the acceptabil-

[9]Susi Wurmbrand (personal communication) notes that this sentence is slightly degraded (at least a ?).

ity of a sentence. For example, the scrambling of CP into a pre-verbal position is sensitive to the size of the verbal complex following CP. (26) illustrates that the rating of a sentence improves as the post-verbal complex is increased from a single particle *aus* (a prosodic word) to a combination of the particle with negation (a prosodic phrase that contains two prosodic words).

(26) a. ?*Das schließt nicht, [$_{CP}$ dass wir hier nicht auch Probleme haben]
this excludes not that we here not also problems have
aus.
PRT
'This does not exclude that we will not have problems here, either'
(Hartmann 2013, p. 463, ex. 48)

b. Das schließt, [$_{CP}$ dass wir hier nicht auch Probleme haben] nicht
this excludes that we here not also problem have not
aus.
PRT
'This does not exclude that we will not have problems here, either'
(Hartmann 2013, p. 463, ex. 49c)

Turning to Haider's Paradox, the combination of CP and V also creates a prosodic monster, since CP is prosodically heavy and V is prosodically light. I propose that Delayed Linearization is one of the strategies to tame this prosodic monster. Under this proposal, we do not expect CP to undergo Delayed Linearization in other positions (unless this new position also creates a prosodic monster). In what follows I turn to the mechanics of the second step of Delayed Linearization. The question about the choice of the strategy to neutralize different prosodic monsters, albeit extremely interesting and relevant, would take us too far afield, so I leave it for future research.

In order to see how the regular linearization algorithm proceeds and how it can be broken by Delayed Linearization, I am going to introduce several assumptions about the internal structure of Spell-Out. I assume following Arregi and Nevins (2012) that Spell-Out is organized into a series of cyclic components shown in (27). A syntactic structure that is sent to Spell-Out is first subjected to morphosyntactic operations that use structural information, after that this structure is linearized, then it is targeted by morphophonological operations that use linear information, and finally all terminal nodes are filled with phonological content.[10]

[10]I slightly simplify the presentation of the postsyntactic processes here. Arregi and Nevins (2012) split Structural Operations into three separate modules — Exponence Conversion, Feature Markedness, and Morphological Concord. Those details are irrelevant to the task at hand.

(27) *The serial modular architecture of Spell-Out*

1. Structural Operations (Fusion, Fission, m-Merger, ...)
2. Linearization
3. Linear Operations (Metathesis, Clitic Doubling, ...)
4. Vocabulary Insertion

I assume that within the Linearization component in (27) the linearization algorithm consists of at least the following four steps which create separate representations:

(28) For each pair of sister nodes in a syntactic tree sent to Spell-Out,

a. determine the precedence relation between these nodes using the Laws of Precedence for this language (Fox and Pesetsky 2005);
b. determine the prosodic counterparts of these nodes (Selkirk 1984) and integrate them into the prosodic tree (Beckman and Pierrehumbert 1986; Nespor and Vogel 1986; Pierrehumbert and Beckman 1988);
c. align the edges of prosodic domains within the rhythmic structure of the utterance with components of the prosodic tree (Ladd 1986) ;
d. combine the information about precedence relations, prosodic domains, and the rhythmic structure into a linear sequence supplied with prosodic boundaries.

For the first step in (28) I adopt the linearization proposal from Fox and Pesetsky (2005).[11] It is organized around the requirement that the application of Spell-Out to a syntactic object is monotonous in the information-theoretic sense, i.e. it can only add new information:

(29) *Order Preservation*
...[I]nformation about linearization, once established at the end of a given Spell-Out Domain, is never deleted in the course of the derivation.
(Fox and Pesetsky 2005, p. 6)

The precedence relation between two sisters X and Y is defined as follows:

(30) *Precedence relation:* $X \prec Y$
The last element (reflexively) dominated by X precedes the first element (reflexively) dominated by Y.

[11] A little bit more formally, their axiomatics is defined using the notion of motherhood, while my presentation is built on the notion of sisterhood. Both motherhood and sisterhood provide the same results for all purposes, see Carnie (2008) and McCawley (1982) for further discussion.

In order to determine the precedence relation between a pair of nodes, the linearization algorithm searches through the Laws of Precedence predetermined for a particular language through the process of language acquisition:

(31) *Law of Precedence:* $X_\alpha \prec Y_\beta$
X with a property/label α precedes Y with a property/label β.

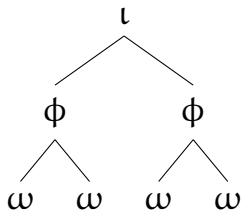
For each pair of sister nodes in a syntactic tree, the linearization algorithm returns their precedence relation. This information is added to the list of precedence relations for the Spell-Out Domain. The precedence relations that survive until the end of the phase (i.e. neither of the sister nodes is affected by movement or ellipsis) are kept for the duration of the derivation, in line with (29).

The second step in (28) involves matching syntactic terminal elements with their prosodic counterparts. After Selkirk (1984) I assume that the following set of rules is guiding this process:

(32) a. *Match Clause*
A clause in syntactic constituent structure must be matched by a corresponding prosodic constituent, call it ι.
b. *Match Phrase*
A phrase in syntactic constituent structure must be matched by a corresponding prosodic constituent, call it ϕ.
c. *Match Word*
A word in syntactic constituent structure must be matched by a corresponding prosodic constituent, call it ω.

After the initial matching, prosodic units must be integrated into the prosodic tree. I assume that the tree is organized according to the prosodic hierarchy in (33). The prosodic hierarchy is a system of hierarchically organized layers of prosodic categories that include at least an intonational phrase (ι-phrase), a phonological phrase (ϕ-phrase), and a phonological word (ω-word) (Beckman and Pierrehumbert 1986; Pierrehumbert and Beckman 1988; Selkirk 1981, 1986).[12]

(33) *Prosodic hierarchy*



[12]For expository purposes I exclude categories smaller than a prosodic word.

The main purpose of the prosodic hierarchy in (33) is to provide the prosodic category for the mother of two prosodic units. For example, if both prosodic units are ω-words, the prosodic category of their mother according to (33) is a ϕ-phrase, if both are ϕ-phrases, their mother is an ι-phrase, and so on.

The most restrictive version of the prosodic hierarchy is offered within the strict layer hypothesis (Nespor and Vogel 1986, p. 7), which postulates that a prosodic constituent of level C^i is exhaustively contained in the unit that dominates it. In addition it bans recursion (i.e. a constituent of level C^i cannot dominate another constituent of the same i-th level) together with level skipping (i.e. a constituent of the i-th level can immediately dominate only a constituent of the $i-1$-th level).

However, it has been shown multiple times that the strict layer hypothesis is too restrictive (see Gussenhoven 2005; Kubozono 1993; Ladd 1986, 1988; Schreuder and Gilbers 2004; Wagner 2005). From Itô and Mester (1992, 2007, 2009) I adopt the following relaxation of the prosodic hierarchy in (33): all higher-level prosodic domains (ω-word, ϕ-phrase, ι-phrase) are recursive in a sense that they can dominate the prosodic constituent of the same category. Everything else remains the same. This makes the following combinations of prosodic units legal:

(34) *Extensions of the prosodic hierarchy*

Prosodic units can be integrated into the prosodic tree only if they obey (33) or (34).

In the third step of the linearization algorithm the containment relation between prosodic units from the previous step is translated into the linear alignment of their left and right boundaries within the rhythmic (linear) structure of an utterance (Ladd 1986, 1988; Nespor and Vogel 1986; Zec and Inkelas 1990). At this step all language-specific prosodic readjustment linear rules apply, e.g. rhythmic restructuring (Kubozono 1993), prosodic simplification (Ghini 1993; Nespor and Vogel 1986), stress assignment (Kubozono 1993), as well any processes targeting either boundary of a prosodic unit (Nespor and Vogel 1986). For this step I use the grid representation in (35). It shows the rhythmic grid that corresponds to the prosodic tree in (33). I put all prosodic constituents of the same category into the same row in the grid if possible.

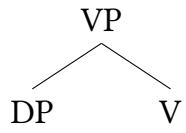
(35) *Rhythmic structure*

$$
\begin{array}{cccccccccccccccc}
(& & & & & & & & & & & & & & &)_{\text{Utt}} \\
 & (& & & & & & & & & & & & &)_{\iota} & \\
 & (& & & &)_{\phi} & & (& & & & & &)_{\phi} & & \\
 & (&)_{\omega} & & (&)_{\omega} & & (&)_{\omega} & & (&)_{\omega} & &
\end{array}
$$

An important assumption I make about this step is that the boundaries of the Utterance, the topmost prosodic unit (Beckman and Pierrehumbert 1986; Ladd 1986; Nespor and Vogel 1986), are present in the rhythmic structure from the very beginning. This assumption makes it possible for a prosodic constituent to be aligned with the left or the right edge of the utterance, which would turn this constituent into the leftmost or the rightmost element in the utterance. This assumption is necessary for the right edge alignment of CP (the second linear effect).

Finally, during the fourth step of the linearization algorithm the list of precedence relations, the prosodic tree, and the rhythmic grid are combined into a linear sequence of syntactic terminals with added aligned boundaries of prosodic domains. Consider a simple example where V is combined with DP. Here are the syntactic tree and all four steps of the Linearization component in (28):

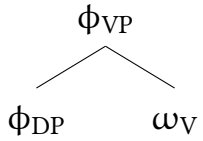
(36) a. *Syntactic tree*



b. *Step 1. Precedence relations*

$\text{DP} \prec \text{V}$

c. *Step 2. Prosodic tree*



d. *Step 3. Rhythmic grid*

$$
\begin{array}{cccccccccc}
(& & & & & & & & &)_{\text{Utt}} \\
 & (& & & & & & &)_{\phi} & \\
 & (& & &)_{\phi} & (& & &)_{\omega} &
\end{array}
$$

e. *Step 4. Linear sequence with prosodic domain boundaries*

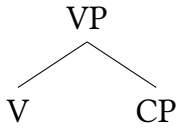
$((\text{DP})_{\phi} \prec (\text{V})_{\omega})_{\phi}$

To summarize, the linearization algorithm receives a syntactic tree sent to Spell-Out. For each pair of sister nodes proceeding from bottom to top it builds four

different representations: precedence relations, a mapping between the syntactic and prosodic units and the prosodic tree, an alignment of hierarchical prosodic domains on the same grid within the rhythmic structure, and, finally, a synthesis of the previous three representations into a linear sequence with added prosodic domains. After that they are passed to other cyclic blocks of Spell-Out.

My proposal about the mechanism of Delayed Linearization is based on the assumption that a constituent cannot be added to the linear sequence (and therefore Spell-Out cannot proceed further) until all four representations converge. Let's consider the linearization of a prosodic monster consisting of CP and V as in (37). I assume that the precedence relation predetermined for this pair is V $\prec$ CP. It is added to the list of precedence relations during the first step of the linearization algorithm in (38).

(37) *Syntactic tree*

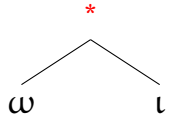


(38) *Step 1. Precedence relations*

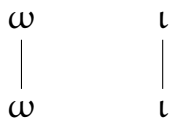
V $\prec$ CP

According to (32), CP is matched with an ι-phrase, while V is matched with an ω-word. The problem arises, of course, with their integration into a prosodic structure as in (39). There is no category in (33) or (34) that could immediately dominate ι and ω at the same time. This makes it a prosodic monster. Because of that the prosodic units are kept separated as in (40). I assume that at this point CP is marked for Delayed Linearization and is excluded, while V is linearized regularly. There is no principled reason why CP is excluded and not V or both of them at the same time. In the current system all are logically possible. A cross-language comparison could help shed some light on whether there are languages that exclude anything other than CP from regular linearization.

(39) *Step 2. Impossible prosodic tree*



(40) *Step 2. Actual prosodic tree*



At the next step the edges of prosodic categories must be aligned. Since there is no mother category for the prosodic correlates of CP and V, they are aligned independently. V has no category immediately dominating it and therefore consists of a single prosodic domain that can only be aligned with itself. CP is marked for Delayed Linearization and, as I mentioned before, I assume that there is a rule that exceptionally aligns the right edge of a prosodic unit marked for Delayed Linearizaiton with the right edge of the topmost category, the Utterance, as in (41).

(41) *Step 3. Rhythmic grid*

( )$_{\text{Utt}}$
( )$_{\iota\text{CP}}$
( )$_{\omega\text{V}}$

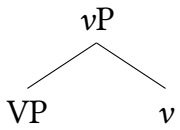
Next, the representation created in the final step combines linear, prosodic, and rhythmic information about V, but not about CP, since its linearization is delayed.

(42) *Step 4. Linear sequence with prosodic domain boundaries*

(V)$_{\omega}$

After the first attempt at the linearization of CP and V is completed, the linearization algorithm proceeds to the next pair of sister nodes. Let's assume that those are *v* and VP as shown in (43). The precedence relation for this pair is VP $\prec$ *v*. It is added to the list of precedence relations in (44).

(43)

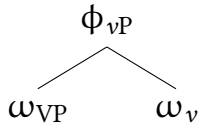


(44) *Step 1. Precedence relations*

VP $\prec$ *v*
V $\prec$ CP

According to (32), *v* must be matched with an ω-word, while VP can either be matched with a prosodic ϕ-phrase or inherit the prosodic category of an ω-word from V. I choose the latter here for expository purposes, but in the current systems both combinations (ω+ω; ω+ϕ) are legal and the prosodic category of their mother is ϕ.

(45) *Step 2. Prosodic tree*



During the next step, the boundaries of ω_{VP} and ω_{v} are linearly aligned with ϕ_{vP} that contains them both. This is shown in (46).

(46) *Step 3. Rhythmic grid*

( )$_{Utt}$
( )$_{\iota CP}$
...
( )$_{\omega vP}$
( )$_{\omega V}$ ( )$_{\omega v}$

Finally, the previous three representations are combined into the linear sequence with added prosodic domains for *v*P.

(47) *Step 4. Linear sequence with prosodic domain boundaries*
$((V)_{\omega} \prec (v)_{\omega})_{\phi}$

Finally, consider what happens when the linearization of the Spell-Out domain is completed.[13] The pair CP and V is still not linearized, because CP could not be added as a part of the same prosodic tree as V. I assume that the linearization algorithm makes a second attempt to add CP by going through the same four steps of the linearization algorithm. The precedence relation between CP and V has already been established: V $\prec$ CP. Since there is no movement in the syntactic structure, the first step of the linearization algorithm does not add any new precedence relations (48).

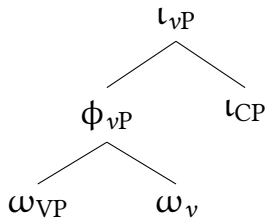
(48) *Step 1. Precedence relations*

VP $\prec$ *v*
V $\prec$ CP

The second step includes the ι-phrase of CP merging with the existing prosodic tree that contains ω_{V}. Let's use the prosodic tree from (45) as an example here. According to (34), the combination of ϕ and ι creates another ι. This time CP can successfully be added to the prosodic tree.

(49) *Step 2. Prosodic tree*

[13] Susi Wurmbrand (personal communication) points out that another possibility to consider is that the second attempt at the linearization of CP takes place immediately after V is embedded into a larger prosodic constituent. This option requires further investigation, but it seems less plausible, because, for example, it predicts (probably incorrectly) that in clauses with complex verbal complexes V1-V2 postverbal adjunct PPs could potentially follow CP, see also Haider (2010) for similar empirical observations.



The rhythmic structure for (49) is as shown in (50). The right edge of the ι-phrase matched with CP and the right edge of the Utterance are aligned with each other. The right edge of the ι-phrase that contains CP is also aligned with the right edge of CP and transitively with the right edge of the Utterance.

(50) *Step 3. Rhythmic grid*

( )$_{Utt}$
( )$_{ι_{vP}}$
( )$_{ι_{CP}}$
( )$_{ω_{vP}}$
( )$_{ω_V}$ ( )$_{ω_v}$

The representation for the fourth step of linearization is built by adding the linear, prosodic, and rhythmic information introduced with CP to (47):

(51) *Step 4. Linear sequence with prosodic domain boundaries*
(((V)$_ω$ ≺ (v)$_ω$)$_ϕ$ ≺ (CP)$_ι$)$_ι$

Note that CP remains the sister of V in the syntactic structure, yet it is not linearly adjacent to V. Anything that appears in the same phase as V and CP and follows V will have to appear between V and CP. This accounts for the first linear effect of CP and the linear part of Haider's Paradox. An extraposed RC that occurs in the same Spell-Out Domain as CP will be linearized between V and CP.

The ι-phrase for CP is marked for Delayed Linearizaiton and, by assumption, is aligned with the right edge of the Utterance in the rhythmic grid. I assume that the Utterance is a unique object that cannot be nested into another Utterance (in contrast to ι-phrases) and that every derivation creates a single Utterance.[14] This way anything that moves to the right across CP would have to cross the Utterance right boundary, which leads to ungrammaticality. Even if movement across CP

[14]Jonathan Bobaljik (personal communication) points out that this assumption in its current form may be too strong. Specifically, it does not cover instances of multiple embedding. In (i) CP is right dislocated via Delayed Linearization to the right edge of a subject-linked RC and not to the right edge of the main clause. If we are to maintain that CP is indeed associated with the right edge of an Utterance during Delayed Linearization, we must conclude that RC (and any other category able to host CP on its right edge) constitutes a separate Utterance.

originates in a higher Spell-Out Domain than CP, it would still need to cross the same Utterance boundary. Effectively, it blocks any rightward movement (linearly) across CP not only within the same phase, but throughout the entire derivation. This is exactly the second linear effect of CP that we saw in Table 1. The relevant part is repeated in (52).

(52) a. $[_{CP}\ [_{vP}\ t_1\ t_{ARG}$ ...$RC_1\ CP_{ARG}\ ]\ ]$
b. * $[_{CP}\ t_1\ [_{vP}\ t_{ARG}$ ...$CP_{ARG}\ ]\ RC_1\ ]$

In (52-a) both RC and CP_{ARG} appear in the same phase (vP). CP_{ARG} undergoes Delayed Linearization. RC is extraposed to the right edge of vP and is linearized there in a regular way. After everything inside vP, including RC, is linearized, the second attempt to linearize CP is made and CP is put at the right edge of the Spell-Out domain. As a result, on the surface RC appears between V and CP. In (52-b) RC and CP_{ARG} are in different phases. During the linearization of vP, CP_{ARG} undergoes Delayed Linearization and becomes the rightmost element in the Utterance. When RC is extraposed in a higher phase, it cannot be linearized to follow CP_{ARG}, otherwise RC would have to be placed beyond the Utterance boundary and it would not belong to the same Utterance as its host, nor can RC precede CP_{ARG}, since it cannot appear in the middle of a previous phase in violation of the Non-Tangling Condition (16). Thus Delayed Linearization blocks rightward movement across CP in the entire derivation of an utterance and not only in the same phase. It accounts for the second linear effect of CP_{ARG} as well as a wider class of multiple right dislocation of RC and CP_{ARG} that also includes the Haider's Paradox sentences.

In this section I introduced a new non-movement mechanism of Delayed Linearization and argued that it targets CP when it is a sister of V and constitutes a prosodic monster. Under this proposal, CP is excluded from the regular linearization algorithm and re-introduced upon the linearization of everything else in the same Spell-Out Domain. I showed that this proposal couched within an explicit version of the linearization algorithm based on Arregi and Nevins (2012) and Fox and Pesetsky (2005) derives both linear effects of CP as well as the linear part of Haider's Paradox. In the next section I switch to the last, structural part of Haider's

(i) Der Mann, [RC der mir gestern gesagt hat, [CP dass es heute regnen sollte,]] hat mir
the man that me yesterday said had that it today rain should had me
heute gesagt, [CP dass die Sonne scheint]
today said that the sun shines].
'The man, who told me yesterday that it was going to rain today, today told me that the Sun is shining.'

It is clear that the proper formulation of this assumption goes beyond the empirical scope of this paper and so I leave it for future research.

Paradox and make a new proposal about the syntax of RC extraposition in German.

5 RC extraposition and Quantifier Raising

Haider's (1994) formulation of the linearization paradox includes two structural claims: CP appears structurally lower than pre-verbal arguments, while extraposed RC is structurally higher than pre-verbal arguments. The paradox lies in the linear order of RC and CP. In the previous section I introduced a new mechanism of Delayed Linearization that changes the linear position of CP while maintaining its structural position as a sister of V. This proposal does not rely on any specific assumption about the mechanism that places RC into the extraposed position and is probably compatible with all of them.

In this section I argue that RC extraposition in German can be analyzed as a movement operation in the narrow syntax on par with English and not as an instance of PF-movement as proposed in Inaba (2005, 2007, 2013). I show that the differences between RC extraposition in English and German can be derived from the locality restrictions on Quantifier Raising proposed in Sauerland (2003). Adopting the proposal from Fox and Johnson (2016) that RC extraposition is parasitic on Quantifier Raising, I offer an account of RC extraposition in German that has the same empirical coverage as Inaba's, but crucially it does not rely on an assumption that RC extraposition in German is created by an entirely different operation than in English.

Inaba (2005, 2007) discusses differences between interpretation effects of RC extraposition in English and German. In English RC extraposition escapes the Condition C Effect as can be seen in (53).

(53) a. *I sent her$_i$ many gifts [that Mary$_i$ didn't like] last year
b. I sent her$_i$ many gifts last year [that Mary$_i$ didn't like]
(Culicover and Rochemont 1990, p. 29, exx. 13a-b)

In contrast, RC extraposition in German does not change binding relations. (54) illustrates that if a pre-verbal argument does not bind into extraposed RC, it is not going to bind into RC that appears in-situ either. Similarly, in (55) if a pre-verbal argument binds into the in-situ RC, it is going to bind into the extraposed RC too.

(54) a. Es hat ihr$_i$ jemand$_1$ prophezeit [dem Ida$_i$ blind vertraut]$_1$ [dass
EXPL has her someone predicted who Ida blindly trusts that
Ida$*_i$ uralt werde]
Ida very.old would.become

b. Es hat ihr$_i$ jemand$_1$ [dem Ida$_i$ blind vertraut]$_1$ prophezeit
EXPL has her someone predicted who Ida blindly trusts
[dass Ida$*_i$ uralt werde]
that Ida very.old would.become

(Inaba 2013, p. 110, exx. 37–38)

(55) a. *Ich habe ihr$_i$ mit Absicht viele Geschenke [die Maria$_i$ nicht mag]
I have her with intent many gifts that Maria not like
geschickt
sent
int. 'I intentionally sent her many gifts that Maria didn't like'

b. *Ich habe ihr$_i$ mit Absicht viele Geschenke geschickt [die Maria$_i$
I have her with intent many gifts that Maria not
nicht mag]
like sent

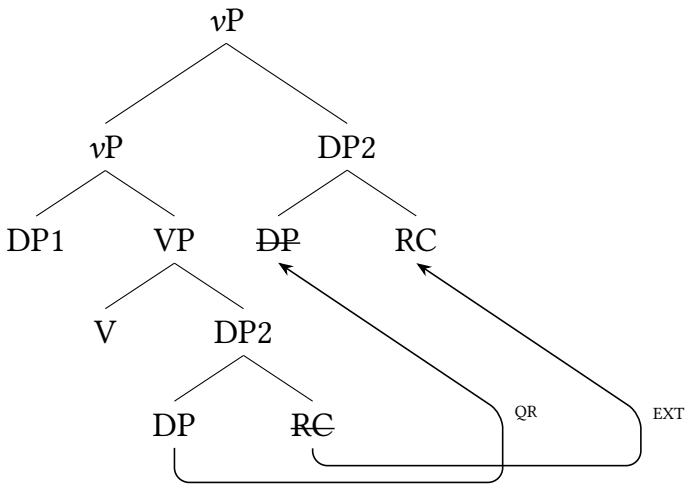
(Inaba 2007, p. 112, ex. 36)

Inaba (2005, 2007) argues that this difference is due to the special status of the RC extraposition movement in German, which moves phonological features alone and leaves the semantic features in-situ. In Section 2 we discussed that Inaba's proposal creates the same results as PF-movement, i.e. a syntactic movement at PF (Sauerland and Elbourne 2002). The crucial part for both is that in German the extraposed RC appears in-situ at LF. Note that both have to assume that RC extraposition in English and RC extraposition in German are created by different operations — narrow syntactic movement in English and either the exceptional feature-splitting movement of phonological features or PF-movement in German. This makes any further cross-linguistic comparison of RC extraposition superfluous if not uninteresting, since in different languages it is simply created by different mechanisms.

Instead, I argue that the lack of semantic effects of RC extraposition in German is due to different locality restrictions on movement than in English. This way the differences between English and German can be explained while maintaining that the same operation creates RC extraposition in both languages. I adopt the proposal from Fox and Johnson (2016) that RC extraposition is parasitic on Quantifier Raising (QR) and therefore the extraposed RC can only appear in those positions that are available to QR. It is based on the proposal from Fox and Pesetsky (2009) that QR is a rightward movement. A simplified version of Fox and Johnson's (2016) account is shown in (56). The host DP moves via QR first, and RC is adjoined to the host after that. Their implementation requires multidominance trees and the simultaneous merger of RC with both hosts in order to avoid movement to a non-c-commanding

position. I skip those details here for simplicity.

(56)



The relevant locality restrictions for QR in German are provided in Sauerland (2003). First, against the claims that German lacks QR, he shows that quantificational DPs in German can move above the coordination of two VPs covertly (i.e. via QR) when there is a variable to bind in the second conjunct. In (57-a) the quantificational DP *kein Buch* stays in-situ and the focus remains on the entire VP (see fn. 4 in Sauerland 2003), while in (57-b) it has to QR outside the conjunction in order to bind a variable in the second conjunct and the focus shifts to the verb alone. This shows that in German QR is possible.

(57) a. Jana hat [kein Buch] gelesen und die Vorlesung nicht verstanden
Jana has no book read and the lecture not understand
'Jana did not read the book and did not understand the lecture'

b. Jana hat [kein Buch]$_i$ gelesen und es$_i$ nicht verstanden
Jana has no book read and it not understand
'Jana did not read the book and did not understand it'

(Sauerland 2003, p. 7, exx. 6a-b)

He further demonstrates in (58) that two quantificational DPs can also bind variables in the second conjunct, therefore both must have undergone QR.

(58) Sie hat [mindestens einem Angestellten]$_i$ [jedes Projekt]$_j$ erklärt und
she has at.least one employee every project explained and
es$_i$ ihm$_j$ übertragen wollen
it him transfer wanted
'She has explained every project to at least one employee and wanted to transer it to him' (Sauerland 2003, p. 25, ex. 33a)

Finally, (59) shows that QR of a quantificational DP across another DP is forbidden. In (59-a) the indirect object DP *mindestens einem Angestellten* moves via QR outside the coordination in order to bind a variable in the second conjunct. Crucially, the direct object DP *jedes Projekt* in (59-b) cannot QR across the indirect object DP and, as a result, it cannot bind into the second conjunct. Sauerland (2003) concludes that QR in German is possible, but it cannot cross another DP.

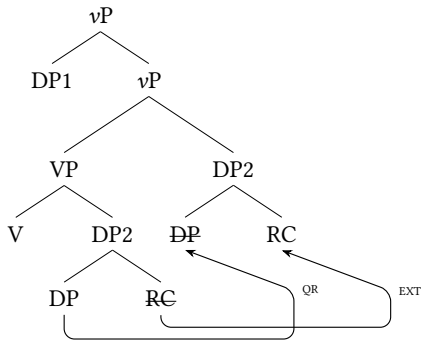
(59) Sie hat mindestens einem Angestellten$_i$ jedes Projekt$_j$ erklärt ...
she has at.least one employee every project explained
'She has explained every project to at least one employee ...'

a. ... und ihm$_i$ Kaffee angeboten
and him coffee offered
'...and offered them coffee'

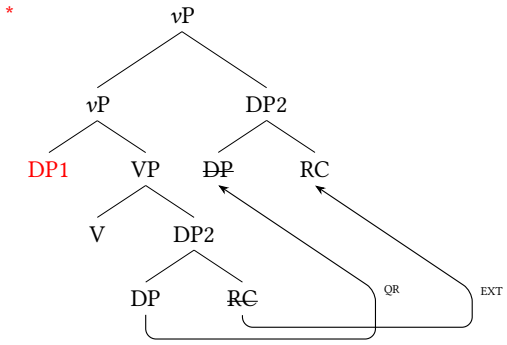
b. *... und es$_j$ verlängert
and it extended
'...and extended it' (Sauerland 2003, p. 36, exx. 34a-b)

Assuming that QR in German cannot cross another DP and that the extraposed RC can only appear in positions available for QR, we predict that extraposition in German will not be able to escape a DP that binds into RC, since QR across it is prohibited. It is only positions lower than DP that are available for QR and RC extraposition. This is shown in (60). Any RC extraposition across another DP would be illegal (61). Thus, under this analysis, in German the (QR) movement that creates RC extraposition cannot move RC high enough in the structure to trigger the semantic effects that Inaba cites as diagnostic of syntactic movement. In this way, independently motivated constraints on QR can give rise to the same patterns of RC extraposition that Inaba took as an argument for the existence of an additional non-syntactic movement operation.

(60) Possible RC extraposition



(61) Impossible RC extraposition



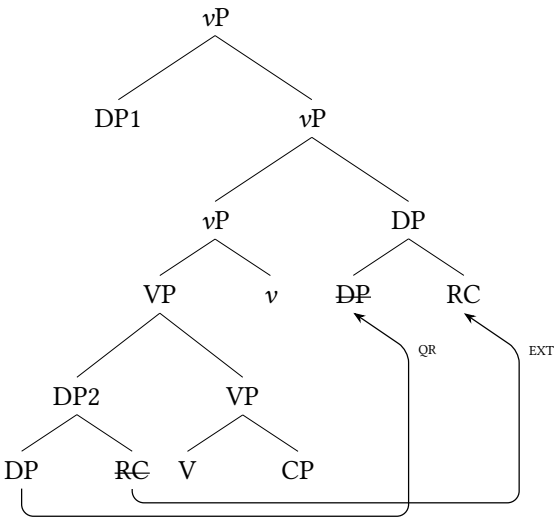
In this section, I have argued that it is possible to explain the differences between RC extraposition in English and German with a single operation of syntactic move-

ment by leveraging independently motivated locality restrictions on QR, which are known to vary from language to language. This makes the timing of RC extraposition and the Delayed Linearization of CP perfectly clear: RC is extraposed in the narrow syntax and CP undergoes Delayed Linearization at PF. This resolves the last part of Haider's Paradox.

6 Conclusion

The linearization paradox introduced in Haider (1994) led us to two seemingly disjoint proposals. The first is that CP is targeted by a new PF mechanism of Delayed Linearization that causes CP to be linearized later than the rest of its Spell-Out domain and places CP at the right edge of the utterance. The second was the unification proposal for RC extraposition in English and German. I argued that both could be created by the same operation of syntactic movement. The only difference is the locality restrictions for QR. Paired with Inaba's (2013) assumption that CP stays in-situ as a sister of V, my proposals provide a complete analysis of Haider's Paradox. It is shown in (62). On the syntactic side, CP stays in-situ, while RC moves to the right after its host (but it cannot move across another DP). At PF, RC is linearized regularly, while CP is delayed such that it adjoins to the linear sequence that already includes RC. This creates the linear part of the paradox.

(62) a.



b. DP1 $\prec$ DP2 $\prec$ V $\prec$ *v* $\prec$ RC $\prec$ CP

I have argued that this proposal provides a simple syntax for both RC and CP in the right field. It, of course, requires a new PF operation as well as a detailed specification of the architecture of Spell-Out. Importantly, it also provides us with means to capture two new effects that were previously out of reach. These are the

interruption of the linear adjacency of V and CP and the alignment of CP with the right edge of the utterance. Further studies of this mechanism are necessary, but I believe that this proposal provides a good starting point for those investigations. It would also be interesting to test this analysis against different languages and to extend it to other constituents that appear in the right field, including rightward scrambling, Heavy NP Shift, and, in particular, result clauses that appear to the right of the post-verbal CP (at least) in German and Hindi (see fn. 11 in Manetta 2013). I leave these questions for future research.

References

Arregi, Karlos and Andrew Nevins (2012). *Morphotactics: Basque Auxiliaries and the structure of Spellout*. New York: Springer.

Barbiers, Sjef (2000). "The right periphery in SOV languages". In: *The Derivation of VO and OV*. Ed. by Peter Svenonius. John Benjamins Amsterdam, pp. 181–218.

Bayer, Josef (1995). "On the origin of sentential arguments in German and Bengali". In: *Studies in comparative Germanic syntax*. Springer, pp. 47–75.

Beckman, Mary and Janet Pierrehumbert (1986). "Intonationsl structure in English and Japanese". In: *Phonology* 3, pp. 255–309.

Bošković, Željko (2018). "On Movement out of Moved Elements, Labels, and Phases". In: *Linguistic Inquiry* 49.2, pp. 247–282.

Büring, Daniel and Katharina Hartmann (1997). "Doing the right thing". In: *The Linguistic Review* 14, pp. 1–42.

Cardinaletti, Anna (1990). *Impersonal constructions and sentential arguments in German*. Padova: Unipress.

Carnie, Andrew (2008). *Constituent structure*. Oxford linguistics 5. Oxford ; New York: Oxford University Press. 292 pp.

Chomsky, Noam (1993). "A minimalist program for linguistic theory". In: *The view from Building 20: Essays in linguistics in honor of Sylvain Bromberger*. Ed. by Ken Hale and Samuel Jay Keyser. Cambridge, MA: The MIT Press, pp. 1–52.

– (2001). "Derivation by Phase". In: *Ken Hale: A Life in Language*. Ed. by Michael Kenstowicz. Cambridge, MA: MIT Press, pp. 1–52.

– (2008). "On Phases". In: *Foundational Issues in Linguistic Theory: Essays in Honor of Jean-Roger Vergnaud*. Ed. by Robert Freidin, Carlos P. Otero, and Maria Luisa Zubizarreta. The MIT Press. Chap. 7.

Corver, Norbert (2017). "Freezing Effects". In: *The Wiley Blackwell Companion to Syntax*. Ed. by Martin Everaert and Henk C. van Reimsdijk. John Wiley & Sons.

Culicover, Peter W. and Michael S. Rochemont (1990). "Extraposition and the Complement Principle". In: *Linguistic Inquiry* 21.1, pp. 23–47.

Epstein, Samuel David et al. (1998). *A derivational approach to syntactic relations*. Oxford: Oxford University Press.
Féry, Caroline (2015). "Extraposition and Prosodic Monsters in German". In: *Explicit and Implicit Prosody in Sentence Processing*.
Fox, Danny and Kyle Johnson (2016). "QR is Restrictor Sharing". In: *Proceedings of the 33rd West Coast Conference on Formal Linguistics*. Ed. by Kyeong-min Kim. Somerville, MA: Cascadilla Proceedings Project, pp. 1–16.
Fox, Danny and David Pesetsky (2005). "Cyclic Linearization and its interaction with other aspects of grammar: a reply". In: *Theoretical Linguistics* 31.1.
– (2009). *Rightward Movement, Covert Movement, and Cyclic Linearization*.
Ghini, Mirco (1993). "Phi-formation in Italian: A new proposal". In: *Toronto working papers in linguistics* 12.2.
Guéron, Jacqueline (1980). "On the syntax and semantics of PP extraposition". In: *Linguistic inquiry* 11.4, pp. 637–678.
Gussenhoven, Carlos (2005). "Procliticized phonological phrases in English: Evidence from rhythm". In: *Studia Linguistica* 59.2-3, pp. 174–193.
Haider, Hubert (1994). *Detached clauses-the later the deeper*. IBM Deutschland, Wiss. Zentrum, Inst. für Wissensbasierte Systeme.
– (1997). "Extraposition". In: *Rightward movement*. Ed. by Dorothee Beerman, David LeBlanc, and Henk van Reimsdijk. Amsterdam/Philadelphia: John Benjamins, pp. 115–152.
– (2000). "OV is more basic than VO". In: *The Derivation of VO and OV*. Ed. by Peter Svenonius. John Benjamins Amsterdam, pp. 45–67.
– (2010). *The Syntax of German*.
Hartmann, Katharina (2013). "Prosodic constraints on extraposition in German". In: *Rightward movement in a comparative perspective*. Ed. by Gert Webelhuth, Manfred Sailer, and Heike Walker, pp. 439–472.
Inaba, Jiro (2005). "Extraposition and the directionality of movement". In: *Proceedings of ConSOLE 13*, pp. 157–169.
– (2007). *Die Syntax der Satzkomplementierung: Zur Struktur des Nachfeldes im Deutschen*. Vol. 66. Walter de Gruyter.
– (2013). "Review Article: Hubert Haider The Syntax of German Cambridge: Cambridge University Press, 2010 xiv+371pp." In: *Gengo Kenkyu* 143, pp. 95–116.
Itô, Junko and Armin Mester (1992). "Weak layering and word binarity". In: *Ms., University of California, Santa Cruz*.
– (2007). "Prosodic adjunction in Japanese compounds". In: *Formal Approaches to Japanese Linguistics 4*. Vol. 55. MITWPL, pp. 97–111.
– (2009). "The extended prosodic word". In: *Phonological domains: Universals and deviations*. Mouton de Gruyter Berlin, pp. 135–194.
Kayne, Richard S. (1994). *The Antisymmetry of Syntax*. Cambridge, MA: MIT Press.

Koster, Jan (2016). *Domains and dynasties: The Radical Autonomy of Syntax*. Vol. 30. Dordrecht: Foris.
Kubozono, Haruo (1993). *The Organization of Japanese Prosody*. Tokyo: Kurosio Publishers.
Ladd, D. Robert (1986). "Intonational phrasing: the case for recursive prosodic structure". In: *Phonology* 3, pp. 311–340.
– (1988). "Declination ''reset''and the hierarchical organization of utterances". In: *The Journal of the Acoustical Society of America* 84.2, pp. 530–544.
Lee-Schoenfeld, Vera (2008). "Binding, phases, and locality". In: *Syntax* 11.3, pp. 281–298.
Manetta, Emily (2013). "Clauses and the prosody of the right edge in Hindi-Urdu".
McCawley, James D. (1982). "Parentheticals and Discontinuous Constituent Structure". In: *Linguistic Inquiry* 13.1, pp. 91–106.
Müller, Gereon (2011). *Incomplete category fronting: a derivational approach to remnant movement in German*. Dordrecht; London: Springer.
Nespor, Marina and Irene Vogel (1986). *Prosodic phonology: with a new foreword*. Vol. 28. Walter de Gruyter.
Pierrehumbert, Janet and Mary Beckman (1988). *Japanese tone structure*. Linguistic inquiry monographs 15.
Richards, Marc (2006). "Weak pronouns, object shift, and multiple spell-out: Evidence for phases at the PF-interface". In: *Minimalist essays, ed. C. Boeckx*, pp. 160–181.
Ross, Haj (1967). "Constraints on Variables in Syntax". PhD Thesis. Massachusetts Institute of Technology.
Sauerland, Uli (2003). "On Quantifier Raising in German".
Sauerland, Uli and Paul Elbourne (2002). "Total Reconstruction, PF Movement, and Derivational Order". In: *Linguistic Inquiry* 33.2, pp. 283–319.
Schreuder, Maartje and Dicky Gilbers (2004). "Recursive patterns in phonological phrases". In: *Speech Prosody 2004, International Conference*.
Selkirk, Elisabeth (1981). "On prosodic structure and its relation to syntactic structure". In: *Nordic Phonology*. Ed. by T. Fretheim. Trondheim: Tapir.
– (1984). *Phonology and syntax: the relation between sound and structure*. Cambridge MA: MIT Press.
– (1986). "On derived domains in sentence phonology". In: *Phonology* 3, pp. 371–405.
Truckenbrodt, Hubert (1995). "Extraposition from NP and prosodic structure". In: *Proceedings of the North Eastern Linguistics Society Annual Meeting 25*. Ed. by Jill N. Beckman, pp. 503–517.
Uriagereka, Juan (1999). "Multiple Spell-Out". In: *Working Minimalism*. Ed. by Samuel Epstein and Norbert Hornstein. Cambridge, MA: MIT Press, pp. 251–282.

Wagner, Michael (2005). “Prosody and Recursion”. Massachusetts Institute of Technology.
Wall, Robert (1972). *Introduction to mathematical linguistics*. Englewood Cliffs, New Jersey: Prentice Hall.
Webelhuth, Gert (1989). “Syntactic Saturation Phenomena and the Modern Germanic Languages”. PhD dissertation. University of Massachusetts Amherst.
Wexler, Kenneth and Peter W. Culicover (1980). *Formal principles of language acquisition*. The MIT Press.
Wiltschko, Martina (1995). “IDs in Syntax and Discourse: An Analysis of Extraposition in German”. Doctoral dissertation. University of Vienna.
Wurmbrand, Susi (2006). “Licensing case”. In: *Journal of Germanic Linguistics* 18.3, pp. 175–236.
– (2007). “How complex are complex predicates?” In: *Syntax* 10.3, pp. 243–288.
Wurmbrand, Susi and Jonathan Bobaljik (2005). “Adjacency, PF, and extraposition”. In: *Organizing grammar: Linguistic studies in honor of Henk van Riemsdijk*, pp. 679–688.
Zec, Draga and Sharon Inkelas (1990). “Prosodically constrained syntax”. In: *Phonology-syntax connection*. Ed. by Draga Zec and Sharon Inkelas. Chicago: University of Chicago Press, pp. 365–378.
Zwart, Jan-Wouter (1993). “Dutch syntax: A Minimalist approach”. Doctiral dissertation. University of Groningen.