Non-local binding in Slavic languages and restructuring

Jakub Dotlačil

Non-local binding of anaphors is one of the most discussed issues in the theory of anaphora. The classical analysis, starting with Pica (1987), connects the variation in the binding possibilities with the type of the anaphor that enters the binding relation. I argue that Czech and Russian exhibit non-local binding of a different origin. Non-local binding in these languages arises because of variation in the architecture of infinitival clauses. More concretely, it is argued that infinitival clauses may lack PRO, and the absence of PRO makes non-local binding possible. This account is compared to the analysis of restructuring elaborated in Wurmbrand (2001).

1. Introduction

In the study of anaphora, the question of why the size of the binding domain seems to vary across languages is a matter of constant debate.

For example, the domain in which an anaphor is bound in English is stated in Chomsky (1981) as follows:

(1) An anaphor α is bound in its binding category, which is the minimal category containing α and a SUBJECT accessible to α (SUBJECTS (for clauses): NP in Spec,IP (TP nowadays) or subject AGR)

[after Chomsky 1981:220]

This definition of the domain correctly excludes binding of the anaphor in English cases like the following (the square brackets in the examples mark the binding category as it is defined in (1)):

(2) a. *Lucie thought that [Max talked to herself]
b. *Max allowed Lucie [PRO to talk about himself]

However, in many languages anaphors may be bound by an antecedent outside the binding category, as for example in Chinese:

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(3) Zhangsan$_i$ renwei [Lisi$_j$ zhidao [Wangwu$_k$ xihuan ziji$_{i,j,k}$]]
Zhangsan thinks [Lisi knows [Wangwu likes self]]
'Zhangsan thinks that Lisi knows that Wangwu likes himslef/him.'

[Chinese, from Cole et al. 1990]

Russian is another example. Here the anaphor *svoj* is bound outside the infinitival clause (compare this with the English example (2-b)).[1]

(4) Professor$_i$ poprosil assistenta$_j$ [PRO čitat' svoj$_{i,j}$ doklad]
professor asked assistant [PRO read$_{inf}$ self's report]
'The professor asked the assistant to read his (=professor's or assistant's) report.'

[Russian, from Rappaport 1986:104]

The data from Chinese, Russian and other languages present clear counterexamples to a universal application of the binding theory as proposed in Chomsky (1981). The question is whether the differences in the binding possibilities of anaphors are accidental (which would seriously undermine any universal approach to binding) or follow from some independent factors. Pica (1987) was the first to observe that anaphors which may be non-locally bound have a series of properties in common: they are monomorphemic, subject-oriented, they may be non-locally bound in special syntactic environments only (for instance, infinitival clauses in Russian, subjunctive and infinitival clauses in Icelandic). These observations have inspired elaborate theories of binding which may look superficially different but share the assumption that the reason for the variation in the binding possibilities of anaphors stems from the interplay between the type of clause and the type of anaphor.

For the sake of concreteness, let us take two examples of binding theories. The first is a movement approach to non-local binding. Under this analysis (starting with Pica 1987; see also Cole et al. 1990, Cole & Sung 1994 or Cole et al. 2001), it is assumed that an anaphor that is head-like may rise into a higher binding category by head movement.[2] The head movement of the anaphor takes place at LF, feeds binding,[3] and is optional (since non-local binding is possible, not obligatory).

Another example of a theory of binding is the Relativized SUBJECT approach set up by Progovac (Progovac 1992; 1993; 1994). Progovac makes use of Chomsky's binding theory (see (1) above) but relativizes the notion SUBJECT to the type of the anaphor involved, in the spirit of Rizzi's Relativized Minimality (Rizzi 1990). When the anaphor is a head, the SUBJECT of its binding category is AGR (i.e., a head), when the anaphor is an XP, the SUBJECT of its binding category is the NP in Spec, IP (i.e., an XP). Null AGR nodes (that is, the AGR nodes of infinitival predicates or the AGR nodes of finite predicates in languages like Chinese) must create a chain with a higher AGR node. When this chain is created, the binding category is

[1]For reasons to consider the Chinese case in (3) as an example of a bound anaphor rather than a pronoun, see Cole et al. (2001), for Russian, see Rappaport (1986).

[2]The notions head and phrase in this system refer to the internal structure of the anaphor, not to its external distribution. In other words, monomorphemic anaphors are considered heads, whereas anaphors which consist of more than one morpheme (as him-self) are considered phrases.

[3]Binding itself may be captured by the binding theory of Chomsky (1981) without any modification.

effectively broadened and the anaphor may be bound non-locally, i.e. apparently outside the binding category, as defined in Chomsky (1981). Notice that this is only true of head-like anaphors since only in these cases does AGR serve as the SUBJECT of the binding category.

In sum, both the movement approach and the relativized SUBJECT approach are able to derive the correlation between non-local binding and monomorphemic anaphors.[4] As a bonus, the Relativized SUBJECT approach also derives the fact that non-local binding of monomorphemic anaphors appears only when AGR is null (as is assumed in some analyses for Chinese, which lacks an overt agreement, or for infinitival clauses) or 'impoverished enough' (as Progovac 1994 assumes to be the case in subjunctive clauses in Icelandic).

The main point of this article is that there are cases of non-local binding that do not fit in an explanation that relates monomorphemic anaphors and non-local binding. To be sure, the main point is not that the LF head-movement or the Relativized SUBJECT approach fails to capture these instances of non-local binding. Rather, the point is that the rationale behind the theory fails in some cases. In the rest of this article, I try to show that in Czech and Russian, non-local binding is possible not because the anaphor is monomorphemic but because of the properties of the infinitival clause in which the anaphor is contained. It is argued that in infinitival clauses in Czech and Russian, the element that closes off the binding category, that is, PRO, can be omitted. Consequently, an apparent case of non-local binding arises.

2. Non-local binding in Czech and Russian

In Czech, there are three types of reflexive anaphors: the clitic form *se*, the personal form *sebe* 'self' and the possessive form *svůj* 'self's'.

Reflexive anaphors must be bound inside a finite clause:[5]

(5) Pavlína$_i$ Honzovi$_j$ dovolila aby [*pro* se / sebe / svou$_{*i,j}$ dceru lépe
Pavlina$_{nom,f}$ Honza$_{dat,m}$ allowed$_f$ that$_{3sg}$ [pro self$_{cl}$ / self / self's daughter better
poznal].
recognized$_m$]
'Pavlina allowed Honza to get to know himself/his daughter better.'

However, when a reflexive anaphor appears in an infinitival clause, it may be bound by the subject of the higher clause:[6]

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[4]It remains a question if this is a good result. Notice that under Progovac's approach any monomorphemic anaphor should be a possible candidate for non-local binding. But, as Cole et al. (2001) note, it seems that monomorphemicity is a necessary but not sufficient condition for non-local binding. For example, German *sich* does not appear to have an internal structure but still must be bound locally.

[5]Abbreviations: nom=nominative, dat=dative, instr=instrumental, sg=singular, pl=plural, m=masculine, f=feminine, inf=infinitive, pass=passive, recipr=reciprocal, cl=clitic, aux=auxiliary.

[6]This does not hold of the clitic anaphor. I will turn to binding of the clitic anaphor shortly.

(6) a. Pavlína$_i$ Honzovi$_j$ dovolila [mluvit o sobě$_{i,j}$].
Pavlina$_{nom,f}$ Honza$_{dat,m}$ allowed$_f$ [talk$_{inf}$ about self]
'Pavlina allowed Honza to talk about herself/himsself.'
b. Pavlína$_i$ Honzovi$_j$ dovolila [zpívat svou$_{i,j}$ písničku].
Pavlina$_{nom,f}$ Honza$_{dat,m}$ allowed$_f$ [sing$_{inf}$ self's song]
'Pavlina allowed Honza to sing her/his song.'

These cases in which the reflexive anaphor is bound by the subject of the higher clause represent apparent counterexamples to Chomsky's binding approach given in (1). Of course, these facts are accounted for in the Relativized SUBJECT approach or the movement approach to non-local binding. The reflexive anaphors are monomorphemic (if we abstract away from the case ending), therefore they are possible candidates for non-local binding. As the Relativized SUBJECT approach expects, non-local binding should take place only in infinitival clauses since these are assumed to lack AGR that could block it.[7]

Nevertheless there is reason to believe that Chomsky's version of the binding theory can derive the non-local binding of anaphors in cases like these as well. The key assumption that we have to make is that the NP in Spec, TP, i.e., PRO in infinitival clauses, may be absent in infinitival clauses in Czech. Notice that this assumption gives us the right binding facts since now we have two types of infinitival clause; one with a PRO and one without. Only the former defines a binding category.

The two variants of an infinitival clause are exemplified in (7-a) and (7-b):[8,9]

(7) a. Pavlína$_i$ Honzovi$_j$ dovolila [PRO$_j$ zpívat svou$_{*i,j}$ písničku].
Pavlina$_{nom,f}$ Honza$_{dat,m}$ allowed$_f$ [PRO sing$_{inf}$ self's song]
'Pavlina allowed Honza to sing his song.'
b. [Pavlína$_i$ Honzovi$_j$ dovolila zpívat svou$_{i,*j}$ písničku].
[Pavlina$_{nom,f}$ Honza$_{dat,m}$ allowed$_f$ sing$_{inf}$ self's song]
'Pavlina allowed honza to sing her song.'

Let us put aside for a while the question of how the infinitival subject is interpreted in the absence of PRO, and concentrate on evidence that supports this view. The analysis presented here makes the prediction that once PRO is present in an infinitival clause, a reflexive anaphor must be locally bound. And in fact, once we establish that PRO is present, we can see that non-local binding of the anaphor is not possible.

There are two cases in which we have to assume that there is a PRO subject. First, PRO must be present to serve as the antecedent of reflexive anaphors.

[7] See, for example, Progovac (1994) for this analysis of non-local binding in Russian, which does not seem to differ from non-local binding in Czech in any relevant respect. See also below.

[8] The question of what happens to the AGR node remains. Either it is absent entirely in infinitival clauses (Chomsky 1981, Progovac 1994) or it is absent when PRO is missing since otherwise the features of AGR would remain unchecked.

[9] From now on, I include PRO in the examples which are unambiguous and in which according to my analysis PRO *must* be present. Apart from the illustrative examples (7-a) and (7-b) I do not write ambiguous sentences twice from now on (once with PRO and once without). However, the reader should keep in mind that exactly this ambiguity is assumed in these cases.

Reflexive anaphors are subject-oriented in Czech. In example (8-a), the antecedent of the reflexive anaphor can be only *Pavlína*, the external argument and the subject of the clause. When the verb is passivized the external argument is realized as a PP and the internal argument becomes the subject of the clause. In that case, the internal argument becomes the only possible antecedent for the anaphor (8-b).[10]

(8) a. Pavlína$_i$ Honzu$_j$ políbila až na své$_{i,*j}$ svatbě
Pavlina$_{nom,f}$ Honza$_{acc,m}$ kissed$_f$ until on self's wedding
'Pavlina didn't kiss Honza until her wedding.'

b. Honza$_j$ byl políben Pavlínou$_i$ až na své$_{*i,j}$ svatbě
Honza$_{nom,m}$ aux$_{pass,m}$ kissed$_m$ Pavlina$_{instr,f}$ until on self's wedding
'Honza was not kissed by Pavlina until his wedding.'

However, a reflexive anaphor in an infinitival clause may also be bound by the argument that controls the subject of the infinitival clause. This happens even in cases in which the controller is not the subject of a higher clause, as in the example (9) where the controller *Honzovi* bears dative case:

(9) Pavlína$_i$ Honzovi$_j$ zakázala zpívat svou$_{i,j}$ písničku.
Pavlina$_{nom,f}$ Honza$_{dat,m}$ forbade$_f$ sing$_{inf}$ self's song
'Pavlina forbade Honza to sing her/his song.'

The generalization that reflexive anaphors are subject-oriented can be maintained only if we assume that it is not the controller of the infinitival subject that binds the reflexive anaphor in the cases like (9) but the infinitival subject itself, that is, PRO.

Recall that our approach suggests that non-local binding is possible because PRO can be omitted in the infinitival clause. However, as we have just shown, PRO must be present in the infinitival clause to bind a reflexive anaphor. Thus, we get the clear prediction that in case a reflexive anaphor is bound by PRO, another reflexive anaphor in the same infinitival clause cannot be non-locally bound anymore.

In the example below, the phrase *cpát do sebe* 'to stuff oneself' contains a reflexive anaphor which must be bound locally otherwise its meaning ('to eat') would be lost (instead, the phrase would mean 'to feed'). And precisely in this case, another reflexive anaphor in the same infinitival clause cannot be bound by the higher subject, even though that interpretation would be perfectly reasonable.

(10) Pavlína$_i$ Honzovi$_j$ zakázala [PRO$_j$ cpát do sebe$_j$ svůj$_{*i,j}$ nejlepší oběd
Pavlina$_{nom,f}$ Honza$_{dat,m}$ forbade$_f$ [PRO stuff$_{inf}$ into self self's best lunch
tak rychle].
so quickly]
'Pavlina forbade Honza to gorge himself on his best lunch so quickly.'

Furthermore, the reflexive clitic has to be bound locally in every case. Thus, we get the prediction that when the reflexive clitic appears in an infinitival clause, another reflexive anaphor must

[10]To save space, I present only data with the possessive reflexive anaphor.

be interpreted locally as well. This prediction is borne out, as the example (11) shows. Notice that this example differs from example (9) only in the presence of the reflexive clitic *si*.[11]

(11) Pavlína$_i$ Honzovi$_j$ zakázala [PRO$_j$ zpívat si$_j$ svou$_{*i,j}$ písničku].
Pavlina$_{nom,f}$ Honza$_{dat,m}$ forbade$_f$ [PRO sing$_{inf}$ self$_{cl}$ self's song]
'Pavlina forbade Honza to sing his song.'

A second reason to assume the presence of PRO stems from the morphology of secondary predicates.

Secondary predicates agree in case, number and gender with the noun they modify:

(12) a. Honza se smál Pavlíně opilý.
Honza$_{nom,m}$ self$_{cl}$ laughed Pavlína$_{dat,f}$ drunk$_{nom,sg,m}$
'Honza laughed at Pavlina being drunk.'
b. Honza se smál Pavlíně (opilé / *opilá).
Honza$_{nom,m}$ self$_{cl}$ laughed Pavlína$_{dat,f}$ (drunk$_{dat,sg,f}$ / *drunk$_{nom,sg,f}$)
'Honza laughed at Pavlina while she was drunk.'

In the infinitival clause in (13), the secondary predicate that modifies the infinitival subject appears in nominative, even though the controller of PRO *Honzovi* is in a different case (dative):

(13) Pavlína Honzovi zakázala [PRO lézt na střechu opilý].
Pavlína$_{nom,f}$ Honza$_{dat,m}$ forbade$_f$ [PRO climb$_{inf}$ on roof drunk$_{nom,m}$]
'Pavlina forbade Honza to climb up on the roof while he would be drunk.'
Not: 'While Honza was being drunk Pavlina forbade him to climb up on the roof.'

The correlation between the case that the secondary predicate bears and the fact that only the infinitival subject is modified suggests that there is a PRO, which can license secondary predicates in nominative in the embedded infinitival clause. This reasoning holds at least for cases when the overt argument controlling PRO bears a different case (as is the case in (13)).

The prediction for our approach is that a secondary predicate modifying the subject of an infinitival clause must rule out non-local binding of a reflexive anaphor since the infinitival clause contains PRO in this case. And, in fact, this prediction is borne out:[12]

[11] Even though the reviewers share the same judgments as in (9)-(11) for Slovenian, they claim that there are examples in which anaphors may possibly be bound by two distinct subjects:

(i) Modni kreator$_i$ mi$_j$ je svetoval dat nase$_{*i,j}$ svojo$_{i,j}$ najnovejšo umetnino.
fashion designer$_{nom,m}$ me$_{dat}$ aux advised$_m$ put on-self self's newest creation
'The fashion designer advised me to put his/my newest creation on.'

[Slovenian]

Possibly, *nase* 'on self' is not understood as an anaphor any longer in this case. This is suggested by the fact that (at least in Czech) when *se* 'self' is substituted by, for example, an object 'someone', the idiomatic reading 'to dress' is lost. Instead, in that case the verbal phrase means literally 'to cover someone with his/my newest creation'. However, I did not test whether the same is true for Slovenian.

[12] As the reviewers pointed out to me the acceptability of non-local binding may depend on the position of the

(14) Pavlína$_i$ Honzovi$_j$ zakázala [PRO$_j$ zpívat svou$_{*i,j}$ písničku opilý].
Pavlina$_{nom,f}$ Honza$_{dat,m}$ forbade$_f$ [PRO sing$_{inf}$ self's song drunk$_{nom,m}$]
'Pavlina forbade Honza [to sing his song drunk].'

Notice furthermore that when a secondary predicate is licensed by the argument that controls PRO and not by PRO itself, a reflexive anaphor in the infinitival clause retains its ambiguity. In the example below, *drunk* is licensed by the overt argument since it agrees with it in case. The reflexive anaphor can be non-locally bound.

(15) Pavlína$_i$ mi$_j$ opilému zakázala zpívat svou$_{i,j}$ písničku
Pavlina$_{nom,f}$ me$_{dat,m}$ drunk$_{dat,m}$ forbade$_f$ sing$_{inf}$ self's song
'While I was drunk, Pavlina forbade me to sing her/my song.'

Similar, but probably more convincing cases are represented by constructions in which the accusative argument, instead of the dative argument, controls PRO. In these cases, a secondary predicate that modifies the infinitival subject can surface either as nominative or as accusative.

(16) Marie naučila Honzu chodit domů střízlivý / střízlivého
Marie$_{nom,f}$ taught$_f$ Honza$_{dat,m}$ go$_{inf}$ home sober$_{nom,m}$ / sober$_{acc,m}$
'Marie taught Honza to come home sober.'

[from Przepiórkowski & Rosen to appear]

Following Przepiórkowski & Rosen (to appear), I assume that accusative case on a secondary predicate is licensed by the matrix internal argument (i.e., the controller of the infinitival subject). On the other hand, nominative case on a secondary predicate is licensed by PRO. The clear prediction that we arrive at is that only a secondary predicate in nominative should block non-local binding, whereas a secondary predicate in accusative should not. This prediction is

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secondary predicate. They claim that in the Slovenian examples below non-local binding is marginally possible when the secondary predicate follows the anaphor (i-a). On the other hand, when the secondary predicate precedes the anaphor, non-local binding is "at least strongly disfavored" (i-b).

(i) a. Modna kreatorka$_i$ mi$_j$ je prepovedala [PRO$_j$ nosit svojo$_{?i,j}$ najnovejšo umetnino bos]
fashion designer$_{nom,f}$ me$_{dat}$ aux forbade$_f$ [PRO wear$_{inf}$ self's newest creation barefoot$_{nom,m}$]

b. Modna kreatorka$_i$ mi$_j$ je prepovedala [PRO$_j$ bos nosit svojo$_{??i,j}$ najnovejšo umetnino]
fashion designer$_{nom,f}$ me$_{dat}$ aux forbade$_f$ [PRO barefoot$_{nom,m}$ wear$_{inf}$ self's newest creation]
'The fashion designer forbade me to wear ??her/my newest creation barefoot.'

[Slovenian]

I have no other explanation than that processing may be involved in these examples. In example (i-a) there is nothing that precludes non-local binding by the time the anaphor appears. Thus, I assume, non-local binding may be computed at this moment. This interpretation may be "remembered" even after the moment when the presence of the secondary predicate tells us that PRO must be present in the infinitival clause.

On the other hand, in example (i-b), by the time the anaphor appears there is a clear hint that PRO is present in the infinitival clause. Non-local binding should be strongly degraded in this case, which seems to be true.

borne out:

(17) a. Marie$_i$ nutila Honzu$_j$ [PRO$_j$ chodit bosý ve svém$_{*i,j}$ bytě]
Marie$_{nom,f}$ forced$_f$ Honza$_{acc,m}$ [PRO walk$_{inf}$ barefoot$_{nom,m}$ in self's appartment]
'Marie forced Honza to walk in his appartment barefoot.'

b. ?Marie$_i$ nutila Honzu$_j$ chodit bosého ve svém$_{i,j}$ bytě
Marie$_{nom,f}$ forced$_f$ Honza$_{acc,m}$ go$_{inf}$ barefoot$_{acc,m}$ in self's appartment
'Marie forced Honza to walk in his/her appartment barefoot.'

To conclude the discussion of the Czech data so far, there are two cases in which the presence of PRO in the syntax seems necessary. The first case is when a reflexive anaphor is bound by the subject of the same infinitival clause. The second case is when a secondary predicate modifying the subject of an infinitival clause bears the nominative case even though the overt argument controlling the subject bears a different case. And as we have seen, non-local binding of a reflexive anaphor is impossible in both of these cases.[13]

Let us turn briefly to some Russian data. As is the case in Czech, the personal reflexive anaphor *sebe* and the possessive reflexive anaphor *svoj* must be bound inside the clause if the clause is not infinitival; if it is, they may be bound outside of it (Rappaport 1986). However, as in Czech, non-local binding becomes impossible when PRO is arguably present.

First, as in Czech, the reflexive anaphor is subject-oriented in Russian (Rappaport 1986). When a reflexive anaphor is bound by the infinitival subject, another reflexive anaphor appearing in the same clause must be bound locally, too. In the example below, the phrase *svojej ženě* 'self's wife' refers to *Ivan*. On the other hand, the phrase *svoim mužem* 'self's husband' most

[13]The impossibility of non-local binding can be obviated by movement of an anaphor into a higher binding domain. The reviewers notice that the matrix subject can bind an anaphor when the anaphor is scrambled across PRO into the matrix clause, as in (i):

(i) Modna kreatorka$_i$ mi$_j$ je svojo$_{i,j}$ najnovejšo umetnino prepovedala [PRO$_j$ nosit bos]
Fashion designer$_{nom,f}$ me$_{dat}$ aux self's newest creation forbade$_f$ [PRO$_j$ wear$_{inf}$ barefoot]

'The fashion designer forbade me to wear my/her newest creation barefoot.'

[Slovenian]

This is similar to other cases in which movement of an anaphor creates new binding possibilities. Compare (the marginally acceptable) wh-movement of an anaphor from a finite clause, which enables binding by the higher subject (ii-a) and an example in which the anaphor stays in the lower clause (ii-b):

(ii) a. ?O který svý$_{i,j}$ knížce *pro*$_i$ chceš aby [Marie$_j$ mluvila]?
About which self's book pro want$_{2sg}$ that$_{3sg}$ [Marie$_{nom,f}$ talked$_f$]
'Which of your/her books do you want Mary to talk about?'

b. *pro*$_i$ chceš aby [Marie$_j$ mluvila o svý$_{*i,j}$ knížce]?
pro want$_{2sg}$ that$_{3sg}$ [Marie$_{nom,f}$ talked$_f$ about self's book]
'Do you want Mary to talk about her book?'

naturally refers to *Maša*, which becomes impossible and the sentence is pragmatically ruled out.

(18) *Maša sovetovala Ivanu [PRO govorit' o svojej ženě so svoim
Maša$_{nom,f}$ recommended$_f$ Ivan$_{dat,m}$ [PRO talk$_{inf}$ about self's wife with self's
mužem]
man]
'Maša recommended Ivan to talk to her husband about his wife.'

[Russian]

Second, as in Czech, another reason to assume PRO can be found in the morphology of secondary predicates. Secondary predicates can agree in case with the argument they modify. However, in some special instances they may appear in the non-agreeing instrumental form. The non-agreeing form is available *only* when the secondary predicate modifies an argument that bears structural case – nominative or accusative. When an argument bears dative, the non-agreeing form of its secondary predicate is ruled out:

(19) Boris$_i$ sovetoval Saše$_j$ golym$_{i,*j}$
Boris$_{nom,m}$ recommended Sasha$_{dat,m}$ naked$_{instr,m}$
'Boris advised Sasha nude.' (Boris=nude)

[Russian, from Bailyn 2001:13]

Now, notice that a secondary predicate that appears in an infinitival clause and modifies its subject may result in instrumental (in many cases, actually, it has to). This happens even if the overt argument in the higher clause appears in dative, which suggests that it is not the higher argument that licenses this instrumental case. An empty argument that bears structural case such as the infinitival subject is clearly needed in these cases.

What is important for our discussion is that when a non-agreeing secondary predicate is present in an infinitival clause, a reflexive anaphor in the clause must be bound locally.

(20) *Maša sovetovala Ivanu [PRO govorit' trjeznym so svoim
Maša$_{nom,f}$ recommended$_f$ Ivan$_{dat,m}$ [PRO talk$_{inf}$ sober$_{instr,m}$ with self's
mužem]
man]
'Maša recommended Ivan to talk to her husband sober.'

[Russian]

I take it that these examples suggest that in Czech and Russian binding cannot cross the boundaries of an infinitival clause that contains PRO. This interpretation of the data needs nothing beyond Chomsky (1981)'s theory of binding.

Notice that cases in which non-local binding is excluded because of the presence of PRO are unexpected and unaccounted for in theories that connect non-local binding to the type of the anaphor. In both the Relativized SUBJECT and movement approach, non-local binding of anaphors is parametrized with respect to the type of the anaphor. Since we have dealt with the same anaphor and yet it could be bound outside an infinitival clause in some cases, whereas in other cases it could not, the parametrization with respect to the anaphor does not seem a possible way to explain the whole range of data. The only alternative way to go is to employ the assumption from the Relativized SUBJECT approach that non-local binding of monomorphemic anaphors is blocked when the AGR node does not create a chain with a higher AGR node. As Progovac (1994) assumes the blocking takes place only when agreement is overt.

The Relativized SUBJECT approach could explain why the presence of secondary predicates in an infinitival clause blocks non-local binding since secondary predicates express agreement. However, it remains unclear under this approach why non-local binding is excluded when another anaphor in the same clause is bound by PRO. I repeat the relevant example:

(21) Pavlína$_i$ Honzovi$_j$ zakázala [PRO$_j$ zpívat si$_j$ svou$_{*i,j}$ písničku].
Pavlina$_{nom,f}$ Honza$_{dat,m}$ forbade$_f$ [PRO sing$_{inf}$ self$_{cl}$ self's song]
'Pavlina forbade Honza to sing his song.'

To capture example (21), Progovac would have to assume that after all, agreement does not need to be expressed overtly for AGR to be present and close off the binding category of an anaphor. This would represent a serious blow for her theory. In Progovac (1994), it is assumed that overt agreement may in some special cases result in AGR which does not close off the binding category. To explain the Czech and Russian data, one would have to add that no agreement may result in AGR that does close off the binding category. In sum, any correlation between agreement on a predicate and the size of the binding category would be lost. I consider this an unwelcome result because this correlation has found quite rich cross-linguistic support (see Progovac 1994).

Thus, instead of going the way of further parameterizing the Relativized SUBJECT approach, I assume that Russian and Czech anaphors must be bound in the local bidning domain as it is defined in Chomsky (1981). The very fact of apparent non-local binding stems from variation in the architecture of the infinitival clause in Czech and Russian.

Variation in the architecture of infinitival clauses has been explored by Wurmbrand (2001) as a way to explain the phenomenon of restructuring in German. The notion restructuring refers to the fact that a clause can become transparent for some processes that are normally clause-bound. For example, an argument can A-move across the boundaries of its infinitival clause. This is the case in example (22). Here, the internal argument of the infinitival verb surfaces as the subject of the matrix clause when the matrix verb is passivized. Wurmbrand (2001) argues at length that this case of long A-movement can take place only when the infinitival clause is realized as VP (i.e., it lacks the functional categories vP, TP, CP and PRO).

(22) Der Lastwagen und der Traktor wurden zu reparieren versucht
The$_{nom}$ truck and the$_{nom}$ tractor were to repair tried
'One tried to repair the truck and the tractor.'

On the other hand, long A-movement is ungrammatical in English:

(23) *The truck was tried to repair.

Wurmbrand stipulates that this is the case because English does not have VP infinitives. The same stipulation must be exploited in the case of non-local binding. Czech and Russian show non-local binding because they have PRO-less infinitives. Consequently, an anaphor inside the PRO-less infinitival clause may be bound outside it, i.e. apparently non-locally. On the other hand, English does not have non-local binding since it lacks PRO-less infinitives.

Notice that Wurmbrand (2001) assumes that long A-movement is possible only when all functional categories above VP are missing. This is connected with the way restructuring is constrained. Wurmbrand assumes that a clause can be deprived of its functional categories only when the functional categories are peeled off from the top down. The German case of long A-movement gives empirical support for this analysis. As Wurmbrand shows, an infinitival clause from which long A-movement takes place cannot license temporal adverbs or negation (which, in her analysis, require the presence of a T node).

On the other hand I have assumed so far that infinitival clauses that enable non-local binding lack only PRO. There is empirical support for this view. As we can see, non-local binding does not disappear when the infinitival clause hosts a temporal adverb (24-a)[14] or negation (24-b).

(24) a. Pavlína$_i$ Honzovi$_j$ zakázala zpívat zítra na večírku svou$_{i,j}$ písničku.
Pavlina$_{nom,f}$ Honza$_{dat,m}$ forbade$_f$ sing$_{inf}$ tomorrow on party self's song drunk$_{nom,m}$
'Pavlina forbade Honza to sing her/his song at the tomorrow's party.'

b. Dramatik$_i$ přikázal divadlu$_j$ neměnit žádnou ze svých$_{i,j}$ her.
Playwright$_{nom,m}$ ordered$_m$ theatre$_{dat}$ not-change$_{inf}$ none of self's plays
'The playwright ordered the theatre not to change any of his plays.'

If the analysis of non-local binding is on the right track, this has some implications for the theory of restructuring. Concretely, the way that a clause is deprived of its functional categories should not be restricted only to top-down peeling. Unpleasant as it may seem, this conclusion is probably inescapable. The absence of certain functional categories appears to violate the top-down restriction in other cases, too: clitic climbing in Czech is impossible from a clause that has PRO, but is not degraded if the clause hosts a temporal adverb (Lenertová 2002). Therefore, for clitic climbing to take place, the infinitival clause must be realizable with T node but without PRO. I showed that the same holds of long-distance agreement in Czech (Dotlačil 2004).[15]

[14]Notice that the matrix verb is in past tense, which is incompatible with the adverb *zítra* 'tomorrow'. Therefore, the temporal adverb must be hosted by the infinitival clause.

[15]There is another surprising fact that concerns the clause structure of the infinitival clause in case of non-local binding. Even though PRO is missing it is possible to have an argument in accusative (písničku 'song$_{acc}$' in (24-a)). Not only is this problematic for Wurmbrand's top-down peeling approach, but it also goes against one implication of Burzio's generalization: ACC → External argument. However, it has been noted before that Slavic languages have constructions that represent counterexamples to this implication of Burzio's generalization (Lavine 2000 for Ukrainian, Markman 2003 for Russian). Furthermore, the Russian constructions that are problematic for Burzio's generalization do appear in Czech, too. Thus, we might follow Markman (2003) who suggests to disassociate the introduction of the external argument and the assigning/checking of accusative (for Russian, but this may be extended to other Slavic languages).

Alternatively, one could assume that accusative is assigned/checked in the matrix clause in case the infinitival clause lacks PRO. One potential problem could be the following example in which the matrix clause has an accusative argument.

3. The interpretation of the subject

Notice that in case of non-local binding, which requires the absence of PRO, the interpretation of the infinitival subject does not seem to differ from the cases in which PRO may/must be present. For example, the infinitival subject in (25) must refer to the same entity as the internal argument of the higher clause no matter whether the anaphor is interpreted as bound locally or non-locally. In other words, the interpretation of the subject is the same no matter whether PRO is present or not.

(25) Pavlína$_i$ Honzovi$_j$ dovolila zpívat svou$_{i,j}$ písničku.
Pavlina$_{nom,f}$ Honza$_{dat,m}$ allowed$_f$ sing$_{inf}$ self's song
'Pavlina allowed Honza to sing her/his song.'
Not: 'Pavlina allowed Honza that anyone could sing her/his song.'

Clearly, theories in which the interpretation of the infinitival subject is mediated by PRO (Manzini 1983, Chomsky 1981) or, under different assumptions, by the subject trace (Hornstein 1999), are inapplicable to these cases if we want to keep to the presented analysis of non-local binding. A different approach is needed.

To explain these facts, I follow Wurmbrand (2001) and Wurmbrand (2002)'s elaboration on Chierchia (1984).

Chierchia (1984) suggests that the interpretation of the infinitival subject is a lexical property of the predicate that selects the infinitival clause. To know the meaning of, for instance, the verb *force* means, among other things, to know that the subject of its infinitival clause must be co-referential with its internal argument. Technically, Chierchia achieves this result by loading the lexical meaning with appropriate meaning postulates. For example, the lexical meaning of the verb *force* includes the following meaning postulate (the capital letter Z represents a property variable, M$_a$ stands for the modal frame that control predicates select; it specifies the type of the modal relation (in this case, necessity) and the conversational background to which the modal relation is relativized (in this case, deontic modality)):

(26) [force'(Z, x, y) $\leftrightarrow$ M$_a$ Z(x)]
(y forces x to do Z iff in all the situations compatible with what y imposes on x, x does Z).

By application of such meaning postulates we get the right interpretation for the subject of the embedded infinitival clause if its reference is exhausted by one of the arguments of the predicate that selects the infinitival clause. Exactly in these cases we expect that PRO may be missing and non-local binding may arise; the right interpretation of the infinival subject is determined

(i) a. Marie$_i$ mě$_j$ nutila zpívat svou$_{i,j}$ písničku
Marie me$_{acc}$ forced sing$_{inf}$ self's song$_{acc}$
'Marie forced me to sing her/my song.'

To licence the embedded accusative argument, the matrix clause would have to be able to check/assign accusative more than once, even in case the two accusative arguments have conflicting Φ-features (see Anagnostopoulou 2003 for arguments that more goals can agree with the same head only if the goals do not have conflicting Φ-features).

by the meaning postulate.[16] However, notice that PRO does not *need* to be missing. In fact, it must be present in many cases exactly because of the reasons discussed in section 2 (i.e., local binding of reflexive anaphors or the presence of secondary predicates in nominative (in Czech) or instrumental (in Russian)). This means that the meaning postulate allows the absence of PRO but does not require it, which is the result Wurmbrand arrives at in discussing VP infinitives in German. In other words there are cases in which both PRO and the meaning postulate guarantee a reference to the infinitival subject. As Wurmbrand suggests, we can imagine this as some kind of a checking mechanism: PRO, if present, bears a reference which must match the meaning postulate, otherwise a semantically anomalous sentence arises.

In addition to these cases, there are cases in which the meaning postulate cannot ensure the right interpretation of the infinitival subject. The infinitival subject can bring a reference of its own which is not exhausted by one of the arguments of the matrix predicate. In these cases PRO must be present. In our application that means that non-local binding should be ruled out. This is borne out, as we are about to see.

The first relevant case concerns partial control (27-a) and (27-b) - i.e., the infinitival subject denotes a superset of the reference set of the controller (see Landau (2000) for a thorough analysis). In examples (27-a) and (27-b), the superset denotation of the infinitival subject is controlled for by a collective predicate in the infinitival clause. Since collective predicates require more than one entity,[17] and the controller in both examples denotes one entity, the controllee (i.e., the infinitival subject) must be a superset of the reference set of the controller.

Another case is a split control (27-c) - i.e., the infinitival subject denotes the union of two arguments in the matrix clause.

(27) a. Já se chci sejít dneska odpoledne.
I se$_{recipr}$ want meet$_{inf}$ today afternoon
'I want to meet today in the afternoon.'
b. Ředitel upřednostňuje sejít se ve škole.
Director prefer meet$_{inf}$ se$_{recipr}$ in school
'The director prefers to meet today at school.'
c. Pavlína$_i$ mi$_j$ navrhla [PRO$_{i+j}$ jít do Prahy společně].
Pavlina me suggested [PRO go$_{inf}$ into Prague together]
'Pavlina suggested to me to go to Prague together.'

In both cases non-local binding should be excluded. The data seem to point in this direction:

(28) a. ??Já$_i$ se nechci [PRO$_{i+}$ sejít ve svém pokoji].
I se$_{recipr}$ not-want [PRO meet$_{inf}$ in self's room]
'I do not want to meet in my room.' (intended)

[16]Notice that this suggests that binding of anaphors takes place before the semantic representation. The same conclusion is arrived at in Reinhart & Reuland (1993) for English.

[17]In other words, this sentence is out:

(i) *Petr se sešel dneska odpoledne.
Petr se$_{recipr}$ met today afternoon
'*Petr met today in the afternoon.'

b. ??Ředitel upřednostňuje sejít se ve své pracovně.
Director prefer meet$_{inf}$ se$_{recipr}$ in self's office
'The director prefers to meet in his office.' (intended)

c. Pavlína$_i$ mi$_j$ navrhla [PRO$_{i+j}$ jít společně do svého$_{*i,?i+j}$ pokoje].
Pavlina me suggested [PRO go$_{inf}$ together into self's room]
'Pavlina suggested to me to go together into (?our) room.'

Finally, in still other cases of control the interpretation of the infinitival subject cannot be included in the meaning postulate of the matrix predicate simply because the matrix predicate does not select either the controlling argument – i.e., arbitrary or long-distance control –, or it does not select the infinitival clause – i.e., adjunct control. Neither of these cases exists in Czech but arbitrary and adjunct control do exist in Russian. Both types disable non-local binding, as has been noted in the literature before. I present adjunct control only:

(29) Ja poprosil ego absoljutno vse den'gi otdat' prežde čem [PRO prodat' svoj
I asked him absolutely all money give$_{inf}$ before what [PRO sell$_{inf}$ self's
dom]
house]
'I asked him to turn over asbolutely all the money before selling his/*my house.'

[Russian, from Rappaport 1986:110]

The loss of non-local binding in these cases is unexpected in the head movement approach or Relativized SUBJECT approach.

Putting aside (28-a)-(28-c), one could suggest that the impossibility of non-local binding in example (29) follows in the movement approach from head movement constraint. The complementizer *prežde čem* 'before what' is quite likely realized in C^0 of the infinitival clause. The anaphor cannot skip C^0 on its way into the higher clause. Presumably, the complementizer cannot move into the higher clause along with the anaphor, either; therefore, the movement of the anaphor and consequently non-local binding is excluded in (29).

Notice that this works only under the assumption that excorporation of heads is prohibited. However, the movement approach to non-local binding assumes that anaphors may excorporate. In fact, this assumption is clearly needed because non-local binding can normally skip heads like verbs or aspectual markers in Chinese and other languages (see, among others, examples in Cole & Sung 1994). In sum, the fact that the most embedded infinitival clause contains an overt complementizer does not help the movement approach explain why non-local binding is impossible in this clause.

The Relativized SUBJECT approach can exclude non-local binding only in case agreement is present. As far as I can see, there is no reason to assume a different agreement for the adjunct infinitival clause and the complement infinitival clause to explain the absence of non-local binding in (29). Or, similarly, it is hard to see how an agreement could differ in the cases of exhaustive control and partial or split control ((28-a) and (28-c)).

On the other hand, our analysis predicts these distinctions since in the cases (28-a) to (29) the meaning postulate cannot replace PRO, hence PRO cannot be omitted and consequently, non-local binding is precluded.

4. *Conclusion*

It may be worth pointing out what this paper did not try to achieve, instead of what it did. It did not try to present a novel approach to non-local binding that is superior to the previous approaches. Something along the lines of the relativized SUBJECT approach or the movement approach to non-local binding is clearly needed to account for cases in which an anaphor may be bound outside of the clause that contains the overt subject, as, for instance, in this Chinese example repeated from above:

(30) Zhangsan$_i$ renwei [Lisi$_j$ zhidao [Wangwu$_k$ xihuan ziji$_{i,j,k}$]]
Zhangsan thinks [Lisi knows [Wangwu likes self]]

I see no way to account for this case without any modification in Chomsky (1981)'s binding theory. In view of these data, some kind of parametrization of the binding theory is required.

In fact, there are reasons not to exclude a parametrization of anaphora in Czech either. Recall that reflexive clitics cannot be non-locally bound (see (11) above). This is unexpected if their binding category would be defined in the same way as the binding category of other reflexive anaphors. Clearly, another restriction on binding of reflexive clitics must be included.[18,19]

However, it seems to be the case that not all instances of apparent non-local binding can be explained by the parametrization of the binding theory itself. I have argued that Czech and Russian represent the cases in which non-local binding follows from the varying architecture of the infinitival clause rather than anything else. Once one bears this in mind, apparent non-local binding in Czech and Russian becomes local and therefore no longer represents an exception to Chomsky (1981)'s binding theory.

The main point is that there may be more variables in play that determine binding possibilities in languages. Whereas the parametrization of anaphors is well-studied, the parametrization of clauses in connection with the study of binding is quite unknown. However, even the latter parametrization may find empirical support, as I tried to show.

[18]Notice, however, that the parametrization that connects non-local binding and monomorphemicity does not fare better in this case since reflexive clitics are clearly monomorphemic. Progovac (1993) suggests that the connection between monomorphemicity and non-local binding does explain why reciprocals in Russian, which are polymorphemic, must be bound locally. This is quite probably caused by the independent factor that reciprocals generally do not participate in non-local binding, which is more obvious when one considers Czech instead of Russian. In Czech, the anaphor *sebe* is ambiguous between a reflexive and reciprocal reading. Under non-local binding, the reciprocal reading disappears (see also Reinders-Machowska 1991 for the same facts in Polish).

[19]This parametrization cannot be stated in [+/-local] because all instances of binding are local in Slavic, as I tried to show. One possible way would be to implement Reinhart & Reuland (1993)'s theory in which syntactic and semantic predicates are distinguished for the purposes of binding. Unlike other reflexive anaphors, reflexive clitics would have to be bound locally in the *semantic* predicate.

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Structurally underspecified semantics for distributive plural predication

Respectively constructions in Lexical Resource Semantics

Jakub Fast

This paper sets out to provide an apparatus for dealing with the semantics of some coordinated structures — specifically, with plain distributive and 'respectively' readings of predication over nominal phrases — within the underspecified formalism of Lexical Resource Semantics (LRS) for Head-driven Phrase Structure Grammar. The proposed solution offers a method of providing ambiguous sentences that afford both regular distributive and 'respectively' readings with a structural, underspecified representation that resolves to both the licensed interpretations, and allows for an incremental introduction of constraints that limit the available readings. Additionally, a method for constructing representations of coordinated sentences, not previously available in LRS, is developed along the way.

1. Background and motivation

1.1. Data

The goal of this paper is to provide adequate semantic representation for sentences like (1) below, which, apart from a potential collective interpretation, permit two classes of distinct readings exemplified by (2a) and (2b).

(1) Tom and Mary brought a pencil and an eraser.

(2) a. Tom and Mary brought a pencil and an eraser, respectively.

b. Tom and Mary brought a pencil and an eraser each.

In (2a) there is only one pencil and one eraser — the pencil brought by Tom and the eraser brought by Mary, while in (2b) there are two collections composed of a pencil and an eraser each. In (2a), the adverb *respectively* enforces a reading where elements from both the subject and object NPs are selected in a pair-wise manner and predicated over separately. Apart from allowing coordination of phrasal elements other than NPs, and more than two parallel structures in one sentence, this mechanism generalizes straightforwardly to constructions involving a larger number of conjuncts.

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(3) Tom, Mary, and Kate brought a pencil, an eraser, and a notebook.

as well as constructions, where the structure of one of the coordinated entities is indicated deictically or anaphorically, like in

(4) These men are (respectively) the cook and the waiter.

(5) Those five men are Polish, Irish, Armenian, Italian, and Chinese, (respectively). (McCawley 1968)

(6) They live in Chicago and New York, (respectively). (Stockwell et al. 1973)

or even

(7) How do you film buffaloes being shot and killed during a stampede without injuring a single beast? How do you get a buffalo to charge an actor without endangering either? By using, respectively, fake and stunt buffaloes [...] (from the New York Times, Dalrymple & Kehler 1995)

1.2. Previous treatment

Respective readings have recently been dealt with by Gawron and Kehler (Gawron & Kehler 2004; also Gawron & Kehler 2000; 2002; 2003), who extend a standard Linkian (Link 1998) algebraic semantics for plural entities into a hyperintensional framework along the lines of Thomason (1980) additionally positing join semilattice structures over propositions and relations, not just over individuals. In their treatment, coordinated phrases are treated uniformly with plurally-denoting constructions: they are interpreted as group entities — be they individual sums, property or relation sums (for predicates), or propositional sums (for boolean conjunction). The elements of thus construed group objects are recoverable through the application of a *sequencing function*

$$f:\ \mathcal{G} \longrightarrow (\mathbb{N} \longrightarrow \mathcal{U})$$

which maps the set of all entities excluding atoms ($\mathcal{G}$) into a function from natural numbers to the set of all entities ($\mathcal{U}$; note, however, that the top element of the semilattice will never figure in the function's range). More specifically, f takes a non-atomic group entity and an integer index, and returns an atomic or non-atomic object that is strictly lower than, i.e., is a proper component of, that entity. In order to handle respective predication, they introduce the following operator.

$$\textsc{Resp}_f = [\![\text{respectively}]\!] = \lambda P \lambda g \bigsqcup_{1 \leq i \leq |f|} [f(P)(i)](f(g)(i))$$

RESP accepts a predicate sum (P) and an individual sum (g) and returns a proposition sum equivalent to the conjunction of sentences composed by applying each salient property in P to a corresponding entity in g. The correspondence is established by a sequencing function which is a parameter to RESP and has both P and g in its domain. The function carries a cardinality

($|f|$, equal to the number of elements in f's range) that needs to correspond to the number of salient components of both P and g. Thus, their baseline treatment of respectively sentences follows the sketch below.

⟦Sue and Karen jog and drive, respectively⟧

$$\begin{aligned} &= \textsc{Resp}_f(\text{jog} \sqcup \text{drive})(\text{Sue} \vee \text{Karen}) \\ &= \bigsqcup_{1 \leq i \leq 2} [f(\text{jog} \sqcup \text{drive})(i)](f(\text{Sue} \vee \text{Karen})(i)) \\ &= \text{jog}(\text{Sue}) \sqcup \text{drive}(\text{Karen}) \end{aligned}$$

⟦Tom and Mary brought a pencil and an eraser, respectively⟧

$$\begin{aligned} &= \textsc{Resp}_f(\text{bring}(\text{pencil}) \sqcup \text{bring}(\text{eraser}))(\text{Tom} \vee \text{Mary}) \\ &= \bigsqcup_{1 \leq i \leq 2} [f(\text{bring}(\text{pencil}) \sqcup \text{bring}(\text{eraser}))(i)](f(\text{Tom} \vee \text{Mary})(i)) \\ &= \text{bring}(\text{pencil})(\text{Tom}) \sqcup \text{bring}(\text{eraser})(\text{Mary}) \end{aligned}$$

where $\vee$ represents individual summation, and $\sqcup$ represents relation and proposition summation. This approach, enriched with an analogous $\textsc{Dist}_f$ operator, generalizes well to an account of a whole range of phenomena involved in plural reference and predication.

It should be noted that in all but the simple sentences containing overt coordinated phrases with the same number of conjuncts, the sequencing function needs to be established pragmatically in a non-trivial way. Its cardinality, the ordering of subsequent elements, and the actual kind of entities picked out from the sums have to be inferred from the context of the utterance and world knowledge. Consider the contrasts between sentences in the following sets.

(8) a. The three medalists are Azerbaijani, Namibian, and Costarican, respectively.
b. The medalists are Namibian, Azerbaijani, and Costarican, respectively.
c. ?? The medalists are Namibian and Azerbaijani, respectively.

(9) a. The two men and the two women are from the Ministry of Foreign Affairs and from the Department of State, respectively.
b. The two men and the two women are the chief of staff, the minister of foreign affairs, the prime minister, and the president, respectively.

In both (8b) and (8a) the order in which the medalists are mentioned needs to be established independently from the utterance, furthermore in (8b) a reference to general world knowledge is required in order to ascertain the cardinality of the denotation of the subject NP. In spite of different orderings of conjuncts in the object phrase, both these sentences may well describe the same situation if, say, (8b) refers to the athletes in the order in which they crossed the finish line, and (8a) names them in the spatial left-to-right sequence of standing on the medal podium. (9a) and (9b) illustrate the phenomenon of *intermediate distributivity* — in (9a) the range of the sequencing function for the subject sum consists of two individual sums, while in (9b) the same function ranges over four atoms, even though the group that is the argument to the function is the same in both cases.

1.3. Motivation and organization of this paper

Gawron and Kehler's analysis is geared specifically at a modular semantics framework with local compositionality, where the meaning of a phrase is established through functional application from the denotations of its daughters and no other sources. They present no systematic account of the ambiguity exemplified by (1). The only way it is honored is by way of allowing for a free distribution of the RESP and DIST operators, irrespective of surface occurrence of appropriate lexical items. The analysis is applicable solely to fully specified and disambiguated input: there is no intermediate representation that would cover both respective and distributive predication, and the sequencing function must be determined in advance for the constructions to have any meaning.

The goal of this paper is to lay down the groundworks for an *underspecified* analysis of *respectively* phenomena — one which would represent the ambiguity of (1) in a compact and tractable way. The considered construction will be the baseline case of a sentence with two coordinated NPs of the same number of elements predicated over with a binary verb. The analysis will provide (1) with a representation that subsumes both of the sentence's readings, additionally allowing for straightforward, incremental disambiguation. Such an approach allows for a systematic treatment of the ambiguity involved, while avoiding the (chiefly technical) problems of dealing with a freely ocurring, phonologically null operators. Additionally, the technical apparatus employed in this paper does not require positing rich, deeply structured models, the way Gawron and Kehler's solution does, and allows for a much freer choice of the semantic object language. The proposed analysis uses two properties of an underspecified semantics framework for HPSG, Lexical Resource Semantics (Richter & Sailer 2003, Richter 2004) in a relatively novel way — it uses the combinatorial, constraint-driven method of assembling meanings that is common to a wider class of underspecified formalisms to combine expressions on a level that is more fine-grained than that of truth-evaluable formulae and it makes makes extensive use of the consequences of the denotational approach to the LRS metalanguage in the HPSG equivalent of the syntax-semantics interface.

This paper is organized as follows. Section 2 discusses the basic notions of the particular subclass of underspecified formalisms Lexical Resource Semantics belongs to and summarizes the apparatus for representing meanings used in this theory. Section 3 presents the fundamental ideas that lead to the proposed solution and a sketch of the representations which will be assigned to *respectively* sentences, however omitting the technicalities of deriving them from the syntax of the sentence. The subsequent part, Section 4, provides a rather detailed account of the LRS mechanism for establishing semantic representations on the basis of syntactic descriptions, and discusses the modifications and enhancements it requires in order to accommodate the analysis of *respectively* constructions delineated in the preceding section. The apparatus necessary to represent coordination in LRS is also developed in Section 4.

2. Underspecification and Lexical Resource Semantics

Theories of semantic underspecification are a relatively heterogenous class of frameworks which are all geared at providing compact and efficient means of dealing with ambiguity on all levels of semantic processing. To date, underspecified formalisms have been used to account for such types of ambiguity as homonymy and polysemy, the count/mass ambiguity, ambiguous relative quantifier scope, quantifier and modifier distributivity, metonymy, syntactic scope ambiguities, attachment ambiguities, anaphor and deixis resolution, and ellipsis (cf. Bunt 2003).

Underspecified formalisms often use radically different means to achieve their goals, and a common definition for the entire class proposed in König & Reyle (1997) is rather general: it identifies a theory of underspecification with any theory that posits such representations for ambiguous sentences that are more compact than a disjunction of all possible readings. Nonetheless, this paper will be concerned solely with a specific subclass of underspecified semantic theories, composed of formalisms geared at dealing with ambiguities that are structural in nature (such as scope and attachment ambiguitites) and which will henceforth be termed collectively as *structurally* underspecified semantic theories (SUSTs). This group consists of theories such as Hole Semantics (Bos 1995), the Constraint Language for Lambda Structures (Egg et al. 1998), Underspecified Semantic Description Language (Pinkal 1995), and Lexical Resource Semantics for Head-driven Phrase Structure Grammar (Richter & Sailer 2003, Richter 2004 — henceforth LRS).

SUSTs allow for an elegant treatment of structural semantic ambiguity, such as the one arising in the classic case of unresolved relative quantifier scope in the example below.

(10) a. Every student reads a book.
 b. Two languages are spoken by every linguist.

Instead of relying on the standard Montagovian method of constructing the meaning of a sentence through a sequential use of function application along the projections of the syntactic tree, in SUSTs, the composition of meaning is conducted only after the entire tree is processed. Expressions representing the meaning of terminal nodes are then combined in a manner established on the basis of constraints read off the syntactic structure of the sentence in the initial processing phase. Ultimately, the composition method may, but need not, correspond to the one in the standard, locally compositional Montagovian framework, however, the key feature of SUSTs is that syntactic structures of ambiguous sentences will impose such constraints on the resultant logical form that will allow for more than a single way of composing the logical expressions contributed by lexical items into a formula representing the meaning of the entire sentence, therefore providing it with more than one reading.

Let us take an example of a simple structurally ambiguous sentence used by Bos (1995) and render it in LRS.

(11) Everybody is not here.

This sentence has at least two possible interpretations: one where the universal quantifier scopes above the negation and which amounts to saying that everyone is somewhere else, and another, where the negation outscopes the universal quantifier, and which is equivalent to some people not being here (yet). In LRS, this sentence would have the following structure — an *lrs* — as its semantic representation.

(12)
$$\begin{bmatrix} \textit{lrs} & \\ \text{EXCONT} & \boxed{0} \\ \text{INTCONT} & \boxed{1} \\ \text{PARTS} & \left\langle \forall x\ \boxed{2} \Rightarrow \boxed{3}, \neg\,\boxed{4}, \mathsf{P}(x), \mathsf{H}(x) \right\rangle \end{bmatrix}$$
$\mathsf{P}(x) \triangleleft \boxed{2},\ \mathsf{H}(x) \triangleleft \boxed{3},\ \mathsf{H}(x) \triangleleft \boxed{4}$

The PARTS list represents the individual semantic contributions of the elements of the sentence (P and H are shorthand representations of the quantifier's restrictor and scope: being a person and being here)[1]. Note that the scope-bearing expressions in the PARTS list contain numbered *tags*, metalinguistic variables that stand in for some unspecified subexpressions, which will later be identified with other elements of the PARTS list. The EXCONT attribute, representing the utterance's *external content*, is a singled out metalinguistic variable that is meant to represent the meaning of the entire sentence. Below the matrix are the *subordination constraints* for the structure. They impose conditions on the ways in which the metalinguistic variables in the PARTS and the EXCONT may be filled with elements of the PARTS list. In (12), the conditions state that $\mathsf{P}(x)$ needs to be contained in the restrictor of the universal quantifier (it either should be equal to $\boxed{2}$ or be a component of the formula substituted for $\boxed{2}$), and $\mathsf{H}(x)$ has to be both in the scope of the negation (under $\boxed{4}$) and of the universal quantifier (under $\boxed{3}$). The possible readings of the sentence, i.e. possible values of the EXCONT, are found by constructing all expressions which: (i) consist of all and only the elements of the PARTS list, (ii) are well-formed formulae, and (iii) conform to the subordination constraints. In this example, the conditions do not specify the relative scopes of the quantifier and of the negation — therefore, there are two possible values of $\boxed{0}$.

(13) a. $\forall x\ [\mathsf{P}(x) \Rightarrow \neg\,\mathsf{H}(x)]$
b. $\neg\,\forall x\ [\mathsf{P}(x) \Rightarrow \mathsf{H}(x)]$

Now suppose further information is obtained that permits one to disambiguate the sentence in (11), ruling out the reading in (13b). This can be achieved simply by adding the following constraint to the structure in (12).

(14) $\neg\,\boxed{4} \triangleleft \boxed{3}$.

In this way, the negation is forced to take scope inside that of the quantifier, and the set of possible readings (that is: the set of possible substitutions of tags that obey the conditions set out above) is limited to the expression in (13a).

Keeping theoretical considerations in view, it is important to determine what an *lrs* is as an object of linguistic theory and as a mathematical structure. It might be instructive to see it as a specification of a rewriting procedure which iteratively substitutes tags for formulae in the PARTS list and checks the resultant expressions against well-formedness and other criteria.

[1]The PARTS list is actually richer than the one presented here: it contains *all* the possible subexpressions of the formulae contributed by the lexical items, so in the present example it would actually contain the following additional elements: $\{\boxed{2} \Rightarrow \boxed{3}, \mathsf{P}, \mathsf{H}, x\}$. For the sake of simplicity of exposition, they have been omitted throughout the initial sections of this paper. Please note that the INTCONT attribute in the *lrs* above can be disregarded for now. It is meant to correspond to the scopally minimal element of the sentence, its *internal content*, and it only plays a role in deriving proper subordination constraints from the syntactic tree (this is covered in Section 4).

However, the language of LRS is defined as a part of the standard HPSG description language (Richter 2000), and therefore has a full-blown denotational interpretation. An *lrs* is actually a description in the HPSG description language that has a set of objects in its denotation — logical formulae of the elected language of semantic representation. In this sense, the language of LRS refers to concrete algebraic structures, and finding the possible readings of an *lrs* amounts to identifying the class of models and assignment functions for a grammatical description that map the EXCONT tag of the *lrs* to an object that satisfies the descriptions in the PARTS list and that does not contradict the subordination constraints (another set of descriptions).

Such denotational view of structural underspecification, where underspecified descriptions are taken to refer to independently construed objects interpreted as logical formulae, provides several advantages, which will be exploited in the analysis of *respectively* phenomena in the following sections.

3. *Respective readings — an outline of the analysis*

A consequence of the denotational approach to underspecified descriptions is that it allows one to talk about the properties of the reference relation between the descriptions of the metalanguage and the objects in its denotation. One such property is the question of possible token-identity of referents: that is, whether two metalinguistic descriptions of formulae of the object language in the PARTS list always have to refer to two distinct objects in the denotation. At first blush, such possible co-reference, where two elements of a PARTS list end up contributing a single expression to the overall logical form, might seem superfluous. However, identities of a similar kind are a standard analytic device in HPSG, and one should expect them to be applicable in semantic processing as well. In fact, they have already been applied to account for natural language phenomena with LRS.

Richter & Sailer posit a principle in LRS that forces identities to arise whenever possible (see the TY2 IDENTITY PRINCIPLE in Richter (2004)). Consequently, every two expressions in the PARTS list that describe structurally identical formulae refer to a single formula of the object language. They apply this mechanism in Richter & Sailer (2001) to explain Polish negative concord data, where two lexical negating elements correspond to a single negation in the semantic representation. Consider the mock *lrs* below.

(15) $$\begin{bmatrix} \textit{lrs} & \\ \text{EXCONT} & \boxed{0} \\ \text{INTCONT} & \boxed{1} \\ \text{PARTS} & \left\langle \neg\boxed{2}, \neg\boxed{3}, \mathsf{P}(x), \mathsf{P}, x \right\rangle \end{bmatrix}$$

Following the identity principle stated above, the *lrs* has two possible readings which differ in respect to whether the two negative expressions are identified with each other:

(16) a. $\neg\neg\mathsf{P}(x)$, when $\neg\boxed{2} \neq \neg\boxed{3}$,
b. $\neg\mathsf{P}(x)$, when $\neg\boxed{2} = \neg\boxed{3}$.

Note that the first reading does not violate the identity principle: given this interpretation, $\boxed{2}$ and $\boxed{3}$ stand in for different expressions ($\mathsf{P}(x)$ and $\neg\,\mathsf{P}(x)$), and therefore *under this particular* *substitution of tags* the first two expressions in the PARTS list of (15) cannot be identified with each other.

The single most significant problem in providing the simple *respectively*-licensing sentence in (17) with an LRS representation that would allow for both readings in (18) is controlling the number of occurrences of the basic structural elements of the sentence's possible interpretations.

(17) Tom and Mary like John and Kate

(18) a. $\mathsf{like}(\mathsf{tom}, \mathsf{john}) \wedge \mathsf{like}(\mathsf{tom}, \mathsf{kate}) \wedge \mathsf{like}(\mathsf{mary}, \mathsf{john}) \wedge \mathsf{like}(\mathsf{mary}, \mathsf{kate})$

b. $\mathsf{like}(\mathsf{tom}, \mathsf{john}) \wedge \mathsf{like}(\mathsf{mary}, \mathsf{kate})$

The *lrs* for (17) needs to be set up in such a way that would make it possible for the number of atomic propositions in its resolutions to vary between four (like in 18a) and two (in 18b). Likewise, there need to be three conjunctive subexpressions in (18a), and only one in (18b). This can be achieved by allowing appropriate elements of the PARTS list of a posited *lrs* to be identified with each other.

To illustrate how this is possible, consider the following description of a list of atomic propositions, where P is a predicate and v_1 to v_4 are variables or constants of the object language. Its denotation is a singleton set uniquely described by the expression below.

(19)
$$\begin{array}{c} \langle \mathsf{P}(v_1, v_3), \mathsf{P}(v_1, v_4), \mathsf{P}(v_2, v_3), \mathsf{P}(v_2, v_4) \rangle \\ \rightsquigarrow \\ \langle \mathsf{P}(v_1, v_3), \mathsf{P}(v_1, v_4), \mathsf{P}(v_2, v_3), \mathsf{P}(v_2, v_4) \rangle \end{array}$$

This description can be reformulated as follows, without changing the set of objects that make up its denotation:

(20)
$$\begin{array}{c} \langle \mathsf{P}(v_1, \boxed{a}), \mathsf{P}(v_1, \boxed{b}), \mathsf{P}(v_2, \boxed{c}), \mathsf{P}(v_2, \boxed{d}) \rangle \\ \boxed{a} = v_3 \;\&\; \boxed{b} = v_4 \;\&\; \boxed{c} = v_3 \;\&\; \boxed{d} = v_4 \\ \rightsquigarrow \\ \langle \mathsf{P}(v_1, v_3), \mathsf{P}(v_1, v_4), \mathsf{P}(v_2, v_3), \mathsf{P}(v_2, v_4) \rangle \end{array}$$

Among the four atomic propositions, there are no possible identifications, because each is required to contain a different set of variables. However, if the boolean relations between the four conditions above are changed from conjunctive to disjunctive (and if we add an additional condition not permitting other variables than v_3 and v_4 to appear as second arguments), the number of objects in the denotation of the description increases.

(21)
$$\begin{array}{l}\langle \mathsf{P}(v_1,\boxed{a}), \mathsf{P}(v_1,\boxed{b}), \mathsf{P}(v_2,\boxed{c}), \mathsf{P}(v_2,\boxed{d})\rangle \\ (\boxed{a} = v_3 \textbf{ or } \boxed{b} = v_3) \\ (\boxed{c} = v_4 \textbf{ or } \boxed{d} = v_4) \\ \{\boxed{a},\boxed{b},\boxed{c},\boxed{d}\} = \{v_3, v_4\}\end{array}$$
$$\rightsquigarrow$$
$$\begin{array}{ll}\langle \mathsf{P}(v_1,v_3), \mathsf{P}(v_1,v_4), \mathsf{P}(v_2,v_3), \mathsf{P}(v_2,v_4)\rangle & \text{when } \boxed{a} \neq \boxed{b} \;\&\; \boxed{c} \neq \boxed{d} \\ \langle \mathsf{P}(v_1,v_3), \mathsf{P}(v_2,v_3), \mathsf{P}(v_2,v_4)\rangle & \text{when } \boxed{a} = \boxed{b} \;\&\; \boxed{c} \neq \boxed{d} \\ \langle \mathsf{P}(v_1,v_3), \mathsf{P}(v_1,v_4), \mathsf{P}(v_2,v_4)\rangle & \text{when } \boxed{a} \neq \boxed{b} \;\&\; \boxed{c} = \boxed{d} \\ \langle \mathsf{P}(v_1,v_3), \mathsf{P}(v_2,v_4)\rangle & \text{when } \boxed{a} = \boxed{b} \;\&\; \boxed{c} = \boxed{d}\end{array}$$

The constraints above state that a variable should fill either one, or both tags in each predicate pair. If both tags are filled, then the relevant predicates end up being identical, because the variable in the first position is the same in each pair. If the tags refer to distinct variables, no identification can take place.

The denotation of the description in (21) is still to broad to cater for a respective reading, however it can be easily trimmed down to eliminate the two undesired elements of its denotation by imposing an additional condition of the form '$\boxed{a} = \boxed{b} \Leftrightarrow \boxed{c} = \boxed{d}$.' Thus, four descriptions of simple propositions can be formulated in a way that allows them to refer to either two or four atomic expressions required for the two readings of (17). The three conjunctions present in (18a) can similarly become identified with a single object in the denotation, thus allowing (18b) to be constructed. The proposed LRS representation for (17) is thus the following.

(22)
$$\begin{bmatrix} \textit{lrs} & \\ \text{EXCONT} & \boxed{0} \\ \text{INTCONT} & \boxed{1} \\ \text{PARTS} & \left\langle \begin{array}{l} \boxed{2}\wedge\boxed{3}, \boxed{4}\wedge\boxed{5}, \boxed{6}\wedge\boxed{7}, \\ \mathsf{like}(\mathsf{tom},\boxed{a}), \mathsf{like}(\mathsf{tom},\boxed{b}), \mathsf{like}(\mathsf{mary},\boxed{c}), \mathsf{like}(\mathsf{mary},\boxed{d}) \\ \mathsf{john}, \mathsf{kate}, \mathsf{tom}, \mathsf{mary} \end{array} \right\rangle \end{bmatrix}$$
$$\begin{array}{l}\mathsf{john} \triangleleft \boxed{a} \textbf{ or } \mathsf{john} \triangleleft \boxed{b};\;\; \mathsf{kate} \triangleleft \boxed{c} \textbf{ or } \mathsf{kate} \triangleleft \boxed{d}; \\ \{\boxed{a},\boxed{b},\boxed{c},\boxed{d}\} = \{\mathsf{john},\mathsf{kate}\};\;\; \boxed{a}=\boxed{b} \Leftrightarrow \boxed{c}=\boxed{d}; \\ \mathsf{john} \triangleleft \boxed{2};\;\; \mathsf{mary} \triangleleft \boxed{3};\;\; \mathsf{john} \triangleleft \boxed{4};\;\; \mathsf{kate} \triangleleft \boxed{5}; \\ \textbf{for all } \boxed{x} \in \{\mathsf{like}(\mathsf{tom},\boxed{a}), \mathsf{like}(\mathsf{tom},\boxed{b}), \mathsf{like}(\mathsf{mary},\boxed{c}), \mathsf{like}(\mathsf{mary},\boxed{d})\} : \boxed{x} \triangleleft \boxed{2}\wedge\boxed{3} \;\;\&\;\; \boxed{x} \triangleleft \boxed{4}\wedge\boxed{5}\end{array}$$

The *lrs* above yields precisely the two desired interpretations of (17). Naturally, in any sentence more complicated than this toy example, especially one where the NPs contain more material than named constants, the set of conditions in the *lrs* will have to be enlarged with constraints that regulate the containment relations between the three conjunctions and other elements of the sentence. A further issue to be resolved is how this particular set of constraints can be established on the basis of the syntactic analysis of (17), and in what way can one make two surface conjunctions and one surface verb give rise to 3 conjunctive expressions and 4 atomic propositions in the PARTS list. This is the task of the following section, where the procedure for determining LRS representations on the basis of syntactic structure is described in detail.

4. The syntax-semantics mapping

4.1. The LRS composition model

In LRS, lexical items have a semantic representation in the form of an *lrs* structure defined in the lexicon, and the semantic representations for the phrases of a given utterance (and consequently for the whole sentence) are established on the basis of the daughters' *lrs* structures and a series of composition rules derived from two general semantic principles, (23) and (24), and a series of construction-specific rules encoded as a clause in a reformulation of the standard HPSG SEMANTICS PRINCIPLE (25.4). Note that the previously omitted INTCONT attribute finally comes into play. Its purpose is to indicate the phrase's scopally minimal semantic element, and it has an important function in the composition process (cf. 25).

(23) INTCONT PRINCIPLE:
In each *lrs*, the INTCONT value is an element of the PARTS list and a component of the EXCONT value.

(24) EXCONT PRINCIPLE:

1. In every phrase, the EXCONT value of the non-head daughter is an element of the non-head daughter's PARTS list.
2. In every utterance, every subexpression of the EXCONT value of the utterance is an element of its PARTS list, and every element of the utterance's PARTS list is a subexpression of the EXCONT value.

(25) SEMANTICS PRINCIPLE:
In each *headed phrase*,

1. the EXCONT value of the head and the mother are identical,
2. the INTCONT value of the head and the mother are identical,
3. the PARTS value contains all and only the elements of the PARTS values of the daughters,
4. the following conditions hold:
   (a) if the non-head is a quantifier, then its INTCONT value is of the form $\exists x\ \boxed{a} \wedge \boxed{b}$ or $\forall x\ \boxed{a} \Rightarrow \boxed{b}$, the INTCONT value of the head is a component of $\boxed{a}$, and the INTCONT value of the non-head daughter is identical with the EXCONT value of the head daughter,
   (b) if the non-head is a quantified NP with an EXCONT value of the form $\exists x\ \boxed{a} \wedge \boxed{b}$ or $\forall x\ \boxed{a} \Rightarrow \boxed{b}$, then the INTCONT value of the head is a component of $\boxed{b}$.
   (c) ...

The idea is that in every phrase, the PARTS list is constructed through a concatenation of the semantic contributions of a phrase's daughters (25.3), and the scopal relations between elements of the PARTS list of the phrase are established following the constraints stated as construction-specific rules in the SEMANTICS PRINCIPLE (25.4). The INTCONT and the EXCONT values remain identical along a head projection (25.1 & 25.2), and serve as the 'core' semantic contribution of a phrase and as its overall logical form, respectively. This means that the EXCONT value for a full utterance, as well as the EXCONT values along its principal head projection, will correspond to the expression representing the meaning of the entire sentence. This expression is guaranteed to consist of all the elements contributed by all parts of the utterance (24.2). Consequently, the EXCONT value of the matrix verb will be a full proposition, even though its structure is unknown until the meaning of the whole sentence is resolved. In a non-head position, the overall structure of the EXCONT of a completed head projection is determined by one of the non-head phrase's components (24.1), and it can be resolved as soon as the projection is completed. For example, the EXCONT value for nouns is always a quantifier, and by virtue of (25.1) it will carry over to the NP, so the shape of the EXCONT of this kind of phrase can be determined rather early in the composition.

As dominance constraints are added at every step of the composition along all the projections and in all intermediate *lrs* structures, a seemingly unstructured semantic representation for an enitre sentence — which would consist of a further unspecified EXCONT value, an INTCONT value corresponding to that of the matrix verb, and a flat PARTS list containing all the expressions contributed by the components of the utterance — is sufficient to give a full-blown characterization of the sentence's meaning.

Note that the requirement that the EXCONT be composed of all and only the elements of the sign's PARTS list is imposed only on complete utterances (24.2), and not on all completed head projections. If no other constraints intervene, this allows certain elements of the sign's PARTS list to figure outside of the scope of the sign's EXCONT value and within the scope of another sign's EXCONT. Thus, the construction of the theory allows for a large degree of flexibility in terms of where a given expression ends up in the final semantic representation of an utterance, while maintaining the essential scopal and structural relationships.

Let us consider an LRS analysis for 'Every student reads some book.' The relevant lexical entries are found below. The LRS part of the sign is situated in a top-level LF attribute.

(26)
$$\begin{bmatrix} \textit{word} & \\ \text{PHON} & \langle \textit{read} \rangle \\ \text{SYNSEM|CAT|HEAD|ARG-ST} & \begin{bmatrix} \text{SUBJ} & \text{NP}[\text{CONT|INDEX|VAR}\ \boxed{1}], \\ \text{COMPS} & \langle \text{NP}[\text{CONT|INDEX|VAR}\ \boxed{2}] \rangle \end{bmatrix} \\ \text{LF} & \begin{bmatrix} \textit{lrs} & \\ \text{EXCONT} & \textit{t-expression}[2] \\ \text{INTCONT} & \mathsf{read}(\boxed{1},\boxed{2}) \\ \text{PARTS} & \langle \mathsf{read}(\boxed{1},\boxed{2}) \rangle \end{bmatrix} \end{bmatrix}$$

[2] *t-expression* is a sort designating all object language expressions of type $\langle t \rangle$, i.e. full propositions.

(27) a.
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \ \langle \textit{student} \rangle \\ \text{SYNSEM|CONT} \ \begin{bmatrix} \text{INDEX|VAR} & \boxed{1} \\ \text{MAIN} & \mathsf{student} \end{bmatrix} \\ \text{LF} \ \begin{bmatrix} \textit{lrs} \\ \text{EXCONT} & \begin{bmatrix} \textit{quantifier} \\ \text{VAR} \ \boxed{1} \end{bmatrix} \\ \text{INTCONT} & \mathsf{student}(\boxed{1}) \\ \text{PARTS} & \langle \mathsf{student}(\boxed{1}) \rangle \end{bmatrix} \end{bmatrix}$$

b.
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \ \langle \textit{book} \rangle \\ \text{SYNSEM|CONT} \ \begin{bmatrix} \text{INDEX|VAR} & \boxed{1} \\ \text{MAIN} & \mathsf{book} \end{bmatrix} \\ \text{LF} \ \begin{bmatrix} \textit{lrs} \\ \text{EXCONT} & \begin{bmatrix} \textit{quantifier} \\ \text{VAR} \ \boxed{1} \end{bmatrix} \\ \text{INTCONT} & \mathsf{book}(\boxed{1}) \\ \text{PARTS} & \langle \mathsf{book}(\boxed{1}) \rangle \end{bmatrix} \end{bmatrix}$$

(28) a.
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \ \langle \textit{every} \rangle \\ \text{SYNSEM|CAT|HEAD|MOD} \ \left\langle \begin{bmatrix} \text{CAT|HEAD} & \textit{noun} \\ \text{CONT|INDEX|VAR} & \boxed{1} \end{bmatrix} \right\rangle \\ \text{LF} \ \begin{bmatrix} \textit{lrs} \\ \text{EXCONT} & \textit{t-expression} \\ \text{INTCONT} & \forall \boxed{1} \ (\boxed{a} \Rightarrow \boxed{b}) \\ \text{PARTS} & \langle \forall \boxed{1} \ (\boxed{a} \Rightarrow \boxed{b}) \rangle \end{bmatrix} \end{bmatrix}$$

b.
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \ \langle \textit{some} \rangle \\ \text{SYNSEM|CAT|HEAD|MOD} \ \left\langle \begin{bmatrix} \text{CAT|HEAD} & \textit{noun} \\ \text{CONT|INDEX|VAR} & \boxed{1} \end{bmatrix} \right\rangle \\ \text{LF} \ \begin{bmatrix} \textit{lrs} \\ \text{EXCONT} & \textit{t-expression} \\ \text{INTCONT} & \exists \boxed{1} \ (\boxed{a} \wedge \boxed{b}) \\ \text{PARTS} & \langle \exists \boxed{1} \ (\boxed{a} \wedge \boxed{b}) \rangle \end{bmatrix} \end{bmatrix}$$

The appropriate variable bindings are established already in the lexical entries through the selectional requirements of the words. The lexical entries for nouns (27) posit that their EXCONT be a quantifier of some sort without specifying its exact kind. This quantifier is required to bind an appropriate variable, which is realized through the quantifiers' MOD entry. The full analysis of the sentence is presented in Figure 1.

Notice that in the analysis, the value of the EXCONT for the head projection remains unspecified, and it needs to be resolved to be identical with one of the elements of the top-level PARTS list. The only two choices that do not violate the dominance constraints introduced along the way are the quantifier expressions contributed by the two determiners. The dominance relationships between these two expressions are not stated anywhere, however they have to contain all the other semantic material in the utterance, and therefore they have to be the two scopally maximal elements in the utterance's interpretation.

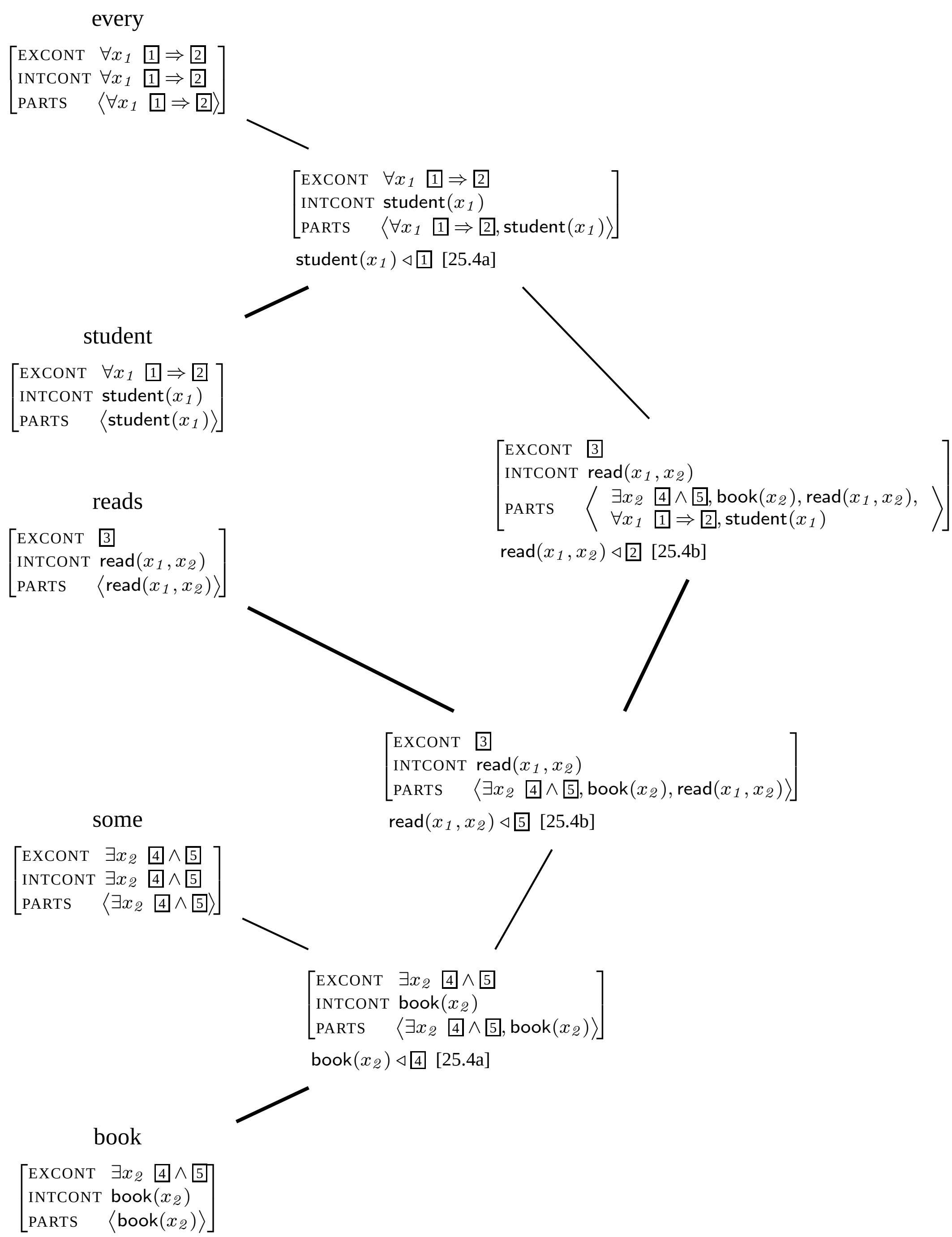

Figure 1: The analysis for ‘Every student reads some book.’ Dominance constraints added at each step are indicated underneath the AVMs with a reference to a relevant principle in square brackets. Note that in addition to the conditions spelled out in the figure, in every phrase above, the INTCONT value is constrained to be a component of the EXCONT, as stipulated by (23). Thicker lines indicate the head components of phrases.

4.2. Coordination

The first obstacle on the way to deriving appropriate *lrs* structures for (17) is that in its present form, LRS does not support constructions involving coordination. Accomodating such constructions requires a number of changes in the theory. First of all, let's construct an appropriate lexical entry for a binary *and*.

(29)
$$
\begin{bmatrix}
\textit{word} & \\
\text{PHON} & \langle \textit{and} \rangle \\
\text{SYNSEM} & \begin{bmatrix} \text{CAT}|\text{HEAD}|\text{ARG-ST}|\text{COMPS} & \left\langle \begin{array}{l} [\text{CONT}|\text{INDEX}|\text{VARS}\ \boxed{1}], \\ [\text{CONT}|\text{INDEX}|\text{VARS}\ \boxed{2}] \end{array} \right\rangle \\ \text{CONT}|\text{INDEX}|\text{VARS} & \boxed{1} \oplus \boxed{2} \end{bmatrix} \\
\text{LF} & \begin{bmatrix} \text{EXCONT} & \boxed{3} \wedge \boxed{4} \\ \text{INTCONT} & \textit{list(expression)} \\ \text{PARTS} & \langle \boxed{3} \wedge \boxed{4} \rangle \end{bmatrix}
\end{bmatrix}
$$

The appropriateness conditions for the sort *index* have to be changed to include a new VARS attribute of the sort *list(variable)* that replaces the usual attribute VAR and carries the variables for both conjuncts, and not just a single variable. The sort of the INTCONT attribute for all signs is also changed into a list, to reflect the fact that in coordinated phrases, the INTCONT needs to refer to the scopally minimal elements of both the conjuncts. For the sake of simplicity, coordination is taken to be syntactically flat, and the item *and* is treated as the head of a coordinated phrase. Adequate dominance constraints and requirements as to the contents of the INTCONT for coordinated phrases are introduced as an additional clause in point 4 of the SEMANTICS PRINCIPLE (25).

(30) [In every headed phrase,] if the head of the phrase is a conjunction with an EXCONT value of the form $\boxed{a} \wedge \boxed{b}$, then a concatenation of all the elements of the INTCONT attributes of the non-head daughters is the value of the phrase's INTCONT attribute, the elements of the linearly preceding non-head daughter's INTCONT are components of $\boxed{a}$, and the elements of the linearly succeeding non-head daughter's INTCONT are components of $\boxed{b}$.

An appropriate combinatorial rule is also required to account for coordinated phrases acting as non-heads higher up in the tree.

(31) If the non-head daughter is a coordinated phrase with an EXCONT value $\boxed{a}$, then all elements of the head's INTCONT value are components of $\boxed{a}$.

Secondly, in LRS appropriate variables are selected for predication in the lexical entries for the verbs (cf. pt. 26 above). The mechanism in its present shape does not support the new VARS attribute, and it does not not allow for assigning more than one combination of variables to a binary predicate (and as (22) above shows, we need 4 combinations under a distributive reading and 2 under a respective interpretation). Here is a new principle governing the lexical entries for binary verbs.

(32)
$$\begin{bmatrix} \textit{word} & \\ \text{PHON} & \boxed{0} \\ \text{SYNSEM} & \begin{bmatrix} \text{CAT}|\text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{ARG-ST} & \begin{bmatrix} \text{SUBJ} & \text{NP}[\text{CONT}|\text{INDEX}|\text{VARS}\ \boxed{1}], \\ \text{COMPS} & \langle \text{NP}[\text{CONT}|\text{INDEX}|\text{VARS}\ \boxed{2}] \rangle \end{bmatrix} \end{bmatrix} \\ \text{CONT}|\text{MAIN} & \boxed{3} \end{bmatrix} \\ \text{LF} & \begin{bmatrix} \textit{lrs} & \\ \text{EXCONT} & \textit{t-expression} \\ \text{INTCONT} & \boxed{4} \\ \text{PARTS} & \boxed{5} \end{bmatrix} \end{bmatrix}$$

$$\longrightarrow \quad \texttt{generate-atoms}(\boxed{3}, \boxed{1}, \boxed{2}, \boxed{4})$$
$$\& \ \texttt{subexpression-closure}(\boxed{4}, \boxed{5})$$

The `generate-atoms` relation is responsible for making sure that the verb's INTCONT is composed of atomic propositions created by predicating over all relevant combinations of variables. Its semi-formal definition would look the following.

(33) The relation `generate-atoms(predicate,` $\texttt{vars}_1$`,` $\texttt{vars}_2$`, atoms)` holds, iff:

a. `predicate` is a predicate name, $\texttt{vars}_1$ and $\texttt{vars}_2$ are lists of variables, and `atoms` is a list of atomic propositions of the sort *t-expression*, and

b. for every element (v_1, v_2) of the cartesian product $\texttt{vars}_1 \times \texttt{vars}_2$, there exists an element of `atoms` of the form $\texttt{predicate}(v_1, v_2)$, and

c. `atoms` contains no other elements than the ones mentioned above.

The other relation, `subexpression-closure`, holds between two lists if the second list contains all the expressions in the first list plus all their subexpressions. A derivation of a simple VP with a coordinated object phrase is presented in Figure 2. The only possible value for the top EXCONT, $\boxed{0}$, is '$\mathsf{like}(x_1, \mathsf{john}) \wedge \mathsf{like}(x_1, \mathsf{kate})$' or a logically equivalent expression.

However, the present apparatus is not sufficient to generate an appropriate reading for a sentence where an analogous VP is accompanied by a coordinated NP in the subject position, like in our baseline sentence in (17). A brief inspection of the analysis in Figure 2 reveals that even if another expression of the form $\boxed{a} \wedge \boxed{b}$ were contributed by the subject, there would simply not be enough conjunctive expressions in the PARTS of the utterance to generate a proposition like (18a), where three conjunctions appear, each with different subexpressions as conjuncts. The situation would only get worse if there was more material (like quantifiers or adjuncts) associated with the conjuncts in a way that would require or allow it to take scope under the conjunctions and above any of the matrix predicates. In order to achieve a correct distributive reading, all such expressions need to be allowed to occur in the resultant formula twice, however with different atomic propositions in their scope. This is achieved through a revision of the combinatorial principle stated in (31) above.

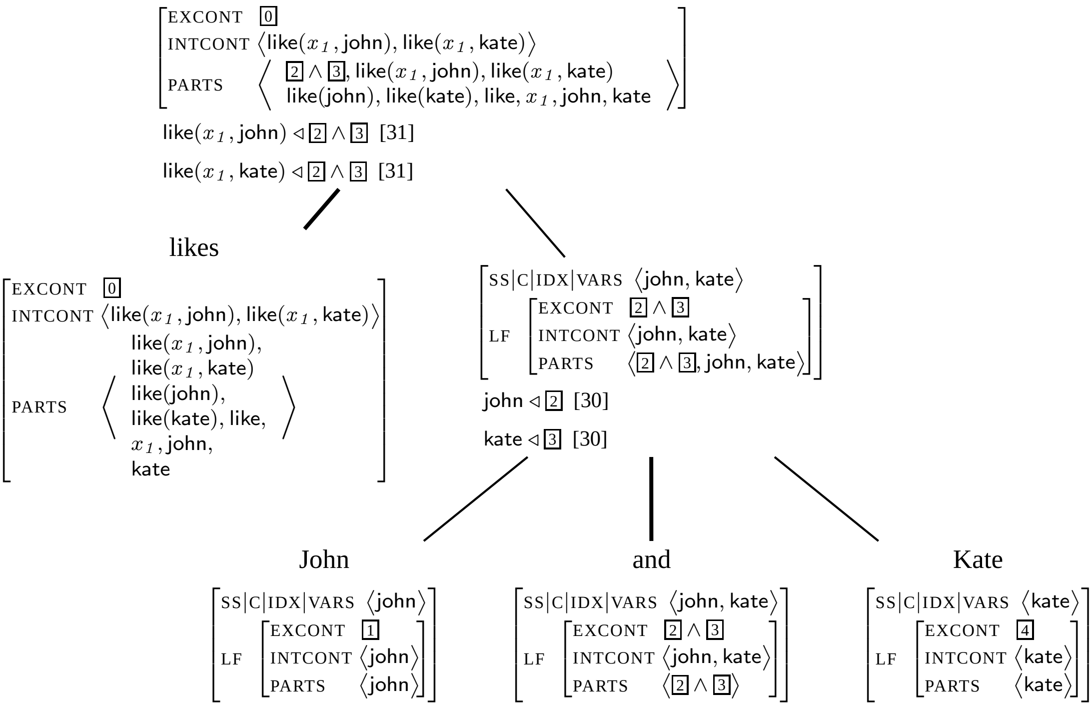

Figure 2: Analysis of the VP 'likes John and Kate.' For the sake of illustration, the analysis assumes there is a single variable x_1 contributed by a subject phrase.

(34) If the non-head daughter is a coordinated phrase with an EXCONT value $\boxed{a}$ and the head is a verb or a verbal phrase with an INTCONT value of $\boxed{b}$, then all elements of $\boxed{b}$ are components of $\boxed{a}$. Additionally, if $\boxed{c}$ is the PARTS value of the head daughter, $\boxed{d}$ is the PARTS value of the non-head daughter, and $\boxed{e}$ is a list of expressions, then the PARTS attribute of the phrase has the value $\boxed{c} \oplus \boxed{d} \oplus \boxed{e}$, and the following relation holds: `equal-upto-atoms`($\boxed{c}$, $\boxed{b}$, $\boxed{e}$).[3]

The `equal-upto-atoms` relation is based on an idea analogous to that of the *equality up-to* relation found in CLLS (Egg et al. 1998), where it is used to derive proper constraints for the representation of syntactically parallel constructions. Above, it is applied to make sure that apart from being a concatenation of the PARTS list of the daughters, the PARTS list for the phrase with a coordinated daughter, for every element of the head's PARTS list that has one of the atomic predicates generated in the lexical entry for a verb as a proper subexpression, includes an additional element that is identical to the original element, save for analogous occurrences of any of the atomic propositions formed with predicate representing the verb. In a manner of speaking, every expression that has any of the generated atoms in its scope is duplicated, yet in a

[3]Technically, this principle contradicts pt. 3 of the SEMANTICS PRINCIPLE stated in (25). (25.3) could be reformulated as follows:

3. The PARTS value of the phrase $\boxed{a}$ is a function of the concatenation of the PARTS values of the daughters $\boxed{b}$, that is $\boxed{a} = f(\boxed{b})$, where f is the identity function unless otherwise stated in a relevant construction-specific compositional clause in 4 below.

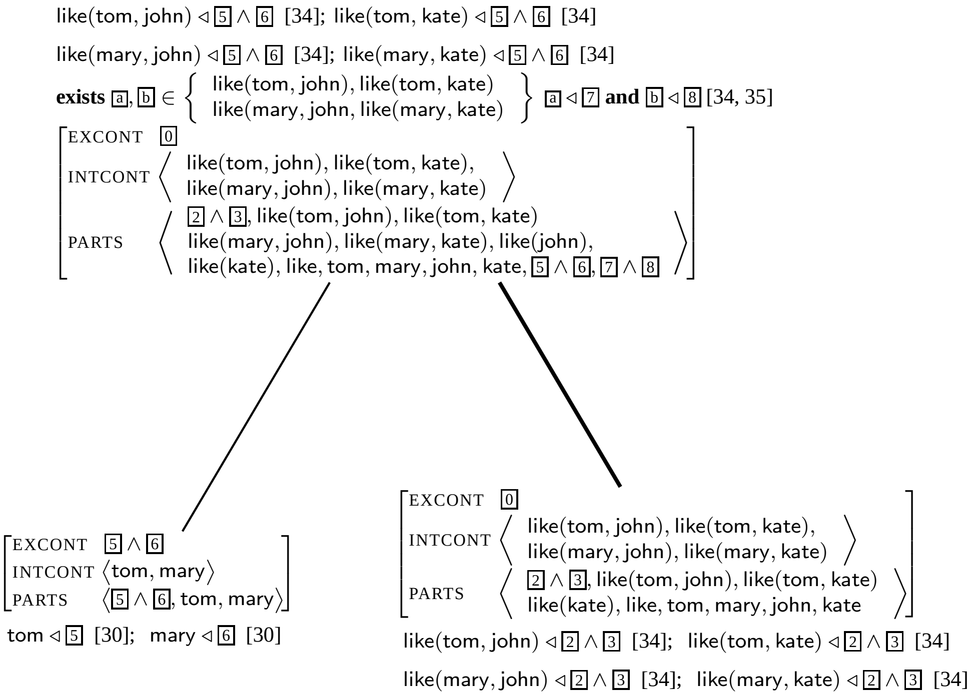

Figure 3: Analysis of 'Tom and Mary like John and Kate.' The structure of the VP is eqivalent to that presented in Figure 2, apart from the fact that appropriate variables for the subject are added to the verbal projection. The subject NP is constructed analogously to the object NP.

way that permits substituting all the occurrences of these atoms for other atoms in the same set. In this way, a completed non-head coordinated projection acts like a verbal adjunct, affecting the semantic material in head by duplicating its relevant scope-bearing elements. The definition of the `equality-upto-atoms` relation is the following.

(35) The relation `equal-upto-atoms(expr`$_1$`, atoms, expr`$_2$`)` holds, iff:

a. `expr`$_1$ and `expr`$_2$ are lists of expressions, and `atoms` is a list of atomic meaningful expressions, and either

b. `expr`$_1$ and `expr`$_2$ have only one element each, x_1 and x_2. x_1 contains an element of `atoms` as a proper subcomponent, and x_2 is identical to x_1 if all occurrences of the elements of `atoms` are removed from both x_1 and x_2,

c. or `expr`$_1$ and `expr`$_2$ contain more than one element each, there exists a list s constructed from all elements of `expr`$_1$ that contain an element of `atoms` as a proper component, and `expr`$_2$ is a list constructed from an empty list in the following way: for every element x_i of s an element y_i is appended to `expr`$_2$ such that the following relation holds:
`equal-upto-atoms`$(\langle x_i \rangle,$ `atoms`$, \langle y_i \rangle)$.

As far as the analysis in Figure 2 is concerned, no 'duplication' is involved, as no expressions in the PARTS list of the head contain any of the atomic predicates in the INTCONT of the verb as *proper* components. Consider the remaining part of the derivation of 'Tom and Mary like John and Kate' in Figure 3 (the previous analysis of the VP is modified to reflect the fact that the subject NP contributes two variables). An additional conjunction ($\boxed{7} \wedge \boxed{8}$) appears in the PARTS list for the whole sentence as stipulated by the `equal-upto-atoms` relation in (34). The only expression in the PARTS list of the VP that contains any of the predicates as proper subexpressions is the conjunction '$\boxed{2} \wedge \boxed{3}$.' Therefore, given that the non-head is a coordinated phrase, the PARTS list of the parent needs to contain another element that is identical to it, save for possible substitutions of the atomic propositions from the verb — that element being '$\boxed{7} \wedge \boxed{8}$.' Notice that in principle $\boxed{7}$ and $\boxed{8}$ need not refer to the atomic propositions. If the conjunction in the object NP scoped over conjunction in the subject NP, the subject conjunction would have to be duplicated with it, and $\boxed{7}$ and $\boxed{8}$ would be more complex expressions that would contain the atomic propositions deeper down. However, such scoping is impossible in the present case because it would not allow for the construction of any expressions that would be composed of all the elements in the top-level PARTS list and that could thus be used as the value of the utterance's EXCONT: there would be two independent two-layer conjunctions with three atomic propositions at their leaves which could not be combined with each other, so one of the conjunctions and one of the predicates would have to be left out from the final semantic representation — which is illegal on the basis of (24.2). Thus, in the sentence under consideration, $\boxed{7}$ and $\boxed{8}$ have to correspond to atomic propositions (and therefore $\{\boxed{7}, \boxed{8}\} = \{\boxed{a}, \boxed{b}\}$). The analysis produces the correct meaning for the sentence, and no additional dominance constraints are necessary, as all combinations of three conjunctions and four predicates in the PARTS list end up being logically equivalent to (18a).

Now we are ready to extend this formalism to deal with the ambiguity between respective and standard distributive readings, following the insights in Section 3. We need to incorporate the identities mechanism into the above theory in a way that will lead to the derivation of constraints analogous to those in (22).

4.3. Respectively *sentences*

An analysis of 'Tom and Mary like John and Kate' that provides both the possible readings (Figure 4) is essentially equivalent to that presented in Figures 2 and 3, however with a different mechanism for dealing with the atomic expressions generated in the main verb. This requires a new formulation of the `generate-atoms` relation.

(36) The relation `generate-atoms(predicate,` $\texttt{vars}_1$, $\texttt{vars}_2$, `atoms)` holds, iff:

a. `predicate` is a predicate name, $\texttt{vars}_1$ and $\texttt{vars}_2$ are lists of variables, and `atoms` is a list of atomic meaningful expressions, and
b. for every element v of $\texttt{vars}_1$, there exists a sub-list s of `atoms` with the same number of elements as $\texttt{vars}_2$, such that every element of s is an atomic expression of the form $\texttt{predicate}(v, x)$ and the set of variables that stand in for x in s is either equal to the set of all elements of $\texttt{vars}_2$ or to the singleton set containing the variable v' which figures in $\texttt{vars}_2$ at the same index as v figures in $\texttt{vars}_1$, and
c. `atoms` contains no other elements than the ones mentioned above.

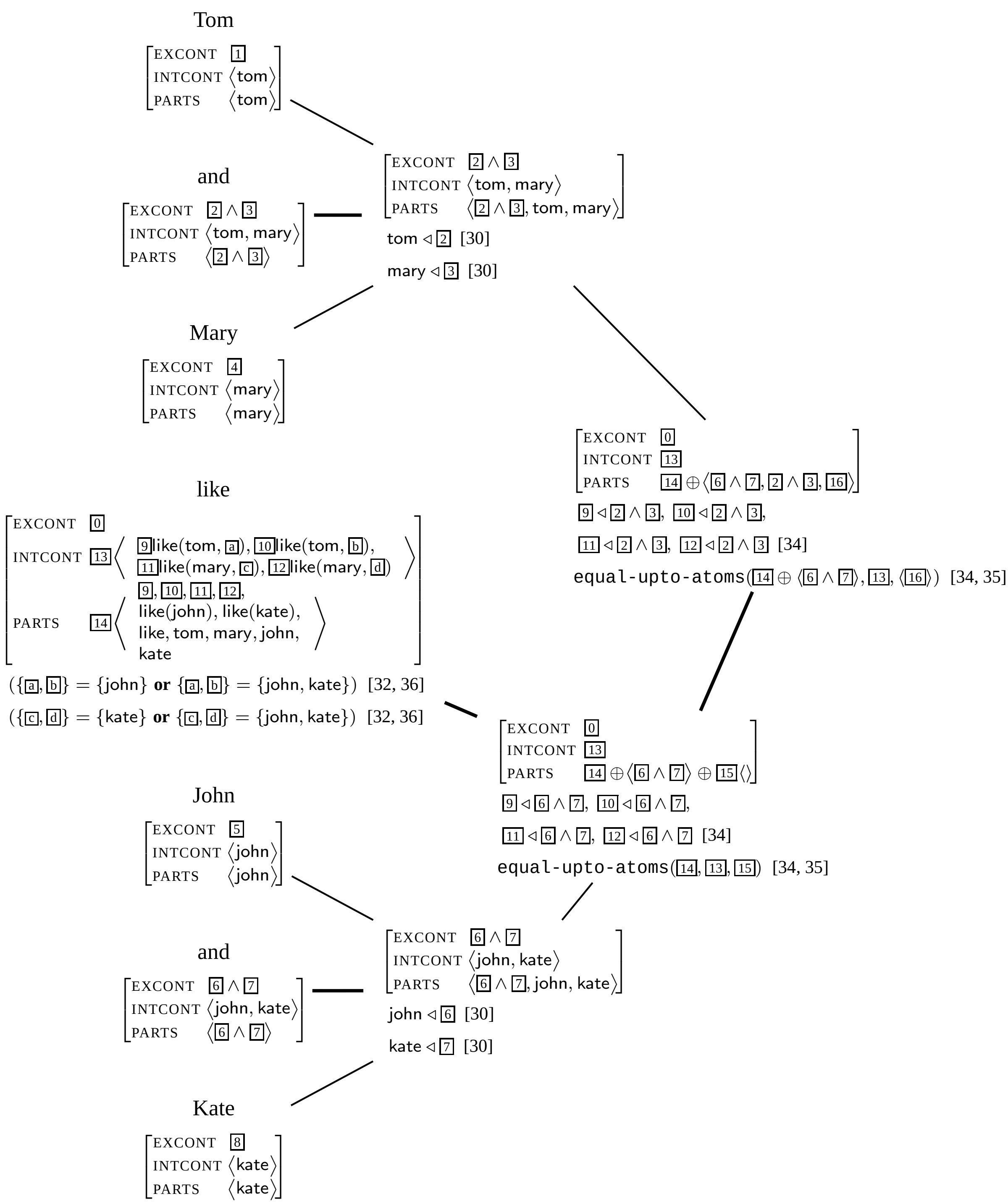

Figure 4: The analysis of ‘Tom and Mary like John and Kate’

Two additional relations are required to provide the modification mechanism for the adverbs *respectively* and *each*.

(37) The relation `force-equal(atoms)` holds, iff:
  a. `atoms` is a list of atomic meaningful expressions, and
  b. every two elements of `atoms` that have the same variable in the first position are identical.

(38) The relation `force-not-equal(atoms)` holds, iff:
  a. `atoms` is a list of atomic meaningful expressions, and
  b. no two elements of `atoms` that have the same variable in the first position are identical.

These relations need to hold of the verb's INTCONT if the adjuncts *respectively* or *each* are present in the sentence. However, as the LF attribute of the sign is situated outside the SYNSEM attribute, and therefore is unavailable for the standard MOD adjunction mechanism, the behavior needs to be reproduced through appropriate clauses in the construction-specific fragment of the SEMANTICS PRINCIPLE.

(39) In a *head-adjunct* phrase, where the head is a verbal phrase with an INTCONT value of $\boxed{a}$, and the non-head is the adverb *respectively*, the following relation holds: `force-equal(`$\boxed{a}$`)`.

(40) In a *head-adjunct* phrase, where the head is a verbal phrase with an INTCONT value of $\boxed{a}$, and the non-head is the adverb *each*, the following relation holds: `force-not-equal(`$\boxed{a}$`)`.

5. *Final remarks*

The apparatus above handles the baseline case of *respectively* phenomena adequately, and with a minor amount of changes, it should be expected to cover other constructions, such as those involving coordination of phrases of categories other than nouns. Moreover, there are no fundamental obstacles in extending it to account for constructions involving anaphoric binding (such as (6) above), if only appropriate variables are injected into the VARS attribute of a relevant pronoun by some discourse resolution mechanism.

Probably the most glaring problem in terms of the coverage of the analysis sketched above is that it does not account for various interactions between negation and coordination (see for example Szabolcsi & Haddican 2004), including the simplest ones, and it should not be expected that correct readings are assigned to sentences including negation and coordination at this point.

Furthermore, an area into which it is unlikely the present treatment would be extended is that of general respective predication phenomena that are not structural in nature, which Gawron and Kehler's analysis does account for, such as the one illustrated by the following sentence from (Schwarzschild 1996).

(41) The fiction books complement the non-fiction books.

The fundamental difficulty lies in the fact that the analysis presented here operates on the metalinguistic level, it uses discrete elements of linguistic descriptions as the building blocks and is in no way related to a general account of plurals. Squaring the analysis with phenomena such as the one in (41) would require hoisting the full structure of group objects such as 'fiction books' into the grammatical formalism, for example by giving each element of that set a distinct variable in the VARS list, which seems more than cumbersome.

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Jakub Fast
University of Warsaw and Collegium Invisibile
kuba.fast@gmail.com

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Matching and Raising compared

Scott Fults

This paper argues that English clausal comparatives are generated by means of two different syntactic derivations. Comparative deletion structures are given a 'raising analysis' in which the correlate moves into its structural case position and then moves out of the comparative clause to the matrix head position. In comparative subdeletion structures, the correlate and the head are base-generated separately. The analysis invokes remnant movement within the comparative clause to account for certain A-bar properties of comparatives attested by new parasitic gap evidence. Finally, it is shown that raising analyses are less stipulative concerning the semantic properties of comparatives than 'matching' proposals.

1. Introduction

English clausal comparative constructions come in at least two varieties: comparative deletion (CD) exemplified in (1) and comparative subdeletion (CSD) as in (2).

(1) a. Scott is **taller** than Cilene is <~~tall~~>.
 b. Bill owns more **DVDs** than Scott owns <~~DVDs~~>.

(2) a. Violet is **wider** than she is **tall**.
 b. John reads more **books** than he reads **magazines**.

In CD, the correlate (located inside the *than*-clause) necessarily deletes, while the head (located in the matrix clause next to it or attached to the comparative morphology) does not. In CSD, the head and correlate are distinct lexical items and neither deletes.

This paper has several goals. First, I will claim that English CD and CSD constructions are generated via two different syntactic derivations (Chomsky 1977 basically made this claim). This claim goes against standard analyses of clausal comparatives, which attempt to unify the two constructions by treating CD as a special case of CSD (for instance, Bresnan 1973, 1975; Heim 1985; Kennedy 2002a). I will provide reasons for not reducing CD to a case of CSD in Section 3. In Section 4, I will claim that CD is most aptly accounted for under a raising analysis in which the correlate moves to the head position. CSD, on the other hand, involves base-generation of a separate head and correlate.

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Second, I will propose that CD and CSD both involve overt remnant movement within the than-clause. In CD, the NP must first move out of the Number Phrase (NumP) projection that dominates it to check case followed by movement to the matrix head position.[1] The remnant NumP then moves to Spec CP of the *than*-clause for interpretive purposes. CSD also involves movement out of the NumP to check case, but there is no further movement into the head position. I will present new parasitic gap evidence for this analysis. This will be discussed in Section 5.

Third, in Section 6, I will compare matching to raising theories in order to buttress my claim that CD should not be reduced to a special case of CSD. I will point out that both matching and raising theories invoke non-traditional stipulations. However, matching requires more of these stipulations than the analysis presented in previous sections. I will also argue that CSD constructions do not provide an argument for a unified matching analysis.

In the next section, I will provide a short review of raising, matching and ellipsis accounts of clausal comparatives.

2. Theories of clausal comparatives

Three types of analyses have been offered to account for English style clausal comparatives. I will present a short review of ellipsis, raising and matching analyses in turn.

2.1 Ellipsis theories

Ellipsis accounts treat CD and CSD as a special case of redundancy reduction. Bresnan (1973, 1975) argues for an obligatory unbounded deletion mechanism that deletes the degree element as well as all redundant material (up to recoverability). In CD, the correlate and head match entirely, and hence, the correlate is deleted entirely. But in CSD, only the degree term deletes since the correlate and matrix sortals are different, and hence, deletion of the correlate would not be recoverable.

(3) a. Scott is **taller** than Cilene is ~~***n*-much tall**~~.
b. Bill owns **more DVD's** than Scott owns ~~***n*-many DVD's**~~.

(4) a. Violet is wid**er** than she is ~~***n*-much**~~ tall.
b. John reads **more** books than he reads ~~***n*-many**~~ magazines.

But notice that this looks like a very *ad hoc* system, since the deletion mechanism is a construction specific kind of ellipsis (for instance, it is required whereas ellipsis is generally optional). Furthermore, clausal comparatives have many properties similar to relative clauses (these will be reviewed in the next section). As such, ellipsis accounts have been discarded in favor of theories that have been proposed for relative clauses (RCs) such as raising and matching (see Kennedy 2002a for a review).[2]

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[1] I will only provide an analysis of quantity NP comparatives as in (1b) and (2b) and save extending the analysis to AP comparatives for future research.

[2] For examples of raising and matching theories of relative clauses see Vergnaud (1974), Carlson (1977), Chomsky (1977), Kayne (1994), Sauerland (1998), Bianchi (2000), Aoun and Li (2003).

2.2 Raising theories, or one-sortal theories

One type of RC theory, typically referred to as *raising*, has been applied to CD (Lechner 1999). For CD, raising theories base-generate the correlate and then move it up into the head position.

(5) Scott is [tall]er than Cilene is ~~*n* much~~ *t*

I will often refer to raising theories as *one sortal* theories because only one sortal is base-generated.

(6) *One sortal systems (raising)*: the head and the correlate are related via a movement transformation

Raising has difficulty providing a unified account of CSD. There obviously could not be movement of the correlate into the head position, since the head and correlate are different lexical items.

2.3 Matching theories, or two-sortal theories

The second type of RC theory that has been applied to clausal comparatives is usually called *matching* (see Kennedy 2002a,b). Matching theories base-generate two sortals, one in the correlate position and one in the head position. In CD, the correlate moves to a position where it can be deleted under identity with the head (in Kennedy 2002a,b this is a CP position).

deletion under identity

(7) Scott is [tall]er than [~~n much tall~~] Cilene is *t*

I will refer to matching theories as two-sortal theories since two sortals are base-generated.

(8) *Two sortal systems (matching)*: the head and correlate are base generated separately (and, if the correlate 'needs' to delete, it moves to a position where it can be deleted under identity with the head)

CSD also has two sortals base-generated, but the correlate sortal does not move and does not delete. Matching theories, at least on the surface, appear to offer an easy unified account of CD and CSD. In effect, CD is treated as a special case of CSD, since CSD obviously has two sortals base-generated. In this respect, matching is very similar to the ellipsis account. I will offer reasons why CSD is not an argument for a matching analysis in Section 6.

2.4 Summary

This short review of ellipsis, raising and matching theories of comparatives was intended to highlight attempts at unification of CD and CSD. Both ellipsis and matching theories treat CD as a special case of CSD. Raising, on the other hand, does not have an account of CSD. The next section provides arguments against the ellipsis account as well as reasons to believe that CD should be unified with relative clauses, not CSD.

3. CD and relative clauses vs. CSD

In this section, I will review several data points that show that CD and CSD pattern like relative clauses in key respects, but CSD differs from CD and relatives in other ways. This will lay the groundwork for the claim that CD and CSD should not be unified under one matching or raising analysis. The data will also indicate that ellipsis theories are inadequate for CD and CSD.[3]

3.1 The difference: PF deletion

The main difference between CD and relative clauses on the one hand and CSD on the other concerns deletion of the correlate. The correlate must be deleted in CD (9) and relatives (10), but deletion is prohibited in CSD (11).

(9) a. John has more books than Bill has.
    b. *John has more books than Bill has books.

(10) a. Kip saw the movie that I saw.
     b. *Kip saw the movie that I saw the movie.

(11) a. *John bought more books than Bill bought <~~magazines~~>.
     b. John bought more books than Bill bought magazines.

Ellipsis, however, is generally optional. Therefore, ellipsis theories of comparatives must somehow *require* deletion of the correlate. This makes ellipsis theories look rather construction-specific and detracts from their appeal.

The next two data points stem from the required deletion property of CD and relatives. There is a locality restriction on the resolution of CD that is not present in typical ellipsis structures (Kennedy 1997). This is also true of relative clauses (Williams 1977). The examples in (12) are taken from Kennedy (1997).

(12) a. The table is wider than the rug is, but the rug is longer than the desk is.
     b. The table is wider than the rug is, but the rug is longer than the desk is <~~long~~>.
     c. *The table is wider than the rug is, but the rug is longer than the desk is <~~wide~~>.

(13) a. Kip saw the movie that Marc saw, and Chad has the picture that Anthony saw.
     b. Kip saw the movie that Marc saw, and Chad has the picture that Tony saw <~~picture~~>.
     c. *Kip saw the movie that Marc saw, and Chad has the picture that Tony saw <~~movie~~>.

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[3] Much of this review was taken from Kennedy (2002a) except that Kennedy does not discuss relative clauses in the same way that I will here. Also, I will draw a different conclusion from Kennedy, who provides a unified matching analysis of CD and CSD.

This test doesn't apply to CSD, since its correlate has not deleted. Notice that this data also argues against an ellipsis account. As noted by Williams (1977) and Kennedy (1997), a VP gap can be resolved with a VP that is local or far away (examples taken from Kennedy 1998).

(14) a. Marcus read every book I did and I bought every book Charles did.
b. Marcus read every book I did and I bought every book Charles did <~~buy~~>.
c. Marcus read every book I did and I bought every book Charles did <~~read~~>.

If comparative deletion were really a general form of ellipsis then we would expect it to not have a locality restriction on its resolution.

Lastly, it has been noted that relative clauses behave ambiguously with respect to certain reconstruction properties (Chomsky 1993; Lebeaux 1992; Munn 1994; Sauerland 1998).

(15) a. The relative of John$_i$ that he$_i$ likes lives far away. (Munn 1994)
b. The relative of his$_i$ that everybody$_i$ likes lives far away.

CD displays the same paradox.

(16) a. There were more relatives of John$_i$ at the reunion than he$_i$ wanted there to be.
b. There were more of their$_i$ relatives at the reunion than everybody$_i$ wanted there to be.

CSD, of course, has no reconstruction properties since the correlate is pronounced in its base position. I will ignore why and how this reconstruction data is explained, and instead use it only as support for the claim that CD and RCs are similar. (But see Sauerland 1998 for a discussion and review of the literature concerning this paradox for RCs).

To summarize, CD and RCs pattern alike with respect to required deletion, locality of resolution and reconstruction effects. CSD, on the other hand, does not delete the correlate. Furthermore, ellipsis accounts can only stipulate the required deletion and cannot account for the locality requirement on resolution.

3.2 The similarities: movement

Relatives, CD and CSD behave very similarly with respect to movement diagnostics. First, the deleted correlate in comparatives and relatives cannot be located inside an island. (see Sauerland 1998, ch. 2 and references cited therein). The (a) and (b) examples in (17) – (22) are taken from Kennedy (2002a).[4]

(17) Complex NP islands
a. *Michael has more scoring titles than Dennis is a guy who has.
b. *Michael has more scoring titles than Dennis is a guy who has tattoos.
c. *Michael won the scoring title that Dennis is a guy who wanted.

(18) Wh-islands
a. *The shapes were longer than I wondered whether they would be.
b. * The shapes were longer than I wondered whether they would be thick.
c. *Mary likes the shapes that I wondered whether she would.

[4] Note that Chomsky (1977) argues that island diagnostics cannot be used on CSD.

(19) Adjunct islands
   a. *My sister drives as carefully as I avoid accidents when I drive.
   b. *My sister drives as carefully as I avoid accidents when I drive carelessly.
   c. *My sister drives a car that I avoid accidents when I drive.

(20) Sentential subjects
   a. *There are more stars in the sky than that the eye can see is certain.
   b. *There are more stars than that the eye can see planets is certain.
   c. *There are many stars in the sky that the eye can see is certain.

Second, CD and CSD display weak and strong crossover effects as reported by Kennedy (2002a). His examples are used below. Relatives also display this property.

(21) Weak Crossover:
   a. More Democrats$_i$ voted than their$_{*?i/j}$ friends expected to vote.
   b. More Democrats voted than their$_{*i/j}$ friends expected Republicans$_i$ to vote.
   c. John voted for the Democrats$_i$ who their$_{*i/j}$ friends expected to win

(22) Strong Crossover:
   a. More Democrats$_i$ voted than they$_{*i/j}$ expected to vote.
   b. More Democrats voted than they$_{*i/j}$ expected Republicans$_i$ to vote.
   c. John voted for the Democrats$_i$ who they$_{*i/j}$ expected to win.

Ellipsis theories have no explanation for the results of these movement diagnostics, since ellipsis is does not show movement properties. Therefore, we can conclude that comparatives and relatives are not a matter of a general ellipsis mechanism. Instead, any account of comparatives and relatives must involve movement. Recall that both raising and matching invoke movement.

3.3 Summary

The similarities presented in this section indicate that a movement analysis is preferable over an ellipsis account. Furthermore, the similarities make a unified analysis look very appealing. But the PF differences indicate that CD is very much like relatives, while CSD is somehow different. Herein lies the difficulty: how do we accommodate CSD structures which show island and crossover effects (indicating movement), but don't delete the correlate? The answer I will provide in the next section is that CSD should not be unified with CD. Rather, CD and CSD are generated differently.

3.3.1 One sortal vs. two sortals

While each construction type tests positive for movement, only relatives and CD require deletion of the correlate; CSD cannot delete the correlate. Rather than trying to unify CD and CSD by providing either a one or two sortal system for both of them, I will propose in 4.1 and 4.2 that they are have distinct derivations: CD base-generates one sortal, while CSD base-generates two. That is, CD is a raising construction and CSD is a matching construction under the following definitions of raising and matching.

(23) *Raising*: one sortal is base-generated in the correlate position and then moves to the head position.

(24) *Matching*: one sortal is base-generated in the correlate position and a second sortal is base-generated in the head position.

This will account for the fact that CD constructions require deletion of the correlate. Typically, only one member of a chain can be pronounced. (This is Lechner's 1999 argument for raising in CD). Notice that matching is defined as a derivation *without deletion under identity* (see Kennedy 2000a,b for a typical matching analysis with deletion).

(25)

CD	raising (one sortal)
Relative clauses	raising (one sortal)
CSD	matching (two sortals)

This analysis will allow us to solve a problem for movement theories first brought up by Bresnan (1973). Bresnan's problem only arises when CD and CSD are given a unified two sortal analysis. I will discuss Bresnan's problem and the solution for it in Section 4.3.

4.1 One sortal for CD

In this section, I will present the raising analysis of CD offered by Lechner (1999).[5] This will suffice for the current purpose of explaining the data in the previous section, but I will modify the account in Section 6. The derivation is as follows. First, a NumP is constructed by merging the sortal *books* with an abstract Num^0, which I will assume is the functional head MANY.[6,7] MANY also takes an internal degree argument, which in this case will be the variable *n*. The sortal *books* is inserted with an uninterpretable feature that Lechner calls [–COMP].

(26) [$_{\text{NumP}}$ books MANY *n*]
[–COMP]

The comparative clause is constructed without anything interesting happening until the comparative morpheme *more* is inserted. The comparative morpheme has a [+comp] feature that can check the uninterpretable feature on the correlate. Therefore, the correlate moves into the head position where it checks its uninterpretable feature.

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[5] Lechner (1999) treats only AP-NP comparatives of the sort *Mary knows younger authors than Peter knows.* I will adjust his basic analysis to account for the quantity comparatives I am analyzing here.

[6] I will assume the NP projects a NumP (the analogue of the AP projection DegP). The degree phrase projection is a typical assumption in comparative analyses; see Kennedy (1997), Lechner (1999), among many others. These assumptions are based on Abney (1987).

[7] MANY is a function that allows degrees to combine with NP sortals compositionally. While there are many different proposals for what MANY is, they all have in common that it relates the cardinality of the set of entities referred to by the NP and a degree term. See Hackl (2000) and references cited therein for a discussion of MANY.

(27) [$_{DP}$ [$_{NumP}$ books$_i$ more [$_{CP}$ than Bill bought [$_{NumP}$ ~~books$_i$~~ MANY *n*]]]]
[~~–COMP~~][~~+COMP~~] [–COMP]

Lechner assumes the NumP raises to insure a proper compositional semantics.[8,9] I will assume that it moves to a CP position.

(28) [$_{DP}$[$_{NumP}$ books$_i$ more [$_{CP}$[$_{NumP}$ ~~books$_i$~~ MANY *n*]$_j$ than Bill bought [$_{NumP}$ ~~books$_i$~~ MANY *n*]$_j$]]

This A-bar movement of the NumP is remnant movement (Müller 1998) done covertly. Finally, in order to get the word order correct, I will assume that *more* raises to a D head position.

Lechner's basic proposal accounts for the data presented in section 2. First, deletion of the correlate is expected in CD since deletion of lower copies in a movement chain is normal. Second, we expect the gap to be resolved with the local head of the comparative, because the gap is just the lower member of the chain that contains the head as its top member. Third, because there is movement, we can explain the island and crossover effects.

4.2 Two sortals for CSD

The task now is to provide an analysis of CSD constructions that is compatible with the raising analysis of CD, but still accounts for the fact that the correlate must delete in CD but not in CSD. This will be accomplished by base-generating two sortals in CSD. The derivation of CSD looks very similar to CD, but in CSD the numeration contains two sortals, which must be merged into the sentence.

First, we merge the correlate into the NumP. This time the correlate is without a [–COMP] feature. The rest of the comparative clause is constructed normally.

(29) [$_{CP}$ than Bill bought [$_{NumP}$ books MANY *n*]]

The derivation continues by merging *more* which possesses the [+COMP] feature. Then, the second sortal is merged into the position where the correlate moved in CD. This time, however, the head has the [–COMP] feature. This feature is deleted on its initial merge with *more*.

---

[8] See Lechner (1999:50-51). Lechner argues that the gap position is interpreted as a bare plural weak indefinite, denoting an individual property. Therefore, it is of the wrong type to combine with the verb, which needs type <e>. I will assume along with Lechner that QR of the NumP leaves a trace of type <e>, and that the NumP can combine with the lambda-abstract created by the QR. Lechner points out that there are other possible ways to make the compositionality work out correctly, but since I will be offering evidence of overt A-bar movement of the NumP, I will stick to his account. Kennedy (2002a) provides other evidence for A-bar movement of the NumP. This will be discussed in Section 5.

[9] An anonymous reviewer points out that the need for this QR seems weakened by the data in (16) which argues for some type of reconstruction. But the reconstruction effects only require that the sortal NP be reconstructed, not the NumP. Furthermore, it may be a requirement that the NP reconstruct without the entire *wh*-phrase. See Chomsky (1977) and Heim (1987) for discussion of this point.

(30) [$_{\text{NumP}}$ magazines more [$_{\text{CP}}$ than Bill bought [$_{\text{NumP}}$ books MANY *n*]]]
[~~–COMP~~] [~~+COMP~~]

Again, the NumP must A-bar raise to a CP position in order for the compositional semantics to work out (see footnote 8 above). Hence, there is covert movement of the NumP, as in CD, explaining why CSD shows movement properties.

(31) [$_{\text{NumP}}$ magazines more [$_{\text{CP}}$[$_{\text{NumP}}$ books MANY *n*]$_{\text{j}}$ than Bill bought [$_{\text{NumP}}$ books MANY *n*]$_{\text{j}}$]]

We can now explain why the movement diagnostics indicate A-bar movement in CSD: there is covert A-bar movement. Also, we expect to pronounce both the head and the correlate since both are base-generated separately.

4.3 A solution to Bresnan's Problem

Bresnan (1973) pointed out a problem for movement theories of comparatives: how can we get movement and deletion when the correlate and the head match (CD), but no movement or deletion when they don't (CSD)?

(32) a. John reads more books than Bill reads.
b. *John reads more books than Bill reads books.

(33) a. John reads more books than Bill reads magazines.
b. *John reads more books than magazines Bill reads <~~magazines~~>.

However, Bresnan's Problem only arises when one tries to unify CD and CSD to either a one or two sortal system. If CD and CSD are treated differently, as they are here, the problem doesn't even arise. The sortal either moves to the head position, requiring deletion of the lower copy, or it doesn't move and hence there is no deletion. However, there is one prediction that this analysis makes which looks like a form of Bresnan's Problem: we should be able to get a CSD construction where the sortals match.

(34) John bought more books than Bill bought books.

It has been noted before (Chomsky 1977; Sag 1976; Kennedy 2002a) that (34) can actually be acceptable under certain circumstances. In the discourse presented in (35), it seems to be acceptable.

(35) A: Did John buy more books than Bill bought magazines?
B: Not only did John buy more books than Bill bought magazines, but he bought more books than Bill bought BOOKS!

So, (30) isn't really a problem: it is just a case of CSD that appears to be the deep structure of CD. This contrasts with relative clauses, which don't allow anything like (30).

(36) A: Did John buy the magazines that Bill bought?
B: #Not only did John buy the magazines that Bill bought, but he bought the books that Bill bought BOOKS!

But that is okay, since relatives don't allow subdeletion structures. Whatever is responsible for disallowing subdeletion (two-sortal structures) in relatives is what is responsible for ruling out (36).

4.4 Summary

There is no need to unify CD and CSD in terms of how many sortals are base generated. A one sortal analysis of CD and a two sortal analysis of CSD can account for the major difference between the two constructions: the correlate deletes in CD because it moves to the head position. And, yet, we can still account for the similarities since both constructions involve A-bar movement. In addition, we don't have to deal with Bresnan's Problem. Kennedy (2002a, b) points out that there are other differences between CD and CSD. The analysis presented above will have to be modified slightly, but the basic claim that CD is a raising construction (one sortal) and CSD is a matching construction (two sortals) will be able to account for these differences.

5. Movement within the comparative clause

The previous section claimed that both CD and CSD involve covert A-bar movement of the correlate for semantic reasons and to account for the weak crossover effects. In this section, I will revise the account so that this A-bar movement is *overt remnant movement* for both constructions in order to account not only for the facts in Section 2, but also some differences between CD and CSD reported by Kennedy (2002a,b) and some new evidence reported here. The only difference between CD and CSD will again be how many sortals are base generated — one or two.

5.1 More differences between CD and CSD

Kennedy (2002a, b) points out three differences between CD and CSD, which he attributes to their behavior at PF. Given that an ellipsis account is inadequate, and that both CD and CSD test positive for movement, he concludes that only CD displays overt A-bar movement of the correlate, while CSD displays covert A-bar movement of the correlate (Kennedy argues for a unified matching account). The data in (37) through (39) is taken from Kennedy (2002a).

First, Kennedy uses languages that prohibit preposition stranding as a test for overt movement. In languages that have this prohibition, CD constructions display preposition stranding effects, while CSD constructions do not, as in the Czech example below. He argues this indicates that CD involves overt movement, but not CSD.

(37) a. *Kterych mestech Vaclav bydlel ve?
which city Vaclav live in
'Which city does Vaclav live in?'
b. *Bydlel jsem ve vice mestech nez ty jsi bydlel v.
lived have in more cities than you have lived in
'I have lived in more cities than you have lived in'
c. Chci bydlet ve vice americkych mestech nez jsem bydlel v
want lived in more American cities than have lived in
europskych mestech.
European cities
'I want to have lived in more American cities than I have lived in European cities'

Second, CD constructions show a *that*-trace effect, while CSD constructions do not. Again, this seems to indicate overt movement for CD but not CSD.

(38) *That*-trace effects:
a. More books were published than editors said (*that) would be.
b. More boys flunked than I predicted (*that) would pass.
c. More books were published than editors said (that) articles would be.
d. More boys flunked than I predicted (that) girls would pass.

Third, contraction is disallowed in English when a trace immediately follows the contracted element. CD constructions disallow contraction of the copula in the comparative clause, while CSD constructions allow contraction. This again seems to indicate that the correlate moves overtly in CD but not in CSD.

(39) Contraction:
a. I thought there was more than there is/*'s.
b. John was more upset than he is/*'s now.
c. There is more meat than there's rice.
d. John was more upset than he's angry now.

To summarize, Kennedy attributes these differences to an overt/covert distinction between CD and CSD. However, there is evidence that this distinction doesn't exist.

5.2 Evidence for overt A-bar movement in comparatives

There are two data points that argue for overt A-bar movement inside the comparative clause in both CD and CSD. The first comes from a dialect of English (that I speak), which allows pronunciation of the NumP in the Spec of CP position in CD and CSD. (Chomsky 1977 notes the acceptability of 40d).

(40) a. John bought more books than how many books Bill bought .
b. John bought more books than how many magazines Bill bought .
c. John bought more books than how many books Bill did.
d. John bought more books than what Bill bought .

I will assume that this dialect of English displays overtly what all other dialects of English do least covertly: move the NumP to the CP position.

The second one uses parasitic gap licensing as a test for overt A-bar movement. Kennedy (2002a) claims that only CD licenses parasitic gaps. His claim rests on the following data:

(41) a. I threw away more books than I kept without reading <pg>.
b. *I threw away more books than I threw away magazines without reading <pg>.
c. *I threw away more books than I did without reading <pg>.

Kennedy concluded from this that CD involves overt A-bar movement, but CSD involves covert A-bar movement. He also concluded that VP ellipsis as in (41c) forces covert A-bar movement in CD constructions. However, (42) indicates that what is wrong with the data in (41b) and (41c) has to do with some kind of parallelism constraint, not with a lack of A-bar movement. When an adjunct parasitic gap is added to the matrix clause, all of the constructions license parasitic gaps including CD with VP ellipsis.

(42) a. I threw away more books without reading than I kept without opening <pg>.
b. I throw away more books without reading than I keep magazines without opening <pg>.

In (42), we can see that CD and CSD each license parasitic gaps inside the comparative clause. Assuming that parasitic gaps are licensed only by overt A-bar movement, then we must conclude that the correlate moves *overtly* to Spec of CP in both CD and CSD, not covertly.

5.3 Revised analysis of comparatives

I will now revise my analysis to accommodate the data presented in Section 5.2 by adding overt A-bar movement. But I will also retain a distinction between the PF properties reviewed in Section 5.1. Notice that each of the PF diagnostics (P-stranding, *that*-trace effect, contraction) test for case positions, not base-generated positions. As such, I will propose that both CD and CSD involve overt A-bar movement, but that this is remnant movement. The sortal will first move out of the NumP and into its case checking position. It is from this position that the sortal will move to the matrix clause in CD, or remain in CSD.

For this analysis to work, I will make several additional assumptions. First, I will assume that NPs carry an uninterpretable case feature that must be checked. Second, I will assume that DP projections may act as a mediary between the case feature on the NP and the case feature on the checking head, but NumPs, DegPs or empty DPs cannot[10]. Therefore, an NP must move out of the NumP in order to get case.

5.3.1. The remnant analysis of CD

There will be several changes to the analysis of CD presented above. First, the sortal in the correlate position will first move through a Case checking position before it moves to the

[10] I see this as something like feature percolation of the NP's uninterpretable Case feature up to the DP level where it can be licensed by a Case checker, but percolation is blocked by null functional heads.

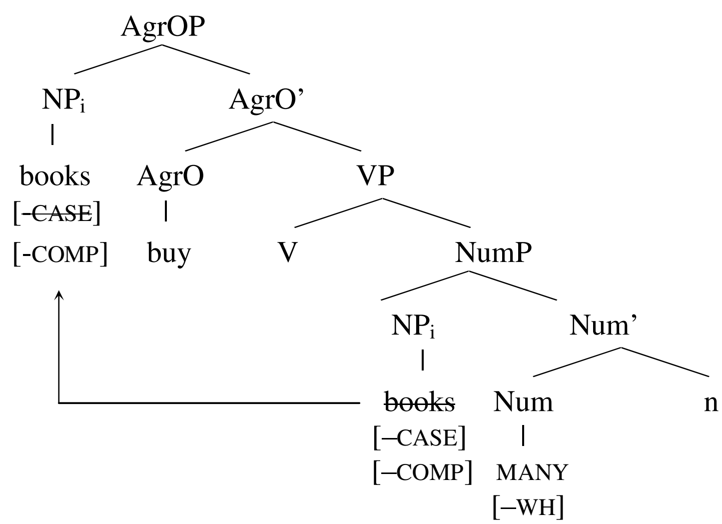
head position. And, second, the NumP remnant moves to A-bar position. Below is the derivation of the CD construction *John bought more books than Bill bought*.

The sortal *books* is introduced with not only an uninterpretable comparative feature, but also an uninterpretable case feature. The NumP phrase is introduced with an uninterpretable [-WH] feature to insure that there is overt A-bar movement.

(43) [$_{\text{NumP}}$ [$_{\text{NP}}$ books] MANY n]
[–CASE] [–WH]
[–COMP]

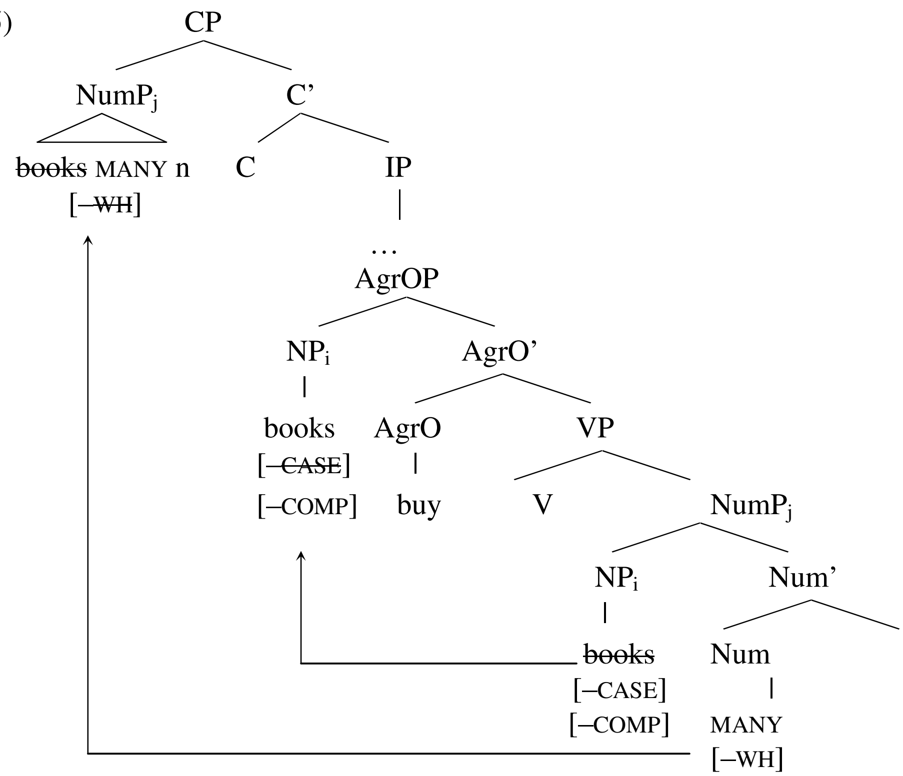
The derivation proceeds by moving the sortal *books* out of the NumP and into its case checking position in Spec of AgrO.

(44)



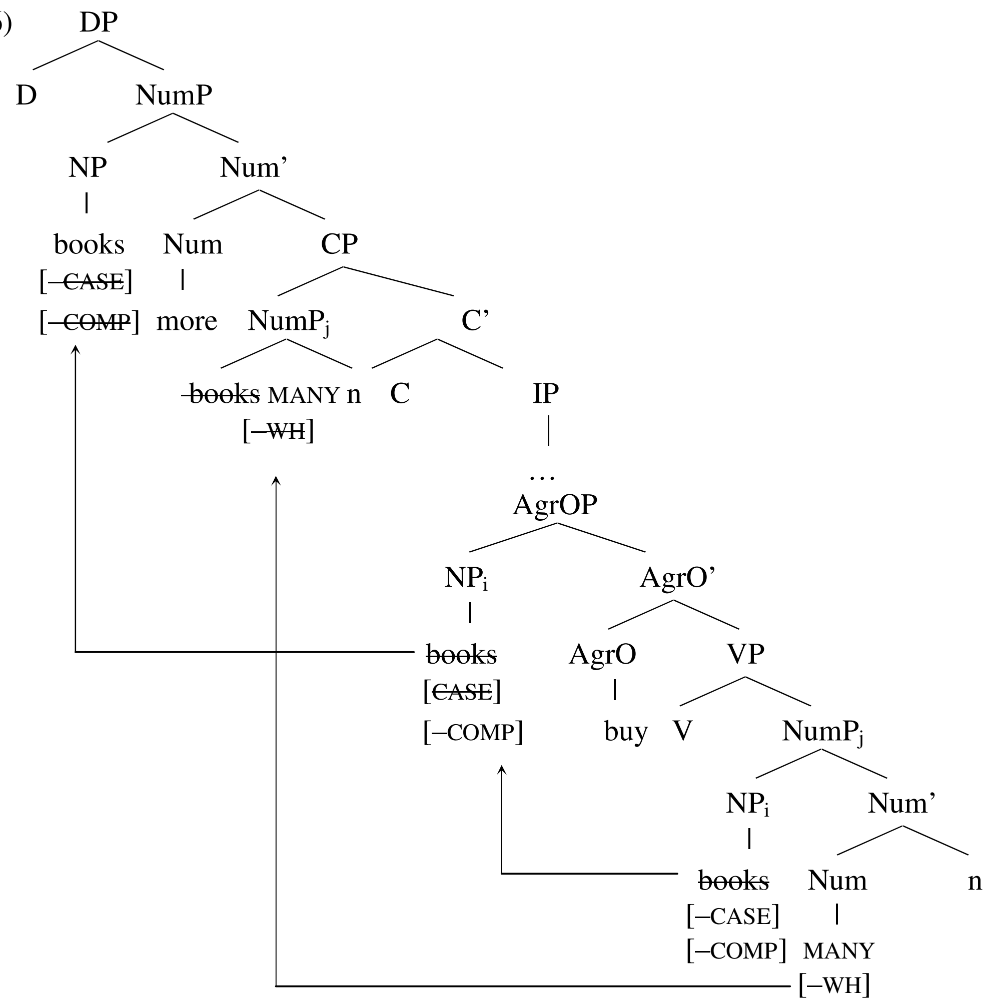
The derivation of the comparative clause continues as expected until merger of the CP projection allows the NumP to check its uninterpretable [–WH] feature. This requires remnant movement of the entire NumP to Spec of CP.

(45)



At this point the comparative morpheme *more* merges with a [+COMP] feature that can check the uninterpretable [–COMP] feature on the correlate. The sortal *books* copies and remerges in the spec of NumP.

(46)



There are two differences between this derivation and Lechner's derivation presented in Section 4.1. First, the correlate moves into a Case checking position before it moves into the head position. And, second, the NumP A-bar moves overtly, rather than covertly.

5.3.2. The remnant analysis of CSD

I will give the derivation of the CSD construction *John bought more magazines than Bill bought books*. To begin, the numeration includes both sortals (*books, magazines*). The *how many* phrase is built in a way similar to the CD derivation, except that this time there is no uninterpretable [–COMP] feature on the sortal.

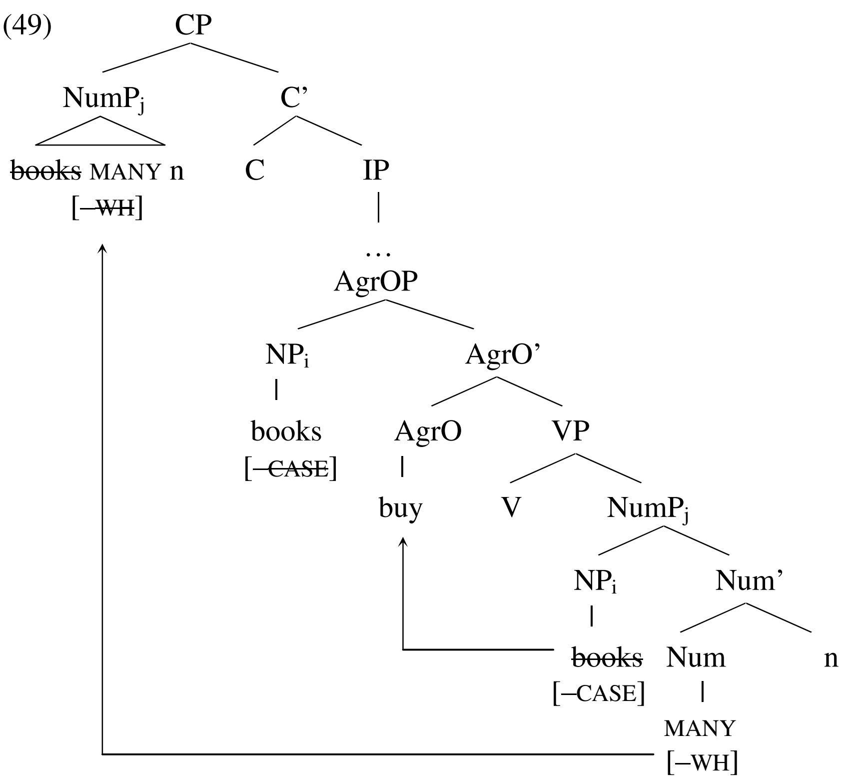
(47) [$_{\text{NumP}}$ books MANY n]
[–CASE] [–WH]

The derivation follows the same initial steps as in CD. The NP must move out of the NumP into the spec of AgrO where it can check its case feature.

(48) [$_{\text{AgrOP}}$ books$_i$ buy [$_{\text{VP}}$ [$_{\text{NumP}}$ ~~books$_i$~~ MANY n]]
[–~~CASE~~] [–CASE] [–WH]

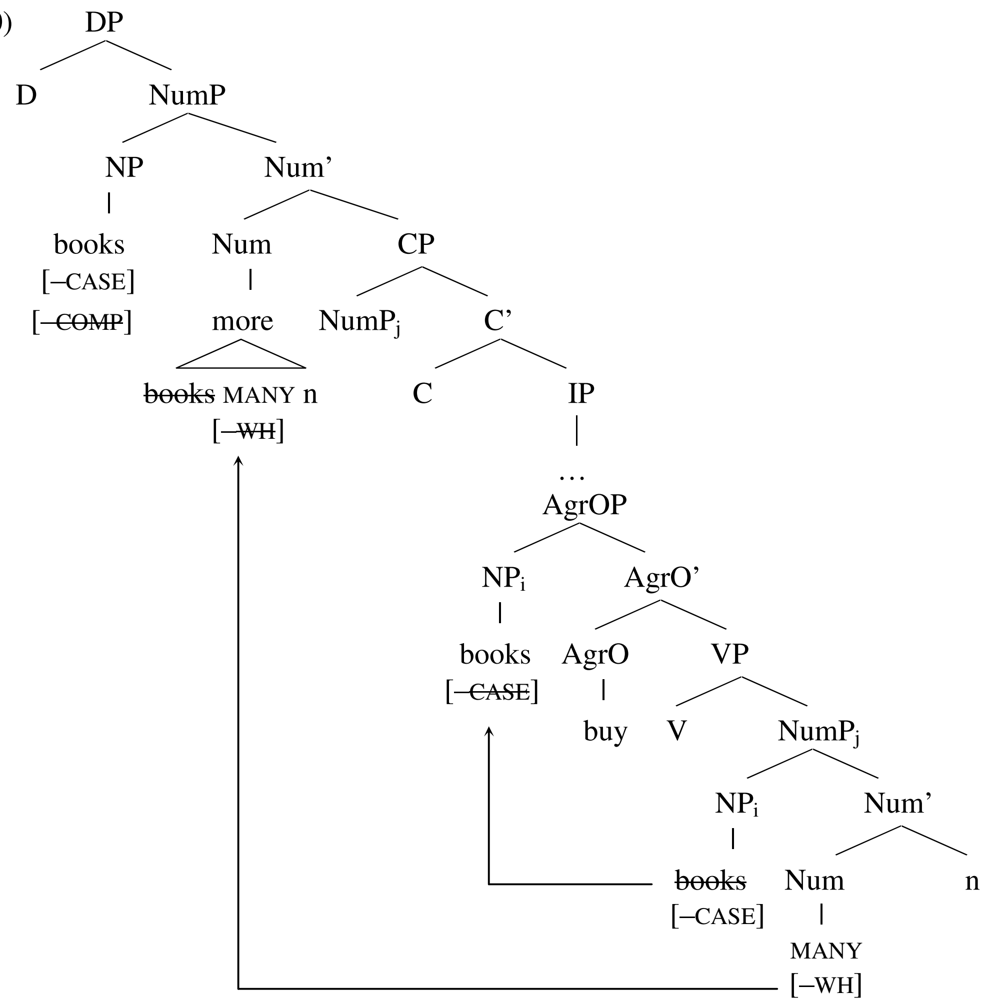
The derivation continues as expected until the CP position, where the entire correlate will A-bar move (remnant move) to CP to check its [-WH] feature. Again, this is the same as the derivation of CD.

(49)



The rest of the derivation follows as in the previous derivation of CSD in Section 4.2. The comparative clause merges with *more* which heads the matrix NumP, followed by the merger of *magazines*. This second sortal possesses the uninterpretable [–COMP] feature, which is checked by *more*.

(50)



The only differences between this derivation and the one given in Section 3.2 is that the correlate moves out of the NumP to check case and the NumP A-bar moves overtly.[11]

5.4 Arguments for a overt/covert distinction revisited

With the remnant analysis of comparatives, we can account for the parasitic gap data presented in Section 5.2. The parasitic gap in the comparative clause is licensed by overt movement of the NumP to spec of CP in *both* CD and CSD.

The difference between CD and CSD in the revised analysis is whether the sortal moves from its Case checking position to the matrix head position or stays put. This difference is what accounts for the gap diagnostics, because the contraction, *that*-trace, and preposition stranding examples all involve testing Case positions for gaps. In CD there is a gap left by the moved correlate, and in CSD there isn’t a gap because it hasn't moved.

[11] The anonymous reviewer pointed out to me that the word order of the correlate sortal and verb is wrong. Since I need the sortal to move overtly, I will have to assume that the verb raises further, say to adjoin to a little *v* head position.

Contraction is disallowed in CD because the correlate has moved from its Case checking position up into the head position, leaving a gap next to copula. But contraction is allowed in CSD because the correlate is still in its Case position next to the copula.

(51) a. I thought there was more [meat]$_i$ than there is/*'s [$_{AgrP}$ ~~meat~~$_i$ [$_{NumP}$ ~~meat~~$_j$ MANY *n*]]
b. There is more meat than there's [$_{AgrP}$ rice$_i$ [$_{NumP}$ ~~rice~~$_i$ MANY *n*]]

There is *that*-trace effect in CD because the correlate has moved and left a trace next to the complementizer. In CSD, there is not trace next to the complementizer.

(52) a. More [books]$_i$ were published than editors said (*that) [~~books~~]$_i$ would be [$_{NumP}$ ~~books~~$_i$ MANY *n*] published.
b. More [books] were published than editors said (that) [articles]$_i$ would be [$_{NumP}$ ~~articles~~$_i$ MANY *n*] published.

Prepositions are stranded in CD because the correlate will move to the head position. But they will not be stranded in CSD because the correlate will not move.

(53) a. *Bydlel jsem ve vice
lived have in more
[mestech]$_i$ nez ty jsi bydlel [$_{pP}$ v [$_{AgrPP}$[~~mestech~~]$_i$ [$_{PP}$ [$_{NumP}$ *n* MANY [~~mestech~~]$_i$]]].
cities than you have lived in
b. Chci bydlet ve vice [americkych mestech] nez jsem bydlel
want lived in more American cities than have lived
[$_{pP}$ v [$_{AgrPP}$[europskych mestech]$_i$ [$_{PP}$ [$_{NumP}$ *n* MANY [~~europskych mestech~~]$_i$]]
in European cities

6. Responding to several semantic arguments for matching

Let's summarize what we have done so far. First, we reviewed reasons for eliminating ellipsis accounts as possible theories of clausal comparatives. Second, we reviewed arguments for providing a movement analysis for clausal comparatives and relative clauses. Third, we noticed that CD differs from CSD in that CD requires deletion of the correlate. Given this crucial fact, an analysis was proposed that did not reduce CD to a special case of CSD. Rather, CD was given a one-sortal analysis, while CSD was given a two-sortal analysis. This allowed an easy solution to Bresnan's problem, since this problem only arises when CD and CSD are unified as two-sortal constructions. Lastly, the analysis was revised in order to account for Kennedy's data.

So far, we have one reason to choose this analysis over a unified matching analysis. The matching analysis has a difficult time accounting for the necessary deletion of the correlate (i.e. Bresnan's Problem), whereas the raising analysis of CD explains why deletion is obligatory.

In this section, I will present two (related) semantic arguments that have been used to argue for a matching analysis, and I will respond to each in turn.

6.1 Identity of substance

We've already seen that the required deletion of the correlate in CD can be explained in terms of the PF interpretation of chains: we expect only the topmost copy of movement chains to be pronounced. We can make the following descriptive generalization.

(54) The head and the correlate of CD must be members of one chain for the PF component to interpret.

If this is correct, and we accept the raising analysis of CD, then we understand why there is necessary deletion in CD but not in CSD; the head and correlate are not members of the same chain in CSD. (Lechner 1999)

But, there is another requirement, on the LF side, that seems to contradict the PF requirement. When CD constructions are interpreted, the LF component needs the correlate and the head to be members of two different chains. CD patterns like CSD in this respect and not like relatives. Let's start by looking at a typical restrictive relative clause.

(55) Tom has the students that Bill has.

Relative clauses are typically interpreted as intersective with the head noun. That is, in this example the set of students that Tom has must be part of the set of students that Bill has. I will refer to this type of reading as *identity of substance* (IDS). While a sortal that is modified by a relative clause must adhere to IDS, the matrix sortal of a comparative construction does not need to.

(56) Samson eats more doggie-treats than Pauli eats.

Clearly, the doggie-treats that Samson eats are not the same ones that Pauli eats.[12] This fact is generally accounted for by existentially closing off both the comparative and matrix clauses. (57) is the general form of the interpretation of comparatives. (58), however, is disallowed for comparatives.

(57) $\exists X\ [_{\text{Matrix}} \ldots \textit{sortal}\ X \ldots \& \ldots X \ldots]\ \&\ \exists X\ [_{\text{Comparative}} \ldots \textit{sortal}\ X \ldots \& \ldots X \ldots]$

(58) $^{*}\exists X\ [[_{\text{Matrix}} \ldots \textit{sortal}\ X \ldots \& \ldots X \ldots]\ \&\ [_{\text{Comparative}} \ldots \textit{sortal}\ X \ldots \& \ldots X \ldots]]$

This is surprising given that relative clauses do seem to require an IDS reading.[13] Relative clauses do have the general form in (58). We can make the following generalizations.

(59) a. The IDS reading is required for relative clauses
b. The IDS reading is optional in comparatives

[12] There are some comparatives that appear to require an IDS reading (Irene Heim, pc):
(i) Samson eats as many doggie-treats as I give him.
But, notice that both the IDS and the non-IDS readings are actually available in (i). Samson could be eating the doggie treats that my neighbor gives him, but he eats as many of those as what I give him.

[13] Relative clauses also have what are often referred to as 'kind' readings and 'amount' readings. I will discuss amount readings in section 5.2. I won't discuss kind readings in this paper.

DP chains are normally interpreted with one quantification. I will take this to mean that the optional IDS reading is a requirement that there be *two chains* for the LF component to interpret in comparatives.

(60) The head and the correlate of a comparative must be members of two separate chains for the LF component to interpret.

This is the opposite of what we concluded from the PF deletion requirement, repeated here.

(61) The head and the correlate of a comparative must be members of one chain for the PF component to interpret.

Matching and raising theories are different in their assumptions about what is base generated: one sortal or two. In the end, both theories have to make non-traditional stipulations to satisfy either PF or LF. Matching theories need to invoke a type of chain merger to satisfy the PF requirement, and raising theories need to invoke some type of link deletion to split the one movement chain into two in order to satisfy the LF requirement.

(62) a. Matching

2 chains

2 chains (Spell Out)

chain merger

1 chain (PF) 2 chains (LF)

b. Raising

1 chain

1 chain (Spell Out)

link deletion

1 chain (PF) 2 chains (LF)

The chain merger and link deletion can be instantiated in different ways. The PF component in Kennedy (2002a) treats the two chains as if they were one, pronouncing only the chain that contains the head. Lechner (1999) uses a syntactic process that explicitly breaks the one chain formed by movement of the correlate to the head position into two chains after the derivation has been spelled out. Rather than argue for independent evidence for one mechanism or the other, I would like to offer a different kind of argument in favor of the raising analysis of CD.

In section 3, it was argued that comparatives bear a striking resemblance to relatives. Let's say that they should therefore be accounted for using the same type of analysis, either matching or raising. If both are raising structures, then we need to employ link deletion in order to get the non-obligatory IDS reading in comparatives. Relatives work out nicely, since we would expect a single movement chain to be interpreted only once. If both are matching structures, however, we have to employ a PF chain merger mechanism in order to insure deletion in both relatives and CD. But, we also need to employ some type of new interpretation mechanism for relatives. If the non-obligatory IDS reading can be used as an argument for matching, then we have to ask why relatives do not also get a non-obligatory IDS reading. A non-obligatory IDS reading for relatives would not be incoherent. In (63), a NP modified by a relative clause such as in (63a) would have the interpretation in (63b).

(63) a. the book that John threw out

b. *the [book(x) & ∃x John threw out [book(x)]]

The relative clause would simply be closed off by an existential operator (which is typically assumed for comparative clauses). So, while a matching theory can handle the LF side of comparatives quite well, it would then have trouble with relative clauses. Accounting for relatives would require some type of stipulation in addition to the PF stipulation that requires deletion of the correlate. The conclusion I want to draw from this discussion is that while a raising theory must employ an *ad hoc* mechanism of interpretation for CD, it is only one *ad hoc* mechanism. Matching, when we use it for both relatives and comparatives, must employ two ad hoc mechanisms.

6.2 Subdeletion is not an argument for matching in CD

Matching theories attempt to reduce CD to CSD in that there are two sortals base-generated for both constructions. Kennedy (2002a,b) argues that this makes sense since the LF requirement of comparatives makes it look as if CD behaves like CSD in that the head and correlate are interpreted separately. In other words, if all comparatives base-generate two sortals, then subdeletion can be thought of as a natural consequence. Kennedy also points out that relative clauses have no construction analogous to subdeletion.

(64) a. *Mr. Salt went down the chute that Veruca went down *shaft*.
b. *John read some books that Tom read *magazines*.

Since the head and correlate of relatives are not interpreted separately, we shouldn't expect them to have subdeletion structures. Kennedy (2002b) then concludes that English relative clauses must be raising structures. CD and CSD are given a unified analysis (matching) while relatives are given an unrelated analysis (raising). I think this argument can be summarized as the following generalization:

(65) Subdeletion Generalization:
a. We get subdeletion in constructions where the head and correlate are interpreted separately (matching).
b. We don't get subdeletion in constructions where the head and correlate are interpreted intersectively (raising).

I have two arguments against this generalization. The first is empirical. Amount relative clauses (Carlson 1977) have a non-IDS reading, just like comparatives, indicating that the relative is not interpreted intersectively with the head. Instead there is existential closure as with comparatives. (Grosu & Landman 1998; von Fintel 1999) Here is an example of an amount relative from Heim (1987).

(66) It will take us the rest of our lives to drink the champagne that they spilled that evening.

The champagne spilled is not the champagne it will take the rest of our lives to drink. Rather, the relative clause seems to denote the *amount* of champagne that was spilled last night, and (66) means something like 'it will take us the rest of our lives to drink as much champagne as they spilled that evening'. But, while the head of the amount relative (the champagne that we drink) is not identical to the correlate (the champagne that they spilled), amount relatives do not allow subdeletion.

(67) *It will take us the rest of our lives to drink the champagne that they spilled beer that evening.

So, interpreting the head and correlate separately may be necessary to license subdeletion, but it is not sufficient.

The second argument is that the reason there is no subdeletion in relative clauses cannot be due to an incoherent meaning. A relative subdeletion structure would have the perfectly coherent logical form in (68b).

(68) a. *… [a person which man is standing in the corner]
b. … [∃X s.t. X is a person & X is a man and X is standing in the corner]

The point here is that subdeletion has nothing to do with whether or not there is predicate modification. Predicate modification structures are just as able to give us a subdeletion meaning as existentially closed structures like comparatives. While the second conjunct of the generalization in (65) is probably descriptively correct, it is not the semantics (as it is currently defined) that is going to account for it.

7. Conclusions

I first argued in this paper that CD and CSD should not be given a unified analysis (where 'unified' means base-generating either one or two sortals for both constructions). CD should be given a one-sortal analysis along with relatives because this explains the deletion of the correlate requirement. This means that CD is a raising structure and the correlate moves into the head position. CSD should be given a two-sortal analysis. The correlate and head are each base-generated separately in CSD.

I then revised the analysis so that the correlate overtly moves out of the NumP to check its Case, followed by overt remnant movement of the NumP to a CP position. The syntactic differences between CD and CSD were explained by whether or not there is movement of the NP correlate from its Case position into the matrix head position or not. In CD the correlate does raise to the head position and in CSD it stays in its Case checking position.

In addition, I argued that not unifying CD and CSD under either a one or two sortal analysis was not a drawback. Instead, I pointed out that a raising theory of CD does unify it with (restrictive) relative clauses, and this is a benefit. While it is true that the raising analysis of CD must employ a stipulative interpretation mechanism, matching theories must employ two stipulative mechanisms, one to require deletion of the correlate and one to interpret relative clauses.

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Why can bare NPs in Japanese have universal readings in certain environments?

Yukio Furukawa

This paper first observes that a bare NP in Japanese can bear a wide scope universal reading over negation, and that its universal reading is not available unless it is a clause-mate of the sentential negation. Then, I propose that the sentential negation marker in Japanese (*nai*) is not a simple truth-functional connective, but a total adjective which induces a universal reading of a bare NP.

1. Universal readings of bare NPs in Japanese

Bare NPs in Japanese, which lack overt determiners, are ambiguous in several ways. As is shown in (1), the bare NP topic *kudamono* 'fruit' bears a kind reading. (2) is ambiguous in several ways, depending on the interpretations of its bare NP object. What is remarkable in (2) is that it can bear a universal reading, as is indicated by the translation (2b).

(1)	**kudamono-wa**	yasai-to-kurabete	vitamin A-ga	sukunai.
	fruit-TOP	vegetable-to-comparing	vitamin A-NOM	little

'Compared to vegetables, fruits have little vitamin A.'

(2)	John-ga	**kudamono-o**	tabe-*nakat*-ta	(koto).
	John-NOM	fruit-ACC	eat-NEG-PAST	(fact)

a. '(the fact that) John did not eat the fruit(s)/a certain fruit/certain fruits.'
b. '(the fact that) for all fruits, John did not eat them.'

Note that, for the meaning of total negation[1] that is intended by (2b), people might think that *kudamono* is not a universally but an existentially quantified element that stays in the scope of negation. The following subsections show, however, that (2) does not use the narrow scope

[1] I am using 'total negation' as a cover term to refer to the meanings expressed e.g. by the sentences in (i): none of these sentences allows the existence of a person that John saw. The idea behind total negation is that the relation between the two relevant sets in (i), i.e. the set of people and the set denoted by the (negative) predicate, is total. Thus, I will not connect total negation to a particular logical form.

(i) a. For everyone, John did not see him or her.
b. John did not see anybody.
c. John saw nobody.
d. John did not see even one person.
e. John saw zero persons.

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existential quantification under negation (3b), but the wide scope universal quantification over negation (3a) as a strategy for total negation, and therefore, *kudamono* really bears a universal reading.

(3) a. $\forall x[\text{fruit}(x) \rightarrow \neg \text{eat}(j,x)]$
b. $\neg\exists x[\text{fruit}(x) \wedge \text{eat}(j,x)]$

Before that, I would like to note one important aspect of the universal reading of a bare NP: as is shown in (4) and (5), universal readings of bare NPs are not available in non-negative environments or in embedded clauses without negation.

(4) John-ga **kudamono-o** tabe-ta (koto).
John-NOM fruit-ACC eat-PAST (fact)
a. '(the fact that) John ate a fruit/fruits/the fruit(s).'
b. *'(the fact that) John ate every fruit.'

(5) Mary-wa [John-ga **kudamono-o** tabe-ta to] iw-*anakat*-ta.
Mary-TOP [John-NOM fruit-ACC eat-PAST COMP] say-NEG-PAST
a. 'Mary did not say that John ate a fruit/fruits/the fruit(s).'
b. *'Mary did not say that John ate every fruit.'

1.1 Modifiability by almost-type adverbs

Modifiability by *almost*-type adverbs is used as a diagnostic for universality of a modified element (e.g. *every*, *no*, etc.); *almost* does not modify existentially quantified expressions like *anyone*.[2] Modification by *hotondo* 'almost' in (6b) confirms universality of *kudamono*.[3]

(6) a. They didn't talk to (*almost) *anyone*. (Horn 2000)
b. John-ga hotondo **kudamono-o** tabe-*nakat*-ta (koto).
John-NOM almost fruit-ACC eat-NEG-PAST (fact)
'(the fact that) for almost all fruits, John did not eat them.'

[2] Lee and Horn (1994) and Horn (2000) point out that *almost* can modify existential quantifiers with higher values in scales. As is shown in (ib), however, *hotondo* in Japanese does not do this; it does not modify existential quantifiers. Note that, *hotondo* is ambiguous between 'almost' and (floated) 'most', but prenominal *hotondo* unambiguously means 'almost'.

(i) a. I could solve almost {all / any / half / none / 50 / *many / *most / *few} of the problems. (Horn 2000)
b. boku-wa hotondo {subete/*gojuu-mon}-no-mondai-o toi-ta.
I-TOP almost {all/50-CL}-GEN-problem-ACC solve-PAST
'I solved almost {all/50} of the problems.'

[3] As is shown in the previous footnote, *hotondo*-modification is more reliable as a diagnostic for universality than *almost*-modification. However, (6b) is still weak evidence for universality of bare NPs. We will see later that *nai* is an instance of total adjectives (such as *complete*, *dry*, *pure*, *straight*, etc.). As is shown in (ia), total adjectives are basically compatible with modification by *almost*-type adverbs, and this also applies to total adjectives in Japanese (see ib). If *hotondo* does not modify (universally quantified) bare NPs but *nai*, compatibility with its modification in (6b) may not be a piece of evidence for their universality.

(i) a. This road is almost *straight*.
b. kono-miti-wa hotondo *massugu* da.
this-road-TOP almost straight CPL

The absence of its universal reading in non-negative environments or embedded clauses without negation is confirmed by its incompatibility with *hotondo*-modification.

(7) a. John-ga (??hotondo) **kudamono-o** tabe-ta (koto).
John-NOM almost fruit-ACC eat-PAST (fact)
'(the fact that) for almost all fruit, John ate them.'

b. Mary-wa [John-ga (??hotondo) **kudamono-o** tabe-ta to]
Mary-TOP [John-NOM almost fruit-ACC eat-PAST COMP]
iw-*anakat*-ta.
say-NEG-PAST
'Mary did not say that John ate almost all fruits.'

1.2 Association by exception phrases

Since an exception phrase requires a universally quantified host NP for an exceptive meaning (cf. Moltmann 1995), its associativity also confirms universality of its host NP. In Japanese, exception phrases are followed by a particle *sika*. As is shown in (8), bare NPs cannot host exception phrases unless they are clause-mates of the sentential negation. For details of exception phrases in Japanese, I refer readers to Furukawa (2005).

(8) a. John-ga rigo-sika **kudamono-o** tabe-*nakat*-ta (koto).
John-NOM apple-except fruit-ACC eat-NEG-PAST (fact)
'(the fact that) for all fruits except apples, John did not eat them.'

b. John-ga (*rigo-sika) **kudamono-o** tabe-ta (koto).
John-NOM apple-except fruit-ACC eat-PAST (fact)

c. Mary-wa [John-ga (*rigo-sika) **kudamono-o** tabe-ta to]
Mary-TOP [John-NOM apple-except fruit-ACC read-PAST COMP]
iw-*anakat*-ta.
say-NEG-PAST

1.3 Relative scope

Bare NPs exhibit scope interactions with other quantificational elements. Both (9) and (10) contain three scope bearing elements, i.e. the Q-adverb *taitei* 'mostly', negation *nai* and the bare NP *gakusei* 'student'. While (9) has the intermediate reading of 'every student' (9b),[4] (10) has its highest reading (10a).[5] Especially, (10) is strong evidence for the universality of a

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[4] The continuations in (i) confirm the intermediate reading of 'every student' in (9).
(i) …(dare-ka) iru-to sureba, {Peter-da/getuyoo-noasa-da}.
(someone) exist-if {Peter-is/Monday-gen morning-is}
'If anyone is ever there, {it's Peter / it's Monday mornings}.' (cf. Shimoyama 2004)

[5] The highest reading of 'every student' in (10) is confirmed by (i); while (10) can be followed by the continuation (ib), it cannot be followed by (ia).
(i) a. #iru-to sureba, Peter-da.
exist-if Peter-is
'If anyone is ever there, it's Peter.'

bare NP, since it is impossible to create an equivalent reading to (10a) in terms of an existential QP like ‘any/some student’ (instead of ‘every student’): a pragmatic import based on $\forall\neg \approx \neg\exists$ does not play any role.

(9) zizitu-tosite kopiisitu-ni nitiyou-ni <u>taitei</u>(-no baai) **gakusei-ga** i-*nai*.
fact-as copy.room-in Sunday-on in.most.cases student-NOM exist-NEG
a. *every student$_x$ [mostly ¬[x is in the copy room…]] (∀>mostly>¬)
b. √mostly [every student$_x$ ¬[x is in the copy room…]] (mostly>∀>¬)
(cf. Shimoyama 2004)

(10) zizitu-tosite **gakusei-ga** kopiisitu-ni nitiyou-ni <u>taitei</u>(-no baai) i-*nai*.
fact-as student-NOM copy.room-in Sunday-on in.most.cases exist-NEG
a. √every student$_x$ [mostly ¬[x is in the copy room…]] (∀>mostly>¬)
b. *mostly [every student$_x$ ¬[x is in the copy room…]] (mostly>∀>¬)
(cf. Shimoyama 2004)

To summarize, this section mainly observed three things about universality of bare NPs (see (11)). Then, why are their universal readings unavailable unless they are clause-mates of the sentential negation? I suspect that something happens not within bare NPs but in *nai* (the sentential negation in Japanese). In Section 2, I will focus my attention on the status of *nai*.

(11) a. Bare NPs in Japanese can bear universal readings.
b. In fact, their universal readings are wide scope universal readings over negation. They do not exhibit narrow scope universal readings.
c. Their universal readings are not available unless they are clause-mates of negation.

2. Status of the sentential negation nai

As is observed in the previous section, a universal reading of a bare NP is not available unless it is a clause-mate of the sentential negation *nai*. Here, I do not want to say that a covert determiner, which corresponds to *every*, can be associated with a bare NP for the reading. If it can, it would be impossible to predict the absence of its universal reading in other environments.

Rather, I would like to cast a doubt on the naïve assumption that *nai* is a simple truth-functional connective ¬. The reason why I am suspicious about this assumption is that *nai* is an adjective. As indicated by its inflection pattern (12), it is morphologically an adjective. In addition to this, it has a predicative usage (13a) and a modificational usage (13b). Furthermore, we will see in Section 4 that it is semantically an adjective.

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b. iru-to sureba, {getuyoo-no asa-da / zibun-no happyoo-no mae-dake-da}.
exist-if {Monday-gen morning-is / self-GEN presentation-GEN before-only-is}
‘For each person, if he or she is ever there, it’s {on Monday mornings / only before his or her presentation}.’ (cf. Shimoyama 2004)

(12)

+present tense[6]	+conditional	+past tense
siro-i 'white'	sirok-ere	sirok-at
ooki-i 'large'	ookik-ere	ookik-at
waka-i 'young'	wakak-ere	wakak-at
na-i	nak-ere	nak-at

(13) a. **tama-ga** *nai* (koto).
ball-NOM NEG (fact)
'(the fact that) for all balls, they are not (t)here.'
b. Yukio-wa [*nai* **kane-o**] youkyuusi-ta.
Yukio-TOP [NEG money-ACC] request-PAST
'Yukio asked for money that I did not have.'

To explain universality of a bare NP in its local domain, two analyses about *nai*, listed in (14), seem plausible. Section 3 discusses (14a), first.

(14) a. Since *nai* is the adjectival form of 'always not', a universal reading of a bare NP is obtained through unselective binding by the universal Q-adverb in *nai*.
b. Since *nai* is a total adjective, quantity of a bare NP must be maximized through a comparison with the maximal standard.

3. Analysis 1: decomposing nai *into a universal Q-adverb and* ¬

3.1 The status of bare NPs

According to research on genericity (see Carlson & Pelletier 1995), the indefinite subject in (15a) (*a Moroccan*) cannot bear a universal reading but has a generic reading. Contrary to (15a), *a Moroccan* in (15b), by association with a universal Q-adverb *always*, bears a universal reading, which is confirmed by *almost*-modification. This line of research claims that *always* is a universal quantifier, but lacks a variable, contrary to QPs such as *everyone* or *every Moroccan*. Since the matrix predicate is an individual-level predicate, the only variable that *always* in (15b) can bind is *a Moroccan*. In short, its universal reading is due to unselective binding by the universal Q-adverb.

(15) a. **A Moroccan** knows French.
b. **A Moroccan** (almost) *always* knows French.

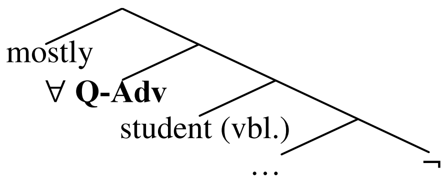
The paradigm of unselective binding in (15b) also tells us that bare NPs in Japanese can be variables. Assuming (i) that *tuneni* 'always' is a universal Q-adverb and (ii) that *eigo-ga umai* 'be good at English' is an individual-level predicate that lacks its situational variable, it can be concluded that, since its universal reading is available due to unselective binding by *tuneni*, the bare NP subject *gakusei* 'student' in (16b) is a variable bound by the universal Q-adverb.

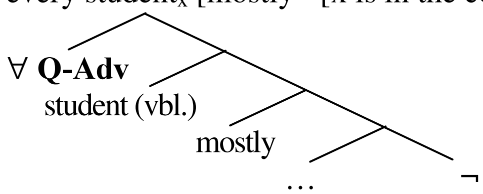
[6] There is a debate about the status of *-i* suffix in this series, i.e., whether it is an inflectional suffix or a present tense morpheme (see Murasugi 1991) or something else. Basically, this issue is independent of the issue of this paper, and the point in (12) that *nai* is morphologically an adjective is maintained even without discussing it. Note that, to avoid any complication, *nai* is glossed as 'NEG' throughout this paper.

(16) a. (??<u>hotondo</u>) **gakusei-ga** eigo-ga umai (koto)
almost student-NOM English-NOM good (fact)
'(the fact that) a student is (?almost) good at English'
b. (<u>hotondo</u>) *tuneni* **gakusei-ga** eigo-ga umai (koto)
(almost) always student-NOM English-NOM good (fact)
'(the fact that) a student is (almost) always good at English'

3.2 Unselective binding by a universal Q-adverb in nai

By decomposing *nai* into a universal Q-adverb-like element and ¬, the universality of a bare NP can be analyzed in the same way as (16b), i.e., the universal Q-adverb in *nai* binds a bare NP as its variable. Then, the intermediate reading of 'every student' in (9), repeated in (17a), and its highest reading in (10), repeated in (18a), can be analyzed as (17b) and (18b), respectively.[7]

(17) a. zizitu-tosite kopiisitu-ni nitiyou-ni <u>taitei</u>(-no baai) **gakusei-ga** i-*nai*.
fact-as copy.room-in Sunday-on in.most.cases student-NOM exist-NEG
mostly [every student$_x$ ¬[x is in the copy room…]] (mostly>∀>¬)
b.


(18) a. zizitu-tosite **gakusei-ga** kopiisitu-ni nitiyou-ni <u>taitei</u>(-no baai) i-*nai*.
fact-as student-NOM copy.room-in Sunday-on in.most.cases exist-NEG
every student$_x$ [mostly ¬[x is in the copy room…]] (∀>mostly>¬)
b.


Note that this analysis independently needs (i) a vocabulary insertion rule about *nai*, and (ii) a locality condition on unselective binding by its universal Q-adverb.

As for vocabulary insertion, *nai* cannot be divided into two morphemes that may correspond to the universal Q-adverb and ¬. Under this analysis, however, they should structurally be disjointed from each other for the scope relations in (17) and (18). To pronounce those disjointed components as a single word, a vocabulary insertion rule, which is often discussed by Distributed Morphology (see Harley & Noyer 1999), is independently necessary.

As for locality of unselective binding, we observed in (5) that bare NPs in embedded clauses without negation do not bear universal readings. To predict the absence of their universal readings, this analysis has to somehow define locality of unselective binding that

[7] The discussion here puts aside the issue about whether or not the universal Q-adverb can occur in a left branch in the structure.

can be sensitive to clause boundaries. Even if these two points are stipulated, however, this analysis has at least three problems.

3.3 Three problems in the unselective binding analysis

First, to explain the scope relations in (17a) and (18a), this analysis has to claim that the structural position for the universal Q-adverb must be lower than *mostly* in (17a) but higher than *student* (and *mostly*) in (18a), as is shown in (17b) and (18b). Needless to say, this is very *ad hoc*, and there seems to be no fundamental reason to define its structural position in this way.

Second, just like (19a), (19b) may end up with vacuous quantification in this analysis; for the sake of the individual-level predicate and the definite expressions, it contains no variable that the universal Q-adverb can bind. Hence, its ungrammaticality is predicted, though it is, in fact, grammatical.[8]

(19) a. ??John always knows French. (Chierchia 1995)
b. Yukio-ga eigo-ga umak-*unai* (koto)
Yukio-NOM English-NOM good-NEG (fact)
'the fact that Yukio is not good at English'

Finally, if this decomposition is correct, *nai* may not contain any element that forces it to be adjectival, since neither its universal Q-adverb nor ¬ is specifiable as an adjective. Hence, this analysis has no fundamental explanation for its adjectival nature.[9]

To summarize, although this decomposition may have an explanation about universality of a bare NP, it has several problems. Especially, I think that the problem of individual-level predicates is fatal. Therefore, I do not adopt this analysis. Section 4 examines the second analysis in (14), i.e. the total adjective analysis.

4. Analysis 2: nai *as a total adjective*

In Section 2, we observed two pieces of evidence for the adjectival nature of *nai* (i.e. its inflection pattern, and its predicative and modificational usage). However, one might argue against this view (i.e., *nai* is an adjective) for the following reason: as is shown in (20), *nai* does not accommodate comparative phrases or clauses.

(20) **tama-ga** (*guroobu-yori) *nai* (koto)
ball-NOM glove-than NEG (fact)
'(the fact that) there are fewer balls than gloves.'

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[8] An anonymous reviewer points out that grammaticality in (19b) is not problematic if it is assumed that *nai* is ambiguous between ¬ and ∀ Q-adverb + ¬. This assumption is wrong, however. If *nai* is ambiguous in such a way, it is predicted that total negation with a bare NP and *nai* should be ambiguous between a wide scope universal reading and a narrow scope existential reading: existential readings of bare NPs have no restriction, as is observed earlier. As we have seen, however, total negation with a bare NP and *nai* is obtained as a wide scope universal reading, and it never bears a narrow scope existential reading. Therefore, *nai* should not be ¬.

[9] Old Japanese had two types of negation, i.e. a non-adjectival negation marker *zu* (see (38)) and an adjectival negation marker *nasi*, which is the origin of *nai*. In fact, Old Japanese did not use *nasi* but *zu* as its sentential negation. As far as I can see, the sentential negation began to be shifted from *zu* to *nasi* in Middle Japanese, and, except for a few cases, *zu* has not been used as the sentential negation anymore in Modern Japanese.

Example (20) apparently shows that no scale is associated with *nai*. However, its incompatibility with comparative phrases or clauses does not necessarily mean absence of scales for *nai*. It can accommodate modification by a *fully*-type adverb (*mattaku*) and a proportional modifier *hanbun* 'half': scales are necessary for their modification. Hence, I propose that *nai* is a predicate with a scale, i.e. a gradable adjective.

(21) a. mizu-ga mattaku *nai* (koto).
water-NOM fully NEG (fact)
'(the fact that) there is no water at all.'
b. migi-asi-ga hanbun *nai* (koto).
right-leg-NOM half NEG (fact)
'(the fact that) half of the right leg is missing.'

Especially, modification by 'fully' or 'half' is only compatible with one class of adjectives, i.e. total adjectives. I propose (i) that *nai* is a total adjective, and (ii) that comparison against its maximized standard forces universality of a bare NP. The next subsection gives a brief introduction to total adjectives, and observes that *nai* exhibits the properties of total adjectives.

4.1 Total adjectives

Adjectives like *complete*, *dry*, *pure*, *straight*, etc. have several distinct properties from those that adjectives like *tall*, *short*, *heavy*, *light*, etc. have. Compare the two antonymous pairs *dry-wet* and *tall-short*. As is shown in (22b), *John is not tall* does not entail *John is short*, since *John is not tall but he is not short* is not contradictory. Contrary to *tall-short*, *this towel is not dry* entails *this towel is wet*, since *this towel is not dry, but it is not wet* is contradictory.[10]

(22) a. This towel is not dry; therefore/?moreover, it is wet.
b. John is not tall; moreover/?therefore, he is short. (Rotstein & Winter 2004)

Following Kennedy & McNally (1999, 2004), Rotstein & Winter (2004), Yoon (1996), let us assume the distinction between these two classes of adjectives. Furthermore, let us call adjectives in the former class (*complete*, *dry*, *pure*, *straight*, etc.) 'total adjectives' and adjectives in the latter class (*tall*, *short*, *heavy*, *light*, *expensive*, etc.) "partial adjectives".

As the contrast between (23) and (24) shows, modification by, e.g., *100%*, *completely*, *fully*, *half*, etc. is only compatible with total adjectives. Kennedy & McNally (2004) conclude that total adjectives use bounded (or closed) scales to accommodate their modifications.

(23) a. Her brother is (??completely) tall/short.
b. The pond is (??100%) deep/shallow.
c. Max is (??fully) eager/uneager to help. (Kennedy & McNally 2004)

[10] (i) expresses this entailment relation, more schematically.
(i) a. dry ≈ has no degree of wetness = has the maximal degree of dryness
≠ has some degree of dryness
b. wet ≈ has some degree of wetness
≠ has no degree of dryness (cf. Rotstein & Winter 2004)

(24) a. This towel is completely *dry*.
b. This product is 100% *pure*.
c. The pipe is now fully *straight*. (cf. Kennedy & McNally 2004)

They further claim that not only partial adjectives but also total adjectives are gradable adjectives, which undergo comparisons against standards. Contrary to partial adjectives (like *tall*),[11] the standard of comparison for *dry* in (25a) is defined as the maximal degree of dryness. (In (25b), 'max' is defined as a function from a scale associated with an adjective S_{adj} to its maximal degree.) In this sense, standards for total adjectives are absolute, and contextually independent.

(25) a. This towel is dry.
b. $[\![$ [dry] $]\!]$(this towel) = $\exists$d [d=max(S_{dry}) $\wedge$ [dry](this towel) $\geq$d]
c. max(S_{dry}) = the maximal degree of dryness = no degree of wetness

Coming back to *nai*, modification by *100%*, *completely*, *fully*, *half*, etc. is compatible with *nai*, as is shown in (21) and (26).[12] I conclude that *nai* is a total adjective.

(26) a. kanousei-ga hyaku-paasento *nai* (koto).
possibility-NOM 100-percent NEG (fact)
'(the fact that) there is no possibility at all.'
b. syooko-ga kampekini *nai* (koto)
evidence-NOM completely NEG (fact)
'(the fact that) there is no evidence, completely.'

4.2 A compositional meaning of nai

Consider, first, two antonymous partial adjectives *ooi* and *sukunai*, which correspond to predicative 'many/much' and 'few/little', respectively. Degrees returned by the degree functions [*ooi*] and [*sukunai*] are quantities of their bare NP subjects.

(27) a. **gakusei-ga** *ooi* (koto).
student-NOM many (fact)
'(the fact that) students are many.'

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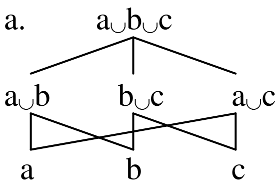
[11] The standard of comparison for *tall* is relative and context dependent. Then, the meaning of (ia) is compositionally obtained by (ib) (cf. Kennedy 1997). Note that, following Kennedy (1997), I differentiate $[\![$[Adj]$]\!]$ from [Adj]. The former corresponds to an adjective as a predicate, and the latter corresponds to an adjective as a degree function. While the former is a function from its argument to a truth value, the latter simply returns a degree on a relevant scale from its argument.
(i) a. John is tall.
b. $[\![$[tall]$]\!]$(john) = [tall](john) $\geq d_{s(tall)}$ (The value of the standard $d_{s(tall)}$ is contextually determined.)

[12] (i) apparently shows that falsity of *mizu-ga nai* 'no water is (t)here' entails truth of 'some water is (t)here'. However, (i) might simply show either $\neg\neg\exists = \exists$ or $\neg\forall \approx \exists$. In this sense, entailment relation in (i) is weak evidence for totality of *nai*, contrary to (22a).
(i) mizu-ga nai koto-wa nai. yueni mizu-ga aru.
water-NOM NEG fact-FOC NEG therefore water-NOM exist
'It is not the case that no water is (t)here; therefore, some water is (t)here.'

b. **gakusei-ga** *sukunai* (koto).
student-NOM few (fact)
'(the fact that) students are few.'

Let us assume that a bare NP in Japanese is structured as a join semi-lattice, following Chierchia 1998ab, and Kobuchi-Philip 2003 (cf. Link 1983). For convenience of explanation, consider a small world. Suppose that the present world has exactly three students, namely a, b, and c. Then, *gakusei* 'student' in (27) has a structure like (28a).[13] Suppose that context defines that 2 and 3 are many as a quantity of students. Since the partial order about individuals in (28a) is homomorphic to the partial order about quantity (28b), for the truth of (27a) in this context, *gakusei* must denote one of the four elements, i.e. a∪b, b∪c, a∪c and a∪b∪c.

(28) a.


b.


Coming back to *nai*, let us call the adjectival aspect of *nai* 'Adj*nai*'. The translation of (29) apparently indicates that the scale associated with Adj*nai* is also a scale about the quantity of its bare NP subject and hence, that, because of its nature as a total adjective, Adj*nai* maximizes the quantity of *gakusei* 'student' through the comparison against its absolute standard (cf. Kennedy 1997, Kennedy & McNally 1999, 2004). However, maximizing (or totalizing) its quantity does not necessarily result in the total negation meaning of (29) that additionally requires that each atomic element in the maximal member should be negated.

(29) **gakusei-ga** i-*nai* (koto).
student-NOM exist-NEG (fact)
'(the fact that) for all students, they are not (t)here.'

We need to assume that *nai* somehow creates negative context for a negative meaning, since, e.g. in (29), nothing but *nai* has a negative force. Let us call this negative aspect of *nai* 'Neg*nai*'. Here, I propose that two functions (i.e. the negative function $[\![\mathrm{Neg}_{\mathrm{nai}}]\!]$ and the total adjective function $[\![\,[\mathrm{Adj}_{\mathrm{nai}}]\,]\!]$) are pronounced as a single word *nai*.

(30) **gakusei-ga** eigo-ga umak-*unai* (koto)
student-NOM English-NOM good-NEG (fact)
'(the fact that) for all students, they are not good at English.'

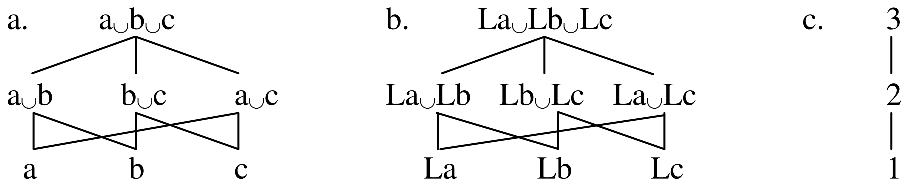
Consider total negation in (30). It is widely assumed that Japanese is productive about compound predicates such as V-V compounds, A-V compounds, N-A compounds, and so on (see Matsumoto 1996). I propose that, through the compound predicate formation (though I am neutral at this stage about whether the compound predicate formation is a morphsyntactic operation or a lexical-semantic operation), $[\![\mathrm{Neg}_{\mathrm{nai}}]\!]$ is defined as a function from a predicate

[13] In (28a), I use ∪ as a symbol for the join operation.

to its complement set (see (31)). Then, in (30), $[\![\text{Neg}_{nai}]\!]$ returns $\lambda x.\neg$good.at.english(x) from the non-negative predicate $\lambda x.$good.at.english(x).

(31) $[\![\text{Neg}_{nai}]\!](\gamma) = \neg\gamma$ where γ is the predicate to which *nai* attaches[14]

As is claimed earlier, $[\![[\text{Adj}_{nai}]]\!]$ is a total adjective. For the meaning of total negation in (30), the quantity of *gakusei* should be totalized with the restriction of the negative predicate. What I would like to suggest here is that the totality of $[\![[\text{Adj}_{nai}]]\!]$ maximizes the relation between the two sets, i.e. the set denoted by *gakusei* and the set denoted by the negative predicate. The basic idea is the following. Let us define 'L' as a link from a member in the domain $[\![$*gakusei*$]\!]$ to a member in its co-domain, i.e. the set denoted by the negative predicate $\lambda x.\neg$good.at.english(x). Furthermore, let us assume that 'La' is defined if and only if an individual 'a' is both in the domain and in its co-domain.

(32)


Consider (30) in the small world which I used earlier. In (32), we can easily find a partial order isomorphism between the individuals (32a) and the relations (32b), and a partial order homomorphism between the relations (32b) and the quantity (32c). As is shown in (32b), the maximal relation is defined as La∪Lb∪Lc where each of the students (a, b and c) establishes a link in the negative predicate, in other words, a, b and c are also members of the set denoted by $\lambda x.\neg$good.at.english(x). Remember, 'La' is defined if and only if an individual 'a' is both in the domain (the set of students) and in its co-domain (the set denoted by the negative predicate). Therefore, its intended meaning 'for all students, they are not good at English' is obtained. I propose (33) as a definition of $[\![[\text{Adj}_{nai}]]\!]$.

(33) a. $[\![[\text{Adj}_{nai}]]\!]$ is a function from a set of relations *R* to a relation R such that R is the maximal relation of *R*.
b. *R* is a set of all relations between the two sets α and β where α is a quantity bearing element (i.e. a bare NP) and β is the negative predicate obtained by $[\![\text{Neg}_{nai}]\!]$.
c. The maximal relation R is defined if and only if the quantity of the links between the two sets is maximal.

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[14] (31) has a prediction: negation obligatory takes narrower scope than QPs in the same clause. As far as I can see, this may be the case, as is shown in (i) (further investigations are warranted). However, Miyagawa (2001) reports that there exists a case where the object universal QP in (ii) takes narrower scope than negation. I have strong suspicions both about his judgment about (ii) and about his assumption that *zen'in* is a universal quantifier, but, since this issue is beyond the scope of this paper, I postpone its discussion to another paper.

(i) John-ga itu-tu-izyou-no-kudamono-o tabe-*nakat*-ta (koto).
John-NOM 5-CL-more.than-GEN-fruit-ACC eat-NEG-PAST (fact)
'(the fact that) There are more than five fruits such that John did not eat them.' (more than 5>¬)

(ii) Taroo-ga zen'in-o home-*nakat*-ta (yo).
Taroo-NOM all-ACC praise-NEG-PAST (PRT)
'Taro did not praise all.' √¬>all, (*)all>¬ (Miyagawa 2001)

4.3 Three remaining issues

In this subsection, I would like to discuss three remaining issues. The first one is the case seen in (34). Since (34) does not contain any bare NP, it apparently lacks an element that participates in creating the maximal relation. However, I assume that maximization by $[\![[\text{Adj}_{\text{nai}}]]\!]$ trivially occurs even in (34). Otherwise, the meaning of (34) is undefined, though it is really meaningful. Suppose (i) that $[\![\text{Yukio}]\!]$ is a set consisting of one atomic member (i.e. Yukio), and (ii) that $[\![[\text{Adj}_{\text{nai}}]]\!]$ maximizes the relation between the singleton set and the negative predicate. Then, since, by the partial order isomorphism between the individuals and the relations, the maximal relation is also atomic, i.e. L_{Yukio}, the comparison with the standard trivially occurs. Therefore, its meaning, 'Yukio is not good at English' is obtained.

(34) Yukio-ga eigo-ga umak-*unai* (koto)
Yukio-NOM English-NOM good-NEG (fact)
'(the fact that) Yukio is not good at English.'

The second issue that I have to address is the following. As is observed in (5), repeated in (35), a bare NP in an embedded clause without *nai* cannot bear a universal reading. Absence of its universal reading is predictable in the total adjective analysis. I assume that the predicate to which *nai* attaches is not $[\![$said that John ate *fruits*$]\!]$ but $[\![$said *the proposition*$]\!]$. Since the dimension of quantity of fruits is not involved in its maximization, its universal reading is absent in (35).

(35) Mary-wa [John-ga **kudamono-o** tabe-ta to] iw-*anakat*-ta.
Mary-TOP [John-NOM fruit-ACC eat-PAST COMP] say-NEG-PAST
a. 'Mary did not say that John ate a fruit/fruits/the fruit(s).'
b. *'Mary did not say that John ate every fruit.'

Finally, total negation in (13a), repeated in (36), also bears a wide scope universal reading of the bare NP subject, but the predicate where *nai* attaches is apparently absent in (36). Then, how can $[\![[\text{Adj}_{\text{nai}}]]\!]$ define the maximal relation in (36)? There seem to be two accounts of its wide scope universal reading. One analysis is to associate with *nai* a covert predicate (or a covert verb) that may correspond to 'exist', such that its total negation meaning is defined in the same way as (30). The other analysis is to define the predicative Neg*nai* as a truth value 0, such that Adj*nai* evaluates and totalizes the quantity of links from the set of balls to the truth value.[15] At this stage, I have not found any decisive evidence yet, and I leave it as an open question.

(36) **tama-ga** *nai* (koto).
ball-NOM NEG (fact)
'(the fact that) for all balls, they are not (t)here.'

[15] In this case, it might be possible to say that (36) denotes a characteristic function such that Adj*nai* evaluates and totalizes the quantity of the members that are falsified (or have 0 as a value of their image).

5. Conclusion

In this paper, I observed (i) that a bare NP in Japanese bears a wide scope universal reading over negation, and (ii) that this reading is not available unless it is a clause-mate of the sentential negation *nai*. By appealing to the adjectival nature of *nai*, I proposed that this reading is induced by its totality effect. Note that, if the adjectival nature of *nai* is simply a morphological matter, the unselective binding analysis that I rejected in Section 3 might survive. Even so, however, the problem about individual-level predicates raised in Section 3.3 still remains. Moreover, as is observed in Section 4.1, *nai* is semantically an adjective. Thus, I believe that the total adjective analysis is more plausible than the unselective binding analysis.

One intriguing issue remains, however. As is shown in (37), *nai* can attach to a partial adjective *ooi* 'many/much'. Consider (37) in the small world that I used in Section 4.2, again. (37) is true in this world and context if and only if the quantity of the students is less than two. The problem in (37) is that maximization of the quantity of the students seems absent (see (37b) where *hotondo*-modification is incompatible). Its meaning apparently suggests that *nai* in (37) is either a simple truth-functional connective ¬ or a scale reverser.

(37) a. gakusei-ga ⠀ **ook**-*unai* ⠀ (koto).
student-NOM ⠀ many-NEG ⠀ (fact)
'(the fact that) students are not many.'
b. (??<u>hotondo</u>) ⠀ gakusei-ga ⠀ **ook**-*unai* ⠀ (koto).
almost ⠀ student-NOM ⠀ many-NEG ⠀ (fact)

At this stage, I have no idea about why maximization by Adj*nai* is apparently absent in (37), but one thing that I would like to note here is that negation of an adjectival sentence may not be so simple at least in Old Japanese. As is mentioned in Footnote 9, Old Japanese used a non-adjectival sentential negation *zu*. Interestingly, while *zu* can directly attach to verbs, it cannot attach to adjectives (see the contrast between (38a) and (38b)). As is shown in (38b), a verb *ar(u)*, which corresponds to 'exist', mediates between an adjective and *zu*. If *ar(u)* in (38b) retains the meaning of 'exist', it might be the case that adjectives in Old Japanese somehow rejected negation and that negation of an adjectival sentence in Old Japanese was not obtained by negating its adjective but by negating the proposition (containing it) that was taken by *ar(u)* as its argument. If adjectives in Modern Japanese retain this property, we might have to take additional factors that are absent in (30) into consideration in the case of (37). I leave this issue for future research.

(38) a. Asihiki-no ⠀ yama-ni ⠀ ik-ikemu ⠀ yamabito-no
Asihiki-GEN ⠀ mountain-to ⠀ go-seem ⠀ mountain.man-GEN
kokoro-mo-**sir**-*azu* ⠀ yamabito-ya ⠀ tare
mind-even-know-NEG ⠀ mountain.man-Q ⠀ who
'I don't understand the reason why the person went to the mountain, who is the person?' (Man'youshuu, maki 20: 4294, cf. Sawada 2005)
b. onazi-hodo, ⠀ sore-yori ⠀ geharu-no-kaui-tati-ha ⠀ masite
same-level ⠀ that-than ⠀ low.ranked-GEN-maid-PL-FOC ⠀ moreover
yasuk-<u>ar</u>-*azu*.
calm-exist-NEG
'Those maids who were not only of the same status as hers, but also in lower positions, became nervous.' (Genji, Kiritsubo)

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Yukio Furukawa
McGill University
yukio.furukawa@mail.mcgill.ca

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Minimality effects in agrammatic comprehension

Nino Grillo

A new approach to agrammatic comprehension in Broca's aphasics is proposed that provides a link between processing based and representational approaches to the topic. The central claim is that the latest formulation of Relativized Minimality (Rizzi 1990, 2001; Starke 2001) can provide such a link and make it possible to explain some well acknowledged asymmetries in agrammatic comprehension.

1. Introduction

In this article I propose a new theoretical explanation of some comprehension patterns in agrammatic Broca's aphasia. I will claim that the Relativized Minimality (RM) locality principle (Rizzi 1990, 2001; Starke, 2001) is at the base of some of the most typical asymmetries in agrammatic comprehension, namely those between *canonical* and *non-canonical* structures. In the first part of the paper, I will briefly refer to the so-called *representational* and *capacity limitation* approaches aiming to show the necessity of providing a link between the two in order to solve certain major problems they pose, related to *variation* and *complexity*.[1] I will claim that both the *variation* and the *complexity* problems can be solved, integrating the two approaches and providing a definition of complexity valid in both representational and processing terms. In section 3 some recent developments of Relativized Minimality will be introduced. In section 4 I will claim that a limitation in processing resources can impede agrammatic patients in activating the complete array of morphosyntactic features normally associated with syntactic heads. If this is true it should be possible to predict the *canonical/non-canonical* asymmetry in agrammatic comprehensions mentioned above. Specifically, my prediction would be that sentences involving movement of an NP over another one (or the establishment of a long distance relationship over an intervening NP) should pose more problems than those in which movement does not cross

[1] Some problems raised by representational approaches are very well known and debated (i.e. the so-called variation problem, or the related *optionality* problem in the sense of Avrutin in press). This is not so for other problems concerning capacity limitation approaches, i.e. the *complexity* problem. According to such approaches agrammatic comprehension should be attributed to (and restricted to) more complex syntactic structures, which presumably require more processing capacity. The complexity problem arises when we try to define syntactic complexity without making reference to a theory of syntactic representation, and using a generic definition of complexity (see e.g. Carpenter et al. 1994).

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any 'potential intervener'. In this view the standard application of the fundamental anti-identity locality principle on impoverished structures generates the asymmetries. Relativized Minimality in fact should block the formation of a chain over an intervening element whenever it cannot 'see' any difference in the internal structures of the elements involved. The last part of the article is dedicated to the reanalysis of some of the structures typically problematic for agrammatic patients under this new perspective.

2. *Representational vs. capacity limitation approaches to agrammatic aphasia*

Until the end of the seventies, Broca's aphasia was interpreted as a syndrome whose effects were restricted to language production and it was assumed that comprehension was spared. Starting from a pioneer study conducted by Caramazza and Zurif in 1976, it appeared clear that comprehension was also, at least partially, compromised. Caramazza and Zurif showed that agrammatic aphasics' difficulties in comprehension do not extend to all types of sentences but are in fact restricted to semantically 'reversible' ones. When presented with reversible sentences aphasic patients are not capable of recovering the thematic information. This impairment is even more specific; only a subset of reversible constructions is problematic. So passives, object relatives and object clefts (among others) normally pose more problems than e.g. actives, subject relatives, subject clefts, adjectival passives. To account for these facts Grodzinsky (1990, 1999) has proposed the influential Trace Deletion Hypothesis (TDH). The main claim of the TDH is that not all the syntactic competence is lost in agrammatic aphasia, but only a very specific part of it: agrammatic patients would be incapable of representing traces at S-structure. The most important prediction of the TDH is that, missing the traces from the agrammatic representation, there will be no way to connect the moved elements to their original position and to assign them their original thematic role. Presented with an irreversible sentence (or with a sentence with no transformations) aphasic patients should be capable of recovering the thematic information from other systems external to the core grammar. In the case of irreversible sentences, agrammatic patients would apply a non-grammatical cognitive strategy that makes them assign the agentive theta role to the first NP encountered. This strategy gives positive results when the first NP of the sentence has to carry the agentive theta role (subject relatives, subject clefts…), but generates confusion when the first NP does not have to carry the agentive theta role (object relatives, object clefts, passives…). Crucially all the structures whose comprehension is compromised in agrammatic patients involve the application of a transformation, but this characteristic does not suffice to predict their comprehension patterns. The problems arise only when the moved element does not carry the agentive theta role. Presented with an active sentence agrammatic patients perform at a level above chance (they comprehend more than half of the sentences presented by the examiner). According to the TDH this is so because the first NP encountered has to carry the agentive theta role. This situation is mirrored with passive sentences, in which there is an inversion in the linear order of the respective positions of theta roles. In these cases the application of the cognitive strategy assigning the agentive theta role to the first NP encountered contrasts with the presence of the by-phrase, which also assigns the theta role agent. The presence of two NPs carrying the same theta role in the same sentence is claimed to confuse the patients, who answer at random, performing at chance level. Grodzinsky's analysis has obtained good results in predicting not only the comprehension pattern of English-speaking agrammatic patients but also with languages such as Chinese, Japanese, Serbo-Croatian, and Hebrew. Nevertheless the TDH has been strongly criticized and serious doubts have been shed over its validity.

At the root of the criticism directed at the TDH, its variants (see Hickok 1992; Mauner et al. 1993) and more generally at any representational approach to the topic, lies the observation that, if they correctly predict a variation in performance level based on the structure type, under their perspective, no variation is attested varying the task. This prediction happens to be false: Linebarger et al. (1983) demonstrated that agrammatic patients' performances vary considerably when they have to comprehend a sentence than when they simply have to judge its grammaticality. Crucially agrammatic patients seem to get good results even when asked to judge the grammaticality of a sentence that requires the correct representation of traces in order to be correctly judged.

These facts, together with other evidence of a clear processing deficit in agrammatic patients (slowed lexical access, delayed priming, syntactic priming effects…) have brought many researchers to believe that the linguistic knowledge of agrammatic patients is intact and to hypothesize that what is compromised is the *processing capacities necessary to use that knowledge* (for an extensive presentation see Kolk 1998; Avrutin 2000 and reference cited therein). The general claim of this approaches is that, in the presence of a limitation of processing resources (general or specific), it is natural to expect a variation in performance dependent on the nature of the task: the more difficult the task the lower the chance of the agrammatic patient accomplishing it correctly. This would explain the difference in performance between simple grammaticality judgments, and the more complex operation of comprehension (which requires also the execution of the previous task). A general principle of complexity (based on the observations conducted on normal subjects) is used to explain the attested variation in comprehension: the more 'complex' a sentence is to process, the lower the performance. The most important result obtained through this move from a representational approach to capacity limitation approach is that with the latter we can correctly predict the task dependent variation together with the attested variation in performance between different subjects. This variation cannot be explained in representational terms.

The role of complexity is central to any approach in *processing* terms to language comprehension deficits. Nevertheless it is not rare to find rather generic definitions of complexity, or no definition at all in the literature. The 'definition' provided is sometimes not more than a scale of complexity level derived by psycholinguistic studies conducted on normal adult speakers. These studies have the merit of telling us which constructions are more complex. What they cannot say is why this is so. To answer to this question (and to understand the mechanisms at the base of sentence comprehension) we need to make reference to a representational theory. Only a theory of syntactic representation can tell us *why* it is that one syntactic structure is more complex than another. Of course we want the psycholinguistic evidence and the theoretical reasoning to point in the same direction, and in this sense the psycholinguistic evidence is the source of confirmation or falsification for the theoretical hypothesis. Nevertheless a theory of syntactic complexity can be stated only in representational terms.

In the following sections I will attempt to address these problems from a new perspective that permits to obtain some (preliminary) interesting results. The present approach, in fact, permits to provide a non-trivial definition of syntactic (and computational) complexity. Complexity is defined here in terms of relative quantity (and quality, defined in terms of level of embedding in a feature tree) of morphosyntactic features whose presence is required for a structure not to be ruled out by the anti-identity locality principle.

3. Relativized minimality and the "Cartographic Approach"

In the first formulation of Relativized Minimality (Rizzi 1990) the fundamental distinctions that the principle is sensitive to are those between Heads and Specifiers, and in the latter class between A and A' type. It has been clear since the beginning that the above distinction needed to be enriched to account for several apparent exceptions to the principle (see for example the treatment of D-linking and referentiality in Rizzi 1990 and Cinque 1990). It is only in recent years that the system has been shown to be able to handle this and other problematic apparent exceptions. This result is due in great part to the development of an analysis in terms of the fine grained featural composition of syntactic elements, instead of the simpler A/A' distinction.

Given the definition in (1), (taken from Rizzi 2001) the question of the sensitivity of the principle rely on the definition of 'same structural type'.

(1) Y is in Minimal Configuration (MC) with X iff there is no Z such that
 (i) Z is of the same structural type as X, and
 (ii) Z intervenes between X and Y.

A possible definition is provided by Chomsky (1995) in a formulation in derivational terms of RM: the Minimal Link Condition.

(2) Minimal Link Condition: K attracts a only if there is no b, b closer to K than a, such that K attracts b.

In the above definition the 'sameness' of the intervening element is defined in terms of identity of features. As Rizzi points out, there is sufficient motivation to believe that, while a distinction in terms of A vs. A' has turned out to be too restrictive, the formulation above is too permissive. Quantificational adverbs and negation, for example, differ in featural make-up from wh- elements and yet they do interfere with them (for an exhaustive argumentation see Rizzi, 2001). To solve this puzzle Rizzi makes use of the recent development of the Cartographic Approach, *the attempt to draw maps as detailed and precise as possible of syntactic configurations* (see Belletti, 2002; Cinque, 1999, 2001; Rizzi, 1997, 2004). Rizzi shows that the cartographic studies offer a series of positions which we can continue to define as A' for convenience, but which can provide us with the needed distinctions.

(3) Force Top* Int Top Focus Mod* Top* Fin IP (Rizzi 1997, 2001b)

Each of these positions, in fact, can be defined by its particular set of morphosyntactic features, and such features can be catalogued in virtue of the "class" they belong to.

(4) a. Argumental: person, gender, number, case
 b. Quantificational: Wh-, Neg, measure, focus…
 c. Modifiers: evaluative, epistemic, Neg, frequentative, celerative, measure, manner…
 d. Topic.

In virtue of this classification Rizzi can derive a definition of 'same structural type' which permits us to avoid the excessive freedom of movement generated by the Minimal Link Condition on one side, and the excess of restriction generated by the simple distinction A/A' on the other. Rizzi express this intuition as in (5) below.

(5) 'Same structural type' = Spec licensed by features of the same class in (4).

Given the above formulation, we expect RM effects only between features that belong to the same class, but not among features that belong to different classes.[2]

4. Processing derived structural deficit

Given RM's capacity to 'look inside' the labels and operate upon sets of morphosyntactic features, it follows quite naturally that the possibility to form a chain over an intervening element will depend on the nature and the number of features actually represented. Changing one or both variables, that is, changing the nature and number of the features associated to a particular node in the syntactic tree, we should expect a variation in terms of legitimacy to form a chain, especially if such modifications imply the change of "class" in the sense defined in (4). Let us use an example to make this point clearer, given the familiar configuration in (6).

(6) . . . X . . . Z . . . Y . . .

We know that the possibility of forming a chain between X and Y depends on the nature of the elements involved; following the extended formulation of RM presented above, such possibility will depend on the morphosyntactic features associated with each element. Therefore, we should rewrite the schema in (6) as in (7).

(7)
$$\begin{array}{ccccccc} \ldots & X & \ldots & Z & \ldots & Y & \ldots \\ & \{\alpha,\beta,\gamma,\delta,\varepsilon\}_{\text{class Q}} & & \{\alpha,\beta,\gamma,\delta\}_{\text{class A}} & & \{\alpha,\beta,\gamma,\delta,\varepsilon\}_{\text{class Q}} & \end{array}$$

In (7) a particular set of morphosyntactic features (represented with Greek letters) is associated with every node. Given this configuration, RM should permit the formation of a relation Σ between X and Y: the presence of the element ε suffices for RM to see the difference between X and Z and therefore to authorize the movement of Y over Z (it is necessary to think about ε as the distinctive feature of the particular head and the relevant relation we are considering, i.e. a [wh-] feature in the head of a FocP, which if missed would imply a change of "class" of the relevant set from Argumental to Quantificational). Let's see what a variation in the composition of features of each set would produce (8).

[2] Note that for the present purposes Rizzi's account is equivalent to the one in Starke (2001), I assume the system I will present to be entirely translatable into Starke's model and I will sometimes refer to the latter for ease of presentation.

(8) . . . X . . . Z . . . Y . . .
$\{\alpha,\beta,\gamma,\delta\}_{\text{class A}}$ $\{\alpha,\beta,\gamma,\delta\}_{\text{class A}}$ $\{\alpha,\beta,\gamma,\delta\}_{\text{class A}}$

Given the new configuration in (8) and particularly the composition of feature sets associated with each element, it's clear that RM will disallow a relation between X and Y.

Crucially we should expect a limitation in the possibility of forming a chain over an intervening element in the case of a reduction in the number (and quality) of features associated with each syntactic node.

Given these premises, my hypothesis is that comprehension patterns of Broca's aphasics can be thought of as the consequence of "underspecification", that is, an impoverishment in the number and quality of morphosyntactic features in their syntactic representations. This underspecification is seen as a consequence of the limitation of their processing capacities. Given the difficulties in maintaining the activation of lexical information for agrammatic aphasics, it is plausible to think that the information associated with the heads of the syntactic trees can be "impoverished" of some important feature, as an effect of a fast decay of information or because of a more general processing deficit that makes possible only a laborious and partial recovery of information (see Zurif et al. 1993 among others). Furthermore, the representation of some features (i.e. "discourse related"; see Grodzinsky & Reinhart 1993; Avrutin 1999, 2000, 2004) seems to be extremely costly in terms of processing resources since it requires a continuous shifting from the narrow syntactic level to the discourse level. Following this intuition, I will try to reduce agrammatic aphasic's comprehension patterns to a special case of RM violation due to the correct application of this constraint to featurally impoverished syntactic structures.

Consider for instance an object cleft, whose comprehension is notoriously compromised in agrammatic aphasics.

Normal Representation
$\{D, N, \theta_2, \varphi_{\text{s, acc}}, \Sigma\}$ $\{D, N, \theta_1, \varphi_{\text{s, nom}}\}$ $\{D, N, \theta_1, \varphi_{\text{s, nom}}\}$ $\{D, N, \theta_2, \varphi_{\text{s, acc}}, \Sigma\}$
(9) It is the boy [who [the girl] [<the girl> loved <the boy>]]

The representation of an object-cleft in normal adult speakers is schematized in (9). RM authorizes the formation of the relevant chains between the moved NPs and their traces in virtue of the presence of the features [$\varphi_{\text{s,acc}}$;Σ] distinct from the features [$\varphi_{\text{s,nom}}$]. It is specifically the presence of the Σ feature (that we can call a 'relative' feature), that defines the object <who> as a member of a class distinct from the one to which the subject <the girl> belongs. The former belongs to the Operator's class while the latter belongs to the Argumental class.

Let us consider the same structure impoverished with respect to some morphosyntactic feature.

Agrammatic Representation

$\{D, N, \theta_?, \varphi_s, \ldots\}$ $\{D, N, \theta_?, \varphi_s, \ldots\}$ $\{N, \theta_1, \varphi_s, \ldots\}$ $\{N, \theta_2, \varphi_s, \ldots\}$

(10) It is the boy [who [the girl] [<…> loved <…>]]

Because of the extreme impoverishment of features actually represented, RM blocks the formation of the relevant chains; as a consequence it is impossible to assign the correct theta role to each argument. The situation changes completely with subject relatives, which are correctly interpreted by agrammatic patients. In this case, in fact there is no NP intervening between the moved constituent and its trace, which means that there could be no RM effects.

(11) It is the boy [who [<the boy> loved the girl]]

In short, even an underspecified representation of a subject cleft allows us to form the relevant chain and to recover the thematic information: no potential binders intervene between the moved element and its trace.[3]

4.1. Minimality in agrammatic comprehension

Following the same line it is possible explain other comprehension patterns highlighted in the literature. It seems that comprehension is compromised whenever there are potential interveners (i.e. NPs) between a moved NP and its trace, whereas it is preserved when no potential antecedent intervenes. Below I provide a short list of some of the relevant structures, together with a short analysis that basically follows the one highlighted in the previous section.

4.2. Subject vs. object relatives

(12) a. The lion that kicked the tiger
b. [The lion] [< the lion> that [<the lion> kicked the tiger]]

Under current assumption in (12) no NP intervenes between the moved subject and its trace. Our hypothesis correctly predicts a performance above chance in the comprehension of these structures by agrammatic patients. In (13b) the representation of an object relative by a normal adult speaker is schematized. The subject NP intervenes between the moved object and its trace. In such a case only a full representation, which includes all the relevant features,

[3] The intuition of the existence of some long distance principle at work in agrammatic aphasia is not new. We can find some speculation in this direction in Hickok, Zurif & Canseco-Gonzalez (1993) who claim that some sort of long distance principle is at work: '…it seems that when two elements that need to be 'associated' are separated by lexical material, comprehension is poor' (Hickok, Zurif & Canseco-Gonzalez 1993). However, they rapidly abandon this direction in favor of the RTDH claiming 'there is nothing in linguistic theory which corresponds to the present definition of long distance' Much the same intuition is been expressed by Friedmann and Shapiro (2001, see below) see also Grodzinsky (2000c).

will be authorized by RM. RM in fact will permit the formation of a chain only if it 'sees' the two NPs as members of two different classes in the sense explained above.

(13) a. The lion that the tiger kicked

Normal Representation

{D, N, θ_2, $\varphi_{s,\,acc}$, Σ} {D, N, θ_1, $\varphi_{s,\,nom}$} {D, N, θ_1, $\varphi_{s,\,nom}$} {D, N, θ_2, $\varphi_{s,\,acc}$, Σ}

b. *The lion* [*that* [*the tiger*] [<*the tiger*>*kicked* <*the lion*>]]

Agrammatic Representation

{D, N, $\theta_?$, $\varphi_{s,}$ …} {D, N, $\theta_?$, $\varphi_{s,}$ …} {N, θ_1, $\varphi_{s,}$ …} {N, θ_2, $\varphi_{s,}$ …}

c. *The lion* [*that* [*the tiger* [<*…*> *kicked* <*…*>]]

Given an impoverished representation like the one in (13c), it will be impossible to connect the moved phrases to their traces, which will end up in the impossibility to assign the correct theta role to each argument.

4.3. Passives, unaccusatives and adjectival passives

It is a well-known fact that comprehension of semantically reversible passives is compromised in agrammatism, while this is not the case for their active counterpart. Following Baker, Johnson & Roberts (1989) (see also Collins 2004) it is possible to hypothesize that a minimality effect in passives can be induced by movement of the internal argument over the passive morphology on the verb to which, as they hypothesize, the external argument is assigned. This account is supported by data from aphasic comprehension of unaccusatives (Piñango 1999) and adjectival passives (Grodzinsky et. al 1991).

Piñango (1999) has showed that agrammatic patients are capable of correctly comprehend sentences with unaccusatives constructions such as *the girl spun because of the boy*.[4] Under current approaches the syntactic subject of unaccusatives originates in a post-verbal position and only after a transformation it rejoins the subject position. The present approach predicts correctly a positive performance by agrammatics: the moved NP, in fact, does not cross any other argument which means that there can be no RM effect even if the representation is underspecified.

The same is true for agrammatic comprehension of adjectival passives, which Grodzinsky et al. (1991) show to be unimpaired. Under current assumptions the subject of adjectival passives (as in *John was interested in Mary*) is generated in [Spec,VP], this means that contrary to what we have seen for normal passives no minimality effect are expected to arise.

[4] Note that this finding is problematic for the TDH.

4.4. Datives vs. Double Object Constructions

Additional evidence in favor of the present approach is provided by agrammatic aphasic's performance with double object constructions and normal datives. It has been noted (see Hickok 1992 and references cited therein) that agrammatic patients experience much more difficulty in comprehending the former than the latter. Hickok cites the case reported by Caplan and Futter (1986), an agrammatic patient capable of understanding sentences like *The tiger gave the lion to the elephant* perfectly, but who systematically inverts the assignment of theta roles in *The tiger gave the elephant the lion*. Following Larson (1988 and subsequent work), the double object construction has to be considered as a derived construction obtained by an operation of passivization inside the VP. In these constructions, then, the indirect object has to be connected to its trace through a chain in order to get its theta role correctly assigned, which implies the crossing of the object NP. This unable us to expect a minimality effect to arise in case of underspecification of the relevant feature sets. In normal datives, on the other hand, no minimality is expected. The relevant structures are indicated below.

(14) a. The tiger gave the lion to the elephant

Normal Representation

$\{D, N, \theta_1, \varphi_{s,\,nom}\}$ $\{D, N, \theta_3, \varphi_{s,\,obl}, \boldsymbol{\Sigma}\}$ $\{D, N, \theta_2, \varphi_{s,\,acc}\}$ $\{D, N, \theta_3, \varphi_{s,\,obl}, \boldsymbol{\Sigma}\}$

b. [$_{TP}$[The tiger] [$_{T'}$ gave [$_{vP}$[the elephant] the lion [<the elephant>]]]]]

Agrammatic Representation

$\{N, \theta_1, \varphi_{s,} \ldots\}$ $\{N, \theta_2, \varphi_{s,} \ldots\}$

c. The tiger [gave [the elephant the lion <…>]]

As we can see in the representation above the DP *the lion* intervenes between the elephant and its trace in the double object construction (14b,c) but not in the normal dative (14a). Again the correct application of RM over impoverished data gives rise to agrammatic comprehension.

4.5. Object vs. Subject Control

It is interesting to notice that we find much the same pattern in the comprehension of control structures. Caplan and Hildebrandt (1988) (cited in Hickok 1992) have tested the comprehension of such sentences in two patients A.B and C.V. Both patients demonstrate better understanding of object control than subject control structures. A.B. understood 100% of the former and only 33% of the latter, C.V. 85% and 25% respectively.

(15) a. John told Mary$_i$ [PRO$_i$ to go]
b. John$_j$ promised Mary [PRO$_j$ to go]

Note that in (15a) no potential controller intervenes between PRO and its actual controller *Mary*. This is not the case in (15b); in this case the subject in order to control PRO has to cross the direct object. The possibility to unify the explanation of these data under a general problem with non-local dependencies is appealing. I will live to further investigation questions regarding to what extent this analysis is on the right track and on how this relates to recent approaches to control as movement (see Hornstein et al. 2005 ch.4 and works cited therein).[5]

4.6. Hebrew OSV and OVS structures

Friedmann & Shapiro (2003) have examined aphasics' comprehension of active sentences of the basic form SVO and derived OSV-OVS in Hebrew. The results they obtained are quite clear and indicate that aphasic patients have more problems in comprehending the derived active sentences (of the OSV-OVS form), on which agrammatic performance is at chance level, than the normal active SVO on which their patients perform at a level above chance. The authors interpret these results as evidence in favor of the TDH. However it is clear that such evidences can be claimed to support the present hypothesis. Aphasic patients in fact perform badly only when they have to comprehend the structures in which an NP has been moved over another NP. It is worthwhile noticing that the authors (even if only in a footnote) try to express the same intuition we are developing here.

> 'a different possible type of modification would be to restrict impairment only to' non-local movement' as a movement of an argument over another argument of the same verb. Thus objects that move over subjects will lose their traces, because they move non-locally…' (Friedmann & Shapiro 2003)

5. Some problems and some potential developments

There are several potential problems and questions that the present approach raises and need to be addressed. Given the preliminary stage of this work and for reasons related to space limitations I will not address these questions extensively here, I will limit myself to some preliminary considerations and I refer to Grillo (2003) and Grillo (in prep.) for a more extensive discussion.

A first question that merits more deepen investigation is related to one of the basic assumptions of this work. Through the whole paper I assumed implicitly that certain particular features and not others are more likely to be not represented/accessed by agrammatic patients. It is reasonable to question this point asking why certain features should be more complex than others to represent/access. The rationale behind this is that, assuming a feature geometric model *à la* Starke, the most embedded features are also the most 'marked' (specific); my assumption (possibly wrong) relates markedness and processing complexity as directly proportional. The additional assumption being that for economy reasons in case of reduction of processing resources we tend to specify more general features rather than more

[5] But see the concluding remarks section for some additional comments on these and other constructions considered above.

specific ones. This seems to be quite a natural fact regarding all other mental skills and there seem to me to exist no special reasons for language to be an exception in this sense.

Another point that needs to be more extensively discussed is related to the theories of locality I made reference to. In fact given a strict reading of Rizzi and Starke's approach to locality it is not possible to derive all the patterns showed in the preceding sessions. If *relatives* and *clefts* comprehension patterns can be derived without any additional assumptions (crucially absence of a [*wh-*] feature would do the job, changing the class of the relevant set from Quantificational to Argumental in Rizzi's terms), the same cannot be said of other constructions such as *passives* or *control*, but also *double object*. In these cases in fact an impoverishment of the feature set is not connected to any change of class of the relevant feature set, which would not allow us to expect any locality effect (in this sense Rizzi and Starke make exactly the same prediction, for a more detailed analysis see Grillo, in preparation). Note that, regardless of aphasia, movement to A positions posit some problems to actual theories of locality, forcing to add some additional assumption to the basic anti-identity principle (e.g. some version of *equidistance*; see Hornstein et al 2004 chapter 5 for a review). I believe this question to be related with the one above; again it is not possible to address this point extensively here. Nevertheless it seems to me that data from agrammatism can be very precious in this respect. In Grillo (in prep.) I try to pursue the possibility that these data show how these *apparent* exceptions to locality in the A domain do not represent an exception at all (they do satisfy the anti-identity requirements). The intuition I want to pursue is that the anti-identity principle is more sensitive than in Rizzi's and Starke's models, or which is equivalent, that the actual feature tree relevant for locality could be less *flat* than what originally postulated by Starke. This possibility (the simplest possible) to my knowledge has not been pursued yet to account for this apparent anomaly of the locality principle.

A last point that is not possible to discuss here (but see Grillo 2003 for an extensive presentation) relates to the possibility to extend the present approach to comprehension deficits to populations other than agrammatic aphasics, namely children and normal adults with a temporal limitation of processing resources (e.g. normal adults in stressful situation, see Blackwell & Bates 1995, Dick et al. 1998).

6. Concluding remarks

In this paper I have pursued the hypothesis that a reduction of processing capacities can limit the accessibility and representation of the features sets associated with the syntactic heads and that the combination of this with Relativized Minimality approach to locality (Rizzi 1990, 2001; Starke 2001) should give rise to unusual minimality effects, allowing for a natural explanation of some typical comprehension patterns in agrammatism. The approach raises many questions that need to be addressed in future work, the empirical support however is strong and the explanation provides an interesting unified picture of locality effects. The effort to keep *representational* and *processing based* approaches to agrammatism in a coherent picture and the approach from a different perspective (a more promising *capacity limitation* framework and a natural derivation of the asymmetries from locality considerations) allow to recover the powerful intuitions expressed by Grodzinsky in his Trace Deletion Hypothesis.

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Nino Grillo
Siena University & Utrecht Institute of Linguistics OTS
nino.grillo@let.uu.nl

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Place asymmetry and markedness of labials in Japanese
Evidence from loanwords

Manami Hirayama

The terms 'marked' and 'unmarked' can be interpreted in many different ways. One interpretation is that markedness is induced from 'phonetic knowledge'. Hayes & Steriade (2004) argue that this is the driving force for the cross-linguistic patterns. Another interpretation of the term is based on textual frequency in a particular language; the more frequent a segment, the less marked it is. A gemination process in loanwords in Japanese provides evidence that goes against the predictions made by both of these notions of markedness. I propose that another perspective from which to understand markedness is a consequence of the structure of the language, i.e., structural markedness.

1. Introduction

There are several aspects in the notions of 'markedness' or 'being marked/unmarked' in phonology. One way of looking at markedness is that it is induced from phonetic knowledge. Based on facts regarding articulatory and perceptual difficulties, Hayes & Steriade (2004) argue that markedness based on phonetic knowledge is the driving force for the sound patterns found cross-linguistically. Another interpretation of the term 'marked/unmarked' is based on textual frequency in a particular language. Under this interpretation, the most frequent segments are viewed as 'unmarked' in that language. To put it another way, the less frequent segments are regarded as more 'marked' than the other segments in the inventory. We then would predict those less frequent segments show marked behaviour in the language. In this paper, I will propose that the patterns that Japanese shows in a loanword gemination process argue against the predictions made by both of these notions of markedness. I propose that another perspective we can take to understand markedness is to see it as related to the structure of a particular language, that is, a representational approach.

The paper is organized as follows. I first introduce the notion of markedness as deduced from phonetic knowledge, as discussed in Hayes & Steriade (2004) (§2). My particular focus is voicing in obstruents. Then I introduce the place asymmetry found in voiced geminates in loanwords in Japanese to show that the patterns there do not meet the prediction that the phonetic knowledge hypothesis makes (§3). I then look at frequency of segments in the Japanese native vocabulary and show that the textual frequency does not explain the observed

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patterns in loanwords either (§4). I lastly propose an analysis that ties the observed patterns to the underlying representations of Japanese obstruents (§5). I conclude the paper with a brief summary (§6).

2. Cross-linguistic implicational relations as generated by phonetics

Hayes & Steriade (2004) argue that implicational relations found cross-linguistically are the reflections of universal grammar that is ultimately based on phonetics. Since they look at cross-linguistic voicing patterns, which are relevant in examining the patterns in gemination in loanwords in Japanese, I will present their arguments and examples in detail here. Their hypothesis states (Hayes & Steriade 2004:1):

> The hypothesis shared by many writers in this volume is that phonological constraints can be rooted in *phonetic knowledge* (Kingston and Diehl 1994), the speakers' partial understanding of the physical conditions under which speech is produced and perceived. The source of markedness constraints as components of grammar is this knowledge. The effect phonetic knowledge has on the typology of the world's sound systems stems from the fact that certain basic conditions governing speech perception and production are necessarily shared by all languages, experienced by all speakers and implicitly known by all. This shared knowledge leads learners to postulate independently similar constraints. The activity of similar constraints is a source of systematic similarities among grammars and generates a structured phonological typology.

Hayes & Steriade (2004) assume four logical steps. First, there are the facts about phonetics. Second, speakers have implicit knowledge about these phonetic facts. Third, grammatical constraints are induced from this knowledge. Last, reflecting the activity of these constraints, are the sound patterns that we observe in languages. They say that the first and last steps, i.e., facts about phonetics and the observed sound patterns, are accessible in principle, but the two intermediate steps have to be guessed at with regard to their contents.

The particular linguistic phenomenon that they study to test their hypothesis is that of voicing contrasts in obstruents. First, they state the facts of the phonetic difficulty of voicing obstruents. These involve the aerodynamics of voicing, particularly in two dimensions — length and place of articulation. In terms of length, voicing is hard to sustain in general. It follows from this that, other things being equal, it is more difficult to sustain voicing in geminates than in singletons. As for place, voicing is harder to sustain at the back of the mouth than at the front. The consequence of the interaction of these facts is the scale of difficulty in sustaining voicing in obstruents as in (1).

(1) Scale of difficulty in sustaining voicing in obstruents (from Hayes & Steriade (5))
*[+voice]: { g: < d:< b: < g < d < b} ('<' denotes 'worse than')

The scale states that the feature [voice] is hardest to realize in [g:], next hardest in [d:], and so on, and easiest to realize in [b]. This knowledge of markedness, viewed as phonetic knowledge, is reflected in the grammar as a set of Markedness constraints in (2).[1] The ranking there is assumed to be universal.

(2) The set of Markedness constraints according to the phonetic difficulty of the segments that they ban
*gg » * dd » *bb » *g » *d » *b

Following the discussion of the markedness hierarchy, Hayes & Steriade look at the inventories of voiced obstruents in selected languages (3) to show that the fine-graded constraints set like (2) can explain the sound patterns that we observe there. The variations in inventories of voiced obstruents in these languages respect each of the cut-off points in the constraint set in (2).

(3) A typology of voiced stops in selected languages (from Hayes and Steriade 2004:11)

(The original title given to their table is “Illustration of patterns of selective voicing neutralization, on a scale like (2)”. I replaced their unshaded cells by check marks. Check marks indicate that the voiced obstruent in the column header occurs.)

	b	d	g	b:	d:	g:
a. Delaware (Maddieson 1984)						
b. Dakota (Maddieson 1984)	✓					
c. Khasi (Maddieson 1984)	✓	✓				
d. Various (citations under (1)[a?] above)	✓	✓	✓			
e. Kadugli (Abdalla 1973), Sudan Nubian (derived environments; Bell 1971)	✓	✓	✓	✓		
f. Coshin Malayalam (Nair 1979), Udaiyar Tamil (Williams & Jayapaul 1977), Sudan Nubian (root-internal only: Bell 1971)	✓	✓	✓	✓	✓	
g. Fula (Maddieson 1984)	✓	✓	✓	✓	✓	✓

This cross-linguistic tendency may be explained in this way. However, when we look at the patterns of voiced geminates in Japanese loanwords, the predictions made by (2) are not supported. I now turn to this issue.

3. Voiced geminates in loanwords in Japanese

In the adaptation of loanwords, geminates are created under certain conditions.[2] Some examples are given in (4). Voiced stop geminates are in bold face. I will examine them in detail.

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[1] In the article by Hayes & Steriade (2004:9), the segments are expressed in feature bundles. Thus, the constraints set (2) looks like: *[-son, +long, +dorsal, +voice] ‘no voiced long dorsal obstruents’ >> *[-son, +long, +coronal, +voice] ‘no voiced long coronal obstruents’ >> … >> *[-son, -long, +labial, +voice] ‘no voiced short labial obstruents’.

[2] The motivation of geminates is a very interesting topic to pursue. However, it is beyond the scope of this paper. See Kawagoe & Arai (2002) and references therein for discussion.

(4)Gemination in loanwords

English (spelling)	>	Japanese	
hip	>	[hippu]	(Quackenbush and Ohso 1990:38)
mitt	>	[mitto]	(Quackenbush and Ohso 1990:38)
kick	>	[kikku]	(Quackenbush and Ohso 1990:38)
pitch	>	[pittʃi]	(Quackenbush and Ohso 1990:38)
cats	>	[kʲattsu]	
knob	>	**[nobbu]**	(Quackenbush and Ohso 1990:40)
head	>	**[heddo]**	(Quackenbush and Ohso 1990:40)
dog	>	**[doggu]**	(Quackenbush and Ohso 1990:40)
edge	>	[eddʒi]	(Quackenbush and Ohso 1990:40)
kids	>	[kiddzu]	(Quackenbush and Ohso 1990:40)
fish	>	[ɸiʃʃu]	(Quackenbush and Ohso 1990:38)
apple	>	[appuru]	(Quackenbush and Ohso 1990:48)
buckle	>	[bakkuru]	(Quackenbush and Ohso 1990:48)
waffle	>	[waɸɸuru]	(Katayama 1998:80)[3]
castle	>	[kʲassuru]	(Quackenbush and Ohso 1990:48)
wax	>	[wakkusu]	(Quackenbush and Ohso 1990:48)
happy	>	[happii]	(Katayama 1998:75)
cotton	>	[kottoɴ]	(Katayama 1998:75)
cookie	>	[kukkii]	(Katayama 1998:75)

Focusing on loanwords with final oral stops in the source language, *p, t, k, b, d, g*, the following points are relevant: Voiceless stops (*p, t, k*) undergo gemination almost all the time, regardless of the place of articulation. In Kawagoe & Arai (2002), citing the results of Maruta (2001), the percentages of gemination for *p, t* and *k* are 98 percent (67 out of 68), 99 percent (202 out of 203 (204)), and 98 percent (188 out of 191), respectively. Shirai's (2001) survey also shows more than 90 percent of gemination for all of these voiceless stops.

In contrast to this, in voiced stops *b, d, g*, although gemination does occur, geminates are unstable, and a place asymmetry is found. The gemination rate is low in the labial *b*, high in the coronal *d* and around fifty percent in the dorsal *g*, as in (5).

(5) Gemination rates (Numbers in parentheses indicate the total number of words that meet the structural description for word-final gemination.)

	b low,	*d* high,	*g* around 50%
My dictionary survey:	*b* 15% (27),	*d* 83% (41),	*g* 42% (36)
Shirai (2001):	*b* 11% (9),	*d* 58% (36),	*g* 55% (22)
Maruta, in Kawagoe & Arai (2002):	*b* 23% (22),	*d* 71% (35 (36)),	*g* 55% (36)

I give some example words in (6) from my dictionary survey.

[3] I replaced her [f] with [ɸ].

(6)

English	Japanese	
mob	mobbu	
World Wide Web	waarudo-waidouebbu	
knob	nobbu	nobu
tab		tabu
tub		tabu
hub		habu

English	Japanese	
pub		pabu
rib		ribu
wood	uddo	
kid	kiddo	
head	heddo	
red	reddo	
rod	roddo	
period		piriodo
ad: [advertisement]		ado
wig	uiggu	
egg	eggu	
fog	ɸoggu	
leg	reggu	
tag	taggu	tagu
mug		magu
lag		ragu
rug		ragu
log		rogu

In sum, based on the gemination rates, we find the scale as in (7).

(7) Observed scale in loanwords in Japanese based on gemination rates
*bb » *gg » *dd

Notice that the Japanese scale here does not meet the prediction made based on the aerodynamics of voicing. Consider specifically the unexpected position of labials in the scale. From the scale in (2), we would expect labial [b:] to be the most frequent in gemination in loanwords, since labial is the place of articulation for which it is easiest to sustain voicing. However, in Japanese, labials resist gemination the most. Thus, aerodynamics of voicing fails to predict the Japanese facts.[4]

[4] A reviewer points out that there is another phonetic account to be considered: an acoustic/perceptual approach along the lines of Steriade's P-map model. Specifically examining place asymmetry, the reviewer suggests that a potential account for the Japanese facts could be that labial stops have the weakest release burst of the three places of articulation (here the release burst being the cue for stop place identification) and this makes the labial hard to hear. Additionally, voicing for long periods is articulatorily difficult, and these two factors together make voiced labial geminate [bb] especially difficult to perceive. Its failure to geminate in loanwords would thus be driven by perceptual factors.

4. Frequency in text

Can the observed scale in voiced geminates in loanwords be explained by the language-internal frequency? From this viewpoint of markedness, "[t]he unmarked member of an opposition occurs more frequently than the marked member" (Hyman 1975:145). Or, a segment can be unmarked if it has greater lexical (i.e., in morphemes) and textual frequency than other segments in the particular language (Hyman 1975:146). If we interpret markedness as determined in terms of textual frequency, we might expect labial geminates to be lower in frequency in Japanese native vocabulary than other geminates.

If there exists a correlation between the observed scale in loanwords and the textual frequency of these segments in Japanese, then one might argue that frequency explains the patterns. In other words, if the voiced geminates *bb, dd* and *gg* have the frequency scale of *bb* < *gg* < *dd* outside the loanword vocabulary in Japanese, the pattern in the loanwords could be argued to be ascribed to a frequency effect. In investigating this possibility, however, we encounter a problem. Japanese does not have underlying voiced geminates outside the

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I would like to present two points that make this approach unconvincing as an account for the Japanese facts. First, it is not clear if the place asymmetry with regard to the strength of release burst also holds in voiced stops. Second, it is unclear whether the facts about production apply directly to perception. Since there has been limited research done on the perception of place identification in discussion, further study is needed to include the perceptual facts. I explain these two points in detail below.

The reviewer correctly states that sustaining voicing for a long duration is difficult because of the aerodynamics of voicing in production (see §2 for this). The difficulty of sustaining voicing does not distinguish place of articulation, however. The strength of stop release burst at different places of articulation is therefore critical. However, burst may not present a clear picture in voiced stops. I will begin by looking at voiceless stops. The intraoral pressure after the release decreases more rapidly in labials than in velars (the alveolar stops are located somewhere in between) (Stevens 2000:323ff). Thus, the rapid decrease in pressure after the release burst of labial stops makes their burst relatively 'weaker'; the average pressure after the burst is smaller. Furthermore, if the 'strength' of the release burst is correlated with VOT values, i.e., the duration of burst, (that is, weaker release burst correlates with lesser VOT), labials are also relatively 'weaker'. It is known that labial stops have the smallest VOT of the three major places of articulation cross-linguistically, with VOT increasing as the place of articulation goes from the front to the back of the mouth (Lisker & Abramson 1964 for initial position). Homma (1981) found that this is true in voiceless singleton stops [p, t, k] in Japanese both in initial and medial positions.

However, in order for the account suggested by the reviewer to work, the above described place asymmetry in strength of release burst must hold for voiced stop singletons. In terms of the intraoral pressure after the release, the pressure is calculated to be less for voiced stops in general than for voiceless stops (Stevens 2000:468ff). I am not certain if, after this overall decrease in pressure, the place asymmetry of the kind found for voiceless stops is significant in voiced stops. The VOT values do not support the hypothesis that the labial stops have the weakest burst, at least not for Japanese. There are two pieces of evidence for this. First, in Japanese, voiced stops are in general voiced phonetically (Homma 1980:9). Homma 1981:276 found that "VOT … was very rare in single voiced stops, except for /g/ at word initial position". Thus, in word medial positions, there is nothing that makes singleton voiced labial stops particularly 'weak' among the three places of articulation. Second, there is an allophonic lenition process reported for voiced labials and voiced velars in medial position in Japanese (Kawakami 1977). The underlying voiced stops do not even involve burst in the surface forms, because they are realized as continuants. Therefore, in acoustic terms, it is not clear if labial stops have the weakest release burst in voiced series in Japanese. These considerations do not speak directly to geminates, and further work is required to examine if voiced geminates are in fact perceptually weaker than voiced geminates of other places of articulation.

Another consideration to make in advocating the perceptual account concerns place of articulation identification. I am unaware of any experiment that tests the confusability of place differences in Japanese. It would be interesting to test if there are any significant differences in confusability at different places of articulation.

loanwords, at least in the Tokyo dialect. Given this distributional restriction, there is nothing that I can count to make a direct comparison with the voiced geminates in loanwords.

However, one might expect to see a correlation between the observed gemination scale and textual frequencies of singletons, *b, d* and *g* in the native vocabulary. The results show that the frequency scales do not correlate with the geminates scale. I illustrate this below.

If there is a correlation between the loanword gemination patterns and the textual frequency of singletons in Japanese, we would find a scale of textual frequency as in (8). Since markedness as defined by frequency interprets the least frequent segment to be the most marked in the system, *b* should occur least frequently; it shows the marked behaviour in loanwords in that it resists gemination the most.

(8) $b < g < d$

To count the frequency of singletons *b, d* and *g*, I used the written corpus complied from the ninety magazines published in 1956 (Kokuritu Kokugo Kenkyujo (The National Institute for Japanese Language) 1997). This corpus has a total number of 39,997 items in type and 438,712 items in token. Sino-Japanese items and proper names (and, of course, loanwords) were then excluded; I include the Yamato (native Japanese) items and the mimetics. The corpus then has 11,152 items in type (221,351 in token).[5]

First, I counted the frequency of *b, d, g* in the word-initial position. The results are given in (9).

(9) Frequencies of initial voiced obstruents in the native items (The numbers in the parentheses indicate token frequency and the numbers without them type frequency.)
g 109 (837), *b* 119 (890), *d* 187 (4657)

We do not find the scale (8) here. For example, the dorsal *g*, not the labial *b*, occurs least frequently.

Next, I counted the frequencies in word-medial position. Here, I counted onset consonants in the second syllable, i.e., C_2 in $(C_1)VC_2V$… forms. Forms with a coda nasal preceding C_2, i.e., $(C_1)VNC_2V$…, were not included in the counting.[6] The results are given in (10).

(10) Frequencies of word-medial voiced obstruents in the native items
d 344 (4425), *b* 467 (3448), *g* 550 (6238)

Here, again, we do not find the scale (8). *d* occurs least frequently in terms of type frequency in this position, with the occurrence of 344 times in the corpus; *b* (467) and *g* (550) are more frequent. If we look at the token frequency, the least frequent segment is not *d*. Instead, *b*

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[5] The categorization of the vocabulary items, i.e., Yamato, Sino-Japanese, etc., is theirs; the words are labeled in the corpus according to their categorizations.

[6] I did not include coda consonants in counting because they are irrelevant. In Japanese, surface coda consonants are limited to either to a nasal, e.g., *tombo* 'dragonfly', or the first half of the geminate. The coda nasal is ignored because I was counting voiced oral stops. Regarding the first half of geminates, Japanese has no (underlying) voiced geminates outside of loanwords.

occurs least frequently; it occurs 3448 times, while *d* (4425) and *g* (6238) occurs more. However, again, the frequency scale does not totally coincide with the scale in (8).[7, 8]

To conclude, we do not find a correlation between segmental frequency in text and the frequency in the loanword geminates overall.

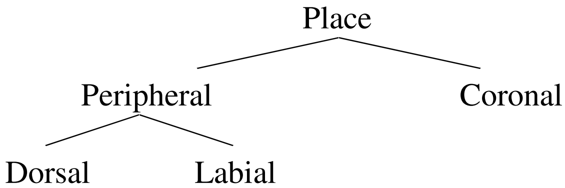
5. Structural markedness

I propose that the patterning of the voiced geminates in loanwords and the 'marked' behaviour of labials as being the most resistant to gemination are a consequence of the underlying representations of the segments in question. In other words, the structural differences among places are the driving force for the observed gemination rates for different places.

5.1. Markedness and place structure of Japanese

The theory in which I work in this paper views markedness as being represented structurally in the underlying representation (http://www.chass.utoronto.ca/~contrast/; e.g., Avery & Rice 1989, Dresher & Rice 1993, Dresher, Piggott & Rice 1994, Rice & Avery 1993, 2004). To be more marked means to have more structure, i.e., more features. I assume privativity of features and feature geometry (Clements & Hume 1995). I also assume contrastive specification; features are underlyingly minimally specified as much as the contrasts in a particular system are sufficiently made (see reference above). An unspecified feature is inert in phonological processes. Feature specifications are language-specific: underlying representations are so analyzed as the phonological processes of the particular language suggest. The exhaustive feature geometry for Place in a three-way contrast system is assumed to be in (11).

(11) Full geometry for Place for consonants — a three-way contrast system (from Avery and Rice 1989)



[7] The discrepancy between the token frequency scale and type frequency scale comes from the fact that there is a small number of words of great frequency (occurring more than 200 hundred times) and they have either *d* or *g* in C_2; there are no such words with *b* in C_2. If we exclude these super high frequency words, the scale $d < b < g$, the same scale as we get from the type frequency, holds, with the occurrences of 2846 for *d*, 3448 for *b* and 4876 for *g*.

[8] The very frequent items are the followings. N, V and Adv denote noun, verb and adverb respectively.
g: *sigoto* (N, 'work') 244 times, *tugi* (N, 'next') 277, *migoro* (N, 'be at one's best') 349, *age-ru* (V, 'give, raise, deep-fry') 284, *sugu* (Adv, 'immediately') 208
d: *kodomo* (N, 'children') 333, *hodo* (N, degree, extent, limit) 445, *kudasar-u* (V, 'give', honorific form) 255, *tada* (Adv, 'simply, merely') 274, *mada* (Adv, 'still, yet,') 272

Compare: The most frequent word with *b* in C_2 in the corpus is *yob-u* (V, 'call'), with 158 times of occurrence.

Keeping in mind the minimal specification of features outlined in the paragraph above, I propose that the structures for individual places of articulation in Japanese are as follows. Labials have a more complex structure than do the other places of articulation (12a). Coronals are the least complex, i.e., unmarked (12b). Dorsals are in the middle (12c). It is as the result of the reflection of this difference in complexity that we observe the different gemination rates in different places of articulation in loanwords.

(12) Japanese places of articulation: contrastive specification

a. Labial	b. Coronal	c. Dorsal
b	*d*	*g*
|	|	|
Place	Place	Place
|		|
Peripheral		Peripheral
|		
Labial		

In the next section, I show this in detail, i.e., how the structure in (12) can explain the observed pattern in loanwords. I situate gemination in loanwords as a whole in the context of Japanese phonology first.

5.2. Length contrast in Japanese

The key to understanding the instability of geminates in voiced obstruents in loanwords lies in the fact that voiced obstruents are new to the system of Japanese; the length contrast is introduced with them (Rice 2004). I first look at this aspect. If we look at words that are not loanwords, a length contrast exists in the voiceless obstruents, while it does not in the voiced obstruents. The presence/absence of contrast provides the base on which the loanwords appear differently between the voiceless geminates (fairly stable) and voiced ones (relatively unstable). I show this below.

With voiceless obstruents, there are some forms that exhibit lexical geminates. For example, Japanese uses lengthening for emphasis (e.g., *yahari* 'as expected' → *yappari* emphatic). However, there are some words that are historically emphatic forms, but have displaced the unemphatic form over time (Vance 1987:43, citing Hamada 1955), with the result that only the emphatic forms are in use in contemporary standard Japanese. Vance gives *mattaku* 'completely' as an example, for which a form without the geminate *[mataku] is not in use. Thus, given forms are analyzable, in the synchronic terms, as having underlying geminates.

Another set of data that suggest underlying voiceless obstruent geminates comes from Sino-Japanese words. Although Sino-Japanese words may mostly be analyzed as compounds that consist of two root morphemes, it may not be so clear for some 'compounds' whether their 'roots' can be separable in modern Tokyo Japanese. An example word is *sekkaku* 'with much trouble, kindly'. I am not certain if any Japanese speakers would analyze this word to be anything but monomorphemic.

As for voiced obstruents, in contrast, there are no underlying geminates. First, surface voiced geminates, unlike voiceless geminates, are very rare, a point that Itô & Mester 1995:819 generalize:

(13) *DD: Geminate obstruents must be voiceless in Yamato, Mimetic and Sino-Japanese

In gemination processes such as intensified adverbs in mimetic vocabulary (Kuroda 1979, McCawley 1968), verb morphology, and verb+verb compounds, the morphologically derived geminates are either long voiceless obstruents or prenasalized stops. If a voiceless obstruent undergoes the gemination rule, it results in a voiceless obstruent geminate. If a voiced obstruent undergoes the rule, it does not derive a voiced obstruent geminate, but it takes the form of prenasalized stop. So, in these processes, we do not find voiced obstruent geminates in the derived contexts. I summarize the patterns in (14).

(14) Coda consonant in certain gemination processes in native grammar

If the following segment is:	then the mora consonant is realized as:
Voiceless obstruent	→ the voiceless mora obstruent (voiceless geminate)
Voiced obstruent	→ the mora nasal

In other cases, surface voiced obstruent geminates are found. Vance (1987:42) notes that standard speakers do lengthen voiced obstruents for emphasis. Kawahara (p.c. 2004) notes that prenasalization and gemination of voiced obstruents are variants for emphasis (e.g., *subarasi-i* 'gorgeous, wonderful, awesome, etc.' → *suNbarasii* ~ *subbarasii*). However, these are derived forms; voiced geminates are not contrastive lexically. Therefore, I conclude that there is no underlying length contrast in voiced obstruents.

If we turn to loanwords, the difference in the underlying length contrast between voiceless and voiced obstruents — presence of a contrast in voiceless obstruents and the absence in voiced obstruents — explains the difference in the degree of gemination between them. The robust gemination of loanwords with voiceless obstruents is made possible by the support of existing underlying geminates. On the other hand, the absence of a contrast in length makes the voiced geminates in loanwords rather unstable. Then, through the adaptation process of gemination, the geminate sites create the place where we find the dynamics.

With this as the baseline, the place asymmetry that we are observing in the unstability of voiced geminates is the emergence of structural complexity of (12). Formally, this is expressed as discussed below.

5.3. The place asymmetry in loanword gemination

Structurally, geminates are more complex than singletons (15).

(15) Complexity: *b* is more complex than *a*

a. Singleton position

```
X
|
A
```

b. Doubly-linked position, i.e., geminates

```
X   X
 \ /
  A
```

Voiced labials, being the most complex, hardly geminate, since complex segments are not well-licensed in complex position (16a), unlike the other places of articulation (16b for coronal and 16c for dorsal). My use of “well-licensed” reflects the non-categorical nature of this phenomenon; [bb] sequences are not absolutely banned, but are less preferred than [dd] or [gg] sequences which are themselves variable.

```
(16)  a. Labial        b. Coronal      c. Dorsal
      *X      X         X     X         X      X
         \   /            \  /            \   /
         Place            Place           Place
           |                                |
       Peripheral                       Peripheral
           |
         Labial
```

One might wonder why we do not find the structural complexity effects in the voiceless series in loanword gemination; the gemination rates do not show a place asymmetry for *p, t, k*, and they all geminate almost all the time. Recall that geminates are lexically present in voiceless obstruents outside of loanwords (§5.2). Thus, categoricity of gemination in loanwords is expected with voiceless obstruents, and there is no reason to expect instability for these items.

For the proposed place structure (12), there exists independent evidence. First, the special nature of labials is recognized outside loans. Singleton [p] is prohibited in Yamato items and has restricted distribution in Sino-Japanese items, while singletons [t] and [k] are found. Itô & Mester 1995:819 express this with a constraint against single [p]:

(17) *P: Yamato and Sino-Japanese forms tolerate /p/ only in a geminated or at least partially geminated form. The *P-constraint governs neither mimetics nor foreign items. [Author’s note: examples are omitted.]

Second, independent evidence also exits for coronal place being unmarked. In the Sino-Japanese assimilation/gemination process, voiceless coronal *t*’s are the target of assimilation/gemination, which suggests that the coronals are unmarked for place in obstruents in this language (Itô & Mester 1996, McCawley 1968; Kurisu 2000 for summary). In contrast, the dorsal *k*’s are the target in the same process only when the next consonant is identical, i.e., *k*. Representationally, this suggests that *k* is more marked than *t*.

6. Conclusions

In this paper, we observed a place of articulation asymmetry in the patterns of voiced obstruent geminates in loanwords in Japanese. Specifically, the special behaviour of labials was recognized — they resist gemination to a greater degree than do the other places of articulation. I argued that the structure of place of articulation, and not the aerodynamics of voicing or textual frequency, accounts for this place asymmetry. This structural markedness, which is independently motivated by other processes, accounts for the marked pattern of labials in loanword geminations in Japanese.

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Manami Hirayami
University of Toronto
manami.hirayama@utoronto.ca

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Analyzing anankastic conditionals and sufficiency modals*

Janneke Huitink

This paper consists of two parts. The first part argues that existing accounts of anankastic conditionals make the wrong predictions in scenarios with multiple non-conflicting goals. In order to avoid the problem, I propose that anankastic conditionals are not interpreted relative to every goal, as previous accounts have it, but relative to those goals that are contextually salient. The second part of this paper is devoted to sufficiency modals, that are formed by combining anankastic conditionals with *only*. I claim that the analysis of von Fintel & Iatridou (2005a) isn't adequate, because it fails to predict that sufficiency modals are transitive. I present an alternative analysis that treats *only* as a modal operator.

1. *Introduction*

Anankastic[1] conditionals state that the complement of the modal in the consequent is a *necessary condition* for achieving the goal introduced in the antecedent (von Wright 1963:9-10). Examples of anankastic conditionals are given in (1). For instance, (1a) expresses that unless you go to Nashville, you do not become a country singer.

(1) a. If you want to be a country singer, you must go to Nashville.
  b. If you want to go to Harlem, you have to take the A train.[2]
  c. You must first empty yourself, if you are to learn anything.

An adequate analysis of anankastic conditionals has to be able to derive the meaning of such sentences compositionally from the meaning of the conditional and the modal. Kratzer's (1981) integrated account of modals and conditionals thus seems a promising candidate for analyzing anankastic conditionals. In her framework, the interpretation of modals is dependent on

*This analysis of anankastic conditionals is also presented in a paper I contributed to the proceedings of Sinn und Bedeutung 9. Consequently, this paper partially overlaps with (Huitink 2005).

[1]From the Greek ἀνάγκη which means 'necessity'.

[2]This is Sæbø's (2001) paradigmatic example of an anankastic conditional. It is based on Billy Strayhorn's song 'Take the A train'.

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two contextual parameters, the *modal base* and the *ordering source*, and *if*-clauses are treated as devices that restrict the modal base of the (possibly covert) modal in the consequent. But a closer look reveals that Kratzer's semantics fails to provide a straightforward account of anankastic conditionals.

The first attempt to mend Kratzer's framework was made by Sæbø (2001). He proposed that the *if*-clause of anankastic conditionals restricts the *ordering source* parameter, and not, as Kratzer has it, the *modal base*. However, it is not the entire antecedent that should be added to the ordering source, but only what Sæbø calls the 'internal antecedent', i.e. the complement of *want to* or *be to*.

Independently of one another, both von Fintel & Iatridou (2005b) and Penka et al. (2004) discovered that Sæbø's theory makes the wrong predictions in scenarios with inconsistent goals. To overcome this problem, von Fintel & Iatridou propose that the goal described in the *if*-clause functions as the so-called designated goal. The designated goal overrides any conflicting goals that you may have. Penka et al. on the other hand propose that the internal antecedent restricts the modal base, and not, as Sæbø maintains, the ordering source.

In this paper I aim to show that these alternative analyses aren't satisfactory either, because they cannot deal with situations where you have multiple, *non*-conflicting goals. In section 2.4 I present a counterexample to von Fintel & Iatridou (2005b) and Penka et al. (2004). In section 3 I propose that the solution to the problem is that teleological ordering sources only contain salient goals: goals that have been explicitly introduced in the discourse.

As observed by von Fintel & Iatridou (2005a), anankastic conditionals may be turned into conditionals that state that something is a *sufficient condition* of something else if we combine them with *only*.[3] Such constructions are called 'sufficiency modals'. An example is von Fintel & Iatridou's (2).

(2) If you want good cheese, you only have to go to the North End.

The above sentence conveys that going to the North End is a means of getting good cheese, and that going to the North End is relatively easy. Note that (2) does not express that going to the North End is the *only* way of getting good cheese. In other words, it does not state that going to the North End is a necessary condition for obtaining good cheese. This necessary condition reading is expressed by the anankastic conditional in (3):

(3) If you want good cheese, you have to go to the North End.

The main problem that faces an analysis of sufficiency modals is the fact that (2) doesn't imply that (3) is true. This is a problem, since in the literature on *only* it is generally assumed that a proposition containing *only* somehow implies its *prejacent* proposition, i.e. the proposition without *only*.Von Fintel & Iatridou solve this problem by decomposing *only* into a negation and an existential quantifier, and the assumption taht the scope of *only* is 'split': the modal scopes

[3] In some languages, for instance in French, sufficient condition is expressed by a necessity modal combined with negation and an exceptive (von Fintel & Iatridou 2005a:3).

(i)	Si	tu	veux	de bon	fromage,	tu	n'as	qu'aller	à	North End.	
	if	you	want	good	cheese,	you	not have	except	go	to the	North End

'If you want good cheese, you only have to go to the North End.'

In this paper I will concentrate on the *only*-languages.

over the quantifier, but under the negation. In section 5 I'll present their analysis in more detail. In this paper I object to their analysis because it fails to predict that sufficiency modals are transitive.

This paper is structured as follows. In the next section I evaluate existing analysis of anankastic conditionals. In section 3 I argue that ordering sources only contain contextually salient propositions. After that, I review a competing theory of anankastic conditionals by von Stechow et al. (2004), who claim that such conditionals are counterfactuals. The last section of the paper is devoted to sufficiency modals.

2. Previous analyses of anankastic conditionals

2.1. Sæbø's analysis

As said in the introduction, Sæbø's (2001) proposal extends Kratzer's doubly relative semantics in order to treat anankastic conditionals. Before presenting his analysis, I'll first introduce Kratzer's framework, and point out why it fails for anankstic conditionals.

In doubly relative semantics, modals are interpreted relative to two conversational backgrounds, the modal base and the ordering source (Kratzer 1981). Kratzer models these parameters as functions that map worlds to sets of propositions. The modal base f assigns to the world of evaluation w a set of propositions $f(w)$ that describes the domain of possible worlds that the modal quantifies over. The ordering source g restricts the domain even further. It assigns a set of propositions to w that partially orders the modal base worlds with respect to how close they are to the ideals expressed by $g(w)$. The definition of an ordering source induced by a set of propositions $g(w)$ is

(4) Ordering Sources
for all worlds w' and w'':
$w' \leqslant_{g(w)} w''$ iff $\{p : p \in g(w) \text{ and } w'' \in p\} \subseteq \{p : p \in g(w) \text{ and } w' \in p\}$

In other words, a world w' is at least as close to the ideal $g(w)$ as a world w'' iff all the propositions of $g(w)$ that are true in w'' are also true in w'.

Modals quantify over those modal base worlds that are best by the ordering source:

(5) Kratzer's Semantics for Modality[4]
(i) *must p* is true in w iff for all $w' \in \bigcap f(w)$ s.t.
$\neg\exists w''$ s.t. $w'' \leqslant_{g(w)} w'$, it holds that p is true in w'
(ii) *can p* is true in w iff there is a $w' \in \bigcap f(w)$ s.t.
$\neg\exists w''$ s.t. $w'' \leqslant_{g(w)} w'$ and p is true in w'

The modal base and ordering source parameter thus determine which worlds are accessible for quantification. Which propositions are made true by the accessible worlds depends on the kind of modality invoked. For instance, if sentence (6) is read epistemically, the accessible worlds

[4] I give a simplified version of the definitions under the assumption that there always exist closest worlds (the so-called Limit Assumption, see Lewis 1973:19-21). I'll make this assumption throughout the paper.

make true every proposition that is known in w. But if, on the other hand (6) is interpreted deontically, the worlds make everything that is commanded in w true.

(6) Harry may spend his summer at the Burrow.
  a. (In view of what is known,) Harry may spend his summer at the Burrow.
  b. (In view of what is commanded,) Harry may spend his summer at the Burrow.

The modal base and ordering source of a given expression are determined in part by its lexical meaning and by its conversational background. For *has to* in (7c), f is circumstantial, picking out the relevant circumstances in w, that Harry is a champion, and g is deontic, containing the school's tradition. Sentence (7c) is true in w relative to f and g iff in all worlds w' in which Harry is a champion and that correspond most to the tradition, Harry dances in w'.

(7) a. According to the school's tradition, the champions and their partners open the ball.
  b. Harry is a champion.
  c. Harry has to dance.

The proposal of Sæbø (2001) differs from Kratzer's semantics in its view on *if*-clauses.[5] Kratzer has it that *if*-clauses always restrict the modal base of the modal in the consequent. The material in the *if*-clause is thus treated as a hypothetical fact. But as argued in (Sæbø 2001), such a view of *if*-clauses is problematic for anankastic conditionals. The following scenario illustrates this. Suppose that in the actual world, you want to become an actor. You do not want to hunt tigers. But I do not know that. To become an actor, you must go to Hollywood. To hunt tigers, you have to go to the jungle. In this scenario, it seems that I can felicitously utter (8) and that my utterance is true.

(8) If you want to hunt tigers, you must go to the jungle.

But Kratzer's theory predicts that it is false. The truth conditions she assigns to the above sentence are

(9) (8) is true in w iff
  in all $w' \in \bigcap f^{+}(w)$ s.t. $\neg\exists w''$ s.t. $w'' \leqslant_{g(w)} w'$, you go to the jungle in w',
  where $f^{+}(w) = f(w) \cup \{$you hunt tigers$\}$

Less formally, (8) is true in w iff you go to the jungle in all those worlds w' such that you want to hunt tigers in w' and as much as possible of what you want *in the actual world*, i.e. to be an actor, is true in w'. Clearly, (8) comes out false, because in the worlds that are best by $g(w)$, you will go to Hollywood. Consequently, you will not go to the jungle in all the best worlds.

To get the truth conditions right, Sæbø proposes that the *if*-clause adds a proposition to the *ordering source*. He thus treats the *if*-clause as a hypothetical ideal, instead of a hypothetical fact. For (8) the initial modal base is circumstantial, specifying all the relevant circumstances about wild life, climate, geography etc. The ordering source is teleological, containing your goals. To this ordering source, the internal antecedent, i.e. the proposition that you hunt tigers is added. Note that the external antecedent, i.e. the proposition that you *want* to go to Harlem

[5] Sæbø (2001) draws on a much earlier manuscript Sæbø (1986).

is not added to the ordering source, since this would have the effect that you want what you want. Sæbø doesn't interpret 'want' but as a signal as to which kind of modality is invoked by the modal in the consequent. The following truth conditions are assigned to (8).

(10) (8) is true in w iff
in all $w' \in \bigcap f(w)$ s.t. $\neg\exists w''$ s.t. $w'' \leqslant_{g^+(w)} w'$, you go to the jungle in w',
where $g^+(w) = g(w) \cup \{$you hunt tigers$\}$

Now (8) comes out true. According to Sæbø's semantics the sentence is true iff you go to the jungle in all circumstantially accessible worlds where your goal of going hunting is satisfied. Hence, in the scenario sketched above, (8) is true.

2.2. Von Fintel & Iatridou's designated goal analysis

Von Fintel & Iatridou (2004b) argue that Sæbø's theory doesn't fare better than Kratzer's. And they are right. Sæbø makes the wrong predictions in the so-called Hoboken scenario.[6] Suppose that in w you want to go to Hoboken. But I do not know that. The only way to Hoboken is the PATH train. The only way to Harlem is the A train. I correctly utter (11).

(11) If you want to go to Harlem, you must take the A train.

Intuitively, (11) is true. but Sæbø predicts that it is false. The modal base for (11) is circumstatial, containing the relevant facts concerning the railroad system, schedules, geography, etc. The ordering source is teleological. Under Sæbø's analysis, your goal of going to Harlem is added to the initial ordering source, which contains what you want in the actual world: going to Hoboken. Sentence (11) is true iff in all modal base worlds w' that correspond most to what you want, you take the A train in w'. The problem is that going to Harlem and going to Hoboken are inconsistent goals, so that you can only realize one of your goals. It follows that modal base worlds in which you go to Hoboken are just as ideal as modal base worlds in which you go to Harlem. So it won't be true that you take the A train in all ideal worlds, since in some of them, you take the PATH train.

Von Fintel & Iatridou (2004b) discuss three possible ways to solve the Hoboken problem. In the end, they decide to go with the designated goal analysis. This analysis postulates that in anankastic conditionals the hypothetical goal overrides any conflicting goals that you actually have (von Fintel & Iatridou 2005b:5). The goal expressed in the *if*-clause then figures as the *designated goal*: the only relevant goal in evaluating the conditional. The main idea is that the ordering source that is obtained by intersecting the hypothetical goal p with the initial ordering source $g(w)$ is further revised to make it consistent.

The designated goal approach makes the right predictions for the Hoboken scenario. Sentence (11) comes out true, since we just don't take your goal of going to Hoboken into consideration. The modal base worlds are only ranked with respect to your ideal of going to Harlem

[6]The Hoboken scenario is invented by von Fintel & Iatridou (2005b). Penka et al. (2004) offer a different counterexample to Sæbø's theory: the mayor scenario. Since both scenarios point out the same deficiency, I limit myself to the Hoboken scenario.

because this is the designated goal. The ideal modal base worlds thus are worlds in which you go to Harlem. In those worlds you do take the A train.

2.3. Penka, Krasikowa & von Stechow: modal base restriction

Penka et al. (2004) propose an alternative solution to the problem from which Sæbø's theory suffers, i.e. the problem of scenarios with inconsistent goals. They claim that in the case of anankastic conditionals the internal antecedent proposition restricts the *modal base* of the modal in the consequent, figuring as a hypothetical fact.[7]

(12) Modal Base Restriction
An anankastic conditional *if want p, then must q* is interpreted relative to a circumstantial f^+ and a teleological g, where $f^+ = f(w) \cup \{p\}$

This semantics also avoids the Hoboken problem. Sentence (11) is true iff you take the A train in all modal base worlds, i.e. worlds in which you go to Harlem, that are best by the ordering source. The ordering source contains the goal that you actually have: going to Hoboken. But this doesn't pose a problem, since the ordering source orders the modal base worlds. The modal base is already restricted to worlds in which you go to Harlem, and thus the worlds in which your goal of going to Hoboken is reached are not accessible.

The analysis of Penka et al. (2004) is essentially the same as the one proposed by von Fintel & Iatridou (2005b). If the designated goal in the *if*-clause overrides any conflicting goals, it behaves as if it were a hypothetical fact. Recall that in Kratzer's framework the modal base has priority over the ordering source if the latter contains propositions that are inconsistent with the former. A proposition is a necessity iff it is true in all worlds in which all of the modal base propositions are true, and as much of the ordering source propositions *as possible*. So von Fintel & Iatridou ultimately claim that the designated goal has the same sort of priority as the propositions in the modal base.

Because the designated goal analysis and the modal base restriction account do not differ from one another, they both face the same problem. In the next section I'll present a scenario that is problematic both for the proposal by von Fintel & Iatridou (2005b) and the account of Penka et al. (2004).

2.4. The Ruud van Nistelrooy problem

Both von Fintel & Iatridou (2005b) and Penka et al. (2004) are able to handle scenarios with inconsistent goals. But they make the wrong predictions in scenarios with multiple consistent goals. The following scenario, which I dub the Ruud van Nistelrooy[8] scenario, should make this clear. Imagine that there are two trains going to Harlem in w, the A train and the B train. I

[7] This analysis is based on von Stechow (2004b).

[8] Ruud van Nistelrooy is the star of the Dutch soccer team. For more information on Ruud (and pictures), see http://www.manutd.com/bio/bio.sps?iBiographyID=3328

ask you about ways to get to Harlem, and you answer by uttering (13). Your utterance is false, since taking the A train is not the only way to get to Harlem.

(13) If you want to go to Harlem, you must take the A train.

But now suppose that in the actual world, I have more goals than just going to Harlem. Suppose that I want to kiss my idol, Ruud van Nistelrooy, and that Ruud happens to be on the A train. Intuitively, the utterance in (13) is still false. But von Fintel & Iatridou predict that it is true.

According to von Fintel & Iatridou, (13) is interpreted relative to an ordering source $g^+(w)$ that contains both my goal of going to Harlem and my goal of kissing my idol. The hypothetical goal does not override my goal of kissing Ruud, because these two goals are not inconsistent. The sentence is true iff I take the A train in all circumstantially accessible worlds w' in which I get most of what I want. According to $g^+(w)$ the best worlds are those in which I get to go to Harlem *and* get to kiss Ruud van Nistelrooy. And in those worlds I will take the A train (say I am not shy and will kiss him when I get the chance). Hence, (13) comes out true.

The problem is that under von Fintel & Iatridou's analysis the modal doesn't quantify over *all* worlds in which I go to Harlem, but only over a subset thereof, i.e., worlds in which I go to Harlem *and* kiss Ruud van Nistelrooy. Consequently, the anankastic reading is not obtained, given that if taking the A train is a necessary condition for going to Harlem, you take that train in every (circumstantially accessible) world in which you go to Harlem.[9]

The treatment by Penka et al. (2004), being by and large equivalent to the designated goal analysis, also incorrectly predicts that (13) is true. According to this analysis the goal described in the antecedent, i.e., going to Harlem, is added to the modal base as a hypothetical fact. But even if the modal base is restricted to worlds in which I go to Harlem, the worlds from the ordering source in which I kiss Ruud van Nistelrooy are still accessible. The best worlds will still be worlds in which I go to Harlem and kiss Ruud. In those worlds I'll take the A train, and so Penka et al. fail to predict that (13) is false.

3. *Analyzing anankastic conditionals*

Let's consider where we are now. Suppose that Sæbø is right in that the goal in the *if*-clause restricts the ordering source parameter, so that an anankastic conditional of the form *if want p,*

[9]Von Fintel & Iatridou actually provide the following truth conditions for anankastic conditionals, and they claim that this semantics doesn't suffer from the Ruud van Nistelrooy problem (von Fintel & Iatridou 2005b:15):

(14) *if p, must q* is true in w relative to modal base $f(w)$ iff all the worlds in $f(w)$ where p is ach ieved are q-worlds

While it is true that this semantics is indeed immune to the Ruud van Nistelrooy problem, two remarks are in order here. First, it is unclear how these truth conditions spell out the 'designated goal analysis' that von Fintel & Iatridou describe and advocate in their paper. Second, if this really is what the designated goal analysis amounts to, it needs further argument. In the above truth conditions *must* is all of a sudden not interpreted relative to a modal base *and* an ordering source parameter anymore, but just relative to a modal base parameter. The question why the interpretation of *must* does not require an ordering source in anankastic conditionals, but does so in other sentences needs to be answered in order for von Fintel & Iatridou's theory to be plausible.

then must q is interpreted relative to an ordering source $g^{+}(w) = g(w) \cup \{p\}$. The Hoboken problem and the Ruud van Nistelrooy problem point out that $g^{+}(w)$ should be further restricted. The solutions of both von Fintel & Iatridou (2005b) and Penka et al. (2004) restrict $g(w) \cup \{p\}$ by demanding that it is consistent, where p has a priority over the other propositions.[10] But, as we've seen, this isn't enough to solve the Ruud van Nistelrooy problem.

In Huitink (2005) I proposed that the Ruud van Nistelrooy problem should be solved by letting the hypothetical goal be the only goal in the ordering source. This semantics correctly predicts that (13) is false, because quantification now ranges over worlds in which I go to Harlem, and you do not take the A train in all those worlds.

(15) Anankastic Conditionals
if want p, then must q is true in w iff
for all $w' \in \bigcap f(w)$ s.t. $\neg\exists w''$ s.t. $w'' \leqslant_{g(w)} w'$
q is true in w'
where $g(w) = \{p\}$

The idea behind this was that ordering sources pick up goals that are salient in the context of utterance and assign these to w, instead of just assigning *all* your goals to the world of evaluation. That is, I depart from the way Kratzer (1981) models ordering sources.

In doubly relative semantics, a teleological ordering source assigns all propositions that are your goals to w, and this assignment is *independent of the linguistic context*. In a similar fashion, juridical ordering sources are assumed to contain *all* propositions that the law provides, and a deontic ordering sources consist of *all* propositions that are considered to be good. This line of thinking is followed by von Fintel & Iatridou (2005b) and Penka et al. (2004), and it is because of this concept of ordering source that their theories run into trouble. In evaluating (13), it is always the case that my goal of kissing Ruud makes it into the ordering source, it interferes with my hypothetical goal of going to Haarlem, and the wrong truth value comes out.

But there is an alternative view on ordering sources. In implementations of Kratzer's framework in dynamic semantics, we find that the ordering source just is a contextually salient (set of) proposition(s). In Frank (1997) for instance, the ordering source parameter is treated as an anaphor that needs to link up to a context referent in the previous discourse. These ideas are already present in the system of Geurts (1995).[11] The difference with Frank's system is that in Geurts' system, the antecedent of the anaphor is a propositional referent and not a context referent.

The analysis of anankastic conditionals, and in particular the Ruud van Nistelrooy scenario, brings to light that these two ways of construing ordering sources are not equivalent. On the first view, a teleological ordering source assigns all your goals to w, whether it is known that these are your goals or not. As a result, (13) is incorrectly predicted to be false. But under the second view, the ordering source only contains those goals that have been explicitly introduced in the conversation. Because of that, we may assume that in the Ruud van Nistelrooy scenario, my goal of meeting my idol is not picked up by the ordering source parameter, and hence will

[10] Of course, the analysis of Penka et al. is stated in different terms, but as seen in section 2.4, their analysis is equivalent to the one by von Fintel & Iatridou.

[11] The material of Geurt's (1995) dissertation is published in Geurts (1999).

not influence the interpretation of the modal in (13).

The anankastic reading thus results from binding the ordering source parameter to the proposition in the antecedent that describes the goal. Introducing a goal in the antecedent of a conditional is a way of making that goal highly salient. Support for this claim can be found in Bittner (2001) where it is argued that *if*-clauses are topical.

Unfortunately, this analysis faces a problem. Von Stechow et al. argue that I have to require that the internal antecedent is compatible with the modal base. If I do not, my analysis makes the wrong predictions. A case in point is (16).

(16) If this water is to boil, its temperature ought to be 100° Celsius.

Assume that in the actual world this water does not boil, and that the modal base contains this fact. The internal antecedent, that the water does boil, is added to the ordering source. The modal in the consequent quantifies over those modal base worlds that are best by this ordering source. In this example, none of the modal base worlds is best by the ordering source. Thus quantification ranges over all worlds in which the water doesn't boil. Obviously, it won't be true that in all these worlds its temperature is 100° Celsius, and so (16) is incorrectly predicted to be false.

Von Stechow et al. point out that if I indeed have to require that the hypothetical goal is consistent with the modal base, my analysis seems to ignore the very reason why Kratzer introduced the ordering source parameter in the first place. Initially, Kratzer (1977) assumed that modals are interpreted relative to just one conversational background, the modal base $f(w)$. This turned out to be problematic in case $f(w)$ is inconsistent, since any proposition is a necessity relative to an inconsistent modal base, and no proposition is a possibility. To solve the problem, Kratzer (1981) proposed that modals are interpreted relative to two conversational backgrounds, the modal base and the ordering source. The modal base contains propositions that describe facts, and the ordering source describes ideals. It may be that the ordering source is inconsistent with the modal base. But if it is, the semantics is so designed that the modal base has priority over the ordering source. A proposition is a necessity if it is true in all the modal base worlds that correspond to the ideals *as much as possible*.

My answer to this objection is that my system does allow for a conflict between the modal base and the ordering source. An example is the mayor scenario of Penka et al. (2004). In this scenario it is given that you want to become mayor and that you do not want to go to the pub regularly. But unfortunately for you, the world is such that you can only become mayor if you do go to the pub regularly. I predict that for (17), the modal base contains the fact that you cannot realize both your goals, and the ordering source contains both the above mentioned goals. Consequently, (17) is false, since you do not go to the pub in all the worlds that are best according to this ordering source.

(17) You have to go to the pub regularly.

But I also predict that (18) is true, since there the ordering source parameter is bound to the goal described in the *if*-clause, under the assumption that a goal in an *if*-clause is highly salient:

(18) If you want to become mayor, you have to go to the pub regularly.

So I do not postulate that the ordering source has to be consistent with the modal base. But this still doesn't change the fact that I predict (16) to be false, when it is actually true. However, as I see it, the wrong predictions for (16) do not depend on my theory that the internal antecedent is the only proposition in the ordering source. This problem rather concerns the *modal base*.

According to Kratzer (1981) there are two basic kinds of modal bases: epistemic ones and circumstantial ones. To appreciate the difference, consider the following two sentences.

(19) a. In dieser Gegend können Zwetschgenbäume wachsen.
in this area can plum trees grow
'Plum trees can grow in this area.'

b. Es kann sein, daß in dieser Gegend Zwetschgenbäume wachsen.
it can be that in this area plum trees grow
'It is possible that plum trees grow in this area.' (Kratzer 1981:53)

Sentence (19a) has a circumstantial and an epistemic reading, but for (19b) only the epistemic reading is prominent, where the necessity or possibility of a proposition depends on what is known. Supposing that you are traveling in an exotic country and discover that the climate there is appropriate for growing plum trees, (19a) can be true on a circumstantial reading: in view of the climate, plum trees can grow in this area. In the same situation, (19b) may be false, given that it is known that this country has had no contact with plum tree growing communities yet.

So epistemic modals are interpreted relative to everything that we know already. But if we use a circumstantial modal, we are interested in what can or must happen, given circumstances of a certain kind, or, in other words, given certain *relevant facts*. Which facts are relevant is not a clear cut matter.

> 'When we talk to each other, we hardly ever make explicit in view of which circumstances something should be necessary or possible. We may give hints. Usually people understand. And they all understand in pretty much the same way.' (Kratzer 1981:53-54)

Consider (20). Depending on the situation, I may say quite different things when uttering this sentence. It may mean, for instance, that I don't know how to play the violin. Or suppose that I only have one hand, then (20) may express that I am unable to play the violin due to my physical condition.

(20) I cannot play the violin.

Let us relate this to sentence (16), von Stechow et al.'s counterexample to my theory. As said, (16) is interpreted relative to a circumstantial modal base, which contains the relevant facts. The question now is which facts are relevant. Clearly, von Stechow et al. assume that because this water doesn't boil in the actual world, this fact has to be added to the modal base. But this is not evident. Intuitively, the modal base should contain facts that are relevant to water's boiling temperature, such as the earth's atmospheric pressure. So that (16) expresses that, given the earth's atmospheric pressure, it is a necessity that if this water boils, its temperature is 100° Celsius. If this were indeed the modal base, and the ordering source would contain the proposition that this water boils, quantification would range over worlds with the same atmospheric pressure as our world and in which this water boils. In all these worlds, the water's temperature will be 100° Celsius, and so (16) comes out true.

Two remarks are in order. First, I do not have a mechanism that determines for any given circumstantial modal the propositions that are in its modal base. It's very hard to give a definition of what a relevant proposition is. Clearly contextual information and world knowledge affect which propositions are in the modal base, but I do not have a theory on the way people understand circumstantial modality. I can just observe, as Kratzer does, that people usually do. So then how can we be sure that the proposition that the water doesn't boil is not in the modal base for (16)? We cannot be absolutely sure. But we do know that it is irrelevant to the boiling temperature of this water whether it boils in the actual world or not. To me, this makes it plausible that the fact that the water does not boil is not a modal base proposition. That I do not give a principled account of the selection of relevant facts is claimed by von Stechow et al. (2004) to make my analysis virtually empty. So be it.[12]

As an alternative to my analysis, von Stechow et al. propose to analyze anankastic conditionals as some sort of Lewis-counterfactuals, where the accessible worlds are worlds in which the internal antecedent is true and that are maximally similar to the actual world. The second remark I want to make is that though it may seem that under my analysis of (16) quantification ranges over the nearest worlds in which this water boils, this is not the case. The set of nearest worlds in which this water boils is not the same as the set of worlds where the earth's atmospheric pressure is 100.000 Pascal and this water boils. The modal in (16) quantifies over the latter set, which is much larger. In the next section I will present the counterfactual analysis of von Stechow et al. (2004), and point out why it ultimately fails.

4. Anankastic conditionals as counterfactuals

The counterfactual analysis of von Stechow et al. (2004) is based on the observation that anankastic conditionals can be paraphrased by means of purpose constructions (Sæbø 2001). That is, (21a) and (22a) are equivalent.

(21) a. If I want to be owner of North America, I must find the Golden Helmet.
b. To be owner of North America, I must find the Golden Helmet.

In addition, von Stechow et al. take anankastic conditionals to be *elliptical* (22a), and they assume that the underlying logical form of a sentence such as (21a) is as in (22b).

(22) a. If I want to be owner of North America, I must find the Golden Helmet, to do that.
b. I I want to be owner of North America, [I must [to be owner of North America] find the Golden Helmet]

According to von Stechow et al. the complex main clause of (22b) alone expresses the anankastic reading. The logical form of an anankastic conditional is thus *to* ϕ, *must* ψ. Following Bech (1957:320ff.) they further assume that purpose clauses have the same function as *if*-clauses: they determine the domain of quantification of the modal in the consequent. So for (21a) the covert *to*-clause provides the domain restriction, and not the overt *if*-clause. Von Stechow et al. argue that the *if*-clause only contributes a felicity condition. They claim that the *if*-clause of

[12] Recently, Nissenbaum (2005) formulated another problem for my analysis: it makes false prediction if the necessity modal in the consequent of the conditional is changed into a possibility modal. Unfortunately, space doesn't permit me to discuss this objection. See however von Fintel & Iatridou (2005b:18-19) for discussion and a possible solution.

an anankastic conditional isn't truly 'conditional', and compare this to other 'non-conditional' *if*-clauses, such as the following.

(23) If the train is leaving in 2 minutes, why are we standing around here talking? (von Stechow et al. 2004:11)

Semantically, von Stechow et al. do not analyze anankastic conditionals as pure Lewis counterfactuals, that are variably strict, but as some sort of strict counterfactuals. If anankastic conditionals were true counterfactuals, their semantics would be as in (24) (Lewis 1973).

(24) Lewis counterfactuals
To ϕ*, must* ψ is true in w iff
$\text{Sim}_w(\phi) \subseteq \psi$

But von Stechow et al. (2004) argue that anankastic conditionals cannot be true counterfactuals, because this would mean that Lewis' *would*-counterfactuals have the same truth conditions as anankastic conditionals. The contrast between (25a) and (25b) shows that this isn't borne out.

(25) a. If kangaroos had no tails, they would topple over. (Lewis 1973)
b. For kangaroos to have no tails, they would topple over.

The anankastic conditional in (25b) clearly makes a stronger statement than (25a): it means that the only way to achieve that kangaroos have no tails is that they topple over, which is false. The counterfactual in (25a) on the other hand is true.

According to von Stechow et al. the relation between the antecedent and the consequent of an anankastic conditional is stricter than the relation of a *would*-counterfactual. They propose that an anankastic conditional is true iff the set of most similar worlds where the antecedent is true is a subset of the set of *most similar* worlds where the consequent holds.

(26) Anankastic Conditionals as Counterfactuals
To ϕ*, must* ψ is true in w, iff
$\text{Sim}_w(\phi) \subseteq \text{Sim}_w(\psi)$

This analysis accounts for the falsity of (25b), since it is unlikely that any of the nearest worlds where kangaroos have no tails belongs to the nearest worlds where kangaroos topple over.

Note that under the counterfactual analysis, the Ruud van Nistelrooy problem vanishes. The worlds that the modal quantifies over are the nearest worlds in which the goal of the antecedent is realized. In Kratzer's terminology, the modal in the consequent is interpreted against an empty modal base (that gets restricted with your goal) and a totally realistic ordering source that orders the modal base worlds with respect to how similar they are to the world of evaluation. The modal in the consequent is thus no longer analyzed as a teleological modal, and so the ordering source no longer contains all your goals.

My main objection against the analysis of von Stechow et al. (2004) is that the restriction on the consequent in their final analysis is too strong. Whenever the internal antecedent is false in the actual world w, but the consequent is true, the analysis of von Stechow et al. predicts that the anankastic conditional is false, whereas such a conditional is intuitively true. Consider for example (27) and suppose that in w oxygen is present, but that combustion does not occur. Since oxygen being present is only a necessary condition, but not a *sufficient* condition for combustion to occur, oxygen may be present without combustion occurring. So (27) is true.

(27) If combustion is to occur, oxygen must be present.

According to von Stechow et al. (27) is true iff the nearest worlds in which combustion occurs are included in the nearest worlds in which oxygen is present. But if oxygen is present in the actual world, then the set of nearest worlds where oxygen is present is just the singleton set containing only the actual world: Sim_w(oxygen is present) = w. It follows that the nearest worlds where combustion occurs are not contained in the nearest worlds where oxygen is present, since we are evaluation (27) under the supposition that combustion does not occur in the actual world. So von Stechow et al. predict that (27) is false.

To conclude, the analysis of von Stechow et al. (2004) doesn't capture the meaning of anankastic conditionals correctly. Therefore it is better not to treat them as counterfactuals.

5. Analyzing sufficiency modals

5.1. Von Fintel & Iatridou's analysis

As said in the introduction, sufficiency modals consist of a necessity modal and an element like *only*. Not all modal auxiliaries can form a sufficiency modal. Only those modals that scope under negation are able to do so. Hence, *need* is fine in such a construction (28a), but *must* is odd (28b), because *need* scopes under negation, but *must* takes wide scope, cf. the contrast between (29a) and (29b).

(28) a. If you want to be a star, you only need to dress like one.
b. *If you want to be a star, you only must dress like one.

(29) a. Harry doesn't need to wear dress robes. (NEG $>$ modal)
b. Harry must not wear dress robes. (modal $>$ NEG)

von Fintel & Iatridou (2005a:10-14) provide examples from many languages that show that this restriction on modals holds cross linguistically.

The main challenge posed by sufficiency modals concerns compositionality. We would like to derive the meaning of (28a) from the meaning of the anankastic conditional (30) and *only*.

(30) If you want to be a star, you need to dress to like one.

But then we face the so-called *prejacent problem*.[13] In a nutshell, the problem is that (28a) does not imply (30). It is however commonly accepted that a proposition containing *only* implies its *prejacent* proposition. There is much debate[14] about whether this proposition is presupposed,

[13]The term *praeiacens* 'prejacent' was introduced by Medieval scholars. See Horn (1996) for references to the relevant sources.

[14]A recent contribution to the discusson is made by Geurts & van der Sandt (2004), who propose that the prejacent is entailed by the (weak existential) presuppositon and assertion of utterances containing *only* taken together. An alternative view is defended by van Rooij & Schulz (2005), who argue that the prejacent is implicated.

entailed or implicated, but it is commonly accepted that an utterance of (31a), among other things, conveys that (31b) is true.

(31) a. Only Harry likes Hermione.
b. Harry likes Hermione.

This isn't borne out for sufficiency modals. An utterance of (30) excludes the possibility of becoming a star without dressing like one, whereas (28a) is compatible with there being many ways of becoming a star.

To solve the prejacent problem, von Fintel & Iatridou (2005a:23-31) assume that *only* means something like *nothing other than* and that it is lexically decomposed into two elements, a negation and an existential quantifier, and that these two elements may take different scope positions. If they do, the scope of *only* is split. They argue that this is the case for sufficiency modals: the modal verb scopes under the negation, but over the existential quantifier.

(32) a. only have to VP
b. negation $>$ modal $>$ $\exists$ something other than $[\![\text{VP}]\!]$

Sufficiency modals are thus treated as an instance of a larger phenomenon which is known as 'negative split'. The literature on this phenomenon mainly focuses on German and Dutch negative determiners, for which it is argued that a lexical decomposition approach is needed to account for the available readings. For instance, Jacobs (1980) claims that the fact that (33) allows for a split reading can only be explained by assuming that at LF the German determiner *kein* decomposes into a negation and an existential quantifier and that the verb intervenes between those two parts of the determiner (but see de Swart 2000 for an alternative view).

(33) Hanna sucht kein Buch.
Hanna seeks no book.
'It is not the case that Hanna is seeking a book.'

Similarly, it seems that in the following Dutch sentence, given the interpretation indicated in (34), the negative quantifier *niets* 'nothing' splits into a negation that scopes over the possibility operator and an existential quantifier that scopes under it.

(34) Jan kan niets zien.
Jan can nothing see.
'Jan cannot see anything.'

Thus, with respect to sufficiency modals, von Fintel & Iatridou claim that the underlying form for sentence (28a) is as in (35).

(35) If you want to be a star, NEG have-to [you (do something more than dress like a star)]

The meaning that von Fintel & Iatridou assign (28a) follows directly from the form in (35). The modal quantifies over a set of worlds that is restricted by the *if*-clause. As with anankastic conditionals, the internal antecedent, i.e. the goal in the *if*-clause, is part of the restrictor. In constructions such as (28a) however, the negation outscopes the modal so that (28a) expresses that in not all of the worlds in which your goal of becoming a star is reached, you do something more than dressing like a star. In other words, (28a) is true iff the proposition that you do not do anything more than dress like a star is true in some worlds in which you become a star. Decomposition of *only* into a negation operator and a quantifier thus solves the prejacent problem (i.e. that (28a) does not imply (30)), because from the fact that you do not have to do anything more than dress like a star in order to become one, it does not follow that dressing like a star is the only way to become a star. In addition, the negative split of *only* also answers the question why only modals that scope under negation may figure in a sufficiency modal: scope splitting typically occurs across modals that scope under negation.

My main objection to the analysis of von Fintel & Iatridou is that it fails to predict that sufficiency modal constructions are transitive. The argument in (36) is judged valid by every native speaker of Dutch in my department that I consulted. The translation of (36) is as in (37).

(36) Als je een voldoende wilt halen voor logica, hoef je alleen maar te kunnen afleiden.
Als je wilt kunnen afleiden, hoef je alleen maar de vuistregels te kennen.
Dus, als je een voldoende wilt halen voor logica, hoef je alleen maar de vuistregels te kennen.

(37) If you want to pass logic, you only have to be able to do deductions.
If you want to be able to do deductions, you only have to know the rules of thumb.
Therefore, if you want to pass logic, you only have to know the rules of thumb.

But under the analysis of von Fintel & Iatridou (2005a) sufficiency modals are analyzed as existential quantifiers, for the first premise of (36) ranging over the set of worlds in which you pass logic. In (38) I give the argument schema that von Fintel & Iatridou assign to (36), where p is the proposition that you pass logic, q the proposition that are able to de deductions and r that you know the rules of thumb.[15] This argument scheme is invalid.

(38) $\exists w(w \in p \wedge w \in q)$
$\exists w(w \in q \wedge w \in r)$
$\therefore \exists w(w \in p \wedge w \in r)$

von Fintel & Iatridou's semantics doesn't predict transitivity because it doesn't assign a true 'sufficiency' meaning to the sentences under consideration. According to a true sufficiency semantics, the first premise of (36) conveys that you pass logic in *every* world in which you are able to do deductions, which captures the intuition that if being able to do deductions is a sufficient condition for passing logic, being able to do deductions is a *sure way* to pass the subject.[16]

However, von Fintel & Iatridou do not believe that the sentences in (36) express sufficient condition. They admit that, in their semantics, it doesn't follow from the first premise that being able to do deductions is by itself sufficient for passing logic, but they claim that this is the

[15] In order to keep things easy to read, I left the 'not anything more than'-part of von Fintel & Iatridou's analysis out of the translation. This part is irrelevant to the (in)validity of the argument scheme.

[16] Similar remarks can be found in (von Stechow 2004a), who also adopts the 'philosophical' notion of sufficient condition that says that if q is a sufficient condition for p, p follows from q. Von Stechow does not relate this to transitivity though.

correct analysis (von Fintel & Iatridou 2005a:31-32). To support their claim, they provide the following contrast.

(39) a. If you want to learn what Morris is working on you only have to go to the Stata Center.
b. You only have to go to the Stata Center and you will find out what Morris is working on.

Sentence (39b) is what von Fintel & Iatridou call a 'causal conjunction'. They take it that sufficiency modals may either be formed by combining an anankastic conditional with *only*, or by a causal conjunction construction and *only*. The difference between (39a) and (39b), according to von Fintel & Iatridou, is that (39a) is compatible with you going to the Stata Center without finding out what Morris is working on, while (39b) excludes this possibility. The reason is that in (39a) you'll have to take some obvious additional steps in order to find out what Morris is working on, for instance asking where Morris is. In (39b) on the other hand, going to the Stata Center will *immediately* cause you to learn what Morris is working on. In other words, (39b) does express 'pure' sufficient condition, but (39a) doesn't.

Von Fintel & Iatridou's argument fails to convince me. Whether or not there is a contrast between (39a) and (39b) doesn't seem to be related to the validity of (36), and the validity of (36) is an indisputable observational fact.

In order to derive the validity of (36), I propose that the modal in the first premise of (36) quantifies over *all* worlds in which you are able to do deductions. The corresponding argument scheme for (36) is given in (40), where p is again the proposition that you pass logic, q the proposition that you are able to do deductions and r that you know the rules of thumb. It is easy to see that (40) is valid.

(40) $\forall w(w \in q \rightarrow w \in p)$
$\forall w(w \in r \rightarrow w \in q)$
$\therefore \forall w(w \in r \rightarrow w \in p)$

Given this analysis, the relation of sufficient condition is the *inverse* of the necessary condition relation. Whereas the modal in the anankastic (41a) quantifies over worlds in which you pass logic, the modal in the consequent of (41b) quantifies over worlds in which you are able to do deductions.

(41) a. If you want to pass logic, you have to be able to do deductions.
$\forall w(w \in p \rightarrow w \in q)$
b. If you want to pass logic, you only have to be able to do deductions.
$\forall w(w \in q \rightarrow w \in p)$

Further note that under this semantics, sufficiency modals do no longer entail their prejacent proposition: (41b) does not entail (41a). So the prejacent problem is solved given a true 'sufficiency semantics'. And the solution does not appeal to negative split of *only*. In the next section I'll address the derivation of this meaning for sufficiency modals from the meaning of the modal and the contribution made by *only*.

5.2. Only *as a modal operator*

Since the medievals it is known that *only* and *all* are converses.[17] In modern times such an analysis is proposed by Horn (1996). That is, *Only B A* is semantically equivalent to *All A B*, hence *Only B A* is true iff $A \subseteq B$. If A and B are sets of individuals, (42a) expresses that the set of lawyers is contained in the set of crooks.

(42) a. Only crooks are lawyers.
b. All lawyers are crooks.
c. $\forall x(lawyer(x) \rightarrow crook(x))$

As far as I know, it is an open question what kinds of sets A and B may be. For instance, Beaver & Clark (2003:3) argue that *only* may take sets of events as its arguments.

(43) a. Sandy only feeds Fido [Nutrapup]$_{\mathrm{F}}$
b. $\forall e(feeding(s, f, e) \rightarrow feeding(s, f, n, e))$

Taking this one step further, A and B might even be sets of *possible worlds*, i.e. two propositions. Then, in case the arguments of *only* are sets of worlds, *only* is the inverse of a necessity modal.

Evidence for this position comes from Norwegian, in which it is possible to form a sufficiency modal construction with *only* and a bare verb (von Fintel & Iatridou 2005a:14, fn. 8).

(44) Hvis du vil til Oslo er det bare aa sette seg paa tooget.
if you want to Oslo is it only to sit Refl on the-train
'If you want to go to Oslo, you only have to get on a train.'

I take it that the modal meaning of (44) comes from the element *bare* 'only'.

A further argument for a modal *only* is that sentences such as (45a) seem to have a modal flavor. The sentence can for instance be interpreted as quantifying over 'typical' worlds, inhabited by 'typical' men. This modal flavor seems to be lacking for the prejacent (45b).

(45) a. Only men can drive.
b. Men can drive.

The main question to address in this section is of course how the meaning of sufficiency modals is derived. Since sufficiency modals do not entail their prejacent proposition, we cannot simply apply the meaning of *only* to the meaning of the corresponding anankastic conditional, in order to figure out the truth conditions for a given sufficiency modal. My point of departure is the following observation. Given that *only* is a modal operator, sufficiency modals contain, at surface form, two universal quantifiers over worlds. But the semantic representation of sufficiency modals intuitively only contains one necessity operator. So the semantic representation of (46a) is (46b).

(46) a. If you want to get good cheese, you only have to go to the North End.

[17] See for instance Petrus Hispanus' *Tractatus*. Critical edition by de Rijk (1972).

b. $\forall w(w \in \{\text{you go to the North End}\} \rightarrow w \in \{\text{you get good cheese}\})$

This suggests, that in sufficiency modals there is a phenomenon often called *modal concord* or modal harmony going on. We speak of modal concord when a clause contains two modal operators, but the meaning of that clause has to be construed using only one such operator (Halliday 1970; Lyons 1977:807). Examples of sentences that allow for a modal concord reading are.

(47) a. He may possibly have forgotten.
b. Bert must certainly be in Belgium.

Both (47a) and (47b) contain a modal auxiliary and a modal adverb, but yet, at least on one interpretation, the semantic representation contains only one modal operator. For instance, (47a) means that it is possible that he has forgotten, and not that it is possible that it is possible that he has forgotten. Similarly, the semantic representation of (47b) contains one necessity operator.

As far as I know, there hasn't been much research about the restrictions on modal concord. It does seem clear however that combinations of modals are harmonic (i) if both modals have the same force (possibility of necessity), and (ii) if they are both of the same type (for instance epistemic, or deontic). Thus (48b) and (48a) do not have a modal concord reading.

(48) a. He may certainly have forgotten.
b. Perhaps the pink dinosaur may leave.

Sentence (48a) doesn't allow for a modal concord reading because the two modals differ in force. By contrast, modal concord is disallowed for (48b) due to a mismatch in modal type, *perhaps* being epistemic and *may* being deontic.[18]

Now suppose that in sufficiency modals, there is modal harmony between *only* and the modal auxiliary in the consequent. This is why in (46b), the semantic representation of (46a), universal modal force is encoded only once. If this is correct, then it shouldn't be possible to form a sufficiency modal by combining *only* with a possibility operator, since this would exclude a modal concord reading by lack of agreement in modal force. It is indeed impossible for modals with existential force to yield a sufficiency reading (cf. von Fintel & Iatridou 2005a:10). Neither one of (49) and (50) express sufficient condition.

(49) If you want to get good cheese, you only may go to the North End.

(50) If you want to kiss Ruud van Nistelrooy, you can only take the A train.

Note that (50) expresses that taking the A train is the only way to satisfy your goal of kissing Ruud van Nistelrooy. In other words, (50) states that taking the A train is a *necessary* condition for kissing Ruud. So, (50) is an anankastic conditional.

Similarly, *should* and *ought* are bad in sufficiency modals, since these modals do not express full necessity, but rather something in between possibility and necessity, such that *should* p means that p is true in most accessible worlds. The next two sentences indeed do not express sufficient condition.

[18]Compare the remarks on modal concord by Geurts & Nouwen:16-20.

(51) a. If you want good cheese, you only ought to go to the North End.
b. If you want good cheese, you should only go to the North End.

Additionally, if there's modal concord going on in sufficiency modals, we may expect that there is a restriction on the type of modals that are harmonic with *only*. Epistemic modals should not be able to figure in sufficiency modal constructions. That is, under an epistemic interpretation of *have to*, (52) should be out. And it is.

(52) If Mary is to be happy, she only has to be in Rome.

So it seems that modals that occur in sufficiency modals have to be goal-oriented. But not all goal-oriented modals form such constructions. Only those that may scope under negation do. This I take to be independent of the phenomenon of modal concord though.

To sum up, it doesn't seem to be utterly implausible that the semantics of sufficiency modals is the result of something like modal concord. So let's assume that even though sufficiency modals contain two necessity operators (*only* and a modal auxiliary), only one of them is encoded in the semantic representation. Then how is this single modal operator to be interpreted? I assume that the arguments of this modal are determined partly by the modal verb in the consequent, so by *have to* in (53), and partly by *only*.

(53) If you want to get good cheese, you only have to go to the North End.

The modal operator in sufficiency modals takes what would be the arguments of the modal verb in an anankastic conditional and reverses them. In anankastic conditionals, as argued in section 3, the domain of the modal is restricted by the goal described in the antecedent. We may thus view anankastic conditionals of the form *if want* p, *then have to* q as expressing that all p-worlds are q worlds.

(54) a. If want p, have to q
b. $\forall w(w \in p \rightarrow w \in q)$

Only, being a reverse necessity modal, takes exactly these arguments, but reverses their relation: all q-worlds are p-worlds.

(55) a. If want p, only have to q
b. $\forall w(w \in q \rightarrow w \in p)$

Note once more that under this analysis sufficiency modals are the *mirror image* of anankastic conditionals, and that sufficiency modals are thus not predicted to entail their prejacent anankastic conditional.

To conclude, I have argued that sufficiency modals are transitive, and that this property falls out if they are analyzed as the mirror image of anankastic conditionals. This analysis also solves the prejacent problem. I have tried to make it plausible that the sufficiency reading results from modal harmony between the modal in the consequent, and *only*, which I have proposed to analyze as a modal operator. I cannot claim to have given a full theory, the modal concord story is to be considered a sketch of an idea. There is still a lot to be investigated, in particular on modal concord and its restrictions across different languages. This is something for future research. Another issue left to be addressed is why only those modal verbs that scope under negation are able to form a sufficiency modal. At the present moment, I cannot answer that question.

6. Conclusions

I have presented an analysis of anankastic conditionals that is able to deal with scenarios in which you have multiple consistent goals. Such scenarios can only be dealt with if anankastic interpretations are sensitive to the goal that is described in the antecedent only. I have argued that this can be made plausible if we adopt the dynamic view on ordering sources, according to which ordering sources are salient sets of propositions.

Additionally, I have proposed that sufficiency modals are, semantically, the mirror image of anankastic conditionals. The element *only* in such constructions has to be analyzed as a modal expression and the sufficiency reading results from modal harmony between *only* and the modal verb. The analysis presented predicts that sufficiency modals are transitive, and solves the prejacent problem.

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Janneke Huitink
Department of Philosophy
Radboud University Nijmegen
j.huitink@phil.ru.nl
http://www.phil.ru.nl/tfl/janneke

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Extraposition and the directionality of movement

Jiro Inaba

This paper deals with extraposition of relative clauses in English and German. Through the examination of data, it will be argued that extraposition in English is a syntactic movement with effects at LF, while it is a phonological operation in German. Based on the concept of directionality and optionality of movement, I will try to give an account for this hitherto unnoticed contrast between the two languages. Specifically, I propose that operations giving rise to non-canonical ordering of elements are more severely restricted, blocking movement of certain features. My analysis will be further confirmed by relevant data from Japanese.

1. Introduction

In this paper I discuss the extraposition of restrictive relative clauses in English and German. I will concentrate on the question of whether extraposition brings about LF-sensitive semantic effects, and try to account for the observed facts in both languages.

As a starting point, let us look at the examples in (1):

(1) a. Peter met [the woman [who likes to drink beer]] yesterday.
  b. Peter hat [die Frau [die gerne Bier trinkt]] getroffen.
  Peter has [the woman [who willingly beer drinks]] met
  'Peter met the woman who likes to drink beer.'

These sentences are regarded as so-called base structures where the relative clause and its antecedent are adjacent. When the relative clause is dislocated into the clause-final position, we get (2). Here and in the examples below, the trace is indicated just for convenience:

(2) a. Peter met [the woman *t*] yesterday [who likes to drink beer]
  b. Peter hat [die Frau *t*] getroffen [die gerne Bier trinkt]

They are the extraposed variants of (1). There are actually some competing analyses proposed in the literature for the extraposition of relative clauses. Typically, the discussion centers around whether there is a rightward movement involved or not. First of all, however, I want to emphasize that the relationship between the sentences in (1) and (2) must be clarified, whichever analysis one assumes for extraposition.

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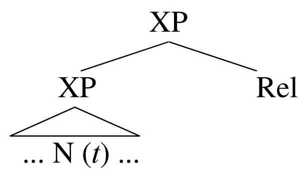
Before going into the discussion, I will just briefly comment on two competing analyses of extraposition. They are the so-called movement analysis and base-generation analysis.[1] The movement analysis (cf. e.g. Müller 1995, Büring & Hartmann 1997) starts from the structure in (1) and then assumes a rightward movement of the relative clause. The relative clause adjoins to some maximal projection, like VP, on the right side. This is shown in (3). Here the base position of the relative clause is indicated by the trace.

(3)



The base-generation analysis (cf. e.g. Culicover & Rochemont 1990, Kiss 2005), on the other hand, assumes the structure in (3) as a base structure; that is, the relative clause is base-generated in some adjoined position. It is specifically the representation (3) without the trace.

The discussion about these two analyses often centers around the problem of whether the extraposition obeys the general constraints on movement. Especially, the proponents of the base-generation analysis emphasize the fact that the relative clause extraposition is different from other types of movement, typically from *wh*-movement.[2] Because of this, it is claimed that the structure in (3) must be base-generated, that is, formed without movement.

It seems to me that this fact does not suffice to argue for the base-generation and against the movement of the extraposed relative clauses. Crucially, although the extraposition behaves differently from *wh*-movement, it nonetheless obeys some kind of locality constraint: it is just that the constraint is different from usual *wh*-movement. It then follows that whichever analysis is assumed, the locality constraint on extraposition must be captured. For that, the movement analysis must answer the question of how far the relative clause can move. Under the base-generation analysis, it is formulated as the question of how far the relative clause in (3) can modify deep into the adjoined-to category. This way, the locality constraint has to be described in both analyses. The observation that relative clause extraposition is subject to some other locality constraint than *wh*-movement therefore gives no positive evidence against the movement analysis for extraposition.

For reasons that will become clear later, I will adopt the movement analysis of the extraposition in the following discussion. But it should be noted that neither the locality problem nor the comparison of each analysis is the topic to be pursued here.

This paper is organized as follows. In the next two sections, relevant data from English and German will be presented. The focus will be placed on whether the extraposition has LF-relevant structural effects. In order to account for the observed facts, I will in section 4 introduce an idea of Fukui (1993) as a preliminary device for the following discussion. In

[1] In addition to these two major analyses mentioned in the text, there are still other proposals advocated in the literature: (i) crossing of branches (McCawley 1982), (ii) base generation of the 'extraposed' relative clause in a deeper position (Haider 1993, 1994), (iii) base generation of the whole constituent in the 'extraposed' position and leftward movement (copy and delete) of the 'non-extraposed' part (Kayne 1994, Wilder 1995), (iv) late insertion of the relative clause to the antecedent moved rightward 'covertly' (Fox & Nissenbaum 1999), (v) phonological approach (Truckenbrodt 1995), etc.

[2] Culicover & Rochemont (1990:23f), for example, report cases where the extraposition is less restricted (i) and more restricted (ii) than leftward A-bar movement.

i) a. [A man *t*] came into the room [that no one knew].
   b. *[With what color hair] did [a man *t*] come into the room?
ii) a. *It was believed [that John saw a picture *t* in the newspaper] by everyone [of his brother].
   b. [Who] did Mary say [that John saw a picture of *t* in the newspaper]?

(Similar German data are found in Müller 1995:216ff.) Culicover & Rochemont subsequently conclude that 'These contrasts pose problems for any account of the alternation [...] that seeks to represent it in terms of an antecedent-gap relation'. Cf. also Kiss (2005:286f).

section 5, a proposal will be made which should capture the different properties of extraposition in English and German. My analysis will then be supplemented by relevant data from Japanese given in the next section. Section 7 summarizes the discussion with some concluding remarks.

2. Extraposition in English

In this section, I will examine some empirical data on extraposition in English. As will be shown later, the analysis for English remains influential also for the analysis of extraposition in German. Based on some naïve intuition, extraposition of relative clause was occasionally regarded as something stylistic (cf. Chomsky 1986: 40f, Rochemont 1985: 13f, 50), especially because the application of this rule is optional. If the extraposition were to apply in some extra-syntactic component, it should have no effect on the truth-conditional semantics or the interpretation in the LF component. In order to examine this, we can contrast the sentences with and without extraposition. Let us first look at the sentences from Guéron (1980: 650), slightly modified here as (4) and (5):

(4) a. The only man (there) [who was interesting to talk to] was invited.
b.*The only man (there) *t* was invited [who was interesting to talk to].

(5) a.*The rule [which has the slightest effect on LF] hasn't been found yet.
b. The rule *t* hasn't been found yet [which has the slightest effect on LF].

As for (4), the extraposition itself is legitimate, as seen below (Guéron 1980: 650):

(6) Only those people *t* will be invited [who were interesting to talk to].

What is crucial for the grammaticality in (4) and (5) is licensing of polarity items. This is presumably a constraint which works in LF. At this point, I cannot go into the exact licensing condition of the polarity items in question. For our purpose, it is sufficient to establish that the extraposition here evidently has LF-sensitive effects. If extraposition were a PF operation, the difference in grammaticality in (4) and (5) could not be predicted.

There are also data concerning extraposition and binding. (7) is from Culicover & Rochemont (1990:37) and (8) is a constructed pair.

(7) a.*I sent her_i many gifts [that $Mary_i$ didn't like] last year.
b. I sent her_i many gifts *t* last year [that $Mary_i$ didn't like].

(8) a. I showed every $book_i$ to the professor [that wrote a review of it_i]
b.??I showed every $book_i$ to the professor *t* yesterday [that wrote a review of it_i]

Binding is a relationship that is sensitive to structural configuration. So both pairs of sentences clearly show that extraposition cannot be a PF phenomenon, but must be an operation that also brings about structural change.

Summarizing, we can safely say that the extraposition in English is not a mere phonological, but a syntactic operation which gives rise to semantic effects. It must be an operation taking place in the syntactic component.

3. Extraposition in German

Next, let us examine extraposition in German. Based on the analogy with English, it is often argued in the literature that relative clause extraposition in German cannot be just a stylistic phenomenon. For example, Müller (1995:221) says that 'a PF-related approach runs into problems given evidence to the effect that extraposition has syntactic consequences', such as binding. We already observed this fact for English. What does it concretely look like in German?

Kiss (2005) also asserts that extraposition, like scrambling, interacts with semantic interpretation. As evidence for this claim, he gives examples in (9) (p.323).[3] (10) is just a control case to show that (9b) is not excluded because of some locality constraint on extraposition. Although I have to admit that (10) is not accepted as natural by every speaker, the contrast to (9b) seems to be obvious.

(9) a. Wir haben niemandem$_i$ die Frage *t* gestellt [auf die
we have nobody$_i$ the question *t* asked [on which
er$_i$ sich vorbereitet hatte]
he$_i$ REFL prepared had]
'No one was asked the question that he expected.'
b.*Wir haben [die Frage *t*]$_j$ niemandem$_i$ *t*$_j$ gestellt [auf die er$_i$ sich vorbereitet hatte]

(10) Wir haben [die Frage *t*]$_i$ niemandem *t*$_i$ gestellt [die
we have [the question *t*]$_i$ nobody *t*$_i$ asked [which
jeder vorbereitet hatte]
everyone prepared had]
'No one was asked the question which was expected by everyone.'

On the basis of these data, Kiss (2005:330) reaches the conclusion that 'extraposition must not be treated as a phonological process.'[4]

However, upon closer scrutiny, these data turn out to be irrelevant to our concern whether extraposition has effects at LF or not. What is demonstrated by these examples is just that it is wrong to treat both extraposition and scrambling as mere stylistic operations (cf. footnote 4). It is indeed an already established fact in German syntax that scrambling does have semantic effects (cf. e.g. Frey 1993, Haider & Rosengren 1998). The sentences given in (9) are actually a minimal pair whereby (9a) is the so-called unmarked structure and (9b) a scrambled variant. When we concentrate on extraposition data, however, the situation seems rather to be the opposite from what Kiss argues. Let us look at the sentences in (11). They represent the base structures for (9), that is, the relative clause stands adjacent to the antecedent noun.

(11) a. Wir haben niemandem$_i$ die Frage [auf die er$_i$ sich vorbereitet hatte] gestellt.
b.*Wir haben die Frage [auf die er$_i$ sich vorbereitet hatte] niemandem$_i$ gestellt.

The comparison of (9) and (11) rather lends support to the view that relative clause extraposition does not influence the binding relation here: each of the extraposed relative

[3] Kiss (2005:327ff) demonstrates that the negative quantifier is a better candidate for examining the configurational relationship of the elements in question rather than a universal quantifier like *jeder* ('everyone'), which allows so-called dynamic binding across a sentential boundary.

[4] Kiss (2005:330) goes on: 'Phonological analyses of extraposition, i.e. analyses that assume that *extraposition (and similarly, scrambling)* is a stylistic operation that does not affect the syntactic structure, cannot explain the intricate interactions between extraposition and word order variation [...].' (emphasis by me, J.I.)

clauses in (9) is interpreted as if it is located in its base position (indicated there by the trace), as in (11).

In spite of the claims by the above-mentioned and other authors, there seems to be no decisive evidence that relative clause extraposition in German brings about LF-sensitive structural change. For example, Müller (1995) cites some literature for arguing against the PF treatment of extraposition in German, but no relevant examples are given there. There are, on the contrary, data that actually show the opposite. (12) demonstrates the same point as (9) and (11), that is, that extraposition does not influence the binding relation (cf. also Grewendorf 1988:315).

(12) a. Niemand [der auch nur das geringste von Marias$_i$ ausgefallenen
nobody [who also just the least of Mary's curious
Schlafgewohnheiten weiß] würde sie$_i$ vor Mittag anrufen.
sleeping-habit knows] would her before noon call
'No one who has the least idea of Mary's curious sleeping habit would call her before noon.'

b. Niemand *t* würde sie$_i$ vor Mittag anrufen [der auch nur das geringste von Marias$_i$ ausgefallenen Schlafgewohnheiten weiß].
(Fanselow 1987:203)

In spite of the lack of evidence, relative clause extraposition in German has thus been regarded as having LF-relevant effects. I believe it is not hard to understand why this incorrect thesis is adopted in the literature. One reason could be that it would enable a uniform analysis of so-called optional operations like scrambling. That is, both scrambling and extraposition are to be treated in the same component of the grammar. This is the case with the claim by Kiss (2005). Other authors just accept the results from the analyses of English, where relative clause extraposition clearly does have LF effects, as we have seen. This is presumably because the operation in question looks, at least superficially, very similar in the two languages. Another, and maybe the most crucial source of the misunderstanding resides in the very naming of extraposition. That is, because of the general SOV-character of German, sentential complements to the right of the clause-final verb are also regarded as 'extraposed' by many authors. Sentential complements and relative clauses are namely both elements that typically appear in the so-called extraposed position. They are, therefore, treated uniformly in most of the literature. See, for example, the contributions in Lutz & Pafel (1995) and Beerman et. al. (1997). Also Hubert Haider, who offers his original analysis for the phenomenon 'extraposition' in a series of his works, is of the opinion that both sentential complements and relative clauses in the 'extraposed position' are located in the structurally same position. Citing the examples (13), Haider (1993: 175), for instance, claims 'dass Relativ- und Objektsätze die gleiche *Extrapositionsposition* einnehmen' ('that relative and object sentences take up the same *extraposition position*'; emphasis by Haider).

(13) a. [Hunde füttern [die Hunger haben]] kann jeder
[dogs feed [which hunger have]] can everyone
'To feed dogs that are hungry, everyone can do that.'

b. [Zugegeben [dass er dort war]] hat er zwar nicht, aber ...
[admitted [that he there was]] has he indeed not, but ...
'Although he did not admit that he was there, ...'

However, it is very questionable whether these two sorts of subordinate clauses can be handled uniformly with respect to their postverbal positioning in German. Kiss (2005), for example, gives some data that demonstrate different behaviours of relative clauses and complement clauses in German. See also the discussion in Inaba (2003).

In opposition to the widespread, but wrongly entertained hypothesis that relative clause extraposition in German must be syntactic, I now want to claim that it is a phonological operation which does not feed LF. At this point, then, we are interested in what the German counterparts of the English data look like, where we observed the relevant structure-sensitive difference caused by extraposition. For the English examples like (8), we have already confirmed in (9) and (11) that extraposition in the comparable German sentences does not influence the binding relation. The German equivalents for the other English data in section 2 (cf. (4), (5) and (7)) are given below:

(14) a. dass der einzige Mann [der interessant war] eingeladen wurde
that the only man [who interesting was] invited was
b. dass der einzige Mann *t* eingeladen wurde [der interessant war]
'The only man who was interesting was invited.'

(15) a. Bis jetzt wurde die Regel [die den geringsten Effekt auf der
till now was the rule [which the least effect on the
LF hat] noch nicht gefunden.
LF has] yet not found
b. Bis jetzt wurde die Regel *t* noch nicht gefunden [die den geringsten Effekt auf der LF hat].
'Till now, the rule hasn't been found yet which has the slightest effect on LF.'

(16) a.*Ich habe ihr$_i$ mit Absicht viele Geschenke [die Maria$_i$ nicht
I have her with intention many presents [which Maria not
mag] geschickt.
likes] sent
b.*Ich habe ihr$_i$ mit Absicht viele Geschenke *t* geschickt [die Maria$_i$ nicht mag].
'I intentionally sent Mary many presents that she doesn't like.'

Somehow surprisingly, there is a clear contrast between the two languages with respect to the superficially similar operations in question.

Büring & Hartmann (1997:16), while assuming a syntactic movement analysis for extraposition, give the following data:

(17) a. weil wir jedem$_i$ [die Daten *t*] gegeben haben [die er$_i$
because we everybody [the data *t*] given have [which he
braucht]
needs]
'because we gave everybody the data that he needs'
b.*weil [ein Mann *t*] jedes Datum$_i$ kennt [der es$_i$ braucht]
because [a man *t*] every data knows [who it needs]
'because a man who needs it knows every piece of data'

Now, the grammaticality of these sentences corresponds to that of the following ones, where the extraposed relative clauses in (17) are located in the base position, respectively.

(18) a. weil wir jedem$_i$ die Daten [die er$_i$ braucht] gegeben haben
b.*weil ein Mann [der es$_i$ braucht] jedes Datum$_i$ kennt

Based on examples of the sort we saw in (9), which point to the same effect as (17) and (18), Büring & Hartmann (1997:17) claim, concerning interpretation, that 'it is the D-structure rather than S-structure position of the extraposed clauses which is decisive for its properties with respect to variable binding and coreference.' Although their analysis is based on syntactic adjunction movement that is not adopted here, I agree to their claim that the extraposed relative clause is interpreted in its base position. This idea of reconstruction amounts to saying that extraposition has no structural effects. Consequently, Büring & Hartmann's evaluation of the data supports my claim here. I just cannot share their syntactic movement analysis that tries to treat not only the relative clause in German but also the complement clause and the data in English in a uniform way.

It may be well worth noting in passing that the observation so far can give a clear answer to the problem of which of the analyses mentioned in section 1 is to be favoured for relative clause extraposition in German. The data show that the extraposed relative clause behaves, as far as the interpretation is concerned, as if it still stands in its base position. This total reconstruction effect seems to be at odds with the base-generation analysis: since under this analysis there is no trace or base position into which the extraposed relative clause could be reconstructed, the above-mentioned fact that the extraposed relative clause is interpreted in its base position is now hard to account for. This state of affairs thus poses a problem for the base-generation analysis like Kiss (2005) and the approach taken up by Hubert Haider in a series of his works.

Before closing this section, a brief comment is in order concerning the conditions on extraposition. The claim made here that extraposition in German is not syntactic should by no means be interpreted as asserting that it can be applied without restrictions. As pointed out in the literature and also mentioned in section 1 of this paper, it is subject to some locality constraint. Within the analysis presented here, there should be not structural, but phonological conditions imposed on the extraposition in German. Concerning this topic, I have proposed in Inaba (2003) the conditions that capture the relevant data. It is also demonstrated there that prevailing analyses based on structural conditions are empirically inadequate. For another approach to extraposition based on phonological issues, see Truckenbrodt (1995). In the present paper, I cannot, however, go into the details further.

As we have seen so far, the empirical data show that relative clause extraposition in German has no LF-relevant structural effects. Summarizing this section, we can say that it should be treated as a post-syntactic operation.[5]

4. Directionality and optionality of movement

So far we have established the difference between English and German with respect to the extraposition of relative clauses. As a preliminary step toward deducing this observation, I will in this section introduce an idea proposed by Fukui (1993).

[5] Chomsky (1995:324f,333) suggests that 'stylistic' or 'rearrangement' rules, as an example of which he mentions extraposition, 'may not really belong to the system we are considering here', namely 'the core computational properties'. Essentially the same point is made also in Chomsky (2000:108,144) and Chomsky (2005:20). (Cf., however, also Chomsky 2001:8.) One could interpret this line of thinking as a suggestion to treat extraposition as an operation outside the domain of the core syntax.

Now, some authors have reported possible functional or information-structural effects brought about by extraposition of restrictive relative clauses, e.g. Ziv & Cole (1974). (Cf. also Huck & Na 1990, Takami 1990, etc.) In this paper, I want to abstract away from these issues and to rather follow the idea of Rochemont (1985: 18f) that 'pragmatic' aspects of interpretation that do not affect the truth conditions of utterance are treated outside the domain of syntax, which seems to be the case with extraposition in German.

Fukui (1993: 401) claims, first of all, that 'the value for the head parameter is fixed locally'. Based on data such as (19) the parameter will be fixed as head-initial for English and head-final for Japanese.

(19) a. [$_{VP}$ [$_{V0}$ eat] [$_{XP}$ an apple]]
b. [$_{VP}$ [$_{XP}$ ringo-o] [$_{V0}$ taberu]]
[$_{VP}$ [$_{XP}$ apple-ACC] [$_{V0}$ eat]]

Fukui calls this parameter value 'canonical precedence relation' (CPR) and assumes that the relevant value can be extended to non-local domains. He now claims that the movement operations that destroy the CPR are costly, whereas those preserving the CPR are costless. This entails, for example, that in head initial languages, rightward operations are costless whereas leftward operations are costly. In head final languages, the situation should be the opposite. Some cases are listed in (20) and (21).

(20) In head initial languages (e.g. English)
- Costless: rightward movement (e.g. extraposition, HNPS)
- Costly: leftward movement (e.g. NP-movement, *wh*-movement)

(21) In head final languages (e.g. Japanese)
- Costless: leftward movement (e.g. scrambling)
- Costly: rightward movement (??)

Fukui now claims that costly operations require some driving force, like a Case feature or *wh*-feature in the case of leftward movements in English. In other words, costly operations can only be applied when they are forced.[6] Costless operations, on the other hand, do not need a driving force and are optional. This is the case, for example, with extraposition in English or scrambling in Japanese. They are actually optional in the sense that non-application of these operations does not render the sentence ungrammatical.

In his formulation, however, Fukui (1993) does not make clear how his notion of optionality of an operation corresponds with the semantic effects it should bring about at LF. Fukui maintains that scrambling in Japanese, for instance, is an optional and costless operation, preserving the CPR. But it is established that scrambling has semantic effects that are relevant at LF. One of many pieces of evidence is given below (Saito 1992:74f).

(22) a.?* Masao-ga [otagai$_i$-no sensei]-ni karera$_i$-o syookaisita.
Masao-NOM [each-other$_i$-GEN teacher]-DAT they$_i$-ACC introduced
'Masao introduced them$_i$ to each other's$_i$ teachers.'
b. Masao-ga <u>karera$_i$-o</u> [otagai$_i$-no sensei]-ni *t* syookaisita.

A similar point can be observed also for German, as in (9).

As has become clearer through the elucidation thus far, the 'optionality' as proposed by Fukui (1993) is rather a theory-internal concept: optional operations are those that are not feature-driven. At the same time, Fukui seems to also share the basic idea behind 'optionality' and to take those operations to be optional that need not take place for the grammaticality of the sentence. I want to follow this concept of optionality. Then, scrambling and extraposition are in principle typical examples of optional movements. Whether differences in interpretation at LF arise or not is another thing. Furthermore, I will adopt the basic intuition behind Fukui's CPR in the ensuing discussion. Crucially, I want to

[6] Fukui (1993:405ff) regards topicalization in English as an obligatory operation triggered by a spec-head agreement relation.

pursue the idea that the operations destroying the CPR are in a sense more severely restricted.

5. Proposal

With the observation and the discussion so far in mind, I now want to try to explain the difference between English and German with respect to the extraposition of relative clauses. The answer which might first come to mind will be to assume a difference as to the level on which extraposition applies. That is, extraposition applies in the overt syntax in English, whereas it applies at PF in German. But this statement is just a reformulation of the question. The point is how this difference can be deduced from other properties of each language.

First of all, I adopt the view that constituents are made up of features such as phonological or semantic features. Phonological features are sent to the PF component and are later realized as sound sequences. Semantic features are delivered to the LF component and are processed there for the sake of semantic interpretation. For the present discussion, it suffices just to distinguish between phonological features and the others, such as semantic or categorial features.

Both in English and German, extraposition is an operation that moves the constituent rightwards. This is schematized as in (23) and (24).

(23) ... V ... [$_{NP}$ ... N *t*] ... X Rel (Engl.)

(24) ... C ... [$_{NP}$ ... N *t*] ... V Rel (Germ.)

First of all, in English, extraposition does not destroy the canonical precedence relation of the language. Remember that this is why Fukui (1993) regards extraposition in English as costless. Now, I want to formulate this state of affairs in the following way: because of its SVO character, the right periphery is so to say 'open' in English and there exists no hindrance against rightward movement. Consequently, extraposition in English is in a sense 'unrestricted' apart from relevant locality conditions, which are not discussed here. The extraposed constituent still lands in the domain where the canonical linear relationship is retained. Speaking in terms of features, extraposition in English can move both the phonological and the other features freely so long as the locality constraint is observed. The movement of the semantic features, for example, now brings about semantic effects.

The situation in German is a little different, in spite of the superficial similarity to English. The crucial point is that extraposition in German moves beyond the sentence-final verb (or verbal complex), as shown in (24). Because the verb in German selects to the left and so to say 'closes off' the clause, extraposition locates the relative clause outside the domain in which it originally found itself. The extraposed relative is now on the right side of the verb and is not in the canonical direction of the language any more. Based on the reasoning by Fukui (1993), the extraposition here thus has to be regarded as a costly operation because it destroys the CPR. The application of extraposition, however, is actually optional in the relevant sense, as opposed to NP and *wh*-movement, which are triggered obligatorily by formal features.[7] Now, when such an optional or not-feature-driven operation takes place and, despite its optionality, lands in a position outside the canonical domain of the language, it would be natural to suppose that the operation in

[7] It must have become clear by now that extraposition in German is a counterexample to Fukui's (1993) claim in that it is costly but nonetheless optional in its application.

question is subject to severer restrictions than feature-driven or 'motivated' operations. Specifically, I would like to propose (25).

(25) In the case of 'optional' movements, only phonological features, but no semantic (and other) features can be moved along when the movement is 'costly'.

From this, it now follows that relative clause extraposition in German can take only phonological features along. This brings about the desired result that it shows a full reconstruction effect with respect to interpretation at LF.

Before closing this section, I want to point out the possibility that the notion of 'costly' in (25) can be expanded in a natural way beyond its original formulation by Fukui (1993). Remember from section 3 that the CPR is established first of all by virtue of local relationship between a head and its complement (cf. 19) and is then extended further to non-local domains. An operation is then judged as costless when the resulting linear positioning of the moved constituent conforms to the CPR thus extended beyond the original local domain. Now a question may arise how far this kind of extention can proceed. It seems implausible to suppose that it is unlimited: When the movement goes 'too far away', it should become impossible to check at all whether the CPR is observed. In such a case, the operation in question cannot be considered as conforming to the CPR and should consequently be evaluated as costly. Based on this reasoning, let us assume that a movement operation is also rendered costly when it crosses a certain domain boundary.

The next question is what category might count as the relevant domain within which a movement operation can comply with the CPR provided that the linearity constraint originally formulated (cf. section 3) is observed. As shown in (19), the local domain in which the value for the directionality parameter is set is the VP. Now it seems natural to assume that the CPR, starting from this VP domain, can be extended to the *v*P, TP and up to the CP domain, because these categories are the extended projections of V in the sense of Grimshaw (2000). That is, the CPR once established for the VP domain can be effective for the operations within the same clause or the CP domain. For the operations beyond the clausal boundary, the CPR cannot be satisfied anymore, and they are thus necessarily costly independently of the linear relationship brought about by the movement. The idea that CP possesses some special property, especially in terms of its seclusiveness, is consistent with the recent theoretical development based on the notion of phase in the minimalist model.

Returning to the case of German, we see that extraposition places a constituent to the right of the verb, which actually 'completes' the clause. Now, the clausal domain whereby the CPR comes into play seems to correspond partly to the so-called topological field, especially when the postverbal field ('Nachfeld') is at issue. Furthermore, it might be also promising to correlate the postverbal field with the phase in the minimalist sense; in particular, this field often shows some freezing effect (cf. e.g. Bayer 1996), which can be regarded as a typical characteristic of a phase. But for the time being, I want to leave this issue open for future research.

6. Long scrambling

Finally, I want to examine the hypothesis (25) against some other cases that seem relevant to the point here, taking up the so-called long distance scrambling in Japanese. An example is given in (26). Here, a constituent is extracted out of a finite clause (Yatabe 1993:173).

(26) [sono hon]-ni Ken-ga nazeka [Naomi-ga *t* sawatta to]
[that book]-DAT Ken-NOM somehow [Naomi-NOM *t* touched Comp]
omotte-iru
think
'Ken somehow thinks that Naomi touched the book.'

Now, let's check how this long scrambling interacts with interpretation. Saito (1989:191) gives the examples in (27).

(27) a. [Mary-ga [[John-ga [donohon]-o tosyokan-kara karidasita]
[Mary-NOM [[John-NOM [which book]-ACC library-from checked-out]
ka] siritagatteiru] koto
Q] want-to-know] fact
'the fact that Mary wants to know which book John checked out from the library'
b. [dono hon]-o [Mary-ga [[John-ga *t* tosyokan-kara karidasita] ka] siritagatteiru]
koto

Wh-phrases in Japanese must be interpreted under the scope of the complementizer *ka*. In order for this to be possible, the long scrambled element in the (b)-sentence must be interpreted in the position of the trace. Hence, Saito concludes that long scrambling in Japanese is a semantically empty operation. He also gives binding data to the same effect. Still another example is given in (28) with weak cross over data, which makes the same point (Yatabe 1993:174).

(28) a.*[sono$_i$/pro$_i$ chosha]-ga [Naomi-ga [dono hon]-ni -mo sawatta
[its/pro author]-NOM [Naomi-NOM [which book]-DAT -PART touched
to] omotte-iru
Comp] think
'Its$_i$ author thinks that Naomi touched every book$_i$.'
b.*[dono hon]-ni-mo [sono$_i$/pro$_i$ chosha]-ga [Naomi-ga *t* sawatta to omotte iru

Here too, long scrambling does not affect the LF semantics. This state of affairs is expressed by Saito (1992: 87), who asserts that '[long distance scrambling] does not, or at least need not, contribute to the interpretation of a sentence.'

Now, the long scrambling in Japanese seems to fulfil the precondition in (25). It is optional or not feature-driven, and it crosses a clause boundary, which renders it a costly operation. As predicted by the analysis here, long scrambling does not seem to bring about LF-relevant semantic effects and thus lends support to the proposal here.

German is said to allow only clause-internal scrambling. But Haider & Rosengren (1998) report a case of long scrambling out of a finite clause under certain conditions. This is called topic- or T-scrambling. I cannot go further into this area here, partly because the data are rather unclear. But if this T-scrambling is just a phonological operation, as claimed, for example, by Yoshida (2001), then it behaves parallel to the Japanese long scrambling.

7. Concluding remarks

In this paper, I first examined empirical data concerning the extraposition of restrictive relative clauses in English and German. In spite of the superficial similarity, extraposition in these languages exhibits a remarkable contrast that has somehow been ignored in the previous research: extraposition in English is a syntactic operation, while it is a phonological movement in German. In order to explain this difference, I have proposed that a certain domain becomes a kind of island for the optional movement of some features. I have tried to deduce the relevant domain on the basis of the concept of directionality. In the German case at hand, the final verb closes this domain, and the extraposition beyond it cannot take the relevant features along. Furthermore, I have suggested that this domain might somehow be identified with the phase in the minimalist sense, which could furthermore be correlated with the topological field of the German clause structure. The analysis advocated here was then tested against long distance scrambling in Japanese. How the proposal in this paper could get theoretically more refined, especially in relation to the notion of phase, I want to pursue at some other occasion.

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Jiro Inaba
University of Frankfurt am Main
inaba@lingua.uni-frankfurt.de

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Graduality and closedness in consonantal phonotactics
—a perceptually grounded approach

Zoltán Kiss

The paper suggests that the phonotactics of languages often displays gradual, non-categorical patterns, in the sense that not all possible combinations are grammatical along the various dimensions of segmental contrast. The graduality of phonotactics is a property that will be shown to be better explained by models that employ perception-based functional principles, such as perception cue licensing according to relative context, and phonotactic closedness. The phonotactic space of a language will be claimed to be defined by hierarchical perceptual difficulty scales that linearly order the various syntagmatic relations a segment can enter into. All existing items (marked as well as unmarked—in the perceptual as well as statistical sense) in the language are accounted for in this model, what is more, their place in the phonotactic space is also predicted. In this model, thus, the notions 'exceptional' and 'accidental gap' are meaningless. Where exactly a language draws the line between a contrast that it makes use of and those that it does not, is arbitrary, but if a perception-wise marked cluster is used in a language, then our model will predict that all the other clusters that are perceptually better cued will also occur in the language, in accordance with the principle of phonotactic closedness. Phonotactic graduality and closedness will be demonstrated in the consonantal phonotactics of languages that are often referred to as possessing 'complicated' phonotactics, Hungarian, English, and Slovak.

1. *Introduction: the graduality of 'complicated' phonotactic systems*

The precise explanation of the consonantal phonotactic patterns of languages that display what is sometimes referred to as 'complicated' syntagmatic sequences has proven to be a serious problem for traditional, representational phonological theories. These languages include, among numerous others, Hungarian, Slovak, Polish, and English. The phonotactics of these languages can be characterized by the property of *graduality*. This means that certain consonantal clusters are fairly common (the statistical aspect of which is that their type frequency is high), whereas others are rare (their type frequency is low), and other—otherwise theoretically possible—combinations do not exist at all. In this paper, I would like to approach the phonotactics of

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these languages from a perceptually grounded point of view, which I claim to be able to avoid the difficulties that the representational models necessarily have to face. The central notion of the paper is that segmental contrast prefers to occur in environments where its perceptibility is cued the most robustly (cf. Steriade 1997; 1999). Less favourable environments in this respect will result in the contrast being less perceptible, which may even lead to its absolute loss (i.e., neutralization). Segmental contrasts can thus be placed on a perception-grounded hierarchy, one end of which represents the best context(s) for the perception of the given contrast, the other end the worst ones. The relevant consonant clusters will fill in this scale according to how robustly the contrast in question is cued. The model will predict the graduality of the distribution of these clusters: the more common clusters will occur at the better cued position of the scale, while the rare ones at the badly cued positions.

The phonotactics of a language can thus be claimed to be a space defined by these perceptual difficulty hierarchies that linearly order the various syntagmatic relations a segment can enter into. As an example, let us consider one such slice of the phonotactic space of Hungarian consonant clusters, the distribution of palatal stops before labial/dental consonants and vowels in intervocalic position in monomorphemic words.[1]

(1) The distribution of palatal stops before labial/dental Cs, and Vs (intervocalic position) (cf. Siptár & Törkenczy 2000:129)

	C$_2$=labial	C$_2$=dental
before Vs:	**c**V (*ku**tya***), **ɟ**V (*bo**gyó***)	**c**V (*ba**tyu***), **ɟ**V (*ra**gya***)
before approximants:	**cʋ** (*ko**tyv**aszt*), **ɟʋ** (*fe**gyv**er*)	**cl** (*tro**tyl**i*$_1$), **ɟl** (*ka**gyl**ó*)
before nasals:	**cm** (*tru**tym**ó*), **ɟm** (*ha**gym**a*)	*cn, *ɟn
before fricatives:	**cf** (*fi**tyf**iritty*$_2$)	*cs, **ɟz** (*je**gyz**ő*$_2$)
before stops:	**cp** (*pi**typ**ang*$_2$), **ɟb** (*bu**gyb**orék*$_1$)	*ct, *ɟd

Glosses: *kutya* ‘dog’, *bogyó* ‘berry’, *batyu* ‘bandle’, *ragya* ‘pockmark’, *kotyvaszt* ‘concoct’, *fegyver* ‘weapon’, *trotyli* ‘tramp’, *kagyló* ‘shell’, *trutymó* ‘suspicious substance’, *hagyma* ‘onion’, *fityfiritty* ‘imp’, *jegyző* ‘town clerk’, *pitypang* ‘dandelion’, *bugyborék* ‘bubble’.

The table tells us that not all combinations are possible. The contrast of a palatal stop is *categorically neutralized* (that is, no words occur) before dental nasals and dental stops. Also, the voiceless palatal stop does not occur before a voiceless dental fricative. Moreover, as indicated by the type frequency numbers, some clusters are *marked* frequency-wise, as they occur in but a handful of words (this we may call *partial neutralization*).

Traditional phonological theories, making use of such representational devices as distinctive features, gross natural classes, prosodic constituents (like the syllable), regardless of whether they are derivational, principles/parameters or constraint-based, face difficulties in giving a precise account of generalizations, like those tabulated in Table (1). For example, a syllable-based

[1] An independent phonotactic constraint does not allow two obstruents with different voicing to stand next to each other in Hungarian. That is, only voiceless – voiceless, and voiced – voiced sequences are allowed. In the first row, I also included examples of the palatal stops being followed by a vowel. The subscript numbers in some cases indicate that the cluster in question only occurs in one or two words, that is, its type frequency is low. I’m using IPA symbols (they are in bold face).

model must declare that the clusters in (1) are coda–onset clusters (they cannot be complex or branching onsets as they cannot stand word-initially, their sonority profile does not make them a suitable branching onset; they cannot be complex codas either, because they do not occur word-finally, or before other consonants). If it is only Prosodic Licensing that is the driving force behind the distribution of segments, than we cannot explain why some clusters are grammatical, why others are not well-formed, and why others are marginal. More concretely, if we allow for palatals in the coda, then our model will *overgenerate*, as it does not account for the lack of palatal–nasal, palatal–stop clusters (their ungrammaticality in Hungarian will have to be regarded as accidental, the non-existent clusters as *accidental gaps*).[2] If we do not allow for palatals in the coda, then the situation is reversed: our model will *undergenerate*: the existing palatal–consonant clusters will have to be treated as *exceptions*. The syllable-based models will have to resort to additional devices to account for these regularities, most of which are rather arbitrary. They include 'Syllable Contact Laws' (Vennemann 1988, Clements 1990), 'inter-constituent government' (Kaye et al. 1990, Rice 1992, Harris 1994), just to name but a few.[3] Note further that the so-called *context-independent*, or absolute *universal markedness* considerations cannot play a role in the explanation of the distributional asymmetry in (1) either. According to Maddieson (1984:32), in the UPSID database, more languages have consonants in the coronal area than in the labial one, in this 'universal' sense then labials are more marked. The problem is that in the case of (1), the clusters whose second member is a dental are actually the ungrammatical, missing ones. What is thus universally marked proves to be unmarked in Hungarian.

To sum up the discussion so far, we have seen that languages with consonant clusters of the 'complicated' kind, like Hungarian, cannot precisely be accounted for by traditional (such as syllable-based) phonological models. In the case of languages with 'simple' phonotactics,[4] those theories are more successful because a given contrast (in a given dimension of the phonotactic space) either always occurs, or never does so. Such a phonotactic space can be represented by a rectangle shape, as in (2a). Since the syllable-based models aim at a simple model, they are successful at capturing a simple (i.e., non-gradual) phonotactic space. In the case of a more complicated phonotactic space, displaying a gradual, or 'terraced' shape (2b), the simplicity-oriented model can either partially cover the gradual space (hence leave out parts, which will be treated as exceptions) or will also include areas that do not belong to the original space (those will be treated as accidental gaps); both cases are shown by the interrupted lines in (2c).[5]

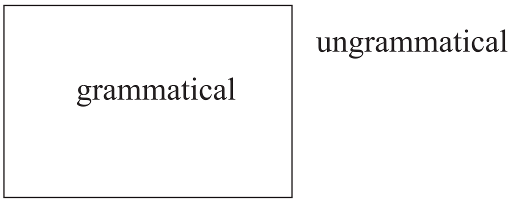
[2] The term 'accidental' here does *not* mean the accidentalness represented by the (well-known example of the) non-existent word *blick* in the English lexicon, which is a possible word phonotactically (as it contains licit sequences, occurring in existing words), it just happens to be a nonsense word in the language.

[3] For example, Törkenczy (1994:384) as well as Siptár & Törkenczy (2000) introduce the Antipalatal Condition, claiming that '[**c**, **ɟ**, **ɲ**] make an interconstituent cluster ill-formed irrespective of whether they occur in the first or the second position' (Siptár & Törkenczy *op.cit.*:137); clearly, they have to treat existing words like *pitypang* 'dandelion', *pletyka* 'rumour', etc., as exceptional, not to mention the fact that the condition against palatals must be introduced *in addition to* the general (trans)syllable-building algorithm, which obviously weakens its explanatory force.

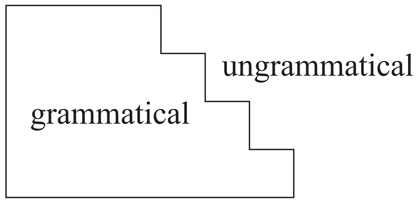
[4] They include languages where a consonant may only occur before a vowel (CV languages), or what are referred to as the 'Prince languages', where only clusters of the homorganic nasal–stop kind or geminates occur.

[5] For arguments and further illustrations of the representation of the phonotactic space as a sum of two-dimensional coordinate systems, see Rebrus & Trón (2002).

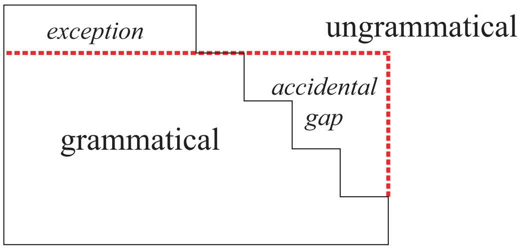
(2) a. ‘simple’ phonotactics



b. ‘complicated’ phonotactics

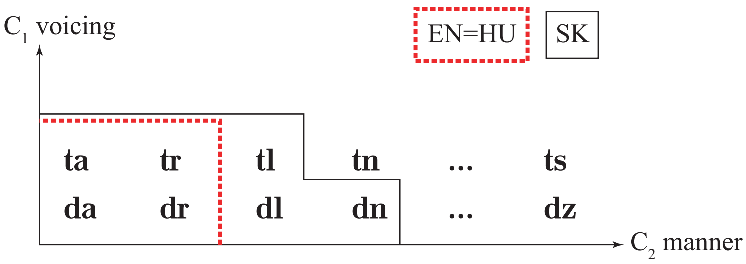


c. the simplification of ‘complicated’ phonotactics



As an example how a simplicity-oriented model may fail in some cases, let us consider the voicing contrast of coronal stops in word-initial position in three languages, English, Hungarian, and Slovak. We may represent this chunk of the consonantal phonotactic space in a two-dimensional coordinate system, the x-axis of which exhibits the manner of the second consonant, the y axis the voicing of the first consonant (cf. (3)).[6]

(3) Word-initial alveolar stops+coronal C clusters



We can see that English and Hungarian impose the same constraint on these clusters, which can be defined as an ‘antihomorganic constraint’:[7] the segments in a word-initial branching onset may not share the same place. This will allow **tr** and **dr** (supposing that the stops are alveolar and the **r** is post-alveolar), but exclude all the other alveolar–alveolar clusters. We can see that this general constraint covers a rectangle-shaped area of the phonotactic space and is successful at accounting for the grammatical vs. ungrammatical sequences, because this given dimension of the English/Hungarian phonotactic space can also be represented as having a rectangle shape (in other words: all the relevant—ungrammatical—clusters are excluded by the antihomorganic constraint). However, the same dimension in Slovak cannot be accounted for by this constraint, as even though in this language *some* of the word-initial coronal–coronal

[6] On the ordering of the segments along the two axes, see the discussion in the following section.
[7] Cf., among others, Harris (1990:277ff, 1994:171), and Brockhaus (1990:282).

clusters are ungrammatical, some of them are not, there *are* words with initial **tl**, **dl** and **dn**. Furthermore, the asymmetry of **dn** vs. ***tn** still awaits explanation. The terraced shape of this chunk of the Slovak phonotactic space thus cannot be covered by the antihomorganic constraint, the use of which would necessarily introduce the ‘accidental gap /exceptionality’ fallacy again.

What is thus clearly needed is a model that precisely predicts the graduality of the phonotactic space of languages with ‘complicated’ phonotactics. In such a model, both the unmarked clusters as well as the marked (rare) ones are predicted to fill the phonotactic space, and the notions ‘accidental gap’ and ‘exceptionality’ will not have to be evoked. It is this model the discussion of which I will turn to in the remaining parts of the paper.

2. *Functionalist principles in phonology: contrast, segmental markedness and perceptual robustness*

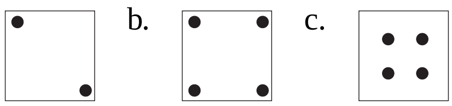
As it has long been established by functionalist accounts, phonological systems of languages are claimed to be shaped by the interaction of the following (partially conflicting) factors.[8]

(4) a. contrast creation;
    b. maximizing the number of contrasts;
    c. maximizing the perceptual distinctiveness of contrasts;
    d. minimizing the articulatory effort.

The first of these principles is responsible for the creation of contrastive cognitive categories; by maximizing the number of contrastive categories (4b), the expressiveness of communication is enhanced by building up a substantial lexicon of categories. Principle (4c) accounts for the salience of the distinct basic categorical elements — according to it, categories must have acoustic properties that make them maximally salient from each other perceptually. The last principle secures that the actual implementation (articulation) of the categories is to be carried out using as little energy as possible.

As Flemming (2004) shows, principle (4c) is inherently in conflict with both principles b. and d. Provided that in the two-dimensional phonological space (see the (5a)), there are two distinct categories (so there is only one contrast), and the two are perceptually well distinguishable (they occupy the opposing corners of this space — thus satisfying principle (4c) this way), principle (4b) is trivially violated, as well as (4d), as the two categories are far from each other in articulatory terms, too. If we try to satisfy principle (4b) by increasing the number of contrast, cf. (5b), the requirement for perceptual distinctiveness is violated, as some categories will necessarily be closer to each other. In (5b), articulation is still energy-consuming; a way to minimize articulatory effort is to bring the categories closer to each other (they are thus produced at a similar place, for example); however, this sacrifices their perceptual salience (5c).

(5) a. b. c.



[8] Cf. Zipf (1949), Liljencrants & Lindblom (1972), Diver (1979), Flemming (1996; 2004), Rebrus & Trón (2002).

It seems clear then that in a functional theory of contrast, some weighting of potentially conflicting principles is inevitable and the weighing may well be language-specific.[9]

Segmental markedness as described in most works on phonology is usually defined in absolute, universal and context-independent terms. In frameworks like those, a (contrastive) segment is said to be marked if it occurs in a relatively small number of languages. A typical example for this approach is Maddieson (1984). For example, since all languages have stops (as opposed to, say, liquids), stops are universally and typologically unmarked. Statements like these form the basis of implicational universals, like, for example, that the presence of a liquid in a language necessarily implies the existence of a stop, too. However, as I will argue below, segmental markedness is more meaningful if it is defined in terms of *relative contrast, context* and *perceptual factors*.

2.1. Segmental markedness is relational

In absolute terms, the vowel **ɯ** for instance is marked, because non-low back vowels are generally rounded (93.5% of the languages in Maddieson's (1984:124) database); also, within a language, if it has a contrastive unrounded back **ɯ**, it must generally have its rounded pair **u**, too; the reverse, however, does not usually stand.[10] The perceptual account of the universal markedness of **ɯ** can be briefly summarized as follows. It is a well-know fact that if a langauge has five contrastive vowels, they are **i, e, a, o** and **u**. This is said to be an optimal system because it fills the available phonological/acoustic space the most optimally. Considering the horizontal dimension, we can say that the front – back contrast is along the line of the vowels' formant 2 values (**i** has the highest F2, **u** the lowest). It is also a well-established phonetic fact that rounding lowers F2, and so a rounded high vowel is maximally distinct from its front unrounded counterpart in F2.

Obviously then, the occurrence of an unrounded back vowel (or a rounded front vowel) in this system makes it suboptimal. What must be emphasized though is that the suboptimality of the hypothetical {**i e a o ɯ u**} system is only due to the perceptual markedness of **ɯ** *with respect to* **u** because their F2 values will be very similar. If we relate **ɯ** to **i**, their F2 values will be on the two ends of the F2 scale, and this way then **ɯ** will not be marked since **i** and **ɯ** are perceptually distinct. It is thus not **ɯ** in itself that is marked but its *contrast* with **u**; as Flemming (2004) puts it, '[the] markedness of sounds is indeed dependent on the contrasts that they enter into.'[11]

[9]This is perhaps why functional phonological approaches are usually shaped in Optimality Theoretic terms.

[10]Japanese is exceptional in this respect with an {**i e a o ɯ**} vowel inventory. Here, effort minimization is preferred over maximal perceptibility.

[11]Flemming (*ibid.*) also shows that a segment that is universally/typologically marked may well be unmarked within a system which does not make use of a particular contrast. For example, in the back – front dimension, high central **ɨ** is universally marked, but in languages that do not contrast back – front vowels (the so-called 'vertical' vowel systems, like Kabardian, Marshallese), the vowels that actually occur have a central quality (like **ɨ** does). Crucially, no 'vertical' languages exist with a {**i e a**} or {**u o a**} inventory.

2.2. Segmental markedness is contextual

A contrast may well be perceptually unmarked in a given context, yet the same contrast is marked in another. In other words, segmental markedness must also be related to the context it occurs in: certain positions favour segmental contrast because in those particular contexts the contrast is well-cued, while in others the same contrast is less salient. This idea is expressed in Steriade's *Licensing by Cue* principle.

(6) *Licensing by Cue* (Steriade 1999:4)

The likelihood that distinctive values of the feature F will occur in a given context is a function of the relative perceptability of the F-contrast in that context.

Let us briefly consider the salience of the voicing of stops in various environments (based on Steriade 1997), using hypothetical examples.

(7) Perception cues for the voicing of stops in various environments

a. (i) V_1__V_2: ***a**p**a**, **a**b**a***; (ii) V_1__son: ***apra**, **abra***
cues: voicing of closure; length of closure; length of V_1; F1 of V_1; length/strength of release; VOT value; F0 and F1 of V_2
b. (i) #__: ***p**a, **b**a, **p**ra, **b**ra*; (ii) obstr__son: *as**p**a, as**b**a, as**p**ra, as**b**ra*
cues: voicing of closure; length of closure; length/strength of release; VOT value; F0 and F1 of V_2
c. V__#: ***ap**, **ab***; cues: voicing of closure; length of closure; length of V; length/strength of release
d. V__obstr: ***ap**sa, **ab**sa*; cues: voicing of closure; length of closure; length of V_1; F1 values of V_1
e. obstr__obstr: *as**p**ta, as**b**ta*; cues: voicing of closure; length of closure
f. obstr__#: *as**p**, as**b***; cues: voicing of closure; length of closure
g. #__obstr: ***p**sa, **b**sa*; cues: voicing of closure; length of closure

(7a) is the context which provides the most cues for the contrast in question; as we go down in this list to (7e–g), the number of the cues is less and less. In this sense then, the hypothetical contrast of *apa* – *aba* is less marked (i.e., less difficult to perceive) than that of *psa* – *bsa*. According to the principle of Licensing by Cue, the *psa* – *bsa* contrast is not likely to occur; it is in fact in the badly cued contexts where we expect the neutralization of the contrast. This state of affairs has two important consequences. The first is that phonotactic patterns can be related to perceptual markedness. Still remaining with our hypothetical example, the fact that in a language there are no forms with a word-initial **bs** cluster (there are only word-initial **ps** clusters) is a direct upshot of the fact that **b** in this position is not salient perceptually—hence the neutralization of the **p** – **b** contrast.

The other important result of this approach is that markedness is based on context. Specific categories need specific positions to be perceptually salient. The place contrast of stops, for example, is best perceived when the stop is before a vowel, but less salient before another stop. Retroflexion, however, is best perceived if the retroflex stop *follows* a vowel; in prevocalic position, the contrast between retroflex stops tends to be neutralized (cf. Steriade 1999). Phonological patterning is thus sensitive to various dimensions: one category (contrast) in one position may be perceptually unmarked, but the same contrast may well be marked when considering another dimension (such as position).

3. Phonotactic Closedness

The list in (7) can thus be translated into a perceptual difficulty (markedness) scale of a given segmental contrast (**p – b**). Markedness scales like (7), together with the principle of Licensing by Cue, predict what contrast in what environment is likely (unmarked) and in what context it is likely to be neutralized. Importantly, these scales *predict the typology of phonotactic patterns found in languages*: which patterns are possible and which are most unlikely. The difficulty scale based on (7) is shown in (8), where '$A > B$' means that A is a more marked/difficult position perceptually for the given contrast than B, because it provides less/worse perception cues.[12]

(8) Perceptual difficulty scale for the voicing contrast of obstruents:

$\{$O__O , O__#, #__O$\}$ > V__O > V__# > $\{$#__, O__R$\}$ > V__R

'more difficult' ← 'less difficult'

As Steriade (1997:17f) shows, one type of voicing neutralization pattern (represented by Polish, Lithuanian, Sanskrit, etc.) corresponds with the scale in (8).

(9) One voicing neutralization pattern:

a. The voicing of obstruents is neutralized word finally (only a voiceless obstruent can occur).
Lith.: *daug* **dauk** 'much', *kad* **kat** 'that'

b. The voicing of obstruents is neutralized before obstruents (there is regressive voicing assimilation).
Lith.: *atgal* **-dg-** 'back', *degti* **-kt-** 'burn-inf.'

c. Obstruents are distinctively voiced before sonorants (vowels/son. Cs).
Lith.: *aukle* **-kl-** 'governess', *auglingas* **-gl-** 'fruitful', *silpnas* **-pn-** 'weak', *skobnis* **-bn-** 'morning'

The table in (10) displays examples for the patterns of the voicing neutralization of stops (taken from Steriade 1997:9).

[12] O = any obstruent; R = any sonorant.

(10)

	#__O, O__#	R__O	R__#	#__R	R__R
Totontepec Mixe					+
Lithuanian				+	+
French			+	+	+
Shilha		+	+	+	+
Khasi	+	+	+	+	+

fewer/weaker cues ←——————→ more/stronger cues
(more marked environment) (less marked env.)

The + indicates that the contrast is available in the given language in the specific environment. The importance of the table above lies in its empty cells: as Steriade says, ‘no language surveyed maintains the voicing contrast in a [perceptually] less informative context, *unless it also does so in the more informative contexts*’ (*ibid.*; emphasis mine). Thus, for example, no language neutralizes the voicing of stops word finally after a vowel without *also* neutralizing medially in the V__obstruent context.

Difficulty hierarchies like (8) can therefore be claimed to set the boundaries of phonological systems, more specifically, that of phonotactic patterns. They delimit what segment combinations can occur in which positions. It can be argued that if a contrast occurs in a given context, then the same contrast will necessarily occur in another context *which provides better perception cues for the contrast*; in simple terms: the existence of the ‘more difficult’ implies the existence of the ‘less difficult’. This idea is phrased in the principle of Phonotactic Closedness.

(11) *Phonotactic Closedness* (cf. Rebrus & Trón 2002:21)
If a given contrast occurs in a perceptually marked environment (one providing few/weak cues), it will also occur in a perceptually less marked environment (with more/better cues). Therefore, the set of segmental contrasts is closed with respect to positional markedness, towards the unmarked cases: the more marked implies the presence of the less marked.

Phonotactic Closedness predicts systems like (12a), but no systems like (12b).[13]

(12) a.

	T–D
#__O (*psa–bsa*)	∗
O__# (*spa–sba*)	∗
R__O (*apta–abta*)	✓
R__# (*ap–ab*)	✓
__R (*pa–ba*)	✓
R__R (*apa–aba*)	✓

b.

	T–D
#__O (*psa–bsa*)	∗
O__# (*spa–sba*)	∗
R__O (*apta–abta*)	✓
R__# (*ap–ab*)	$\boxed{*}$
__R (*pa–ba*)	✓
R__R (*apa–aba*)	✓

The figures in (12) illustrate the voicing contrast of stops in specific environments; the environments are hierarchically ordered in terms of perceptual difficulty (cf. (7) and (8)), the intersonorant context (R__R) being the least marked environment for the voicing contrast. The tick mark

[13]T = any voiceless stop; D = any voiced stop.

indicates that the contrast in question is attested, while the asterisk shows that the contrast is missing (thus only the unmarked occurs, the voiceless stop). (12b) violates Phonotactic Closedness because there is **p** – **b** contrast between a sonorant and an obstruent (R__O), but no contrast after a sonorant word-finally (R__#)—a better cued environment than the other. Closedness predicts that *there cannot be gaps between existing sequences* in hierarchies like (12).

Closedness is a consequence of the functional principles introduced in (4): the ordered markedness hierarchies define a phonotactic space. This phonotactic space is filled with lexical items in a way that they prefer to occur in a perceptually favourable context so that the identification of the contrast may be easier ('maximize perceptibility'). This means that a system, in order to maximize the number of contrasts, only uses a particular context provided that other, perceptually more favourable contexts are also allowed, since in the reverse case, the last two functionalist principles in (4) would be violated.

3.1. Phonotactic Closedness in Hungarian

The phonotactic space as defined by Closedness can thus be represented as a multidimensional space, in which the markedness of sequences increases along each dimension. In a two-dimensional space, this can be illustrated by a coordinate system where the markedness of the items increases as we move from the origin. Returning to our initial example in (1), the relevant phonotactic space of the Hungarian lexicon is shown in (13), where we see the place of the voiceless palatal stop in the phonotactic space with respect to the manner and place dimensions of the following consonant.

(13) manner of C following **c**

__stop	$\mathbf{cp}_2$	$\boxed{\text{*}\mathbf{ct}}$
__fric.	$\mathbf{cf}_2$	$\boxed{\text{*}\mathbf{cs}}$
__nasal	**cm**	$\boxed{\text{*}\mathbf{cn}}$
__approx.	**cʋ**	$\mathbf{cl}_1$
__V	**c**V	**c**V
	labial	dental

place of C following **c**

The vertical axis is the ordered perceptual hierarchy of the manner of the consonants following the voiceless stop. The horizontal axis is the ordered perceptual scale of the place of the consonants after the voiceless palatal stop. According to the perceptual properties of these positions, the ones close to the origin are the ones providing the best cues for the voiceless palatal stop. As predicted by Phonotactic Closedness and Licensing By Cue, forms like *kutya* 'dog', *batyu* 'bag', that is the ones where **c** stands before a vowel, will be more common, more frequent, hence unmarked; while those with the palatal stop followed by say an approximant will be rare, or nonexistent. Closedness declares that the phonotactic space is closed from below; there are no gaps between the existing forms along the dimensions. The phonotactic space is thus defined by the most marked items, as ‘below’ them, all the other existing forms will fill in the space until the least marked item, without interruptions, or gaps.

Let us see other dimensions in the Hungarian phonotactic space. (15) presents voiceless non-dental plus vowel and dental clusters in monomorphemic stems. The vertical axis is the ordered hierarchy of the the manner of the second consonant; the horizontal axis is the ordered scale of the place of the first consonant. The perceptual difficulty hierarchy of these contexts for the relevant place contrasts is (14a). According to Rebrus & Trón (2002), the perceptual difficulty scale for the voiceless non-coronal stops before coronal consonants is (14b).

(14) a. __stop > __fric. > __nasal > __liquid > __vowel
b. **c** > **p** > **k**

(15) VC_1V, VC_1C_2V sequences: C_1 = voiceless non-dental stop, C_2 = dental (cf. Rebrus & Trón 2002:23)

manner of dental C_2 (plus V)			
stop **t**	**kt** (*a***kt***a*)	**pt** (*kri***pt***a*)	$\boxed{\text{*ct}}$
fricative **s**	**ks** (*bu***ks***za*)	**ps** (*ka***ps***zula*)	$\boxed{\text{*cs}}$
nasal **n**	**kn** (*a***kn***a*)	**pn** (*sra***pn***el*)	$\boxed{\text{*cn}}$
liq. **l**	**kl** (*cé***kl***a*)	**pl** (*pa***pl***an*)	**cl** (*tro***tyl***i*)
V	**k**V (*la***ka***t*)	**p**V (*ré***pa**)	**c**V (*ku***tya**)
	k	**p**	**c** → C_1

Glosses: *akta* ‘document’, *kripta* ‘crypt’, *buksza* ‘purse’, *kapszula* ‘capsule’, *akna* ‘shaft’, *srapnel* ‘srapnel’, *cékla* ‘beet’, *paplan* ‘duvet’, *trotyli* ‘tramp’, *lakat* ‘lock’, *répa* ‘carrot’, *kutya* ‘dog’.

As we can see in (15), this slice of the phonotactic space is also closed towards the unmarked items; also, again, the marked elements occur in the ‘outskirts’ of the space. As we go along the vertical axis, the contexts are increasingly more and more difficult for the perception of the first stops in question. The horizontal axis shows the first consonants in the order of their difficulty of perception. Velar and labial stops are said by Rebrus & Trón (2002) to be less difficult to perceive in these environments than the palatal place.

Closedness predicts that we should get the same shape of the phonotactic space in all dimensions (and, actually, universally in all languages). Let us consider now voiceless non-labial stop plus labial clusters.

(16) VC_1V, VC_1C_2V sequences: C_1 = voiceless non-labial stop, C_2 = labial

manner of labial C_2 (plus V)			
stop **p**	**cp** (*pi**typ**ang*)	$\boxed{\textbf{*kp}}$	$\boxed{\textbf{*tp}}$
fricative **f**	**cf** (*fi**tyf**iritty*)	**kf** (*bu**kf**enc*)	⟨**tf**⟩ ⟨*hé**tf**ő*⟩
nasal **m**	**cm** (*tru**tym**ó*)	**km** (*la**km**usz*)	**tm** (*ri**tm**us*)
approx. **ʋ**	**cv** (*ko**tyv**aszt*)	**kv** (*le**kv**ár*)	**tv** (*pi**tv**ar*)
V	**c**V (*ku**tya***)	**k**V (*va**ku***)	**t**V (*sa**tu***)
	c	**k**	**t** → C_1

Glosses: *pitypang* 'dandelion', *fityfiritty* 'imp', *bukfenc* 'somersault', *hétfő* 'Monday', *trutymó* 'suspicious substance', *lakmusz* 'litmus', *ritmus* 'rhythm', *kotyvaszt* 'concoct', *lekvár* 'jam', *pitvar* 'porch', *kutya* 'dog', *vaku* 'flash', *satu* 'vice'; *hétfő* 'Monday' is regarded by some as a polymorphemic word (*hét* 'week' + *fő* 'head').

Again, the space is closed towards the unmarked items; the infrequent items, as well as those in which the contrast is neutralized, occur at the edges. The vertical axis is the same as in (15); however, the markedness of the stops in (15) and in (16) is not the same, it is actually reversed. The relative perception of palatals is more difficult before dentals than that of velars (see (15)); on the other hand, labials provide better cues for the palatal place of stops than for velars, as is shown in (16). In other words, if the first consonant is the voiceless palatal stop, a labial sound is a better choice for the next position than a dental. This markedness reversal is the direct upshot of the fact that markedness is a relational/contextual notion.

3.2. *Phonotactic Closedness in English*

This section focuses on the phonotactic space of intervocalic two-member consonant clusters of English monomorphemic words. The data was collected from a searchable electronic database of about 70,000 English words. The charts below also include the number of the words in which the clusters in question occur, therefore, they indicate the approximate[14] lexical (type) frequency of the clusters. Since—as opposed to Hungarian—stress plays an important role in this language (cf. for example the neutralization of vowel contrast in an unstressed syllable), the clusters have been distinguished whether they occur before or after a stressed vowel.

The first diagram (17) shows the occurrence of voiceless non-coronal stops before coronal consonants (of which the obstruents are voiceless, too); in the first chart, it is the vowel following the cluster that has primary stress (indicated by the accent), while in the second it is the first vowel that bears the stress. The markedness hierarchy (**p** > **k**) follows Rebrus & Trón (2002)'s assumptions (cf. 14).

[14] These numbers are probably far from being accurate; but they nevertheless exhibit important tendencies in the frequencies of the clusters.

(17) English $V_1C_1C_2\acute{V}_2$ – $\acute{V}_1C_1C_2V_2$: C_1C_2: voiceless, C_1: non-cor. stop, C_2: cor.

manner of coronal C_2 (plus V)

stop **t**	*di**kt**áte*$_{83}$	*ca**pt**ívity*$_{24}$
fricative **s**	*e**ks**íte*$_{139}$	*u**ps**ét*$_{13}$
nasal **n**	*te**kn**íque*$_{17}$	*hy**pn**ósis*$_{2}$
liquid **l**	*a**kl**áim*$_{101}$	*a**pl**ý*$_{121}$
V́	*a**k**ústom*$_{1339}$	*a**p**óint*$_{1133}$
C_1	**k**	**t**

manner of coronal C_2 (plus V)

stop **t**	*cá**kt**us*$_{336}$	*á**pt**itude*$_{192}$
fricative **s**	*á**ks**ent*$_{494}$	*ellí**ps**is*$_{111}$
nasal **n**	*á**kn**e*$_{67}$	*shrá**pn**el*$_{21}$
liquid **l**	*á**kl**imate*$_{320}$	*múlti**pl**y*$_{256}$
V	*có**k**oa*$_{2481}$	*có**p**y*$_{1365}$
C_1	**k**	**p**

As (17) shows, the contrast between **p** and **k** is maintained in all positions: the phonotactic space is totally filled by existing words, even at the edges. As it is suggested by Rebrus & Trón (2002:24), the number of the words displaying the given phonotactic pattern increases with their markedness status monotonously: if one member of the opposition occurring in a given environment is less marked than the other, then it is supposed to be more frequent, too. This seems to be the case in (17), as well: in each environment it is the more marked **p** that is less frequent. As far as the markedness of the contexts is concerned, however, the numbers at least suggest that for this contrast (**k** – **p**) the pre-nasal position is more marked than any of the others.

Let us turn our attention to the **g** – **b** contrast in the same environments as in (17) (except that now the obstruents following the two segments are *voiced*).

(18) English $V_1C_1C_2\acute{V}_2$ – $\acute{V}_1C_1C_2V_2$: C_1C_2: voiced, C_1: non-cor. stop, C_2: cor.

manner of coronal C_2 (plus V)

stop **d**	***gd**	*a**bd**úct*$_{7}$
fricative **z**	*e**gz**áct*$_{148}$	*a**bz**ólve*$_{23}$
nasal **n**	*i**gn**íte*$_{75}$	*o**bn**óxious*$_{7}$
liquid **l**	*ne**gl**éct*$_{45}$	*o**bl**íge*$_{37}$
V́	*ci**g**ár*$_{244}$	*a**b**óde*$_{695}$
C_1	**g**	**b**

manner of coronal C_2 (plus V)

stop **d**	*amý**gd**aloid*$_{2}$	*á**bd**omen*$_{17}$
fricative **z**	*é**gz**altation*$_{6}$	*ó**bz**ervation*$_{2}$
nasal **n**	*pré**gn**ant*$_{164}$	*á**bn**egation*$_{13}$
liquid **l**	*ú**gl**y*$_{104}$	*bí**bl**ical*$_{207}$
V	*é**g**o*$_{1015}$	*ló**b**y*$_{1490}$
C_1	**g**	**b**

The first thing that is apparent in the first chart of (18) is that it contains a gap in a position that violates Phonotactic Closedness: the less marked **g** is missing before **d** even though the more marked **b** does occur there (although only in seven words). There can be two approaches to resolve this problem. The first one is somewhat radical: it may well be the case that the markedness of the two segments (**g** and **b**) is to be reversed to **g** > **b**. This would necessarily place the gap in its 'right' position: the *marked* segment would now occur in the *marked* context. As the frequency of the two segments also suggests, especially when they are before a vowel, the reordering of the two segments with respect to their markedness could be justified. According to Maddieson (1984:36), '[among languages that have voiced stops], **g** is more likely to be missing than **b** or [the coronals];' in other words, the universal markedness of voiced stops is

g > **D** > **b**.[15] This markedness hierarchy is grounded in articulatory phonetics in Hayes & Steriade (2003:12ff). According to them, the aerodynamics of voicing requires that there be an active oral tract expansion (e.g., by advancing the tongue root or lowering the larynx) to maintain a continuous airflow so that the vocal folds may be able to vibrate during the production of a voiced stop.[16] If the dimension of place is also brought into the picture, it turns out that to maintain voicing for velar stops is more difficult than for non-velars: the production of bilabials necessarily creates a larger cavity in the mouth, ‘which allows the cavity to continue for a longer time to expand passively in response to airflow’ (Hayes & Steriade *op.cit.*:12).

The other choice that is suggested by (18) is that perhaps stress does not play a role (i.e., it is not an active dimension)—at least not in the phonotactics of CC clusters. Because if we do not separate the two cases, in other words, we collapse the two charts, the gap disappears (see (19a)).

(19) a. English $V_1C_1C_2V_2$ C_1C_2: voiced, C_1: non-cor. stop, C_2: cor.

manner of coronal C_2 (plus V)			
stop **d**	**gd**$_{2}$	**bd**$_{24}$	
fricative **z**	**gz**$_{154}$	**bz**$_{25}$	
nasal **n**	**gn**$_{239}$	**bn**$_{20}$	
liquid **l**	**gl**$_{149}$	**bl**$_{244}$	
V́	**g**$_{1259}$	**b**$_{2185}$	C_1
	g	**b**	

b. English $V_1C_1C_2V_2$ C_1C_2: voiced, C_1: non-cor. stop, C_2: cor.

manner of coronal C_2 (plus V)			
stop **d**	**bd**$_{24}$	**gd**$_{2}$	
fricative **z**	**bz**$_{25}$	**gz**$_{154}$	
nasal **n**	**bn**$_{20}$	**gn**$_{239}$	
liquid **l**	**bl**$_{244}$	**gl**$_{149}$	
V́	**b**$_{2185}$	**g**$_{1259}$	C_1
	b	**g**	

If we reverse the relative difficulty markedness of **b** and **g** (as suggested above), then we get the chart in (19b). If the aerodynamics argument is valid, then the ordering has to be changed accordingly, as it is done in (19b). Notice that two environments are still problematic if we wish to maintain that the frequency of a cluster is parallel with its markedness: there are around six times more **gz** clusters than **bz**, and 12 times more **gn** clusters than **bn** (even if we disregard the stressing difference of the following/preceding vowel). It seems at this point that frequency is merely an indication of markedness but Rebrus & Trón’s (2002) claim about the relationship of frequency and markedness cannot be maintained. The frequency numbers clearly *indicate* that at the origin (the most unmarked area), there are always more items exhibiting the relevant cluster than at the edges (compare the VCV position with VC**d**V position, for example): the ‘density’, as it were, of the phonotactic space is thus always heavier at the origin than at the outskirts.

The following dimension of the phonotactic space of English (20) shows voiceless non-labial consonants before labials (and vowels); notice that the voiceless velar stop is less marked than the coronal before labials (cf. (16)).

[15] **D** represents any voiced dental or alveolar consonant; Maddieson (*ibid.*:35) claims that there are 199 languages with **b**, 195 with **D** and 175 with **g**. There are six languages whose only voiced stop is **b**, for instance, and only two which only contain a **D**. There are only 3 languages with **g** but without **b**, two of these also lack **D**.

[16] This is also a reason why *long* voiced stops are typologically marked: their production is in this sense more difficult to sustain than that of voiceless geminate stops.

(20) English $V_1C_1C_2\acute{V}_2$ – $\acute{V}_1C_1C_2V_2$: C_1C_2: voiceless, C_1: non-labial stop, C_2: labial

manner of labial C_2 (plus V)	**k**	**t**
stop **p**	***kp**	***tp**
fricative **f**	***kf**	***tf**
nasal **m**	***km**	***tm**
approx. **w**	*a**kw**íre*$_{137}$	*be**tw**éen*$_{6}$
V́	*a**k**ústom*$_{1339}$	*a**t**íre*$_{654}$

manner of labial C_2 (plus V)	**k**	**t**
stop **p**	***kp**	***tp**
fricative **f**	*(bréa**kf**ast*$_{1}$*)*	***tf**
nasal **m**	*á**km**e*$_{2}$	*ú**tm**ost*$_{8}$
approx. **w**	*lí**kw**id*$_{231}$	*reper**tw**íre*$_{8}$
V	*có**k**oa*$_{2481}$	*cí**t**adel*$_{4700}$

It is interesting that there are always more clusters if it is the *first* vowel that is stressed (compare, for example V**t**V́ (654 items) with V́**t**V (4700 items)). More importantly, at least for the topic of the present paper, Phonotactic Closedness is not violated.[17] If we consider the same situation, but this time with the contrast of the *voiced* non-labials (**g** – **d**), the picture is apparently problematic again.

(21) English $V_1C_1C_2\acute{V}_2$ – $\acute{V}_1C_1C_2V_2$: C_1C_2: voiced, C_1: non-labial stop, C_2: labial

manner of labial C_2 (plus V)	**g**	**d**
stop **b**	***gb**	***db**
fricative **v**	***gv**	*a**dv**ánce*$_{69}$
nasal **m**	*do**gm**átic*$_{22}$	*a**dm**íre*$_{39}$
approx. **w**	*i**gw**ána*$_{6}$	***dw**
V́	*ci**g**ár*$_{244}$	*a**d**ápt*$_{4700}$

manner of labial C_2 (plus V)	**g**	**d**
stop **b**	*rú**gb**y*$_{1}$	***db**
fricative **v**	***gv**	*á**dv**erb*$_{31}$
nasal **m**	*stí**gm**a*$_{56}$	*á**dm**iral*$_{10}$
approx. **w**	*(wí**gw**am*$_{1}$*)*	*bú**dw**ir*$_{2}$
V	*é**g**o*$_{1015}$	*é**d**it*$_{1385}$

The problem concerns the lack of **gv** clusters in English. Provided that the perceptual hierarchy scale for the contrast of **g** – **d** is what is indicated in (21), Phonotactic Closedness is not satisfied (even if we collapse the two charts into one, thus disregarding the stress difference). The frequencies, again, may well motivate the reordering of the markedness of the two voiced stops into **g** > **d**,[18] if we do this, as well as collapse the two relevant charts, we obtain (22).

This time the lack of **db** clusters raises problems for Closedness. However, the only item with **gb** is *rugby*, which comes from the corresponding town's name, and according to many authors, proper names have a separate phonotactics, which is usually more lenient than that of non-proper names. If we remove this item from the current phonotactic layer (that of non-proper names), then there will be no gap, and so Closedness is not violated. It is obvious then that the dimension of separate phonotactic layers need also be considered; how it is to be

[17] The frequencies of the clusters nevertheless are indicative of splitting the environment VC(C)V into VC(C)V́ and V́C(C)V. Whether the stressing of the first vowel makes the markedness hierarchy different for **k** and **t** (namely that if the first vowel is stressed, then **t** is *less* marked than **k**) is definitely worth further investigating. Especially, it would be instructive to see what role stress plays in the perception of the place contrast of stops.

[18] Cf. V**d**V (6085 items) vs. V**g**V (1259 items), for example.

(22) English $V_1C_1C_2V_2$: C_1C_2: voiced, C_1: non-labial stop, C_2: labial, revised

manner of labial C_2 (plus V)	**d**	**g**
stop **b**	$\boxed{\text{*db}}$	**gb**$_{1}$
fricative **v**	**dv**$_{100}$	$\boxed{\text{*gv}}$
nasal **m**	**dm**$_{49}$	**gm**$_{78}$
approx. **w**	**dw**$_{2}$	**gw**$_{7}$
V	**d**$_{6085}$	**g**$_{1259}$
	C_1	

done is, again, a matter of future research.[19] The relative markedness of **dw** and **gw** is also conspicuous in (22). Possibly all of these words could be considered non-core vocabulary (cf. *boudoir* ˈ**buːdwɑː**, *iguana* **ɪˈgwɑːnə**, *wigwam* ˈ**wɪgwæm**). What is also curious is that the number of **gw** clusters raises provided they follow the velar nasal **ŋ** (e.g., *anguish, distinguish, language, linguist, penguin* etc.). Phonetic research is needed here to confirm the special status of **dw**/**gw** clusters.[20]

The last dimension we consider in this section is the occurrence of **m** before coronals (and vowels). The chart (23) confirms what has been indicated about the relationship of stress and English phonotactics above: no gaps occur unless the dimension of the stressing of the preceding/following vowel is *not* considered.

(23) English $V_1C_1C_2\acute{V}_2$ – $\acute{V}_1C_1C_2V_2$: C_1: **m**, C_2: coronal

	m
stop **t d**	*asy***mt***ótic*$_{2}$ *hu***md***ínger*$_{2}$
fric. **θ ð s z**	$\boxed{\text{*mθ *mð *ms *mz}}$
nasal **n**	*a***mn***ésia*$_{20}$
liquid **l r**	$\boxed{\text{*ml *mr}}$
V́	*a***m***óunt*$_{1442}$

	m
stop **t d**	$\boxed{\text{*mt *md}}$
fric. **θ ð s z**	$\boxed{\text{*mθ *mð *ms}}$ *clú***mz***y*$_{23}$
nasal **n**	*á***mn***esty*$_{66}$
liquid **l r**	*ó***ml***et*$_{11}$ *có***mr***ade*$_{5}$
V	*clí***m***ax*$_{2167}$

Another indication that (23) suggests is that **mn** clusters are ‘better’ (at least more frequent) than any other **m**+coronal clusters. Liquids have been established as relatively good contexts for stops, but this is apparently not the case for **m**: their number is fairly low (and they only occur if the vowel before **m** is stressed). Non-homorganic stops are basically impossible after **m**. If a coronal follows labial **m**, it is preferably either **n** or **z**. These factors point towards two

[19] On the phonotactic layering of the lexicon, see, among others, Itô & Mester (1995) and Rebrus & Trón (2002:36–59). The problem, for example, concerns the issue of what counts as ‘native’, ‘non-proper name’, etc. in the lexicon of a language. It seems that *token* frequency also plays a role here: even if **gb** is perceptually (and hence phonotactically) a marked cluster, which is also indicated by its low type frequency, the fact that it is frequently used makes it seem unmarked. Cf. for example the Hungarian cluster **ɲv** which is marked in word-final position, but since it occurs in the word *könyv* **køɲv** ‘book’, speakers will not consider it special or ‘odd-sounding’.

[20] The relatively high frequency of **dv** clusters (as opposed to **dw**) is also somewhat surprising. It must be noted though that most of them contain the (obsolete) Latinate prefix *ad-*; cf. *advance, advocate, adverb*, etc.

well-known phonological facts: nasals prefer to be homorganic with a following stop, and that obstruents following nasals prefer to be voiced. It is these two issues that we turn to next.

3.3. Postnasal voicing and Phonotactic Closedness

(24) summarizes some of the most important phonological facts concerning nasals, place assimilations, and the voicing of postnasal obstruents.

(24) a. In place assimilations, in C_1C_2, C_1 tends to assimilate the features of C_2.
b. *Nasals* are the most common targets for place assimilation (including static place agreement).
c. The target of nasal place assimilation is frequently restricted to *coronals*.
d. Obstruents following nasals prefer to be *voiced*.

There is abundant literature on the phonetic/functional grounding of (24a–c). On the speciality of C_1 in VC_1C_2V from a phonetic point of view, cf. Ohala (1990) as well as Kohler (1990), who argue that the place cues of (non-retroflex)[21] consonants in CV positions are more robust than in VC, hence the stability of C_2: the place of C_1 is not salient before another consonant. The most often cited phonetic reason why nasals require a homorganic stop after them is that even though nasals as a group are easily distinguishable from other sounds, yet the identification of the nasals from each other is difficult, as their place is weakly cued in themselves—they need stops so that their place may be more salient (on this type of approach to nasal place sharing, cf. Myers 1997 and Maddieson 1984:70f).[22] Accordingly, as Hayes & Steriade (2003:29) argue, the scale of the perception difficulty of the place of C_1 in C_1C_2 is: (strident) fricative < stop < nasal. Among the places, it is velars that are the most and coronals that are the least salient in CC clusters (as the first consonants): velars < labials < coronals[23]—a possible perception-based reason why they are easily confusable and thus why they are the usual targets for place assimilation.

The typology of postnasal obstruents shows that they prefer to be voiced. For example, postnasal voicing was the most important source of the rise of voiced stops in Hungarian.

(25) Uralic ***kumpa** > **kumba** (> current H. *hab* 'foam'); Finno-Ugric ***kunta** > **kunda** (> current H. *had* 'army'); F-U. ***lonca** (> current H. *lágy* **laːɟ** 'soft'); F-U. ***tuŋke** > **tuŋge** (> current H. *dug* 'stick') (cf. Cser 2001:59)[24]

In British English RP, as well as many other English dialects, however, postnasal voicing is not an obligatory phonological process. Examples with postnasal *voiceless* obstruents, such as *antic, bumper, ankle, lance, emphasis,* etc., readily come to one's mind. As a first approximation, we may say that in English postnasal voiced stops are actually more marked than nasal–

[21] As it was mentioned earlier, retroflex consonants are better cued in VC transitions. Pre-aspirated consonants are also more salient after a vowel than before it; on this, see Steriade (1997; 1999).

[22] Browman and Goldstein's (1990) paper gives an articulatory account of nasal place assimilation.

[23] Cf. Jun (1995).

[24] For further—synchronic as well as diachronic examples of postnasal voicing, cf. Kiss (2004).

voiceless stop clusters.[25] However, the situation is more complex than this. Before scrutinizing the case of nasal–stop clusters in English, let us first consider the typology of CC clusters in general; (26) displays some of the implicational universals of such clusters.

(26) Implicational universals for C_1C_2 clusters (C_2 = stop)
(cf. Rebrus & Trón 2004:146f)

a. the presence of voiceless stops before a nasal indicates that of a voiced one (e.g., **nt** > **nd**)
b. the presence of a nonhomorganic nasal–stop sequence indicates that of a homorganic one (e.g., **mt** > **mp**, **nt**)
c. the presence of a liquid + stop indicates that of a nasal + stop (e.g., **rt**, **lt** > **nt**)
d. the presence of a fricative + stop indicates that of a nasal + stop (e.g., **st** > **nt**)

Examples for languages with respect to what non-word-initial CC clusters they allow for are offered in (27). The chart only concentrates on CC clusters whose second element is a stop (the examples all show a coronal stop).[26]

(27)

	English	Italian	Diola Fogny	Manam	Japanese	Yapese	Ojibwa	Lardil
nh-N+stop (**mt**)	(+)							
fric.+stop (**st**)	+	+					+	
liquid+stop (**lt**)	+	+	+				!	+
N+vless stop (**nt**)	+	+	+	+			+	+
N+voiced stop (**nd**)	+	+	+	+	+		+	!
V+stop	+	+	+	+	+	+	+	+

In English, as we have seen, **mt** is rare (hence the bracketing of + for this cluster). Yapese does not permit CC clusters, it is considered to be a ‘codaless’ language (it does have single word-final consonants, though). The implicational universals (26) are all exemplified by the languages in (27). Apparently, there are, however, two problematic languages: Ojibwa and Lardil (consider the gaps with an exclamation mark in the table). The difficulty presented by the Ojibwa case is only problematic if it is presumed that clusters of the **st** type are actually more marked than those of the **lt** type: in this case the more marked element would not imply the occurrence of the less marked — an apparent violation of Phonotactic Closedness. Notice,

[25] Of course, it is not the fact that there are voiceless stops *at all* after nasals that causes difficulties: postnasal voicing as a phonetic fact is observable in all languages; nevertheless, not all of them enforce it to phonologize it (cf. Hayes 1996:6). The existence of voiceless stops after nasals is thus marked (but not impossible) from the viewpoint of postnasal voicing. A more serious problem for the postnasal voicing approach rather concerns languages which apparently only allow for postnasal voiceless stops but lack voiced ones after nasals.

[26] The table is based on Pigott (1999) and Rebrus & Trón (2004:147). ‘nh-N’ is meant to represent a nasal which is *not* homorganic with the following stop. No distinction has been made here as to the position of the clusters (word-internal vs. word-final). In some cases this overgeneralizes the picture; in Diola Fogny, for instance, liquid-initial clusters do not occur word-finally, only the nasal-initial ones (for details, see Pigott *op.cit.*:147).

however, that no implication has been established between the existence (or lack) of **st** and **lt** clusters in (26). This means that the gap (the lack of liquid–stop clusters) in the Ojibwa case is not problematic after all: **st** can exist with or without **lt** in a language, and *vice versa* (cf. Diola Fogny vs. Ojibwa). What *is* an important requirement is that the existence of **lt** does imply the occurrence of **nt** (while the reverse does not stand; cf. English, Italian, Diola Fogny vs. Manam, Ojibwa).

The absolute ban on postnasal voiced stops in Lardil is nevertheless a more painful case with respect to postnasal voicing. This problem takes us back to the English case, which is similar to the one presented by Lardil in some ways. It turns out that we cannot treat all nasal–stop clusters the same way: the position where they occur in the word is highly relevant, as the distribution of the clusters is different if the environments are also different. Let us therefore concentrate on CC (including nasal–stop) clusters in English monomorphemic words in two positions: intervocalic (28), and word-final (29).[27]

(28) English monomorphemic VC_1C_2V clusters (C_2=stop)

j/w/h						
θ/ð						
v						
ʃ/ʒ						
nh.-N						
ʧ/ʤ	(*vegetable*)					
z				(*asdic*)	(*husband*)	(*Glasgow*)
g				(*Magdalene*)	(*rugby*)	
b	obtain	(*subcutaneous*)		abdominal		
d		(*vodka*)	(*jodhpurs*)			(*Edgar*)
p	chapter					
k	actor			(*anecdote*)		
t		(*Atkins*)				
f	after					(*Afghan*)
s	custom	fiscal	hospital			
l	alter	alcohol	pulpit	shoulder	album	vulgar
r	forty	turkey	harpoon	cardigan	turbine	forget
N	winter	wrinkle	temper	bandit	gambit	hunger
V	better	accustom	lepel	ready	ruby	ego
	t	**k**	**p**	**d**	**b**	**g**

[27] The words that are in brackets indicate clusters that occur in just few words (sometimes only in that word). Notice that, unlike in earlier charts, the x-axis now houses C_2, while the y-axis C_1. **r**+C clusters are, of course, only valid for rhotic dialects (like GA); diphthongs are assumed to be transcribed with vowel symbols, thus, for example, the word *fight* **faɪt** does *not* contain a **jt** cluster. For more comprehensive lists of English non-initial CC clusters, see Kiss (2001).

(29) English monomorphemic VC_1C_2# clusters (C_2=stop)

j/w/h						
θ/ð						
v						
ʃ/ʒ						
ʧ/ʤ						
z						
g						
b						
d						
nh.-N	(*dreamt*)					
p	apt					
k	act					
t						
f	soft					
s	mist	ask	wasp			
l	melt	sulk	pulp	hold	(*bulb*)	
r	part	bark	carp	guard	disturb	mourge
N	vent	think	jump	find	!	!
V	cut	make	sip	bed	stab	fig
	t	**k**	**p**	**d**	**b**	**g**

As we can see, the word-final position—as opposed to the word-internal—appears to be highly restrictive for voiced stops in English: only the dental one, and not the labial or the velar may occur after nasals in that position, for example. Such severe restrictions as these are not observable in the intervocalic (crucially: *prevocalic*) position.

An important effect of the independence of markedness scales is that they may sometimes stand in *conflict*. Let us for example consider the voicing contrast of stops in three positions: (i) prevocalically, (ii) after a homorganic nasal, and (iii) word-finally. Using the contrast of **t – d** as a hypothetical example, the following markedness scales can be set up in these three environments.

(30) a. Scale 1: **da** > **ta** b. Scale 2: **nt** > **nd** c. Scale 3: **d#** > **t#**

All three scales can be grounded phonetically, as we mentioned.[28] An important consequence of the scales in (30) is that Scale 2 (the postnasal context, the position on the *left* of the stop) stands in conflict with both Scale 1 (prevocalic position) and Scale 3 (word-final position), two positions on the *right* of the stop. **d** is *marked* before a vowel (**da**), but it is *unmarked* after a nasal (**nd**). Similarly, **d** is *marked* word-finally (**d#**), but, again, it is *unmarked* postnasally.

[28]For example, Hayes (1996) shows that voiceless stops are less difficult to produce than voiced ones before vowels; especially in English, voiceless aspirated (fortis) stops are also easier to perceive than voiceless unaspirated (lenis) stops prevocalically. In word-final position, important cues for the perception of voicing are missing (see (7)), and thus a voiced stop is marked in that position in this respect. The phonetic basis of postnasal voicing has been tackled above.

It can happen that a stop stands in postnasal position *as well as* (i) prevocalically (**nta**/**nda**) or (ii) word-finally (**nt#**/**nd#**). Which markedness scale (the one for the context on the left — the postnasal position, or the one on the right — prevocalic/word-final) 'wins' over the other is a language-specific choice.

Let us first consider the case of *prevocalic nasal–stop clusters* (**nta**/**nda**). If it is the scale for the postnasal context (Scale 2) that wins over the prevocalic scale (Scale 1), then we have a system that will lack ***nta**, but will contain **nda**. If however Scale 1 outweighs Scale 2, the language in question will have **nta**, but no ***nda**. The following systems are thus predicted for the voicing contrast of stops before vowels.

(31) Prevocalic sequences: **ta**, **da**, **nta**, **nda**

a. *System 1*: Scale 1 wins over Scale 2 (i.e., voicing is not preferred before a vowel): **ta**, ***da**, **nta**, ***nda** (e.g., Lardil)
b. Scale 2 wins over Scale 1 (i.e., voicelessness is not preferred after a nasal):
   (i) *System 2*: (**ta**, **da**), ***nta**, **nda** (e.g., Japanese)
   (ii) *System 3*: (**ta**, ***da**), ***nta**, **nda** (e.g., Wembawamba)
c. *System 4*: the markedness statements are not enforced (i.e., voicing is maintained in all sequences): **ta**, **da**, **nta**, **nda** (e.g., Hungarian)

In languages like System 1, there is no voicing contrast for stops whatsoever. This is the consequence of the priority of the post-stop vowel (cf. Scale 1 in (30)): the conflict between the influence of the left environment (the nasal) vs. the right environment (the vowel) is won by the latter. Languages that behave like System 2 and 3 show that the scales in (30) are independent of each other, it is only when they necessarily come together — in the case of prevocalic nasal–stop clusters — that they stand in conflict. A language may allow for marked sequences along Scale 1 (i.e., **da** besides **ta**), while it resolves the N__ vs. __V conflict in favour of postnasal voicing (System 2). In System 3, there is neutralization on Scale 1 (**ta**, ***da**), while the conflict between Scale 1 and 2 is resolved in favour of Scale 2, where postnasal voicing is more important than prevocalic voicelessness: ***nta**, **nda**. Lastly, languages of type System 4 do not enforce the markedness scales, they allow for the marked sequences, too. Crucially, no systems are predicted like **da**, ***ta** or **nta**, ***nda**, where the less marked sequence is missing, while the more marked exists — this would violate Phonotactic Closedness. Notice that Phonotactic Closedness is not testable in cases of conflicting scales, since the hierarchies are undecided, the choice between them is arbitrary (cf. the case of System 2 languages, like Lardil).

The case of the voicing contrast of word-final stops vs. (homorganic) postnasal stops is similar to that of prevocalic stops vs. (homorganic) postnasal stops. If we consider word-final nasal–stop clusters, it is now Scale 3 in (30) that is in conflict with Scale 2. However, the markedness hierarchy of the word-final position seems to be always winning over the postnasal hierarchy: the word-final position is a context where it is difficult to keep up voicing (as well as place) contrast. Accordingly, it is predicted that no system should occur in which there are word-final **nd#** clusters but no ***nt#** sequences (this is what postnasal voicing would suggest). The following cases are predicted thus.

(32) Word-final sequences: **t#**, **d#**, **nt#**, **nd#**

a. *System 1*: voicing is maintained in all sequences: **t#**, **d#**, **nt#**, **nd#** (e.g., Hungarian)
b. *System 2*: only voiceless stops occur: **t#**, ***d#**, **nt#**, ***nd#** (e.g., Polish)
c. *System 3*: voicing contrast for single stops, no postnasal voicing: **t#**, **d#**, **nt#**, ***nd#** (e.g., English)

English (System 3 in (32)) displays the independence of Scale 2 and 3 (30): there can be voicing contrast for stops word-finally, but neutralization into **t** after a nasal.[29] But there are no systems with ***t#**, **d#**, ***nt#**, **nd#**, in accordance with Phonotactic Closedness.

The state of affairs concerning the distribution of word-final nasal–stop clusters in English seems to be even more complex, however. For example, it is not true that *all* voiced stops are missing after nasals word-finally. It is only the noncoronals that are forbidden there. Therefore, another dimension must also be considered — that of place of articulation. As the frequency of the cases in English also indicate, the markedness scales of stops are (33a) (NC#) and (33b) (C#).

(33) a.

nd#$_{285}$	***ŋg#**	***mb#**
nt$_{658}$**#**	**ŋk#**$_{70}$	**mp#**$_{43}$
cor.	vel.	lab.

b.

d#$_{1259}$	**g#**$_{159}$	**b#**$_{106}$
t#$_{3251}$	**k#**$_{1416}$	**p#**$_{406}$
cor.	vel.	lab.

The perceptual (and/or articulatory) grounding of these cases definitely needs further research; the expectation is that 'heavy' clusters (such as voiced labial **mb**) are perceptually less robust word-finally, than the unmarked coronal clusters.

If we consider yet another dimension, the markedness of word-final nasal–stop clusters alters again. This dimension is the quantity and quality of the vowel before the cluster. Some of the most important facts for English in connection with this dimension are summed up below.

(34) a. V**nt#**: V can be of almost any quality (except **ʊ**); V**nd#**: the V can be any vowel (except **ʊ**; **ɪ** only occurs in *wind*)
b. V**mp#**, V**ŋk#**: most cases occur with the low vowels **æ**, **ʌ**; **ɪ**, **ɒ**, **e** are rare; there are no such clusters with **ə** and **ʊ**
c. long/tense vowels are marked before noncoronal clusters: **V:nt#** (50 items), **V:nd#** (61 items), but: ***V:ŋk#**, ***V:mp#**, ***V:ŋg#**, ***V:mb#**
d. if the V before the word-final nasal–stop cluster is long/tense, it is usually non-high:

[29]The situation may well be more intricate than this for English: it is traditionally claimed that English does not contrast obstruents word-finally: they are normally unreleased, voiceless and unaspirated. It is actually the previous vowel (its length/quality) onto which the contrast between fortis ('voiceless') and lenis ('voiced') obstruents is transferred, as it were; thus *beat* **bit** vs. *bead* **bi:d̥** ≈ **bi:t**; *pint* **paɪnt** vs. *find* **faɪ:nd̥** ≈ **faɪ:nt**.

	nt	**ntʃ**	**ŋk**	**mp**
iː/uː				
əʊ	don't$_{3}$			
ɔː	flaunt$_{5}$	launch$_{5}$		
ɔɪ	point$_{6}$			
eɪ	paint$_{13}$			
ɑː	slant$_{6}$	branch$_{5}$		
aɪ	pint$_{1}$			
aʊ	count$_{6}$			

	nd	**ndʒ**	**ŋg**	**mb**
iː/uː	fiend$_{1}$/wound$_{1}$			
əʊ				
ɔː	laundry$_{4}$			
ɔɪ				
eɪ		change$_{9}$		
ɑː	command$_{9}$			
aɪ	find$_{9}$			
aʊ	sound$_{28}$			

The exact phonetic grounding of the relationship between the pre-cluster vowel and the distribution of the nasal–stop cluster is still to be clarified. Nevertheless, it seems that the marked clusters cannot occur with either reduced vowels (like ə) or long/tense vowels. This is only possible if the place of the cluster is the unmarked coronal. Also, only non-high (mostly low) long vowels can occur with nasal–stop clusters, but, again, only provided that the cluster is coronal. Low vowels are also preferred when the cluster is noncoronal (*camp, lamp, trunk, rank,* etc.). Further investigation is needed here, but it seems that clusters which are weakly cued in word-final position need vowels that are the most salient — the low vowels — in order to enhance their own salience.[30]

4. Conclusions

The paper suggested that the phonotactics of languages is often gradual, non-categorical, in the sense that not all possible combinations are grammatical along the various dimensions of segmental contrast. The graduality of phonotactics is a property that has been shown to be better explained by a model that employs perception-based functional principles, such as cue licensing according to relative context, and phonotactic closedness. The phonotactic space is defined by hierarchical perceptual difficulty scales that linearly order the various syntagmatic relations a segment can enter into. All existing items (marked as well as unmarked) in the language are accounted for in this model, what is more, their place in the phonotactic space is also predicted: contrasts in environments with robust perceptual cues are predicted to occur around the 'origin' of the scales making up the space (their number will also be predicted to be relatively high), whereas the marked clusters will occur at the edges. In this model, thus, the notions 'exceptional' and 'accidental gap' are meaningless. Where exactly a language draws the line between a contrast that it makes use of and those that it does not, is arbitrary, but if a perception-wise marked cluster is used in a language, then our model will predict that all the other clusters that are perceptually better cued will also occur in the language, in accordance with the principle of phonotactic closedness. In some cases the perception hierarchies may stand in conflict, it seems that the actual 'output' of the conflict is arbitrary; Phonotactic Closedness cannot play a role in these cases *if the conflicting scales are independent of each other*; Closedness only deals with

[30]The findings of Burzio (2002) support these views. He suggests that both a reduced vowel as well as a long vowel result in the loss of perception cues (especially burst cues) for stops; hence after them, neutralization is predicted to the unmarked place, the coronals.

spaces that are defined by *related* markedness scales. Actually, if in the investigation of two dimensions of a contrast it turns out that closedness is violated, it can usually be taken as an indication that the two dimensions are incompatible, that they cannot be related, or compared.

Further research is needed in finding and further specifying the phonetic bases of the various segment clusters, as phonetic grounding is the cornerstone of this approach, the role of other factors needs to be also considered, such as token frequency, analogy, paradigm uniformity, phonotactic layers, etc., as well as their interaction with Phonotactic Closedness.

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Zoltán Kiss
Eötvös Loránd University (ELTE), Budapest
cash@nytud.hu
http://budling.nytud.hu/∼cash

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Similarity and contrast in consonant harmony systems

Sara Mackenzie

Recent typological studies (Hansson 2001, Rose & Walker 2004) argue that segments participating in consonant harmony systems must be highly similar to one another. This paper proposes that contrastive features within a language determine similarity. Contrasts are determined by hierarchic ordering of features with some features taking scope over others (Jackobson and Halle 1956, Dresher 2003). This is applied to the analysis of consonant harmony in Anywa, Luo, and Bumo Izon. In these languages, segments which participate in harmony processes are similar to one another in that they form a natural class of segments contrastively specified for the harmonic feature.

1. *Introduction*

Consonant harmony is a well-attested, crosslinguistic phenomenon which raises a number of interesting issues for phonological theory. Recent typological studies of consonant harmony systems (Hansson 2001, Rose & Walker 2004) have highlighted some characteristics of long distance consonant assimilation which distinguish it from local assimilation and vowel harmony. While long-distance consonant assimilation is found in many languages, its distribution is more restricted than both local assimilation and vowel harmony. Features which are active in consonant harmony processes are limited to laryngeal features, nasality, and features such as retroflex, strident, and anterior which specify coronal segments. These are a subset of the active features found in local assimilation processes. In addition, the segments that interact in consonant harmony processes must share a certain degree of similarity. Rose & Walker (2004) and Hansson (2001) show that targets and triggers in harmony processes must share major stricture features such as [sonorant] and [continuant]. Many processes also require interacting segments to share major place features. When the segments participating in a harmony process are restricted to a small set they are likely to be those segments which are most similar to one another.

Two theoretical issues raised in the study of consonant harmony are locality and similarity. How are segments at a distance able to interact without affecting intervening segments? What is the relevant definition of similarity as it is manifested in consonant harmony systems? The issue of locality concerns both phonological representations and phonological operations. From a representational perspective we may ask whether there is a tier-based definition of locality so that interacting segments are adjacent with respect to the harmonic feature. A related question is whether harmony results in multiply linked structures

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(see Odden 1994, Gafos 1996 for discussion of locality in harmony processes). Operationally, we can investigate the mechanisms implementing consonant harmony: do they involve autosegmental spreading akin to that of local harmony processes or correspondence relations as posited in recent OT accounts (e.g. Hansson 2001, Rose & Walker 2004)? The issue of similarity, however, is purely representational. What are the representations that allow us to determine which segments are similar? What is the threshold of similarity necessary for consonant harmony? Are the relevant definitions of similarity universal or language-specific?

This paper focuses on the issue of similarity in consonant harmony. I propose that similarity is dependent on featural specifications which are in turn influenced by the system of contrasts in a given language. The level of similarity between two segments can thus differ from language to language depending on the structure of the inventory in which the segments are found. Even languages that appear to have the same surface inventory may have different underlying systems of contrast and thus different similarity relations between segments.

I will begin by reviewing previous theories of phonological similarity with an emphasis on work which has addressed consonant harmony systems. Although the issue of similarity is inherently a representational one, much current work on the role of similarity is undertaken by researchers who have rejected representational theories such as underspecification. As a result, these works are based on either universal similarity hierarchies which use intuitive feature assignments (e.g. Hansson 2001) or use a similarity metric which, while taking into account the contrasts in a system, is incapable of accounting for the patterning of consonant harmony in languages with asymmetric inventories (e.g. Frisch et al. 2004).

The following sections will propose an alternative view of similarity that is linked to the notion of contrast. This proposal will be illustrated in analyses of cooccurrence restrictions and consonant harmony in Luo, Anywa and Bumo Izon.

2. *Similarity and consonant harmony: previous approaches*

A body of work has developed focusing on the issue of determining targets and triggers in consonant harmony processes (e.g. Mester 1986, Hansson 2001, Rose & Walker 2004, Frisch et al. 2004). These works all argue that similarity determines which segments will participate in consonant harmony processes. Work arguing that similarity is crucial in determining participating segments in consonant harmony systems has been carried out in a variety of theoretical and representational frameworks. This section will review recent work arguing for universal similarity hierarchies that are reflected in constraint rankings (Hansson 2001, Rose & Walker 2004) and Frisch et al.'s proposal that similarity of a pair of segments can be given a numerical value based on natural classes.

Recent typological studies (Hansson 2001, Rose & Walker 2004) have argued that consonant harmony is motivated by constraints which require surface segments to be in a correspondence relation with one another. Like correspondence relations between input and output, correspondence relations between output segments entail the existence of faithfulness constraints which demand identity between corresponding segments. In the case of surface correspondence, highly ranked faithfulness constraints will result in consonant harmony.

The role similarity plays in consonant harmony processes is captured in these analyses by proposing that these constraints are universally ranked with constraints requiring the establishment of a correspondence relation between more similar segments ranked above

constraints requiring establishment of a correspondence relation between less similar segments.
The constraint type that establishes correspondence relations between output segments is formulated in Rose & Walker (2004) as shown below.

(1) CORR-C↔C
Let S be an output string of segments. If consonants C_i, $C_j \in S$, then C_i is in relation with C_j, that is, C_i and C_j are correspondents of one another.

Surface correspondence constraints are organized into constraint families with a fixed ranking based on similarity. An example hierarchy from Rose & Walker is shown in (2).

(2) CORR-T↔T >> CORR-T↔D >> CORR-K↔T >> CORR-K↔D

The highest ranked constraint in (2) requires a correspondence relation to be present between surface segments that are identical. The next constraint in the hierarchy establishes correspondence between segments that have the same manner and place but differ in voicing and the following constraint establishes a correspondence relation between surface segments that differ in place but agree in voicing and manner. The lowest ranked constraint in this particular constraint family is the constraint CORR-K↔D that requires a correspondence relation to exist between oral stops that differ in both place and voicing.

The constraints proposed by Rose & Walker (2004) and Hansson (2001) predict that crosslinguistic variation in harmony systems will result from different rankings of input-output faithfulness constraints with respect to the family of CC-correspondence constraints. In order for a language to have consonant harmony at all, it must have both highly ranked surface correspondence constraints and highly ranked IDENT-CC constraints requiring surface segments in correspondence with one another to share identical specifications for some feature. If input-output faithfulness constraints referring to the harmonic feature are ranked above the corresponding IDENT-CC constraints, harmony will not take place as faithfulness to input values of the harmonic feature take priority in the grammar. If the IDENT-IO constraint is below the constraint requiring segments that differ only in voicing to be in correspondence with one another, but above the constraint requiring correspondence between segments that differ in both place and voicing, then homorganic segments will participate in the harmony and heterorganic segments will not.

Both Rose & Walker (2004) and Hansson (2001) show the similarity hierarchies in terms of segments without any detailed discussion about the feature system they are assuming. Rather, the hierarchies suggest an intuitive assessment of features and their importance relative to one another.

Frisch et al. (2004) provide a more explicit method for evaluating relative similarity while attempting to account for the role that redundancy relations play in that evaluation. Assuming full specification for all features, they determine the set of natural classes of which each segment is a member. Natural classes are defined as segments that share some feature or set of feature specifications. The similarity of any pair of segments is then measured and assigned a numerical value by dividing the number of natural classes the segments share by the shared and unshared natural classes.

Contrast and redundancy are able to play a role in determining the similarity measure of segment pairs, because a noncontrastive feature will not lead to the creation of an additional natural class in the similarity equation. In this way, Frisch et al. (2004) are able to reject underspecification and other representational theories while simultaneously attributing importance to redundancy.

3. Contrast and similarity: an approach to consonant harmony

This paper proposes that it is the underlying contrasts in a system which determine the similarity of segments and that determine which segments will participate in harmony systems. Segments which are contrastively specified for the feature active in the harmony process may participate, redundantly specified segments will not. Segments which are similar to one another in their contrastive specifications will interact, not necessarily segments which are most similar phonetically, although phonetic properties constrain possible contrastive specifications. The model of contrast employed here is that of the contrastive hierarchy (Jakobson & Halle 1956, Dresher 2003). The contrastive hierarchy provides a method for determining contrasts in an inventory by ranking features so that some features take scope over others.

Previous work on harmony systems has also recognized the significance of contrast. The relation between contrastiveness in segments and the value of harmonic features has played a crucial role in autosegmental analyses of harmony systems. For example, Shaw (1991) provides a feature geometric analysis of Chumash sibilant harmony. Assuming some version of contrastive underspecification, Shaw accounts for the fact that only sibilants participate in [anterior] harmony, not because they are more similar to one another than to other coronals, but because the feature [anterior] is only contrastive within the sibilants and can thus be left unspecified from other segments in underlying representations.

Hansson's (2001) account of consonant harmony is based on similarity and correspondence relations and works in a framework that rejects representational theories such as underspecification. Nonetheless he often refers to the contrasts in an inventory when giving descriptions of consonant harmony systems. He acknowledges the limitation of fixed similarity hierarchies and suggests that it may be "more reasonable to encode contrast-sensitivity directly into the analysis rather than have it mediated by relative similarity in a highly stipulative manner" (2001:437). Hansson proposes a possible constraint type which would incorporate contrast and preclude the need for the surface correspondence constraints developed in his analysis. Constraints of the type ANTICIPATE [F] are markedness constraints which penalize a consonant which precedes another consonant which has a distinct specification for a contrastive feature. Hansson, however, does not develop an analysis using the ANTICIPATE constraints, nor does he propose a method for determining what is contrastive.

The role of contrast in determining the structure of phonological representations has been stated most obviously in the framework of contrastive underspecification (Steriade 1987) which claims that only noncontrastive features may be absent from underlying representations. Despite the wide range of work making reference to contrast and the explicit use of contrast as a criterion in work in contrastive underspecification, there has never been a consensus on how to determine which features in an inventory are contrastive.

The search for such a method is the subject of recent work by Dresher (2003), who revives a claim of Jackobson & Halle (1956) that contrastive features must be hierarchically ordered with some features taking scope over others. Dresher claims that the language learner first posits all sounds to be allophones of a single, undifferentiated phoneme. When evidence requires more than one sound to be present in the inventory the learner splits the sounds into two phonemes on the basis of a feature. That feature is contrastive for the entire inventory and all sounds will be specified for it. We then have two subsets of sounds. When they are

required to be split into more phonemes the process is repeated with features being chosen until every phoneme in the inventory is uniquely specified. Features lower down in the hierarchy will be contrastive in smaller sets of segments, only those segments that still require the feature in question in order to be contrastively specified.
The contrastive hierarchy for an inventory is determined by examining evidence from phonological processes. If a feature is active in a harmony process, that feature must be specified and thus must be contrastive for at least the segments which spread the feature in the harmony process. Evidence from minimal pairs and inventory shape is also taken into account, but is secondary to evidence from phonological processes.

With respect to consonant harmony, the theory of the contrastive hierarchy predicts that, when the set of participating segments is determined by similarity, the relevant features in determining similarity will be contrastive for the segments in question. In addition, the active feature in the harmony process will be contrastive for that set of segments. The contrastive hierarchy can vary from language to language. This approach thus predicts that the set of segments subject to a harmony process or cooccurrence restriction may differ from language to language and will not be directly dependent on surface phonetic properties.

The following sections provide analyses of consonant harmony systems in Luo, Anywa, and Bumo Izon using the theory of the contrastive hierarchy to assign feature specifications. Only features deemed contrastive by hierarchical ordering will be taken into account in determining relative similarity of segments and determining active values in harmony processes.

4. Bumo Izon

An example of a consonant harmony system in which contrast plays a crucial role is the case of implosive harmony in Bumo Izon. Bumo Izon and related Ijoid languages have a cooccurrence restriction barring implosive and plosive stops from occurring in a morpheme. Some examples of harmonic forms are given below. Data are from Efere (2001).

(3)	búbú	‘rub (powder in face)
	bɪdɛ́	‘cloth’
	ɓʊ́ɓaɪ	‘yesterday’
	ɗɔ̃́:ɗɔ̃́:	‘cold’
	ɗáɓá	‘swamp’

Implosive /ɗ/ and /ɓ/ are barred from occurring with plosive /b/ and /d/ in any combination and any order. The velar plosive /g/ and the labiovelar implosive /ɠɓ/, however, may freely occur with members of both the plosive and implosive series.

(4)	igódó	‘padlock’
	ɗugó	‘to pursue’
	ɓugí	‘to wring (hand)’
	ɠɓaɓú	‘crack (of a stick breaking)’
	ɠɓódaɠɓóda	‘(rain) hard’

The failure of the plosive /g/ and labiovelar /ɠɓ/ to participate in the cooccurrence restriction can be related to the shape of the Bumo Izon inventory. As illustrated in the inventory chart shown below, there is no implosive at the velar place of articulation and no plosive labiovelar

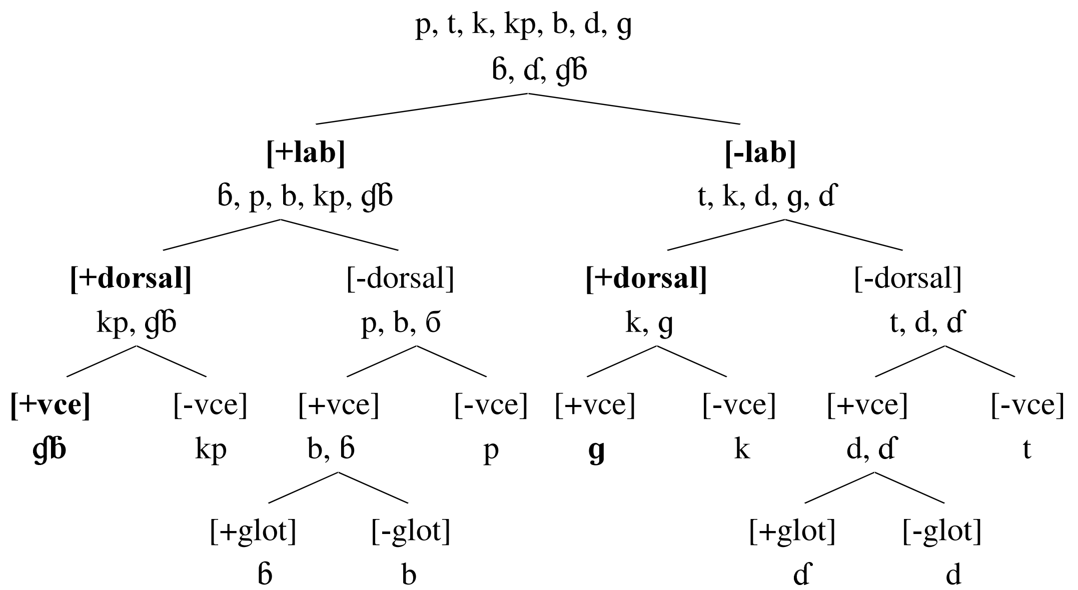
(5) Bumo Izon Oral Stop Inventory (based on Efere 2001)

	Labial	Alveolar	Palatal	Velar	Glottal	Labio-velar
Plosive	p b	t d		k g		kp
Implosive	ɓ	ɗ				ɠɓ

Intuitively, the voiced velar and labiovelar stops do not participate because they lack a partner at the same place of articulation that differs in terms of the pulmonic/implosive distinction. Using the contrastive hierarchy, the pattern of cooccurrence constraints can be accounted for by ordering place features before laryngeal features.

Specifications of the stop series are shown below with the ordering [labial] > [dorsal] > [voice] > [glottalic].

(6) Hierarchy for Bumo Izon
[labial] > [dorsal] > [voice] > [glottalic]



As the above diagram illustrates, with this ordering of features the place features [labial] and [dorsal] are contrastively specified for the entire set of stops. The groups of segments distinguished by place features all contain both voiced and voiceless segments. The feature [voice] is therefore also contrastive for all oral stops. The voiceless stops /p/, /t/, /k/, /kp/ are all uniquely specified at this point and receive no further feature values. The velar stop /g/ and labiovelar implosive /ɠɓ/ are also uniquely specified and require no further feature specifications. The labial and coronal sets however both contain two members. The feature [glottalic] is ordered next and distinguishes between the implosive and pulmonic voiced stops leaving all segments contrastively specified.

With this ordering, the feature [glottalic] is only contrastive for the set of voiced alveolar and labial stops. All voiceless segments are distinguished without reference to glottalic, as are the voiced velar and implosive labiovelar stops. The set of segments that are banned from occurring together are those segments which bear distinct contrastive specifications for the feature [glottalic].

The importance of contrast in determining the patterning of consonant harmony systems is particularly clear in Bumo Izon due to the asymmetric shape of the inventory. Those segments which do participate, /b/, /d/, /ɓ/, and /ɗ/, are similar in that they are all voiced stops. However, the segments /g/ and /ɠɓ/ also share the properties of voiced stops and do not participate in the harmony process. /g/ and /ɠɓ/ differ from the participating segments in that they are not contrastively specified for the feature [glottalic].

The constraint responsible for the ban on implosive and pulmonic stops cooccurring need not be formulated with direct reference to similarity. Rather, a constraint stating that differing specifications of the feature [glottalic] are disallowed morpheme-internally will be sufficient to account for the data. The segments which interact clearly share many properties. Instead of making direct reference to similarity, however, the fact that similar segments will interact is a result of the fact that only segments which are not distinguished by some other feature need be distinguished from one another with a lowly ordered feature like [glottalic]. /g/ also shares many properties with /b/ and /ɓ/ but it does not participate in the cooccurrence restrictions because it is not contrastively specified for the active feature in these restrictions.

Asymmetrical inventories like that of Bumo Izon highlight the importance of determining which features are contrastive. In this case the lack of a partner for the pulmonic velar and the implosive labiovelar result in a lack of specification in these segments for the feature active in the cooccurrence restrictions. Other orderings of contrastive features could result in different specifications and different patterns in harmony and cooccurrence constraints.

Harmony patterns in asymmetric inventories pose a problem for analyses relying on intuitive notions of feature specification and feature counting in order to determine relative similarity of segments (e.g. Hansson 2001). In such an approach, an explicit justification is needed to show how /b/ and /ɗ/ are more similar to one another than are /g/ and /ɗ/.

Hansson (2001) discusses the case of Bumo Izon and acknowledges that it poses a problem for his account. He also points out that the similarity metric advocated by Frisch et al. (2004), while giving a more explicit method of determining similarity, is unable to account for the Bumo Izon data. Hansson (2001) shows that the 'natural classes' method of determining similarity advocated by Frisch et al. falsely predicts that /g/ is more similar to the implosive stops /ɓ/ and /ɗ/ than are the voiced stops /b/ and /d/.

Recall that Frisch et al. (2004) reject underspecification of noncontrastive features and claim that redundancy relations can accurately be reflected in natural classes without the omission of redundant information. When shared natural classes are divided by shared and unshared natural classes in order to achieve a measure of similarity, 'partnerless' segments will appear more similar to other segments in the series. If a segment lacks a partner with which it minimally contrasts in some feature, that segment will be a member of fewer natural classes than segments that have such a partner. This will lead to a higher similarity value between this segment and a corresponding segment in the series because there will be fewer unshared natural classes that shared natural classes must be divided by. In the case of Bumo

Izon, laryngeal specifications for /g/ do not lead to an additional unshared natural class in the denominator of the similarity calculation

The 'natural classes' model thus wrongly predicts that segments without 'partners' in asymmetric inventories will behave as if they are more similar than other segments in a series. The contrastive analysis, on the other hand, shows that the partnerless segment is less similar to the other segments in the series in that it lacks a specification for the harmonic feature.

4. Dental harmony in Nilotic

A contrast between dental and alveolar places of articulation is common in Western Nilotic languages, many of which also have morpheme structure constraints banning the occurrence of dentals and alveolars in the same form. This section provides a contrastive hierarchy analysis of the patterning of dental harmony in two Nilotic languages, Anywa and Luo.

Both languages have a dental/alveolar contrast among the coronal stops and in both languages this contrast is not present within the nasals series which contains only a single coronal /n/. Both languages have coocurrence restrictions on dentals and alveolars. The /n/ behaves differently with respect to the cooccurrence restrictions of the two languages, however.

In Anywa, /n/, like the other alveolars, may not occur with a dental stop. A dental [n̪] appears allophonically in roots containing dental stops.

(7) Anywa (Reh 1996)

n̪ùd̪ò	'to lick'	núudó	'to press something down'
ōd̪óòn̪	'mud'	dīn	'to thrash something'
t̪ùd̪	'ropes'	tu̅ud	'pus'

Luo patterns differently from Anywa in that the /n/ does not participate in the cooccurrence constraint and occurs freely with the dental stops.

(8) Luo (Tucker 1994)

t̪uno	'breast'	dino	'deaf, to be stopped up'
t̪ʊɔn	'brave man'	tɪn	'small'
t̪ed̪o	'to forge'	tedo	'to cook'
d̪ɔd̪ɔ	'to suckle'	diedo	'to'

Rose & Walker (2004) use the patterning of dental harmony in Anywa as an argument against the claim that contrast is the crucial factor determining interacting segments in harmony systems. /n/ participates in the cooccurrence constraints in Anywa even though there is no dental/alveolar contrast among nasals. From this, Rose & Walker (2004) conclude that contrast cannot be the determining factor in selecting participating segments. Rather, they point to the fact that all the segments that participate in the harmony in Anywa are highly similar as the crucial explanatory factor in accounting for their participation.

In Rose & Walker's approach to consonant harmony processes, harmony is the result of surface correspondence constraints which require output segments to be in correspondence with one another. These constraints are ranked in a universal hierarchy with constraints requiring correspondence between more similar segments ranked above constraints requiring correspondence between less similar segments. Faithfulness constraints referring to surface correspondents then demand that output segments agree in some feature.

Although Rose & Walker do not provide a formal account of dental harmony in Anywa, their approach to consonant harmony would require constraints establishing correspondence relations between similar oral stops to be ranked above the constraint establishing correspondence relations between less similar oral and nasal stops. I will use the feature [distributed] to distinguish dental from alveolar place of articulation. In Anywa, the input-output faithfulness constraint referring to [distributed] must be ranked below the constraint establishing a correspondence relation between oral and nasal coronal stops. In Luo, the ranking would be the reverse and the higher ranking IO-FAITH constraint prevents dental nasals from appearing in the output.

The following tableaux are intended to illustrate what a correspondence account of dental harmony in Luo and Anywa would look like. Subscript indices represent the presence of a correspondence relation between the relevant surface segments.

(9) Anywa

n̪ud̪o	ID-CC[dis]	CORR d̪/n̪ - n	**ID -IO [+dis]**	**ID –IO [-dis]**	*n̪
a. n̪ud̪o		*!			
b. n$_x$ud$_x$o			*!		
☞c. n̪$_x$ud̪$_x$o				*	*

(10) Luo

t̪uno	ID-CC[dis]	**I D-IO [+dis]**	**ID -IO[-dis]**	CORR d̪/n̪ - n	*n̪
☞a. t̪uno				*	
b. t$_x$un$_x$o		*!			
c. t̪$_x$un$_x$o			*!		*

Both tableaux show evaluations of disharmonic inputs, and both have an undominated ID-CC constraint requiring surface segments that are correspondence with one another to agree in specification for the feature [distributed]. In (9), the faithful candidate is eliminated because it fails to satisfy the highly ranked constraint requiring correspondence relations between oral and nasal coronal stops. Candidate c is the winner because it satisfies this constraint as well as the constraint ID-IO [+dist] which demands that dental segments in the input are realized as dental segments in the output. This tableau shows how a disharmonic input in Anywa can result in a harmonic output containing dental nasals.

The tableau in (10) shows the evaluation of a disharmonic input in Luo. The ranking in (10) differs from (9) in that the input-output faithfulness constraints referring to [distributed] are ranked above the constraint establishing correspondence relations between oral and nasal stops. In this case, a disharmonic input will be realized as the faithful candidate, candidate a in this example, because faithfulness to input feature values of [distributed] take precedence over the establishment of surface correspondence relations between nasal and oral stops.

Rose & Walker (2004) argue that contrast is not the relevant factor determining which segments will participate in the cooccurrence constraints. In an account using a fixed hierarchy of constraints referring to similarity, both languages are assumed to have the same system of contrasts and similarity will likewise be uniform in both languages. The constraint family establishing correspondence relations between surface segments is universally ranked according to relative similarity. The only difference between Luo and Anywa is the ranking of IDENT-IO [distributed] with respect to the similarity hierarchy. In Luo it is ranked above the constraint establishing correspondence relations between nasal and oral stops and in Anywa it is ranked below this constraint.

The case of dental harmony in Anywa is presented in Rose & Walker (2004) as a counterexample to any claims that contrast is crucial in determining consonant harmony patterns. In Anywa, [distributed] is not contrastive among the nasals yet the nasal participates in the cooccurrence constraints.

Within the framework of the contrastive hierarchy, however, it does not follow that identical surface inventories result from an identical system of contrasts at the level of feature specification. The consonant inventories of Luo and Anywa are presented below, followed by a contrastive hierarchy account of the different patterning of cooccurrence restrictions in the two languages.

(11) Luo consonant inventory (from Tucker 1994:30)

	Labial	Dental	Alveolar	Palatal	Dorsal	Glottal
voiceless stops	p	t̪	t	c	k	ʔ
voiced stops	b	d̪	d	ɟ	g	
prenasal stops	ᵐb	ⁿd̪	ⁿd	ᶮɟ	ᵑg	
nasals	m		n	ɲ	ŋ	
fricatives	f		s			h
liquids			r,l			
glides	w			y		

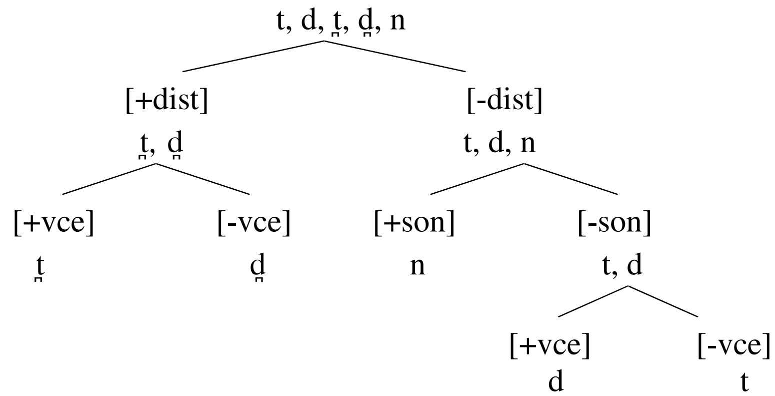
(12) Anywa consonant inventory (from Reh 1996:23)

	Labial	Dental	Alveolar	Palatal	Dorsal	Mute
voiceless stops	p	t̪	t	c	k	
voiced stops	b	d̪	d	ɟ	g	
nasals	m		n	ɲ	ŋ	
liquids			r,l			
glides	w			y		
mute						‘

The lack of a nasal phoneme at the dental place of articulation in the two languages corresponds to two possible orderings of contrastive features. One possibility is that the feature distinguishing dental and alveolar segments is ordered first. All segments are split according to [distributed], which is thus contrastive for the entire inventory including the coronal nasal. The other possibility is that [distributed] is ordered below the feature distinguishing sonorants and obstruents, or nasals and non-nasals. If [distributed] is ordered below [sonorant], the nasal will be isolated from the other coronal stops before the feature [distributed] is specified. [distributed] will not be contrastive for the nasal.

These two possible orderings of contrastive features are able to account for the different behaviour of the nasal stop in Luo and Anywa. In Anywa, the ordering of features corresponds to the first possibility described above. The feature [distributed] is ordered above the feature [sonorant]. /n/ will be specified [-distributed] and [+sonorant]. After these features are added, /n/ is uniquely specified and requires no other features. A feature distinguishing voiced and voiceless obstruents will be required to uniquely specify the voiced and voiceless coronal stops, both dental and alveolar. The contrastive hierarchy for Anywa is illustrated in the tree diagram of figure (13).

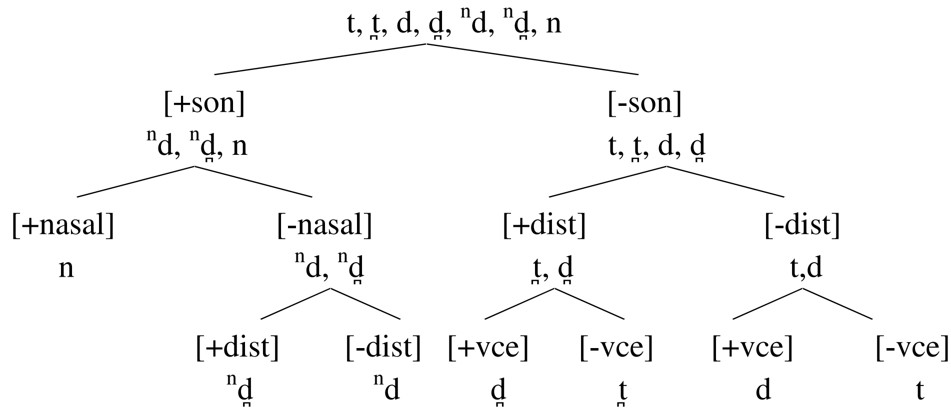
(13) Anywa contrastive hierarchy



The hierarchy of contrastive features in Luo differs from that of Anywa and corresponds to the second possibility described at the beginning of this section. The inventory of coronal stops in Luo is greater than that of Anywa due to the presence of prenasalized stops. I assume that prenasalized stops are sonorants in Luo and as such are specified [+sonorant] and are not phonologically specified for nasality. Nothing crucial hinges on this assumption. The feature [nasal] distinguishes the nasal stops from prenasalized stops. The feature [sonorant] is ordered first, dividing the coronals into sonorants and obstruents. The feature [nasal] is ordered next and distinguishes the nasal from the prenasalized stops. At this point, the /n/ is uniquely specified and requires no other features. The feature [distributed] is ordered next and is contrastively specified on both the obstruents and the prenasalized stops. A feature distinguishing between voiced and voiceless segments is again required to specify the obstruents.

A tree diagram illustrating the order sonorant > nasal > distributed > voice is shown in figure (14) below.

(14) Luo contrastive hierarchy



The contrastive hierarchies given above and the resulting feature specifications are capable of accounting for the different patterning of the two languages. In Anywa the nasal is subject to the cooccurrence restriction barring alveolar and dental stops, and a dental nasal surfaces allophonically in harmonic forms. In this language the nasal is contrastively [-distributed]. The feature responsible for the contrast between dentals and alveolars is thus contrastive for the set of nasals. If the cooccurrence restriction is formulated as a ban on coronal segments with different values for the feature [distributed], the nasal will violate this restriction when it occurs with a dental stop. This violation can be remedied by spreading the feature [+distributed] from the dental to the alveolar nasal resulting in a harmonic form and a dental nasal on the surface.

In Luo, the nasal does not participate in the cooccurrence restrictions and there are no surface dental nasals. The feature [distributed] is ordered after [sonorant] and [nasal]. The coronal nasal is thus already uniquely specified when the feature [distributed] is added leaving [distributed] noncontrastive and unspecified for the nasal stop. If the cooccurrence restriction for Luo is formulated as a ban on coronals that are specified for different values of [distributed] then the nasal will not participate, as it has no specification for the relevant feature. The nasal may freely cooccur with both dental and alveolar stops without incurring any violation of the cooccurrence restriction.

In this account, determining which segments will interact is not achieved by arriving at a similarity measure by counting shared features. Rather, segments which interact form a natural class. In both languages this class can be defined as the set of coronal stops contrastively specified for the feature [distributed]. Distinct segments within this class may not cooccur. Banned structures are eliminated by spreading the value of the [+distributed] coronal to the [-distributed] coronal.

The contrastive hierarchy account draws a connection between the inventory shape and the patterning of the cooccurrence constraint while still allowing variation between languages with similar inventories. The lack of a contrast in the dental series leads to the dental not participating in Luo. The lack of a dental nasal does not require the neutrality of /n/, as shown in the patterning of Anywa, where [distributed] is contrastive for the nasal.

An account relying only on the relative similarity of oral and nasal stops, such as that suggested in Rose & Walker (2004), does not draw a connection between the failure of the nasal to participate in Luo and the fact that there is no dental nasal in the inventory. Such an account would be unaffected if nasal stops were phonemic at both dental and alveolar places of articulation. In Nilotic languages like Shilluk (Gilley 1992) and Päri (Andersen 1988) that do have a contrast between dental and alveolar segments in the nasal series, the nasal participates in the cooccurrence restrictions

The contrastive hierarchy account is able to make explicit what feature specifications will be ruled out by structure preservation. The occurrence of dental /n/s in surface forms in Anywa appears to violate the principle of structure preservation as developed in the theory of lexical phonology (e.g. Kiparsky 1982, 1985). Kiparsky's (1985) definition of structure preservation states that no value of a noncontrastive feature may be specified in the lexical phonology. In the analysis given above, the alveolar nasal in Anywa is contrastively [-distributed]. Because distributed is contrastive for the nasal, structure preservation does not rule out the possibility that the nasal may become specified [+distributed] through phonological processes.

Evidence for this view is found in other phonological processes. Dental nasals also surface outside of harmonic contexts in Anywa. In some morphological processes a final dental stop becomes nasalized and a dental nasal surfaces. This can even result in surface minimal pairs in the language as seen in the data in (15).

(15) Anywa (from Reh 1996)

a)	pòon̪n̪ò	'to become smooth'	<	pɔɔd̪ 'be smooth' + no
b)	póonnó	'to beat for sb.'		

Dental nasals do not appear allophonically in Luo on the other hand, even in morphologically complex forms where an alveolar nasal appears adjacent to a dental stop.

(16) Luo (from Tucker 1994)

a)	lot̪ni	'to be loose'	<	lot̪ + ni	lot̪ + o	'to tie loosely'
b)	lʊd̪nɪ	'to be in want'	<	lʊd̪ + nɪ	lʊd + ɔ	'to maltreat'

The lack of a dental nasal in Anywa is thus an accidental gap, not required by the system of contrasts in the language. In Luo, on the other hand, the lack of a dental nasal is a systematic gap and structure preservation will rule out the creation of a [+distributed] dental nasal, as well as the specification of [-distributed] for this segment. A theory of contrast and reference to the contrastive hierarchy is able to make explicit what feature specifications will be ruled out by structure preservation.

5. Conclusion

The case studies reviewed show the role of contrastive specifications in determining relative similarity and interacting segments in harmony processes. In Anywa, Luo, and Bumo Izon segments which participate form a natural class in that they are all and only the segments specified for the harmonic feature.

The contrastive hierarchy analysis is able to draw connections between inventory shape and patterning of cooccurrence constraints while still allowing variation between languages with similar inventories. This approach can successfully model crosslinguistic differences in harmony patterns and need not be tied to direct phonetic properties.

Questions still arise, however, with respect to the limitations of contrastive ordering. Some contrastive hierarchies seem more plausible than others and the question of what is a possible contrastive hierarchy remains to be answered. Data from consonant harmony systems may shed light on this issue. While this paper has examined crosslinguistic differences in the patterning of coronal harmony systems, Hansson's (2001) typology of harmony systems also suggests some consistencies. For example, none of the laryngeal harmony systems show sonorants participating although they are phonetically voiced. This suggests that no languages with consonant harmony have the feature [voice] ordered above [sonorant]. The data from consonant harmony systems may thus aid in the task of constraining possible orderings within the framework of the contrastive hierarchy.

Sara Mackenzie
Department of Linguistics
University of Toronto
Toronto, Canada
s.mackenzie@utoronto.ca

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De re and *de se* in quantified belief reports

Emar Maier

Percus & Sauerland (2003) use quantified belief reports of the form *Only Peter*$_i$ *thinks he*$_i$*'s* ... to argue for dedicated *de se* LFs. The argument is targeted against any reductionist account that sees *de se* as merely a particular subtype of *de re*, viz. a *de re* belief about oneself from a first person perspective, requiring nothing but an account of *de re* attitudes. My *acquaintance resolution* framework is an attempt at just such a reduction and in this paper I extend that theory with a projection mechanism to allow local accommodation of acquaintance relations. With this extension we can account for their data, as well as for some related data involving quantified belief reports familiar from arguments in the *de se* literature.

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1. *Introduction*

In case your PDF reader doesn't display movies[1] and you are unfamiliar with *Family Guy*[2] what happened in this scene was that a police squad breaks into Peter's house, accompanied by a camera crew filming live, so Peter was able to follow his own arrest live on TV, which he does, but without realizing it's him that's being arrested and filmed. Seeing himself and his wife Lois on the TV, he remarks: "Hey, fatty's wife's a babe". Although his statement is about himself and his own wife, this attitude does not directly contradict his usual reluctance to think of himself as fat, or of Lois as sexy. For the purpose of this paper we should add that Peter's best friend Cleveland is less prone to self-deception and would (rightly) describe himself as fat.

Peter's is a typical case of mistaken self-identity as introduced into the philosophy of language by Kaplan (1989) whose original example had him looking at himself in a mirror while pointing and shouting: "That guy's pants are on fire!". Such scenarios show the difference between *de se* and *de re* beliefs about oneself.[3] On the one hand, Cleveland's "I'm fat" and Peter's "Fatty's wife's a babe" both express (among other things) a similar belief that is in both cases about the utterer himself, viz. that he's fat. On the other hand the cognitive attitudes of these two expressed beliefs differs vastly, as is obvious from the fact that Peter would never express the proposition that he's fat with the words "I'm fat" that Cleveland chose.

On most accounts it follows that both men have *de re* beliefs about themselves, since they are both referring more or less directly to themselves with their statements about who's fat. There is nonetheless an obvious difference in the *way* they manage to refer to themselves: Cleveland's belief is "from a first person perspective" as evidenced by his use of the first person pronoun to refer to himself, while Peter's choice of an expressive with accompanying pointing shows a "third person perspective" on the belief that he's fat. Both beliefs have in common that there's a real and perceptual link between the believer and the object or *res* of his belief: Peter sees it on TV; Cleveland knows he himself is the *res* of his belief. The terminology I'll be using has it that both beliefs are *de re*, because of the perceptual links, but only Cleveland's is *de se*.

The above tentatively suggests a treatment of *de se* attitudes as a subclass of *de re*. In section 2 we will make this precise by giving a semantics of *de re* and *de se* belief. In section 3 we will switch to belief *reports*, and see what the aforementioned semantics predicts as a semantics of reports. Section 4 presents a problem for the reductionist account of *de se* reports sketched above. In section 5 I present my own reductionist attempt, which will be extended in section 6 to cover the problematic constructions of 4.[4]

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[1]Supposed to work in Acrobat reader, versions ≥ 6. The clip can also be downloaded separately, in .mpg format.

[2]Season 3, episode 4 "One If By Clam, Two If By Sea" ©FOX 2001.

[3]I use the terms *de re* and *de se* a bit loosely, to conform to common longuistic practice. Under some definitions of these terms, beliefs like "That guy in the mirror's pants are on fire!" are also *de se* (because *that guy* is a complex demonstrative and, moreover, an *essential* indexical Perry 1977), but not *pure de se*.

[4]There's considerable overlap between sections 2, 3 and 5 of this paper and corresponding sections in its companion (Maier 2005). Both provide different extensions to Maier (2004), each addressing a different set of counterarguments to the *de se* reductionist proposal.

2. *The relational account of* de re *belief*

To carry out the reduction of *de se* to *de re* we must be precise about what *de re* belief is. For this purpose we use a combination of Kaplanian (1969) acquaintance relations and Lewisian (1979) self-ascription. To start with the Kaplanian ingredient, which relies on Quine's (1956) classic Ortcutt scenario as the motivating example:

> There is a certain man in a brown hat whom Ralph has glimpsed several times under questionable circumstances on which we need not enter here; suffice it to say that Ralph suspects he is a spy. Also there is a greyhaired man, vaguely known to Ralph as rather a pillar of the community, whom Ralph is not aware of having seen except once at the beach. Now Ralph does not know it but the men are one and the same [viz. Bernard J. Ortcutt]. (Quine 1956:179)

From the first half we conclude that Ralph in fact believes *de re* of Ortcutt that he is a spy, but from the pillar-of-the-community bit it follows that Ralph believes *de re* of Ortcutt that he is not a spy. How to account for these two facts, without dismissing Ralph as logically insane?

Kaplan (1969) has a simple answer: *de re* belief does not really involve so-called singular propositions, it's just *de dicto* belief with descriptive content provided by the way the believer is (perceptually) *acquainted* with the *res*. Applied to the Ortcutt example, the *res* is Ortcutt, and the relevant acquaintance relations involve Ralph seeing someone in a brown hat, and seeing some guy with gray hair at the beach. In Kaplan's own terminology: there are two *vivid names* of Ortcutt for Ralph: *the man in the brown hat* and *the gray-haired man at the beach*. The logical forms of the two seemingly contradictory beliefs then come out as *Ralph believes that the man in the brown hat is a spy* and *Ralph believes that the gray-haired man at the beach is not a spy*. The notion of belief needed then is simple *de dicto* belief, that is, belief as relating an individual to a general proposition, which we explicate as a set of possible worlds. The believed propositions for the example are given set-theoretically as $\{w \mid \text{in } w \text{ there is a (uniquely salient) man in a brown hat who is a spy in } w\}$ and $\{w \mid \text{in } w \text{ there is a gray-haired man at a beach who is not a spy in } w\}$. The classical *de re*/*de dicto* distinction has now faded somewhat, the only difference is that the content of a *de re* belief must involve a vivid acquaintance relation that actually relates believer and *res*. I will not here decide exactly what makes a relation vivid, but most forms of direct and indirect perception (e.g. on TV or in a mirror) standardly give rise to *de re* beliefs, whereas merely having picked up someone's name presumably doesn't. Equality is the relation that relates someone to the person that she *is*, perhaps the most intimate acquaintance relation of all.

To capture the *de re*/*de se* distinction, however, beliefs need more structure than just propositions construed as sets of possible worlds. This was the conclusion of Lewis's (1979) argumentation, based on examples where people are unaware or mistaken about who they are or are referring to. Take for instance the Family Guy scene discussed above, and imagine that Peter suddenly realizes what's happening, saying "Wait a minute, that's *me*. . . *I* am fat." What is the thing he has come to realize about himself? Of course, now he uses "I", as did Cleveland, so the belief has turned from merely *de re* to *de se*, but does that mean he has learned a new *proposition*? No, says Lewis, proposition-wise nothing has changed; whether he refers to himself in the third person with a pointing at the TV, or with *I*, the expressed proposition constituting his belief is that Peter is fat, i.e. $\{w \,|\, \text{Peter is fat in } w\}$.[5]

Lewis' solution is that belief is *self-ascription of properties*: first, Peter self-ascribes the property of seeing someone on the TV who is fat, then he realizes his mistake and comes to self-ascribe a different (additional) property, viz. that of being fat. In possible worlds semantics, these properties are set-theoretically represented as sets of pairs of individuals+worlds rather than just sets of worlds, in our example: $\{\langle a, w\rangle |\, a \text{ sees a fat person on TV in } w\}$ and $\{\langle a, w\rangle |\, a \text{ is fat in } w\}$, respectively. Self-ascription is a new primitive notion that replaces the old propositional attitude operator. Formally we have shifted from a relation between believer and proposition to one between believer and property. My formalization in section 5 relies on an alternative but equivalent formulation of Lewis' insights which sticks to a kind of proposition, but switches from sets of *worlds* to sets of *centered worlds* or *contexts*. For present purposes a context is simply a world which in addition comes with a unique agent/center, so we can describe Peter's predicament by saying that, first, he believes himself to be the agent of a context in $\{c \,|\, \text{the center of } c \text{ sees a fat person on TV in the world of } c\}$ and then, after realizing his mistake he eliminates from his belief-set the contexts where the person seen by the agent differs from the agent himself, leaving him with only the contexts in $\{c \,|\, \text{the agent of } c \text{ is fat in the world of } c\}$.

We want to extend the broadly Kaplanian analysis of Ralph's predicament to cover Peter and Cleveland's case as well. The obvious idea here is that *de se* belief is just *de re* belief under an "egocentric" description/acquaintance relation. In order for such an analysis of *de re* and *de se* to work, we must obviously heed Lewis' arguments establishing the need for properties instead of just propositions. So, here's how we combine the two (Kaplan and Lewis) into a unified analysis of *de re* and *de se*. First, make the Kaplanian definition of *de re* belief sensitive to properties/contexts:

(1) x believes *de re* of y that it has P iff there is a two-place relation (or rather, a partial function)[6] R s.t.
- (i) R is a sufficiently vivid acquaintance relation
- (ii) R holds between x and y (in the actual world)
- (iii) x self-ascribes the property of bearing R to something P

Applied to Peter and Cleveland we get that both believe *de re* about themselves that they are fat, because for both men x there is an R that holds between x and x (ii) and satisfies the other two criteria: for Peter we can take R to be *seeing someone on TV*, for Cleveland we can just take the relation of equality, since unlike Peter, he believes to "bear equality to someone who is fat" (iii). Formally, the properties verifying clause (iii) are $\{\langle a, w\rangle \,|\, \text{there is a fat person } b \text{ seen by } a \text{ on TV in } w\}$ for Peter, and

[5] To really derive this properly we must assume standard Kripke/Kaplan-style direct referentiality of *I* and *Fatty*+pointing, which means that referential terms like those designate their referents (Peter, in this case) directly, without the mediation of a Fregean *Sinn*, i.e. independent of the world of evaluation (Kripke 1972, Kaplan 1989).

[6] As von Stechow (1982) (backed by the anonymous reviewer) points out, in order to be a proper acquaintance relation R has to be unique in its second argument, i.e. it should satisfy the requirement that for all x there is *at most one* y with $R(x, y)$. Formally, this requirement makes the relation into a partial function.

$\{\langle a, w\rangle \,|\,$there is a fat person b in w and $a = b\}$ (=$\{\langle a, w\rangle \,|\, a$ is fat in $w\}$) for Cleveland.

Next, define *de se* as *de re* under the acquaintance relation of equality:

(2) x believes *de se* to be P iff x believes *de re* of x that he is P, with equality as the 2-place acquaintance relation R

It follows, correctly, that Cleveland's belief is *de se*, but Peter's is merely *de re*. This reduction of *de se* to *de re* can be traced back to Lewis:

> [*de se* belief] is ascription of properties to oneself under the relation of identity. Certainly identity is a relation of acquaintance par excellence. So belief *de se* falls under belief *de re*. (Lewis 1979:p.156)

However, Cresswell & von Stechow (1982) were the first to clearly separate belief and belief reports, and extend the above analysis of *de re* belief to a semantics of *belief reports*, with which the rest of the paper is concerned.

3. *Belief reports*

Belief reports are sentences typically used to convey that someone has some belief or other. As I said, the remainder of this paper provides a semantics for (a certain subclass of) belief reports, that is, a systematic way of deriving logical forms (representations of truth-conditions in a logical language) from surface structures of the form *NP believes that NP VP*. The obvious starting point being that a sentence of that form is true iff the referent of the first NP believes *de re* of the referent of the second NP that that last has the property denoted by the VP, for example:

(3) $[\![$Ralph believes that Ortcutt is a spy$]\!]_w = 1$
iff $[\![$Ralph$]\!]_w$ believes (in w) *de re* of $[\![$Ortcutt$]\!]_w$ that it is a spy
iff there is an R s.t.
(i) R is a sufficiently vivid acquaintance relation
(ii) $R([\![$Ralph$]\!]_w, [\![$Ortcutt$]\!]_w)$
(iii) $[\![$Ralph$]\!]_w$ self-ascribes the property of bearing R to a spy

We already saw that in Quine's example scenario these three clauses are verified by taking R to be the relation of seeing someone in a brown hat. An analogous derivation, with $R(x, y)$ is *x sees y at the beach*, shows the truth of the report *Ralph believes that Ortcutt is not a spy*.

From now on we restrict attention to reports of beliefs about oneself. As Kaplan (1989) has pointed out, in mistaken identity scenarios such as the one where Peter doesn't recognize himself on the TV, the following reports, as uttered by an informed spectator, are both true:

(4) a. Cleveland thinks he's fat.
b. Peter thinks he's fat [though he doesn't realize it].

At least, such has been the received view of philosophers since Kaplan (1989) first put forth the judgment. Perhaps the bracketed continuation or an explicit mention of the scenario will help to convince the reader of the truth of (4b), but there's no denying that (4b) is "not as good" as (4a), and it seems to really require a context in which the mistaken identity is saliently common ground among the speaker and her audience. My account comes with a *pragmatic* explanation of the difference between (4a) and (4b) in section 5, but for now let us just accept Kaplan's *semantic* judgment and see where it leads us.

Kaplan concluded that "purely indexical distinctions," such as the difference between Peter's *de re* and Cleveland's *de se* attitudes, cannot be conveyed by reports in natural language: there are no *de se* reports, only *de se* attitudes. In the reductionist framework discussed above, this boils down to saying that for a report to be true there has to be *some* acquaintance relation, and natural language has no way of specifying on the surface, *which* acquaintance relation. This is exactly what we automatically did in the straightforward report semantics exemplified in (3), which would indeed predict truth for both sentences in (4), in accordance with Kaplan's (1989) conjecture.

Such reductions of *de se* to *de re*, denying the existence of dedicated *de se* LFs for natural language reports have been proposed and defended by Boër & Lycan (1980), Cresswell & von Stechow (1982), and von Stechow (1982). The Lewis/Kaplan-inspired reductionist semantics worked out most explicitly by Cresswell & von Stechow (1982), has been adapted and applied to other linguistic phenomena by Reinhart (1990) (ellipsis in belief reports) and Abusch (1997) (sequence of tense, cf. also discussion on p.217). An equally reductionistic variant has been proposed in Kaplan's own slightly more complicated formalism of two-dimensional character theory, by Kaplan (1989), with significant refinements by Zimmermann (1991) and von Stechow & Zimmermann (2004).[7] Lately, however, there has been a surge in counterarguments, one of which is the topic for the remainder of the paper.

4. *Anti-reductionism*

There are two groups of counterarguments against the general reductionist setup, one appears in work on monsters and *de se* reports (Chierchia 1989, Schlenker 2003, von Stechow 2001; 2002), and the other involves quantified belief reports, most notably embedding under *only* (Percus & Sauerland 2003:=P&S). The first objection I discuss elsewhere, for now we'll focus on *only* and other issues that have arisen from embedding *de re*/*de se* reports under quantifiers.

The P&S argument is meant to give additional evidence to Chierchia's (1989) claim that, contrary to what Kaplan (1989) assumed, language can and does distinguish *de re* from *de se* reports, a case in point being *Mary hopes to win* which is false in a mistaken identity scenario where *Mary hopes that she will win, but she doesn't realize it* is true. Chierchia postulates distinct *de se* and *de re* LFs, so sentences as in (4) are ambiguous, whereas the corresponding infinitival report *believes to be fat*[8] would have only *de se* LF. To be a bit more specific: in

[7] von Stechow & Zimmermann (2004) do not argue for a reductionist account as such, in fact they compare the two reductionist frameworks, Kaplan (1989) vs. Cresswell & von Stechow (1982), and conclude that Kaplan's character theory is superior on grounds of its more obvious compositionality. The current paper will not address this particular criticism nor others related to (strictly Montagovian) compositionality. We focus here on the attack involving quantified belief reports.

[8] The English *believes to be* is pretty rare, so Chierchia resorts to Italian where *crede di essere* is the normal

Chierchia's theory a *de re* belief complement is of a sentential type, with a free variable bound by a *res* from the outside. Such complements become *de se* by fronting them with a λ at LF and binding the free variable, thereby type-shifting the propositional (*de re*) complement into a property (*de se*, Lewis-style). The variable binder has no discernible surface realization, so the ambiguity of (4) boils down to the appearance or non-appearance of this variable binder at LF.

P&S's argument in favor of Chierchia-inspired *de se* separatism starts off with a scenario like our Family Guy scene, i.e. a situation with different people having *de re* beliefs with the same contents, each about herself, but not all *de se*, in our case Peter's *being fat* belief is a mere *de re* and Cleveland's is *de se*. P&S then offer the sentence:

(5) Only Cleveland thinks he's fat.

Let's agree with their judgment that (5) is true, when uttered in the Family Guy context by an informed spectator. The *de se* reductionist semantics proposed in (3) is now in trouble, since it will assign (5) an LF with an existentially quantified acquaintance relation. P&S give reductionists only the narrow scope option, that is a logical form that treats *only Cleveland* as a quantifier and the rest as a simple co-referential belief report *x thinks he's fat* analysed as in (3). The resulting truth-conditions can be paraphrased as: Cleveland is the only x for which there is an R s.t. (i) R is vivid relation of acquaintance, (ii) $R(x, x)$, and (iii) x believes the person he bears R to is fat. This analysis would incorrectly predict falsity for (5) since Cleveland is not the only such x; for Peter there is an appropriate R as well, it's just not the same one. In other words, the reductionist proposal with narrow-scope acquaintance fails.

However, let's not be too hasty dismissing narrow-scope existential LFs, because there happens to be another argument—based also on quantified belief reports—*in favor* of this analysis, viz. Zimmermann's (p.c.) example of a universally quantified report of a mixed *de re*/*de se* situation:

(6) Both men think they're fat.

Zimmermann judges such a report true in our mixed situation,[9] meaning that an LF with narrow existential acquaintance (for both men x there is an appropriate R s.t.. . .) must be possible.

Returning to the P&S example, perhaps we can counter P&S with a wide-scope analysis, i.e. assign (5) an LF where the quantification over R is scoped outside the *only* operator: there is an acquaintance relation R such that only Cleveland has the property of believing himself to be fat *under that* R. This would seem to correctly predict truth for (5) by taking R to be the relation of equality. In fact, this is more or less Abusch's (1997) adaptation of the unified *de re* semantics of Cresswell & von Stechow (1982). Since her analysis comes quite close to the one I'll present myself in that it aims to let R be determined by the context, let me quote her in full:

> I understand the acquaintance relation as being given by the context or, more generally, as pragmatically constructed from discourse and contextual information. In

way to report *de se* belief. For English the point can be made with another attitude verb, e.g. *hopes to be*.

[9] Again, as with (4b), a continuation like 'but only one of them actually realizes it himself' may make the judgment much clearer, and moreover, the fact that such a continuation is well-formed, interpretable and felicitous already makes the point.

contrast, Cresswell and von Stechow quantify the relation in the semantic rule for believe. The definition in footnote 9 of Cresswell and von Stechow (1982) begins as follows:

(i) 'a believes ω of b in w iff there is a suitable relation ξ such that...'

An advantage of leaving the relation unquantified is that one can say that the relation is kept constant through a sequence of belief descriptions where Ralph is understood as presenting the *res* to himself in a consistent way. Further, one can analyze [*Ralph believes that Ortcutt is a spy*] as true in one context but false in another. I feel that an analysis which simply characterizes [that sentence] and [*Ralph believes that Ortcutt is not a spy*] as both true does not do justice to my intuitions. (Abusch 1997:fn.9 on p.9)

What Abusch actually does in the rest of her paper is simply to leave the variable R free, which automatically puts her in the (ultra-)wide-scope camp.[10] Leaving a free variable in a logical form, of course, is the standard way of saying "The binding of this variable to a suitable contextually given individual is left to pragmatics. I, as a semanticist, have nothing to say about that." Indeed, I don't see how one could say more about it in a classical *static*[11] semantic framework like Abusch's. This is the reason my own account to be presented below is couched in a *dynamic* semantic framework that allows this kind of contextual resolution to be an integral part of the (pragmasemantic) formal analysis.

It seems then that wide-scope analyses, especially those taking context-dependence into account, may have some advantages for unembedded belief reports, and can correctly predict truth for P&S's (5). However, as we noted before, the Zimmermann judgment (6) will remain problematic, and more seriously, consider (7):

(7) #Only Peter thinks he's fat.[12]

In our context Cleveland is known to say "I am fat", so (7) should definitely count as false, but the wide-scope analysis sketched above would predict truth again, by taking R to be the relation *seeing someone on TV*; only Peter is so related to himself while believing the person he bears that R to is fat. So, the simple wide-scope acquaintance version of the reductionist semantics exemplified by (3) fails too.

[10]Besides Abusch, this "wide-scope camp" perhaps contains Aloni (2000), who considers a pragmatic analysis where:

The sentence 'a believes b to be φ' uttered in context C is true iff there is a description α *suitable in* C such that α is actually b and a believes that α is φ. (Aloni 2000:p.61)

Additionally, Aloni cites some other logicians/philosophers with supposedly similar ideas (Aloni 2000:fn.34 p.57). I could also count myself in, but with reservations, because the account to be proposed here crucially allows occasional narrow scopings as well.

[11]Static semantic frameworks (like e.g. modal predicate logic) take truth and truth-conditions of sentences as the basic semantic units. In *dynamic* theories, the way an utterance changes its context is the primary focus of semantics, as will become clear in section 5.

[12]This sentence as counter argument to the simple wide-scope analysis was brought to my attention by Henk Zeevat at Szklarska Poreba 2004

The alternative proposed by P&S is simple: just assume separate "dedicated *de se*" and "general *de re*" LFs, as did Chierchia. On its *de se* reading, (5) gets an LF which reports Cleveland as having a first person belief of the form *I am fat*, which is true, so P&S correctly predict a true reading of (5) (in addition to any *de re* LF it might have). They would also get the right result for (7), since its *de se* reading is false, since Peter doesn't have a *de se* belief, and the *de re* reading is also false, since both men have a *de re* belief, be it under different perspectives. Note that this *de re* reading must thus cover both mere or strict *de re* and *de se*, so the syntactic ambiguity posited by P&S in effect must distinguish *de se* from *de re*-or-*de se*, which seems a bit redundant, from a theoretical perspective. Speculatively note that with this "redundant" ambiguity their theory may be able to deal with Zimmerman's (6) by saying that the embedded sentence there has the general *de re* LF, yielding something like the narrow scope existential acquaintance truth-conditions, though then the LF difference between the superficially similar complements of (5) and (6) would be totally *ad hoc*. P&S can give no explanation of why in the Zimmermann sentence we do not get the *de se* LF which should be something like a default, as was in fact also conjectured for universally quantified reports by Chierchia, who remarks, about his analogous sentence (30):

(30) a. Everyone in that room thinks that he is Hume.

> The most plausible interpretation of (30a) claims that each person in the relevant room has a certain de se attitude (perhaps due to schizophreny). (Chierchia 1989:p.10)

My goal will be to get rid of the P&S ambiguity and have the syntax generate only underspecified *de-re*-or-*de-se* LFs, shifting the job of disambiguation onto pragmasemantics. This is the crucial difference setting apart my analysis from its modern (separatist) rivals, who all put the burden on morphology/syntax (cf.Schlenker's 1999, 2003 *agreement* mechanism and Von Stechow's 2001, 2002 *feature deletion*).

In the next sections I propose a way to implement these ideas formally in order to show that we can capture all the above data in a reductionist framework based on a presupposition-like contextual resolution of acquaintance relations.

5. *Acquaintance Resolution*

My proposal, *Acquaintance Resolution*, is formulated in a dynamic semantics framework, viz. Kamp & Reyle's (1993) Discourse Representation Theory with van der Sandt's (1992) presuppositions-as-anaphora. I will here simplify a bit with respect to the formal semantics, focusing more on mapping sentences to representations and deriving correct (representations of) truth-conditions from sentences in their context.[13]

Just *representing* adequate *de re* and *de se* truth-conditions in DRT already necessitates some additions. A DRS consists of a set of discourse referents (think: existentially quantified variables) paired with a set of DRS-conditions, which may be predicates or other DRSs pre- or

[13]In Maier (2004) the interested reader will find the tedious formal semantic details, i.e. a 2-layered fragment of LDRT to account properly for direct reference and indexicality. For simplicity, we now proceed with a 1-dimensional toy version, keeping in mind that certain uniqueness and rigidity facts are left unaccounted for.

infixed by operators, like negation or quantifiers. We add to a standard DRS language an operator "believe(x)" interpreted as in (8), which involves a function $\mathcal{B}el \in [\mathcal{D} \times \mathcal{W} \to \wp\mathcal{W}]$ that assigns each individual a set of belief alternatives (=worlds she cannot distinguish from the real world), and that is given by the model:

(8) $[\![\text{believe(x)}{:}\varphi]\!]^f = \left\{ w \in \mathcal{W} \middle| [\![\varphi]\!]^f \supseteq \mathcal{B}el(f(\text{x}), w) \right\}.$

Now we can represent things like:

(9) a. Peter thinks there's a spy at the beach.
b. $\left[\ \text{x} \,\middle|\, \text{Peter(x), believe(x):} \left[\ \text{y} \mid \text{spy(y), at\_the\_beach(y)} \right] \right]$
c. $[\![\text{(9b)}]\!]_w = 1$ iff there is an individual a, called "Peter", in w, all of whose belief worlds $w' \in \mathcal{B}el(a, w)$ feature some spy who is at the beach (at w')

A second addition to vanilla DRT is the "center" predicate, a generalization of a "speaker" predicate that picks out the speaker of the current utterance. I use "center" to represent first person pronouns, (10a-b), but also to represent the agent/first person of a thought or other attitude, which is useful for capturing *de se* truth-conditions, (10c-d):

(10) a. $\left[\ \text{y} \mid \text{center(y), fat(y)} \right]$
b. $[\![\text{(10a)}]\!]_w = 1$ iff w has a center (speaker) who is fat in w
c. $\left[\ \text{x} \,\middle|\, \text{Cleveland(x), believe(x):} \left[\ \text{y} \mid \text{center(y), fat(y)} \right] \right]$
d. $[\![\text{(10c)}]\!]_w = 1$ iff a certain Cleveland in w has a belief set in which each world has a center (experiencer) who is fat

Due to the abovementioned simplifications (cf. footnote 13) we must now simply assume that "$w$orlds" here are actually more like *centered worlds* or *contexts* (in accordance with the discussion of Lewis on p.214), and we see that (10c) correctly represents the *de se* truth-conditions. But we have not said how to systematically get at such a representation, given a sentence like (4a). This process is often described as a two-stage procedure: first the sentence is parsed and compositionally transformed into a *preliminary DRS*, then (presupposition) resolution merges the preliminary DRS with the context (input) DRS and takes care of context-dependencies by binding or accommodating presuppositions, yielding the final (output) DRS representing the new context. My aim is to give an analysis of belief reports that assigns them all a single uniform preliminary *de re* DRS and in that sense unifying *de re* and *de se* reports. Note that my analysis is thus only weakly reductionistic because although the preliminary sentence representations of say (4a) and (4b) are uniform, after resolution the final representations (the *output contexts* in dynamic semantics jargon) differ, which is as it should be given the observed divergence in truth-conditions for *de re* and *de se* (readings of) reports.

To sketch the workings of acquaintance resolution, consider the 3rd person reports about Cleveland (4a), and Peter (4b), in the mistaken identity context. In our dynamic framework we must first represent this input context, in which it is common ground (among the reporter and her audience, that is, Peter of course is clueless) that there are two men, called Peter and

Cleveland, the first of whom is watching TV but not recognizing himself. This is represented as:

(11) $\left[\,\text{x y} \mid \text{Cleveland(x), Peter(y), see\_on\_tv(y,y)}\,\right]$

Now, the preliminary DRS of (4a) is:

$$(12)\quad \left[\;\left|\;\begin{array}{l} \partial\left[\,\text{z} \mid \text{Cleveland(z)}\,\right] \\ \text{R(z,w)} \doteq ? \\ \text{believe(z):} \left[\,\text{u v}\;\middle|\;\begin{array}{l}\text{center(u), R(u,v), fat(v)} \\ \partial\left[\,\text{w} \mid \text{masc.3.sg.(w)}\,\right]\end{array}\right] \end{array}\right.\;\right]$$

This represents a sort of LF based on the relational analysis of *de re* sketched in section 2. The proper name *Cleveland* and the pronoun *he* have triggered presuppositions, denoted by the ∂DRS, but there is also another kind of underspecification in (12), viz. R, a 2nd order free variable (ranging over 2-place relations), which is supposed to hold of z and w in the main DRS (corresponding to the real world). This R further serves as the descriptive content under which Cleveland has the *de re* belief, as represented in the complement DRS which says "there is a v that the belief center is R-acquainted with, and that v is fat" in accordance with the *de re* analysis of (1), p.214.

After merging (12) and (11), we resolve the regular presuppositions, that is, we try to bind the ∂ referents to *appropriate* ($\approx$predicated content matches pragmasemantically) and *accessible* (van der Sandt 1992) antecedents, in this case binding z (*Cleveland*) and w (*he*) to x (the contextually given Cleveland), and get:

$$(13)\quad \left[\;\text{x y}\;\left|\;\begin{array}{l} \text{Cleveland(x), Peter(y), see\_on\_tv(y,y)} \\ \text{R(x,x)} \doteq ? \\ \text{believe(x):} \left[\,\text{u v} \mid \text{center(u), R(u,v), fat(v)}\,\right] \end{array}\right.\;\right]$$

The resolution algorithm must perform what we might call a "second order binding" to determine R, given that must be a two-place relation that holds in the context between x and x. This 2nd order binding is done by means of 2nd order matching, a (very simple) special case of *higher order unification,* a powerful technique fruitfully applied in e.g. the semantic analysis of ellipsis phenomena by Dalrymple et al. (1991). Here, it means we look for a substitution for R that verifies the equation R(x,x)$\doteq$?, where the $\doteq$ represents $\alpha\beta\eta$-interconvertability of lambda terms (roughly: the left-hand term can be transformed into the right-hand term by executing a finite number of functional applications (β-reductions) and renamings of bound variables), after the "?" has been replaced by a contextually salient relation relating x to x. By default we take x=x for the ?-slot, which is not explicitly written in the context DRS, but can be thought of as always implicitly there, since it adds nothing to the truth-conditions. This gets us (14a). Then there are 4 possible unifying substitutions for R, of which (14b) is the one we want, the non-trivial one that resolves R to the relation of equality.[14] Applying it to the whole gives (14c), which is equivalent to (14d-e):

(14) a.
$$\left[\begin{array}{l|l} & \text{Cleveland(x), Peter(y), see\_on\_tv(y,y)} \\ \text{x y} & \text{R(x,x)} \doteq \text{x=x} \\ & \text{believe(x):} \left[\begin{array}{l|l} \text{u v} & \text{center(u), R(u,v), fat(v)} \end{array}\right] \end{array}\right]$$

b. $\text{R} \mapsto \lambda s \lambda t.s=t$

c.
$$\left[\begin{array}{l|l} & \text{Cleveland(x), Peter(y), see\_on\_tv(y,y)} \\ \text{x y} & (\lambda s \lambda t.s=t)\text{(x,x)} \doteq \text{x=x} \\ & \text{believe(x):} \left[\begin{array}{l|l} \text{u v} & \text{center(u), } (\lambda s \lambda t.s=t)\text{(u,v), fat(v)} \end{array}\right] \end{array}\right]$$

d.
$$\left[\begin{array}{l|l} & \text{Cleveland(x), Peter(y), see\_on\_tv(y,y)} \\ \text{x y} & \text{x=x} \doteq \text{x=x} \\ & \text{believe(x):} \left[\begin{array}{l|l} \text{u v} & \text{center(u), u=v, fat(v)} \end{array}\right] \end{array}\right]$$

e.
$$\left[\begin{array}{l|l} \text{x y} & \text{Cleveland(x), Peter(y), see\_on\_tv(y,y)} \\ & \text{believe(x):} \left[\begin{array}{l|l} \text{u} & \text{center(u), fat(u)} \end{array}\right] \end{array}\right]$$

We have succeeded in assigning a *de se* output DRS, equivalent to our earlier (10c), to an underspecified input.

As for Peter, (4b), a *de se* output would be false, contradicting our judgments, so let's see what happens if we add the same preliminary structure (12), except for the proper name, to the same context (11). After merging and resolving presuppositions, we're at (15a). If now we were to choose the default resolution, y=y for the question mark position and to consequently bind R to equality, we'd get *de se* which the context falsifies. But we can choose a different route, since now there is a salient contextual relation between y and himself: the seeing someone on TV, the derivation of the *de re* reading we get from that is shown in (15). One of the main selling points of this kind of analysis is that we can view the deviation from the default equality acquaintance, and the associated pragmatic backtracking described above, as an explanation of the awkwardness many people feel with (4b)'s way of reporting the situation.

(15) a.
$$\left[\begin{array}{l|l} & \text{Cleveland(x), Peter(y), see\_on\_tv(y,y)} \\ \text{x y} & \text{R(y,y)} \doteq \text{?} \\ & \text{believe(y):} \left[\begin{array}{l|l} \text{u v} & \text{center(u), R(u,v), fat(v)} \end{array}\right] \end{array}\right]$$

b. $\text{R} \mapsto \lambda s \lambda t.\text{see\_on\_tv(s,t)}$

c.
$$\left[\begin{array}{l|l} \text{x y} & \text{Cleveland(x), Peter(y), see\_on\_tv(y,y)} \\ & \text{believe(y):} \left[\begin{array}{l|l} \text{u v} & \text{center(u), see\_on\_tv(u,v), fat(v)} \end{array}\right] \end{array}\right]$$

d. $[\![\text{(15c)}]\!]^f_w = 1$ iff ... [context] ... and all of Cleveland's belief alternatives have a center who sees someone fat on TV

[14] A trivial one is for instance $\text{R} \mapsto \lambda s \lambda t.s=x$

Note in conclusion that the third person feature of the syntactically embedded *he* is straightforwardly interpreted as a semantic condition in the presupposition. This means that in the resolution *he*'s presupposition floats up to the main DRS, which places this account firmly in the reductionist camp championed by Cresswell & von Stechow (1982), opposite the separatists (Chierchia 1989, Schlenker 2003, von Stechow 2002) who all have to somehow semantically ignore the morphological 3rd person of the embedded pronoun to account for the *de se* reading. It remains to be seen if we can do better with respect to the quantified examples.

6. *Quantified belief reports*

We now turn to the more challenging judgments alluded to in 4 above, starting with (6). The quantifier *both* is treated as a generalized quantifier, very much like *all* in that it is interpreted as relating a restrictor set (the men) and a nuclear scope (believe they're fat) by the condition that all members of the restrictor have the property corresponding to the scope with an additional requirement that the restrictor set has exactly two members.[15] In DRT we represent generalized quantifiers as [restrictor]⟨quantifier⟩[nuclear scope], the ⟨quantifier⟩ specifying the variable that is being quantified. In our example the nuclear scope is a belief report like (4a) and the restrictor consists of a presupposed set of men, which we can easily bind to the set formed by Peter and Cleveland, so after the first trivial pronoun and proper name resolutions (to the quantified variable z) the preliminary DRS in context is:

(16)
$$\left[\begin{array}{l|l} x\ y\ X & \text{Cleveland}(x), \text{Peter}(y), \text{see\_on\_tv}(y,y), X=x\oplus y \\ & [\,z \mid z\in X\,]\left\langle\begin{matrix}\text{both}\\ z\end{matrix}\right\rangle\left[\begin{array}{l|l} & R(z,z)\doteq ? \\ & \text{believe}(z){:}\,[\,u\ v \mid \text{center}(u), R(u,v), \text{fat}(v)\,]\end{array}\right]\end{array}\right]$$

This has Cleveland and Peter and asserts that each of these two has the property of bearing R to himself and believing that he's R-acquainted with someone fat. What could R be? Well, no relations are given between z and z, so the default must apply; resolve to equality so that following (14) we get:

(17) a.
$$\left[\begin{array}{l|l} x\ y\ X & \text{Cleveland}(x), \text{Peter}(y), \text{see\_on\_tv}(y,y), X=x\oplus y \\ & [\,z \mid z\in X\,]\left\langle\begin{matrix}\text{both}\\ z\end{matrix}\right\rangle\left[\begin{array}{l|l} & R(z,z)\doteq z=z \\ & \text{believe}(z){:}\,[\,u\ v \mid \text{center}(u), R(u,v), \text{fat}(v)\,]\end{array}\right]\end{array}\right]$$

b. $R\mapsto\lambda s\lambda t.s=t$

c.
$$\left[\begin{array}{l|l} x\ y\ X & \text{Cleveland}(x), \text{Peter}(y), \text{see\_on\_tv}(y,y), X=x\oplus y \\ & [\,z \mid z\in X\,]\left\langle\begin{matrix}\text{both}\\ z\end{matrix}\right\rangle\left[\begin{array}{l|l} & \text{believe}(z){:}\,[\,u \mid \text{center}(u), \text{fat}(u)\,]\end{array}\right]\end{array}\right]$$

[15] The cardinality of the restrictor condition is perhaps best analysed as a presupposition, but we don't have time to go into that here.

In general, this is what we predict: a universally quantified report like (6) is true iff all individuals in the domain have a *de se* belief. This is exactly what Chierchia (1989:p.10) assumed, as witness the quote on page 219 here, and it also corresponds to the *de se* LF that P&S argue exists. In the context under discussion, this means the sentence is false, because Peter's belief is not *de se*.

Perhaps this is a plausible reading, but I agree with Zimmermann who says that *given a mixed context* the sentence is still true. How can we account for that? My proposal is to slightly generalize the acquaintance resolution framework, by positing a full presupposition-like projection mechanism for the second-order resolution of R. The idea is that R really is a presupposed variable, to be represented in the preliminary DRS as a ∂DRS with presupposed content given by the "R(...)$\doteq$?"-condition:

(18)
$$\left[\begin{array}{l|l} \text{x y X} & \text{Cleveland(x), Peter(y), see\_on\_tv(y,y), X=x}\oplus\text{y} \\ & [\,\text{z} \mid \text{z}\in\text{X}\,] \left\langle\begin{array}{c}\text{both}\\ \text{z}\end{array}\right\rangle \left[\begin{array}{l|l} & \partial[\,\text{R} \mid \text{R(z,z)}\,] \\ & \text{believe(z)}: [\,\text{u v} \mid \text{center(u), R(u,v), fat(v)}\,]\end{array}\right]\end{array}\right]$$

The effect will be that in resolution R can now be projected outside of an embedded position and furthermore it can be *accommodated* as well as bound. Recall that in presuppositions-as-anaphora, there's a resolution repair strategy called accommodation, which can be applied if binding fails (e.g. if all possible bindings lead to a false or incoherent output). What accommodation does is to fix the context so that the presupposition is in fact trivially resolved, and in DRT this amounts to just dropping the presupposition's referent and content at a suitable place in the DRS. Uncontroversial are *local* (drop it where it's triggered) and *global* accommodation (drop it at the main DRS), and with these extra resolution options offered by standard treatments of presupposition I will show that if we assume that the context-dependence of acquaintance relations is of a presuppositional nature we can tackle all the problematic examples of section 4. Note that the extension to full presuppositionality is conservative in that all results derived in the DRT framework sofar, can be seen as cases where R is just bound.

Returning to the analysis of the Zimmermann-Chierchia sentence (6): given that, as we saw above, the binding option leads to a false reading, we shall try accommodation. Local accommodation that is; global is not an option here because the presupposition's content contains two z's, which would become unbound if the presupposition were merged in with the main DRS. So, we merge the ∂DRS with it's originating DRS and we're done:

(19)
$$\left[\begin{array}{l|l} \text{x y X} & \text{Cleveland(x), Peter(y), see\_on\_tv(y,y), X=x}\oplus\text{y} \\ & [\,\text{z} \mid \text{z}\in\text{X}\,] \left\langle\begin{array}{c}\text{both}\\ \text{z}\end{array}\right\rangle \left[\begin{array}{l|l} \text{R} & \text{R(z,z)} \\ & \text{believe(z)}: [\,\text{u v} \mid \text{center(u), R(u,v), fat(v)}\,]\end{array}\right]\end{array}\right]$$

We now have a nuclear scope with a non-empty universe, and according to DRT semantics that means we have in fact derived what I termed the narrow-scope existential reading in section 4, i.e. each of the men has the property that there is an R holding between that man and himself and such that that man believes the person he is R-acquainted with is fat. And this is certainly true, as we had already seen.

So far, so good, so let's move on to the P&S and Zeevat examples, (5) and (7). We shall basically analyze *only* as a generalized quantifier that says that *only NP VP* is true iff $[\![\text{NP}]\!] \cap [\![\text{VP}]\!] = [\![\text{VP}]\!]$. In DRT, generalized quantifiers are represented as duplex conditions, so I propose the following semantics of *only* conditions:[16]

(20) a. Only NP VP

b. $\left[\!\!\left[\left[\text{x} \mid \text{NP(x)} \right] \left\langle \begin{array}{c} \text{only} \\ \text{x} \end{array} \right\rangle \left[\; \mid \text{VP(x)} \right] \right]\!\!\right]^{f} = 1$ iff there is a d s.t. $[\![\text{NP(x)}]\!]^{f \cup \{\langle \text{x}, d \rangle\}} =$ $[\![\text{VP(x)}]\!]^{f \cup \{\langle \text{x}, d \rangle\}} = 1$ and for all $d' \neq d$: $[\![\text{VP(x)}]\!]^{f \cup \left\{\left\langle \text{x}, d' \right\rangle\right\}} = 0$

Now we turn to P&S's (5), *only Cleveland thinks he's fat*. Note that the restrictor NP *Cleveland* is a proper name and such needs to be identified with the contextually given Cleveland, but at the same time it has to serve its role as quantified variable, a rather peculiar but harmless situation, represented in (21a). In (21a) we also see that R should hold between the quantified variable z and itself, because of course we're dealing with a sloppy/bound variable reading of the pronoun under *only*, i.e. not the reading *only Cleveland thinks Cleveland is fat [so Peter doesn't think Cleveland is fat]*. Resolution proceeds by trying to bind R: since the presupposition contains z's, again it cannot reach the main context and we're stuck with the default, equality, as the only option in (21b), which then leads to the strong *de se* LF (21c):

(21) a.
$$\left[\begin{array}{l|l} \text{x y} & \begin{array}{l} \text{Cleveland(x), Peter(y), see\_on\_tv(y,y), X=x}\oplus\text{y} \\ \left[\text{z} \mid \text{z=x} \right] \left\langle \begin{array}{c} \text{only} \\ \text{z} \end{array} \right\rangle \left[\begin{array}{l|l} & \begin{array}{l} \partial \left[\text{R} \mid \text{R(z,z)} \right] \\ \text{believe(z):} \left[\text{u v} \mid \text{center(u), R(u,v), fat(v)} \right] \end{array} \end{array} \right] \end{array} \end{array} \right]$$

b.
$$\left[\begin{array}{l|l} \text{x y} & \begin{array}{l} \text{Cleveland(x), Peter(y), see\_on\_tv(y,y), X=x}\oplus\text{y} \\ \left[\text{z} \mid \text{z=x} \right] \left\langle \begin{array}{c} \text{only} \\ \text{z} \end{array} \right\rangle \left[\begin{array}{l|l} & \begin{array}{l} \text{R(z,z)} \doteq ? \\ \text{believe(z):} \left[\text{u v} \mid \text{center(u), R(u,v), fat(v)} \right] \end{array} \end{array} \right] \end{array} \end{array} \right]^{17}$$

c.
$$\left[\begin{array}{l|l} \text{x y} & \begin{array}{l} \text{Cleveland(x), Peter(y), see\_on\_tv(y,y), X=x}\oplus\text{y} \\ \left[\text{z} \mid \text{z=x} \right] \left\langle \begin{array}{c} \text{only} \\ \text{z} \end{array} \right\rangle \left[\; \mid \text{believe(z):} \left[\text{u} \mid \text{center(u), fat(u)} \right] \right] \end{array} \end{array} \right]$$

This output corresponds to the *de se* LF that P&S argue for, and which is true: among the two men, Cleveland is indeed the only one with a *de se* belief.

[16] I am well aware of the difficulties of this simple semantics for *only*, but I choose it because of its intuitive appeal and because it's the straightforward analysis implicit in e.g. P&S and explicit in Schlenker (2003:89), of the already cited works. As a result, I ignore all issues related to *only*'s interaction with focus, intonation and presupposition. Note further that this semantics doesn't work for plural NPs. In footnote 19 I will briefly consider what happens on the one existing (slightly different) analysis of *only* in DRT, viz. Geurts & van der Sandt (2004).

[17] The presupposition may also move to the restrictor and be bound there, but that would make no difference since equality is still the only option.

But there's also Zeevat's observation: if the report were about Peter it would be false. Starting from his (7) we get a preliminary DRS resembling the previous one except for the quantifier. Resolution will of course proceed exactly the same but now the result is false: of the two, the only one with a *de se* fat-belief is certainly not Peter. That's good. But in order to do justice to the Zimmermann intuition we had expanded the system to allow accommodation of R in cases where binding fails, and this is such a case. So we must check that even by accommodation we cannot get a true output.

As we have remarked before, global accommodation and binding are not available given the R-presupposition's content, so we cannot bind R to the globally available relation of seeing someone on TV, which would be one way to make the report true. Local accommodation is the only possibility[18] and that gives:

(22)
$$\left[\begin{array}{c|l} x\ y & \text{Cleveland(x), Peter(y), see\_on\_tv(y,y)} \\ & \left[z \mid z=y\right] \left\langle \begin{array}{c}\text{only}\\ z\end{array}\right\rangle \left[\begin{array}{c|l} R & R(z,z) \\ & \text{believe(z)}: \left[u\ v \mid \text{center(u), R(u,v), fat(v)}\right]\end{array}\right]\end{array}\right]$$

Or, in other words, the narrow-scope existential reading, which is false because now both have the property expressed in the quantifiers scope, viz. there is some acquaintance relation R under which .... So, indeed, accommodation does provide an alternative, but fortunately it too is false, so we have done justice to Zeevat's judgment.[19]

[18] How about intermediate accommodation, if such exists? There's no need to choose sides in that debate since an intermediate "trapping" reading here happens to make very little sense anyway; would an R in the restrictor force quantification over $\langle$R,z$\rangle$-pairs? Then we'd need an extra argument for the only operator as well. And if not, there's still no sensible, let alone plausible, reading that I can attach to the intermediately accommodated output.

[19] It has been suggested that a different DRT analysis of *only*, viz. the one proposed by Geurts & van der Sandt (2004), might make the argument even simpler. Let's see. This alternative *only* analysis assigns the following structure (after resolution of the proper name) to the Zeevat example (7) in context.

(i)
$$\left[\begin{array}{c|l} x\ y & \text{Cleveland(x), Peter(y), see\_on\_tv(y,y)} \\ & \neg \left[\begin{array}{c|l} z & \neg\left[\ \mid z=y\right] \\ & \partial\left[R \mid R(z,z)\right] \\ & \text{believe(z)}: \left[u\ v \mid \text{center(u), R(u,v), fat(v)}\right]\end{array}\right]\end{array}\right]$$

Paraphrase: There is no z s.t. z is not Peter (y) and z believes that he is fat under acquaintance R. Because of the sentence's focus structure, this gets strengthened by Geurts & van der Sandt's (2004) "Background Presupposition Rule" which adds an existential presupposition to the effect that someone believes to be fat under R. Together with the assertion that no z unequal to Peter believes that, this yields the correct implication that Peter believes it. However, the question is here, do we apply BPR before or after the acquaintance resolution? G&S don't consider any sentences where presuppositions and the BPR interact in this way, but the easiest thing would be to first resolve R. If we do this, we can't bind R in the main context, because of the z's, but we can always bind R(z,z) to z=z and R to equality.

(ii)
$$\left[\begin{array}{c|l} x\ y & \text{Cleveland(x), Peter(y), see\_on\_tv(y,y)} \\ & \neg \left[\begin{array}{c|l} z & \neg\left[\ \mid z=y\right] \\ & \text{believe(z)}: \left[u \mid \text{center(u), fat(u)}\right]\end{array}\right]\end{array}\right]$$

To sum up, let's follow the idea of context-dependence of acquaintance to a logical conclusion: the acquaintance relation is presupposed, because that is enough to account for the problematic examples of Chierchia, Zimmermann, P&S and Zeevat. Moreover, merely a static formalization of context-dependence (or wide-scope) of acquaintance (e.g. by leaving the R free Abusch

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This coincides with the false reading that only Peter has a *de se* belief that he is fat, which is false (a correct prediction). So we try accommodation, which in this case can only be local, because global is blocked by the z's and there is no intermediate level. Local accommodation gives

(iii) $$\left[\begin{array}{c|l} \text{x y} & \text{Cleveland(x), Peter(y), see\_on\_tv(y,y)} \\ & \neg\left[\begin{array}{c|l} \text{z R} & \neg\left[\ \middle|\ \text{z=y}\right] \\ & \text{R(z,z)} \\ & \text{believe(z):}\left[\text{u v}\ \middle|\ \text{center(u), R(u,v), fat(v)}\right] \end{array}\right] \end{array}\right]$$

I.e. the narrow scope existential reading, which is false (because there *are* z and R, viz. Cleveland and equality, verifying the embedded DRS).

We see that both resolution outputs, (ii) and (iii), are false, even before applying the BPR (which would make it even more false), so we have done justice to the Zeevat judgment. Furthermore, it's easily seen that the P&S example can be assigned a true output by binding to equality. So, the G&S analysis of *only* works at least as well as the one I proposed earlier. Moreover, the fact that the question about intermediate accommodation does not even arise here (cf. footnote 18), seems an argument in favor of this analysis.

There are however still some problems that make me opt for the duplex condition analysis of (20) eventually. They have to do with the interaction between presuppositions (including anaphoric pronouns) and *only*. The main point is that on the G&S account the surface arguments of *only NP VP*, restrictor (NP) and scope (VP) are reversed in terms of accessibility in the preliminary DRS, and this may wreak havoc, for example with presuppositions triggered in the VP. In G&S, the construction algorithm presumably puts the NP material under the second negation, so that any presupposition triggered there will have access to material provided by the VP, but not the other way around. For example, the *his* in *Only a man loves his computer* will end up in a position from which the *man* is inaccessible so it cannot bind *his*. Note that this problem does not arise so strongly for definite NPs in the restrictor (e.g. proper names as in G&S's and my examples) because they will float up to the accessible global level anyway. But even so, I find it strange that resolution of *her* should depend on resolution of *Lois* in *Only Lois likes her husband*, which moreover then only seem to get a strict reading implying that nobody else likes Lois' husband. This problem is brought out even more clearly by Heim's (classnotes, discussed e.g. in Kratzer) famous *Only I did my homework* which would be assigned the preliminary DRS in (iva), or equivalently, the universal version in (ivb) (*Everybody who did "my" homework is equal to me*), which may help to bring out the same issues of accessibility without the double negation.

(iv) a. $$\left[\begin{array}{c|l} \text{x} & \text{center(x)} \\ & \neg\left[\begin{array}{c|l} \text{z} & \neg\left[\ \middle|\ \text{z=x}\right] \\ & \text{did\_homework\_of(z,y)} \\ & \partial\left[\text{y}\ \middle|\ \text{center(y)}\right] \end{array}\right] \end{array}\right]$$

b. $$\left[\begin{array}{c|l} \text{x} & \text{center(x)} \\ & \left[\begin{array}{c|l} \text{z} & \text{did\_homework\_of(z,y)} \\ & \partial\left[\text{y}\ \middle|\ \text{center(y)}\right] \end{array}\right] \left\langle\begin{array}{c} \text{every} \\ \text{z} \end{array}\right\rangle \left[\ \middle|\ \text{z=x}\right] \end{array}\right]$$

In the subDRS it is given that z is unequal to x, the speaker, so we can't bind the presupposition, y, triggered by *my* to z. The only remaining option is binding to the global speaker x, but this gives us only the marginal strict reading where it's implied that nobody else did my homework. The account I provided in (20) keeps the accessibility from VP to NP intact and is therefore arguably better suited to handle such cases as discussed here. Note that this whole discussion is related to the belief report business, because the supposed advantage of G&S, the avoidance of intermediate accommodation possibilities, is a direct consequence of their swapping restrictor and scope.

1997) is not enough because it gets rid of the narrow-scope possibility that the presuppositional framework provides as accommodation, and that is needed to account for the truth of Zimmermann's (6).

Conclusion

In this paper I argued for a reductionist account of *de se* reports, based on the relational analysis of *de re* belief, according to which *de se* belief is *de re* belief about oneself, under the acquaintance relation of equality (or under the description *the person I am*, if you will). Reductionists typically claim there's no dedicated *de se* LFs for reports, only general *de re* reports, subsuming *de se* and mere *de re* truth-conditions.

My own framework is reductionist in the sense that it assigns a uniform preliminary structure to all reports of the form *NP believes that NP VP*, in which definite NPs are all interpreted as presuppositions, and in which the acquaintance relation is left underspecified. A mechanism is provided by which the presuppositions and acquaintance relation are resolved in context, so it's really pragmatics that disambiguates between *de re* and *de se*, not syntax. As a bonus we get a pragmatic explanation for the fact that non-linguist/philosophers often find it hard to accept a co-referential third person report like (4b) in a mistaken self-identity scenario.

The final part of the paper slightly generalizes the resolution machinery in order to get a correct account of belief reports embedded under quantifiers. This was done mainly because quantified belief reports have been a source of counterexamples to reductionist attempts and of discussion about the nature of *de se* reports. I have shown how we can follow through the idea of context-dependence of acquaintance to a logical conclusion, the acquaintance relation is presupposed. Resolving this presupposition in a standard way is then shown to be enough to account for the problematic examples of Chierchia, Zimmermann, P&S and Zeevat.

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Emar Maier
Radboud University Nijmegen
e.maier@phil.ru.nl
`http://www.ru.nl/phil/tfl/~emar`

A second but probably related problem is the interaction between presuppositions and the BPR noted above. It is unclear which resolution should go first, and if it's the BPR, what happens with unresolved presuppositions in the background? Do they get copied? And are they then resolved independently?

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On phonologically null verbs
GO and beyond

Franc Marušič & Rok Žaucer

The paper discusses the phenomenon of null verbs and provides evidence for three different null verbs in Slovenian. We argue that what looks like a V^0-less structure with a modal taking a PP complement is best analyzed as containing a null V^0 *GO*; we thus add *GO* to *FEEL-LIKE*, discussed in Marušič and Žaucer (2004, 2005), and to the more widely acknowledged *HAVE*. Further, we argue that null verbs do not need any formal licensing (contra van Riemsdijk 2002); however, a recoverability condition mandates that they should co-occur with some elements that will signal their presence and thus make them recoverable.

1. The phenomenon of null verbs

When it comes to null elements, there is little disagreement in current linguistic theory that functional elements can be covert, with recent proposals positing null causatives (e.g. Pylkkänen 2002), null modals (e.g. Rivero & Milojević-Sheppard 2003), null prepositions (e.g. MacDonald 2004), null C, null T, etc. In the domain of lexical categories, however, null heads have not been as popular. In the verbal category, the basic idea has only persisted with regard to a null *HAVE* (Ross 1976; McCawley 1979; den Dikken et al. 1996; Larson et al. 1997) (Larson et al. 1997 add a null *BE*). Recently, however, van Riemsdijk (2002) has made a case for a null *GO* in some Germanic languages and Marušič & Žaucer (2004, 2005) have posited a null verb *FEEL-LIKE* for several Slavic languages. In this paper, we do two things. On the one hand, we present a crosslinguistic extension of van Riemsdijk's Germanic-based proposal for a null *GO* to Slovenian, and on the other, we offer a more general discussion of the phenomenon of null verbs, by drawing on several null verbs.

The paper is organized as follows. Sections 2, 3, and 4 introduce three Slovenian null verbs, *HAVE*, *FEEL-LIKE,* and *GO*, respectively, though we put a strong emphasis on presenting/defending the null *GO*, since *HAVE*, on the one hand, seems more widely acknowledged, and *FEEL-LIKE*, on the other, is discussed in detail in Marušič & Žaucer (2005). Section 5 argues against an ellipsis account of the null *GO* phenomena, instead positing a separate, phonologically null verb *GO* (giving support to van Riemsdijk 2002 and Marušič & Žaucer 2005). Section 6 rejects van Riemsdijk's claim that null verbs need to be structurally licensed, proposing instead that the only obvious (null-verb–specific) condition on their use is recoverability. Finally, in view of an apparent tendency whereby only semantically primitive

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concepts get realized with lexically null verbs, section 7 briefly addresses the status of two further verbs which are in Slovenian frequently absent/unpronounced.

2. Slovenian null verb HAVE

A null *HAVE/GET* has been proposed for English counterparts of sentences such as the Slovenian (1), with a simplified structure as in (2) (e.g. Ross 1976; den Dikken *et al*. 1996).[1,2]

(1) Maša je (včeraj) hotela medvedka ((že) jutri).
Maša AUX yesterday wanted teddy bear already tomorrow
'Yesterday, Maša wanted a teddy bear (as soon as) tomorrow.'

(2) Maša wanted [PRO TO-HAVE a teddy bear].

The reasoning is simple. Sentences like (1) allow two non-agreeing temporal adverb(ial)s (i.e. two positional adverbials referring to two distinct points in time), with *yesterday* modifying the 'wanting' and *tomorrow* modifying the 'having'/'getting'; this suggests that there are two temporally independent events.[3] On the assumption that events are introduced only by verbs and other primary predicates that can replace verbs in a sentence (cf. Svenonius 2004), two events provide evidence for two clausal domains (minimally including two VPs/*v*Ps).[4] Indeed, the adverbial modification in (1) makes such sentences parallel to overtly biclausal control structures such as (3) rather than to monoclausal structures such as (4), thereby confirming the correctness of a biclausal analysis for (1) (along the lines of 2), that is, with an embedded null *HAVE*. For details, see Ross (1976), McCawley (1979), den Dikken *et al*. (1996), Larson *et al*. (1997), Marušič & Žaucer (2005), etc. A question that we leave open for now is whether (1) contains an elided *have* or a separate null verb *HAVE*.

(3) Maša je (včeraj) hotela imeti medvedka ((že) jutri).
Maša AUX yesterday wanted have-INF teddybear already tomorrow
'Yesterday, Maša wanted [to have a teddybear (as soon as) tomorrow].'

(4) * Maša je/bo včeraj igrala košarko (že) jutri.
Maša AUX-PAST/FUT yesterday played basketball already tomorrow
* 'Yesterday, Maša played/will play basketball (as soon as) tomorrow.'

[1] As *GET* is just a change-of-state version of *HAVE*, we will simplify and use *'HAVE'* for both.

[2] Unless noted otherwise, examples in this paper are from Slovenian. Whenever inflection is not relevant for our argument, we omit it from the word-for-word glosses.

[3] Cf. Marušič & Žaucer (2005) for a more detailed discussion of the double adverbial argument, some apparent counterexamples and ways around them.

[4] Note that such an assumption is neither uncommon nor too controversial; it is obviously supported by the majority of linguistic data, and its conceptual simplicity clearly justifies accepting it as the null hypothesis. This assumption seems to underlie any constrained model where the semantics is compositionally read off of the syntax, and it has proven fruitful in the study of intensional transitive verbs (e.g. den Dikken *et al*. 1996), causatives (e.g. Travis 2000), serial verb constructions (e.g. Baker & Stewart 1999), event nominals (e.g. Alexiadou 2001), etc.

3. Null verb FEEL-LIKE

Marušič & Žaucer (2004, 2005) discuss sentences like (5), whose meaning corresponds to what is usually conveyed with two verbal forms while its surface form only exhibits one verbal form. Marušič & Žaucer argue strongly that (5) is best analyzed as containing a null lexical verb *FEEL-LIKE*, thus going against previous analyses (Franks 1995; Benedicto 1995; Rivero & Milojević-Sheppard 2003), which derived the disposition from a null modal/functional head.

(5) Fantom se je prepevalo.
boys-DAT.PL NON-ACTIVE AUX-PAST sang-3P.SG
'The boys felt like singing.'

Marušič & Žaucer's (2004, 2005) clearest evidence for the biclausality of the construction in (5) comes from the possibility of its hosting double non-agreeing temporal adverb(ial)s, as in (6a), and double non-agreeing depictive secondary predicates, as in (6b). Both of these possibilities show that we are dealing with two temporally independent events, and this, in turn (cf. section 2 and footnote 3), suggests that we are dealing with two verbs in two separate clauses. Example (6) further shows that the tense inflection on the auxiliary actually modifies the temporally independent 'feel-like' disposition, not the event denoted by the overt verb, showing that the 'feel-like' disposition must be associated with a TP that cannot be the TP of the overt verb.

(6) a. Črtu se je včeraj ful šlo domov v Petek.
Črt-DAT NON-ACT. AUX-3P.PAST yesterday so went-SG.NEU home on Friday
'Yesterday, Črt really felt like going home this Friday.'
b. Črtu se je pijanemu ful šlo domov trezen.
Črt-DAT NON-ACT. AUX-3P.PAST drunk-DAT so went-SG.NEU home sober-NOM
'When drunk, Črt really felt like going home sober.'

Further, if one assumes a strict hierarchy of functional projections and the correspondingly fixed linear order of (preverbal/IP) adverbs (Cinque 1999), the only way to switch the order of adverbs is to have two sets of functional projections, with the otherwise irreversible adverbs sitting in distinct clauses. Therefore, the fact that (7b), unlike (7a), allows the reversed order of 'again' and 'nonstop' further suggests that (7b) contains two clauses. And even regardless of any assumptions, (7a) only accepts the two adverbs in one order while its *FEEL-LIKE* counterpart admits both orders (see Marušič & Žaucer 2005 for details).

(7) a. Fidel je spet nepretrgoma / *nepretrgoma spet kadil havanke.
Fidel AUX again nonstop / nonstop again smoked Cubans
'Fidel again nonstop smoked Cuban cigars.'
b. Fidelu se je nepretrgoma spet kadilo havanke.
Fidel-DAT NON-ACT AUX nonstop again smoked Cubans
'Fidel nonstop felt like again smoking Cuban cigars.'

Moreover, the Serbian *FEEL-LIKE* construction can contain an inceptive prefix, in which case it is not the overt verb that gets the inceptive reading, but rather the disposition, (8). Since functional projections like modals cannot host such prefixes and do not come with their own set of aspectual (and other functional) projections, the disposition must stem from a null V^0 in its own clause. Also, as inceptivity is widely taken to scope below any kind of modals (e.g. Cinque 2003), *pri-* can only scope over the disposition if the latter is encoded in a V^0.

(8) Pri-jele su mi se jabuke. (Serbian)
INCEPTIVE-eat AUX I-DAT NON-ACT apples
'I started to feel like eating apples.' (not: 'I felt like starting to eat apples.')

And on a different note, Marušič & Žaucer (2005) argue that the null *FEEL-LIKE* cannot be a case of (specified) ellipsis, since in Slovenian, *FEEL-LIKE* sentences can get slightly different interpretation from their overt-verb paraphrases, and since in (some dialects of) Serbian as well as in Albanian, which also exhibit the *FEEL-LIKE* construction, there simply is no overt-verb paraphrases at all, which leaves no verb to serve as the input to ellipsis.

4. Null verb GO

4.1. Introduction

Discussing Germanic structures—parallel to the Slovenian one in (9)—which seem to contain a modal and a directional adverb(ial) but no overt main verb, Van Riemsdijk (2002) argues that they contain a null main verb *GO*. He thus goes against the alternative from Barbiers (1995), which holds that in such structures the modal—normally an F^0—has turned into a full verb (V^0), which obligatorily selects a directional adverb(ial); the motion is then seen as arising from the directionality of the adverb(ial).

(9) Vsak Slovenec mora vsaj enkrat na Triglav.
every Slovenian must at-least once onto Triglav
'Every Slovenian must go up Mt. Triglav at least once.'

Van Riemsdijk shows that while directional adverb(ial)s in Swiss German cannot normally occur sentence finally, i.e. after the auxiliary and/or modals, as shown in (10a-b), this restriction can seemingly be violated in the structures that overtly only contain a modal and a directional (op. cit.:148-9), as in (11). However, if one posits that the overtly sentence-final directional in (11) is actually followed by a null motion verb, such structures present no deviation from the otherwise robust generalization. In addition, this preserves a uniform treatment of modals as FPs, as one avoids having to see the modal in such structures as having turned into a V^0. For Swiss German and a number of other Germanic languages (excluding English), van Riemsdijk thus proposes a null motion verb *GO*.

(10) a. ... wil si iri tochter häi **hetted** **söle** **schicke**.
... because they their daughter home would've had-to send
'... because they should've sent their daughter home.'
b. ... wil si iri tochter **hetted** **(**häi) **söle** **(**häi) **schicke** (*häi).
... because they their daughter would've home had-to home send home

(11) ... wil mer (häi) hetted (häi) söle (häi).
... because we home would've home had-to home
'... because we should've gone home.'

A second possible alternative to avoid positing a null motion verb could claim that the directional PP is a complement of a null copula in *v*P (i.e. with no intervening VP), with the motion coming from the directionality of the PP (just like in the first alternative). If it can be made to work, such an alternative might be theoretically more appealing in that it would manage to keep another null element in the domain of functional categories, rather than having to include it in the lexicon (cf. Emonds 2000). However, an immediate problem for this approach comes from the fact that goal PPs, (12a-b), do not occur in simple predicative constructions. Note that although such structures are possible with source PPs, (12c), they can only get a static/non-motion interpretation, as shown by (12d). It seems, then, that in order to derive the motion in (9), the directionality of the PP alone will not suffice, so we will need to posit some kind of verbal element.

(12) a.*Ta pohod je na Triglav.
this march is onto Mt.-Triglav
b.*Peter je v gostilno.
Peter is into bar
c. Pivo Mack je iz Tromsöja.
beer Mack is from Tromsö
'Mack beer is from Tromsö.'
d. Peter je iz gostilne.
Peter is from bar
'Peter is originally from the bar (i.e. originally comes from the bar).' (not: 'Peter is going away from the bar.')

A third alternative, related to the one just discussed, could derive the motional interpretation from a null *motion* copula/*v* on top of a PP (cf. van Riemsdijk 2002:192-3), rather than from the combination of a *predicative* little *v* and a directional PP. Such an account, however, is implausible in view of the fact that the only uncontroversial copula in Slovenian, 'be', is necessarily overt in predicative sentences (i.e. in [*v*P [PP/AP]] structures), (13c); having to assume that the postulated motion copula is necessarily null, when the predicative/locational one is necessarily overt, is clearly not very appealing. In a similar vein, if a null-motion-copula approach were on the right track for the null *GO* sentence in (9), then one could reasonably expect—on the basis of structural parallelism—that the predicative/locational copula could be unpronounced at least in (13b), where the copula is embedded under an agreement-carrying modal and is followed by a PP/AP; this structure is a perfect match of the one that would be assumed for (9), yet unlike (9), (13b) is ungrammatical. Furthermore, since copulas (at least in Slovenian) do not seem to be as restricted as the structures of the type in (9), a null motion copula that shows a number of restrictions would actually be very similar to a null verb. Therefore, although a null-motion-copula analysis seems in principle possible, we do not see how the kind of copula we would need to posit to account for (9) would differ from a null verb. And since sentences like (13a) are impossible (in contrast to predicative structures with the (overt) copula 'be', 13c), it seems that this third alternative can be rejected in favor of the theoretically simpler option, where the element in (9) is seen as a null verb. (Also, we do not see how one can empirically differentiate between a null little *v* and a null V, and furthermore, the sentences with null *GO* may well have an unaccusative structure—in Dutch they get a 'be' auxiliary, not ‘have’ (van Riemsdijk 2003)—which not every syntactic model sees as containing a *v*P at all.)[5]

(13) a.*Peter v gostilno.
Peter into bar
‘Peter is going to the bar.’
b.*Peter mora v gostilni / pijan.
Peter must-3P.SG.PRES in bar / drunk
c. Peter je v gostilni / pijan.
Peter is in bar / drunk
‘Peter is in the bar / Peter is drunk.’

Unfortunately, Slovenian does not exhibit Germanic-style word-order phenomena, so we cannot replicate van Riemsdijk's argumentation; however, we will now present other kinds of empirical evidence to corroborate the initial claims we have just made about the need for positing a null motion verb in structures like (9). Specifically, section 4.2 will discuss data with non-agreeing adverbials, the ‘purpose’ preposition *po*, supine complements, covert modality, and VP/*v*P conjunction.

4.2. Arguments for the existence of GO in Slovenian

4.2.1. Non-agreeing adverbials

The argument that is often used for null *HAVE*—the possibility of non-agreeing temporal adverbials—can also be applied to *GO*. As (14) shows, a simple sentence with a single verb cannot accept contradictory temporal adverbials (regardless of the tense of the verb). On the other hand, these are fine in (15), even though there is only one overt verb (i.e. ‘feel-like’).

(14) *Včeraj Lina ni / nau šla jutri domov.
yesterday Lina not-PAST/ not-FUT go tomorrow home
‘Yesterday, Lina didn't/doesn't/won't go home tomorrow.’

(15) Včeraj se Lini ni ljubilo jutri domov.
yesterday NON-ACTIVE Lina not-PAST felt-like tomorrow home
‘Yesterday, Lina didn't feel like going home tomorrow.’

Simply, the possibility of two non-agreeing temporal adverb(ial)s in (15) shows that the sentence contains two temporally independent events and, by extension (cf. section 2, footnote 3), a syntactic structure with two VPs/primary predicates. Unless we assume that the directional adverb ‘home’ and the temporal adverb ‘tomorrow’ are actually inside a separate clause (with a null verb *GO*) embedded under ‘feel-like’, it is not clear why the sentence admits non-agreeing temporal adverb(ial)s. An alternative claiming that the directional adverb(ial) is subcategorized for by the verb ‘feel-like’, with the motion arising from the directionality of the adverb(ial),

[5] Note also that van Riemsdijk (2002:192) states that ‘specific lexical properties have to be attributed to the various empty light motion verbs in the different languages under scrutiny’ (i.e., Swiss German, Dutch, Afrikaans, Frisian, etc.), which, in our view, also argues against a null-motion-copula analysis of the null *GO* counterparts in the various languages, since functional elements should not have different lexical properties across languages, or in fact, should not have lexical properties at all.

would have to claim—contrary to standard assumptions whereby temporal adverb(ial)s are dependents of VPs (e.g. Demirdache & Uribe-Etxebarria 2004)—that the second temporal adverb(ial) is somehow a dependent of the directional PP/AdvP.

4.2.2. Purpose preposition po

Besides a directional adverb(ial), a modal can also appear to select for a non-directional PP with the 'purpose' preposition *po*, as in (16).

(16) Peter mora (v trgovino) po kruh.
Peter must to store for bread
'Peter must go (to the store) and get some bread.'

Po is typically said to signify 'movement with a purpose' (Bajec *et al*. 1994), or the NP is said to denote the 'object which someone goes to get' (Herrity 2000:293). Just like goal PPs, *po* cannot be used in predicative constructions, (9). Thus, an analysis taking the PP to be a complement of a null predicative copula in *v*P (i.e. with no intervening VP) again proves to be unfeasible.

(17)* Branje enciklopedije je po dejstva.
reading ecyclopedia AUX for facts
'The reading of an ecyclopedia is for facts.'

The preposition *po* is also barred from clauses without a motion verb, (18), where having a purpose preposition would semantically make perfect sense.

(18) a.*Prebral je knjigo po podatke.
read AUX book for data
'He read the book to get data.'
b.*Basal se je z misliji po čimveč energije.
stuff REFL AUX with cereal for more energy
'He was stuffing himself up with cereal to get more energy.'

Since (16), which contains no overt motion element, nonetheless works fine with the preposition *po*, we have to explain where the motion comes from. As shown by (19a), it cannot come from the modal. A modal taking an overt verbal complement does not have a motion interpretation that would license the presence of *po*. Similarly, a directional PP alone, as in (19b), does not have the motion interpretation that is needed to license *po*.[6]

(19) a.*Črt **mora** delati **po** računalnik.
Črt must work for computer
b.*Črt se je prijavil **na** Šussovo listo **po** čvek.
Črt REFL AUX subscribed to ŠUSS mailing-list for gossip

To sum up, despite there being no overt motion verb, (16) is read as 'he must go and get bread'; at the same time, *po* in (16) needs a motion verb to be licensed. It seems that the only feasible

[6] In other words, the 'motion' that arises solely from a change-of-state operator does not license *po*, the motion coming from motion verbs (such as *iti* 'go', GO, *teči* 'run', *seči* 'reach') does.

conclusion one can draw is that a motion verb is actually present but is not pronounced. While the null predicative copula+PP account is simply unfeasible, the only way to uphold the modal-turned-full-verb account would be to claim that this categorially converted element in (16) also converts semantically, i.e., it comes to encode both modality and motion.

4.2.3. Supine complement

Standard Slovenian distinguishes between infinitive and supine verbal forms, *beračiti* 'to beg' vs. *beračit* (supine lacks final *-i*). Unlike the infinitive, which occurs in typical nonfinite contexts, the supine follows verbs of motion (Herrity 2000), especially *go* and *come* (but also *carry, take, drive, send,* etc.). The supine conveys some kind of 'purpose', *in order to V*.[7] (20) is a typical example.

(20)	Lani	sta	šla	/	prišla	študirat(*-i)	v	Ljubljano.
	last-year	AUX	go	/	come	study-SUPINE	into	Ljubljana

'Last year they went / came to Ljubljana to study.'

Interestingly, the supine can also occur following a modal, as in (21). If the supine gets licensed by the motion verb, then the acceptability of (21) suggests that there must be a null motion verb in the sentence.

(21)	Moram	beračit.
	must-1P.SG	beg-SUPINE

'I must go and beg.' [uttered lying on the bed at home]

Note that there is no directional PP in (21) and that—given the context in the square brackets—the supine is actually the only possible form for (21). Note, further, that the directional PP is impossible in a comparable sentence with an infinitive, (22).

(22)	Za	preživetje	so	morali	(*na	cesto)	beračiti.
	for	survival	AUX-3P.PL.PAST	must-PL	onto	street	beg-INFINITIVE

'In order to survive, they had to beg.'

The alternative that sees the modal in a typical null *GO* example like (9) as a full verb that selects for a PP, as well as the one that posits a null predicational copula/*v* with a directional PP complement—that is, the alternatives that derive the motion solely from the directionality of the PP—cannot explain (21), since the latter contains no directional PP. But if there is no PP in the sentence, where is the motion coming from? It cannot come from the supine, when the

[7] Though reminiscent of the English *come see the band* and *go and see the band*, whose *come/go* Cardinaletti & Giusti (2001) analyze as a lexical verb merged in a functional projection (and the structures as monoclausal), our supine cases are structurally different. The English structures allow only the most primitive motion verbs, while the supine works under any motion verb. The English construction is barred from the past tense, the supine construction works in all tenses. Also, both the motion verb and the verb in the supine can occur in either their perfective or imperfective form (with all 4 combinations possible); if both verbs come with their own AspPs, the structure is presumably biclausal. Moreover, the two verbs can actually have distinct subjects, and can both come with an internal/accusative-marked argument, as in (i), clearly showing that both verbs project VPs.

(i)	Poslali	so	ga	študirat	jezikoslovje.
	Sent-PL	AUX-3P.PL	he-ACC	study-SUPINE	linguistics-ACC

'They sent him to study linguistics.'

supine itself is supposed to be licensed by a preceding motion verb. To explain (21) and the licensing of the supine, the null predicative copula+PP account obviously fails, and the putative modal-turned-full verb in (21) should thus even encode motion semantics. But if the modal-turned-full verb also encodes motion, then it is not clear why the PP in, say, (9) is necessary in the first place. The only way out, for such a proposal, seems to be the completely ad hoc claim that the modal-turned-full verb in (9) lacks motion but the modal-turned-full verb in (21) (as well as (16)) encodes motion as well, or the claim that the motion in (9) in fact also comes from the modal-turned-full verb, with which the PP is obligatory just to signal the converted (F^0-to-V^0) nature of the modal. All these stipulations seem quite ad hoc, and are clearly inferior to the principled, null-verb analysis.

In other words, sentences like (21) (and (16)) simply must contain a (null) verbal element providing the motion semantics. And in view of our discussion above (cf. section 4.1), which shows that positing a null motion copula would be problematic in several respects, we conclude that these sentences contain a null verb GO.

4.2.4. Covert modality

Infinitival [+wh] clauses get some sort of modal interpretation, although they do not have any overt modal element (cf. Bhatt 2000). In Slovenian, these clauses with covert modality can also occur with no overt verb and a directional PP.

(23)	Tinčku	so	pokazali	[kako	do	štacjona].
	Tinček-DAT	AUX-3P.PL.PAST	showed-PL	how	to	train-station

‘They showed Tinček [how to go to the train station].’

The lower clause in (23) has no overt verbal element. Since a clause should not consist of a complementizer and a directional PP alone, some invisible verb has to exist for the PP to be licensed. To explain (23) (assuming that there is no null motion copula in Slovenian, cf. section 4.1 above), we simply have to postulate a null V, either a null modal-turned-full verb or a null GO; but if so, then the alternative analysis, whose only advantage for sentences like (9) would be that it avoids positing null verbs, has to posit a null verb too, obliterating its very purpose of existence. The same objections can be raised also in view of (24), where covert modality co-occurs with the purpose *po*.

(24)	Še	zdaj	ne	ve	[	kako	z	biciklom	po	vino].
	still	now	not	knows		how	with	bike	for	wine

‘He still doesn't know how to go and get wine with his bike.’

4.2.5. VP/vP conjunction

If the GO constructions indeed contain a (null) VP and the modal is just an FP, it should be possible to conjoin the VP with another VP. This prediction is borne out, as shown by the examples in (25).

(25)	a.	Vid	ni	mogel	več	niti	do	avta	niti	postaviti	šotora.
		Vid	not	can	still	neither	to	car	neither	put-up	tent

‘Vid could neither go to the car nor put up a tent.’

b. Črt ni mogel niti po kruh niti dokončati domače naloge.
Črt not can neither for bread neither finish home task
'Črt could neither go and fetch bread, nor finish his homework.'

Since the modal in (25a-b) scopes over both conjuncts, as shown by the gloss, the conjoined phrases have to be smaller than TP and at least a VP, as the second conjunct clearly has a VP. If (25) is a VP conjunction, both conjuncts have to be VPs; therefore, the PP needs a verb to which it is a complement. If (25) conjoins two *v*Ps (or anything higher), the PP could in principle be a complement to *v*; but again, the only option for the *v* of the first conjunct would be the theoretically controversial null motion copula, while a null predicational copula is not an option, since—as we explained above—goal PPs and the purpose *po*-PPs cannot be complements to the predicational copula/*v*. In short, the PP in (25) must be a complement of a null motion verb. Note that this argument is valid regardless of the nature of the modal. Even if the modal is a V^0 (not an F^0), it cannot have the PP as its complement, since the modal scopes over both conjuncts. The complement of the modal is the conjunction, and since the conjoined phrases should be identical, the reasoning applied above applies here as well.

On the one hand, section 4.1 has provided substantial empirical evidence against two of the alternative accounts, namely, the modal-turned-full-verb account and the account with a null, PP-embedding predicational copula. On the other hand, not seeing how one could empirically differentiate between an account with a null motion V^0 and one with a null motion copula/v^0, we have raised several theoretical objections against the null motion copula account. Therefore, we conclude that the constructions under consideration are best analyzed as containing a null motion verb (V^0) *GO*.

4.3. The environments Slovenian GO appears in

Van Riemsdijk (2002) shows that the Germanic *GO* co-occurs with a modal and a directional PP. It seems, then, that the Slovenian *GO* has a wider distribution; we posited the existence of *GO* when a modal co-occurred with a directional PP, (9), with the non-directional purpose preposition *po*, (16), and with the supine, (21). Moreover, we posited *GO* when it co-occurred with covert modality, (23), and when a directional PP occurred under a propositional attitude report verb, (15). Note that the latter use does not stop with *feel-like* but is also found with other main verbs expressing volition, such as *want* or *wish*, (26)-(27).

(26) Peter hoče k najboljšemu zdravniku / po pivo.
Peter wants to best doctor / for beer
'Peter wants to go to the best doctor / … to go and get beer.'

(27) Matija si želi z Jono na pivo / po pivo.
Matija REFL wish with Jona onto beer / for beer
'Matija wishes to go for a beer / … to go and get beer with Jona.'

Furthermore, *GO* also occurs under main verbs expressing permission. Since (28) obviously involves two events occurring at two different times, as the non-agreeing adverbials show, and since the modality-introducing element hosts internal arguments, it has to be a full verb selecting for a clausal complement rather than a functional verb or a verb selecting for a directional PP argument.

(28) Ob petih mi mama ni dovolila v gostilno ob šestih.
at five I-DAT mum not permit into pub at six
'At five o'clock, I did not have mum's permission to go to the pub at six.'

Finally, *GO* can occur with grammaticalized non-verb world-creating elements such as the predicative element *rad* 'like' in (29), as well as with the imperatives in (30).

(29) Kuža bi **rad** k sosedovi psički.
puppy SUBJ like to neighbor's bitch
'The puppy would like to go to the neighbor's bitch.'

(30) Takoj domov / po kruh / spat!
right-now home / for bread / sleep-SUPINE
'Go home right now! / Go get bread right now! / Go to bed right now!'

To sum up, in section 4 we have corroborated van Riemsdijk's (2002) proposal by providing evidence for the existence of a null motion verb *GO* in Slovenian, but we have also shown that Slovenian appears to be more relaxed in its use of the null *GO* than the Germanic languages van Riemsdijk discusses (Swiss German, German, Dutch, Afrikaans, Alsatian, West Flemish, Frisian, and Luxemburgish). (This fact will be of importance in section 6, where we turn to the issue of null-verb licensing.) Next we turn to a discussion of the nature of our null verb *GO*, in particular, whether it represents a case of ellipsis of *iti* 'go' or a separate, phonologically null verb.

5. (Specified) ellipsis of iti *'go' or a separate null verb GO?*

Having established that the structures such as (9) contain a null V^0, one needs to determine whether the nullness of this V^0 is due to (specified) ellipsis (say, of the Slovenian verb *iti* 'go') or simply to the phonological emptiness of a lexical item. Based on independent evidence, van Riemsdijk (2002) and Marušič & Žaucer (2005) reject ellipsis accounts for *GO* in Swiss German and *FEEL-LIKE* in Slovenian, respectively. We will argue that the Slovenian *GO* should also be analyzed as a separate null verb, rather than an elided *iti* 'go'.

First, even in their non-idiomatic uses, *iti* 'go' and *GO* are not always interchangeable, (31), which is obviously incompatible with an ellipsis account (cf. van Riemsdijk 2002) but manageable on a null-verb account. Given that aspectual verbs such as *začeti* 'begin' only admit imperfective complements, (31) suggests that while *iti* 'go' (also) has an imperfective reading (and is thus aspectually underspecified), *GO* is aspectually more constrained, perhaps simply lexically perfective (as is the case with a number of Slovenian verbs, cf. Dickey 2003).

(31) Moral je začeti *(iti) proti meni.
must AUX-3P.SG begin-INF go-INF towards me
'He could start going towards me.'

Note that the impossibility of *GO* in (31) cannot be ascribed simply to the non-delimiting nature of *proti* 'towards', because *GO* does occur with *proti* providing that a perfective reading is available, as shown in (32).

(32) Zdaj boš moral pa počasi (iti) proti domu.
now AUX-3P.SG must-SG PTCL slowly go-INF towards home
'Now you will soon have to head home.'

In addition, given that replacing a word in an idiom typically results in the loss of the idiomatic reading, as in *when the shit hits / #reaches the fan*, the fact that the idiomatic reading of (33a) is blocked if we replace *iti* 'go' with *GO*, as in (33b), suggests that we are not simply dealing with ellipsis but rather with two near-synonymous motion verbs. These two arguments lead us to conclude, with van Riemsdijk (2002) for the Germanic *GO* and Marušič & Žaucer (2005) for the Slovenian *FEEL-LIKE*, that the Slovenian *GO* is not an elided *iti* 'go' but a separate, phonologically null verb. (Note that the argument with idioms can be applied also to *HAVE*.)

(33) a. Šest mescev teme ti ne sme iti na jetra.
six months darkness you-DAT not may go to liver
'Six months of darkness should not get on your nerves.'
b.#Šest mescev teme ti ne sme na jetra.
six months darkness you-DAT not may to liver
'Six months of darkness should not get on your nerves.'

As we have just suggested, the elision of an element should not result in the loss of an idiomatic reading. Indeed, gapping does not block an idiomatic reading; the gapped verb in (34a) normally cooperates in the interpretation of the idiom (note that both conjuncts in (34a) contain idioms with a *go*+PP structure and a very similar interpretation, with the one in the first conjunct expressing a stronger degree of irritation). Similarly, the idiomatic reading is preserved in (34b), where the whole verb phrase has undergone ellipsis. And needless to say, idiomatic reading is also preserved with sluicing, (34c). All of this shows that PF-ellipsis (including gapping) cannot explain the occurrence of the null GO, and (33) and (34) (in addition to 31-32) can safely be taken as support for positing an independent null verb *GO*.[8]

(34) a. Blair mi gre samo na živce, Bush pa že kar na jetra.
Blair I-DAT goes only to nerves Bush PTCL already to liver
'Blair only gets on my nerves, but Bush really annoys the hell out of me.'
b. Bush mi gre res ornk na jetra, Blair pa tudi.
Bush I-DAT goes really a-lot to liver Blair PTCL also
'Bush really gets on my nerves, and so does Blair.'

[8] A similar control test cannot be used for the aspectual facts from (31). Though sluicing and VP-ellipsis could be said to support our claim, we are not too sure of their relevance, since they may delete too much structure. Gapping, however, which in principle *should* be relevant, seems to target the aspectual and the main verb as a unit, thus obscuring the validity of this test as well. That is, if we gap both the aspectual and the main verb *iti* 'go', *iti* can indeed be read imperfectively, (i); however, we cannot test a sentence that gaps only the main verb *iti* without the aspectual verb, since such structures are ungrammatical for independent reasons (regardless of what verb we use), as shown by (ii).

(i) Črt je začel iti proti meni, Vid pa (*je začel) proti tebi.
Črt AUX started go-INF towards me Vid PTCL AUX started towards you
'Črt started going towards me, and Vid towards you.'

(ii) Črt je začel laufati proti meni, Vid pa je začel *(laufati) proti tebi.
Črt AUX started run-INF towards me Vid PTCL AUX started run-INF towards you
'Črt started running towards me, and Vid started *(running) towards you.'

c. Čuti,	da	mu	gre	nekdo	fajn	na jetra,	ampak	ni	zihr,	kdo.
Feels	that	he-DAT	goes	someone	a-lot	to liver	but	not	sure	who

‘He feels that someone really gets on his nerves, but he is not sure who.’

6. Licensing and recoverability of null verbs

Given that null verbs do not seem to be very common, van Riemsdijk (2002) proposes that in addition to the visibility granted upon *GO* by the modal and the directional adverb(ial), its occurrence has to be *structurally licensed* via the presence of a higher modal-verb FP; it is such formal licensing that presumably constrains the occurrence of null verbs. We argue that while null verbs obviously need to be visible/recoverable, they do *not* require any special structural licensing.

6.1. Non-uniformity of ‘licensing’ across null verbs

If licensing were structural, it should presumably be uniform for all null verbs (or else we are bringing structural requirements into the lexicon). This prediction, however, is not borne out. First, van Riemsdijk's formal licensing for *GO* does not work for *HAVE*, which cannot occur under modals, (35) (compare with (1) above). Second, the Slovenian *FEEL-LIKE* also freely occurs without a modal, (36).

(35)	*Janko	mora	medvedka.
	Janko-NOM	must-1P.SG.PRES	teddybear-ACC

‘Janko must have a teddybear.’

(36)	Janku	se	gre	v	hribe.
	Janko-DAT	NON-ACTIVE	go-SG.PRES	to	mountains

‘Janko feels like going to the mountains.’

Third, *GO*—in both Germanic (van Riemsdijk 2002) and Slovenian—is not restricted only to modal environments but also occurs under ‘want’, which is not a modal but a propositional attitude verb (e.g. Heim 1992, cf. also Wurmbrand & Bobaljik 2003, Marušič & Žaucer 2005). Moreover, in Slovenian it also occurs under other full verbs such as ‘feel-like’ (cf. above). Van Riemsdijk's modal-verb licensing therefore cannot capture null verbs in general, as a class.

6.2. Overtness of agreement as structural licensing of null verbs?

Van Riemsdijk (2002) notes that one of the functions of modals in structures with *GO* is to carry inflection. Extrapolating from this, one could perhaps see overtness of agreement as formal licensing for null verbs. This correctly predicts that English modals (e.g. *must*) do not occur with *GO*. The hypothesis also seems to work for *HAVE* as in (1), and *GO* as in (9), as their inflection would have been infinitival/default inflection, which presumably does not really need to be realized. The same may hold for imperative sentences as in (37), which—though containing no element to carry imperative inflection—can be analyzed as infinitival imperatives. On the other hand, agreement is indeed (partly) realized in the case of *FEEL-LIKE* (on the overt verb, cf. Marušič & Žaucer 2005).

(37) Takoj v posteljo!
immediately to bed
'Go to bed right now!'

Similarly, although the null *GO* in (38) would have had the gender and person agreement-carrying form of a participle (as seen on the bracketed forms), the very same agreement is doubled on the (grammaticalized) predicative *rad* 'like', thus presumably saving the overt-agreement generalization.

(38) Tinček/Tinka bi rad/rada (šel/šla) v Partizane.
T-MASC/T-FEM COND like-PRED.M/F go-PTCP.M/F to Partisans
'Tinček/Tinka would like to go to (= join) the Partisans.'

This hypothesis, however, overgenerates. If overtness of agreement were indeed a formal licensor of null verbs, then we falsely predict that null *GO* will be found under *all* functional verbs (e.g. implicationals), that null *HAVE* in Slovenian will be possible under modals (cf. (35)), that English *GO* will be fine under the perfect auxiliary (*have, has, had*) and *want* (*wants, wanted*), etc., none of which is true. And as for the fact that all null-verb occurrences conform to the above generalization, we suggest that this stems from a more general morphosyntactic requirement for overtness of agreement, i.e. a requirement that pertains to any structure, not specifically to null-verb structures.[9] Overtness of (meaningful/finite) agreement may thus be a precondition for null-verb structures, but it is not a structural licensor, and it is not null-verb specific.[10]

6.3. No special structural licensing for null verbs (contra van Riemsdijk 2002)

We have shown that van Riemsdijk's licensing cannot capture all occurrences of null verbs, and that overtness of agreement cannot serve as structural licensing (specific to null verbs) either. In fact, we see no reason why null verbs should require any special structural licensing in the first place. That is, if the lexicon contains phonologically null lexical items, they should be just as good syntactic building blocks as overt ones. Also, while lexical items can have selectional restrictions as to the syntactic category of their complement, they should not be able to lexically

[9] The status of this requirement can be language-specific. Unlike Slovenian, Polish and Czech, Russian allows *GO* with no overt agreement, (i). Interestingly, this pattern correlates with copula ('be') omissibility in predicative sentences, which works in Russian but not in the other languages.

(i) a.✓Ja v magazin. (Russian; McShane 2000: 206)
b.* Ja do sklepu. (Polish; McShane 2000: 206)
c.* Ja do obchodu. (Czech; McShane 2000: 206)
d.* Jaz v štacuno. (Slovenian)
I to store
'I'm going/I'm off to the store.'

[10] Larson *et al*. (1997) formally license null verbs by positing their (abstract) incorporation into the matrix verb (***want*** *a unicorn*) or complementizer (*look* ***for*** *a unicorn*). Though such an approach could perhaps be extended to all null verbs, we reject it as unobservable/untestable (how does one know/show that a null/invisible element is incorporated in another element rather than occurring on its own?), and as such unfalsifiable.

determine the type/extent of functional structure above them. Of course, null verbs have to be visible/recoverable; to be able to interpret (or acquire) them, the hearer has to be able to figure out that they are there. So there obviously have to be some flags signaling the presence of the null element. For example, the presence of *HAVE* is flagged by a DP complement to a propositional attitude verb such as 'want' or 'need'; the presence of *FEEL-LIKE* is flagged by a dative argument, a non-active voice morpheme, default agreement on the verb, incongruent tense and aspect inflection on the overt verb and semantic incongruence of the overtly lexicalized elements with the real-world affairs (Marušič & Žaucer 2005); and the presence of *GO* is flagged by a higher 'world-creating' element (be it a modal F^0, a lexical V^0, a predicative such as the Slovenian *rad* 'like', etc.) and a directional adverb(ial), or in Slovenian also by a supine verbal form or the purpose *po*-phrase. However, in addition to flags that ensure recoverability, there is—in fact there should be—no other, structural licensing. And then, given that these flags are not a case of structural licensing, there is no reason why they could not be construction/null-verb–specific, or (to some extent) language-specific.

But while null verbs require no structural licensing, they are nonetheless fairly rare, so there *does* seem to be something that restricts their occurrence (something non-structural, though, since e.g. *to ski* does not have a null counterpart in any language we know, regardless of whether it occurs under a modal, etc.). Looking at the verbs we have discussed, one option that comes to mind is that only semantically (or perhaps, cognitively) somehow primitive/basic concepts can be encoded with null verbs. Note that while this suggests that such basicness of meaning is a necessary condition for a verb to be null, it does not suggest that it is a sufficient condition; we are thus not predicting that all languages should share the full array of semantically primitive null verbs. The verbs we have discussed indeed all seem to express a primitive/basic relation, *GO*, *HAVE*, *FEEL-LIKE*[11] (cf. also Larson *et al*. 1997), and it may be suggestive that all three fall among the verbs that—still with their lexical meaning—in some languages undergo phonological reduction or are even realized as bound morphemes.[12] Moreover, all three also fall among the verbs that crosslinguistically often come to be used as purely grammatical morphemes for forming future and perfect tenses, which—perhaps from a slightly different perspective—again suggests a somehow basic status.

In sum, not only does van Riemsdijk's modal-verb licensing fail to capture null verbs as a class, it actually seems that there simply cannot—and should not—be any uniform structural licensing for null verbs. We thus conclude that the licensing of null verbs cannot be structural, though their occurrence seems restricted in several ways (overtness of agreement, visibility, semantic basicness). Note that the absence of a formal licensing condition distinguishes the occurrence of null verbs from ellipsis, which presumably *does* require some sort of (uniform) formal licensing (Merchant 2001).

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[11] Note that *FEEL-LIKE* is just a rough gloss for some sort of desire, close to what several Slavic languages also convey with a non-active form of 'want' — a more obvious primitive. Similarly, Larson *et al*. (1997) propose a null verb *FIND*, which may be less obviously primitive; however, note that the Slovenian 'find', *najti*, is (diachronically) merely a combination of *iti* 'go' and the prepositional prefix *na* 'on' (cf. the English prepositional verb *come across*). See also Marušič & Žaucer (2005) for a speculation about a (possibly decomposed) null *GIVE* in Russian, Polish and Czech. But see Inkelas (1993) for some null verbs whose meanings are less obviously basic/primitive.

[12] Note that phonological reduction or morphemic status do not necessarily equal an F^0 nature (cf. e.g. Travis 2000).

7. Other cases of unpronounced verbs in Slovenian

Besides the verbs we described in section 2, Slovenian has at least two other verbs that are frequently unpronounced, *TALK* and *HIT*. While we think one can safely conclude that *TALK* is a case of an elided 'talk', not of a separate null verb, the status of *HIT* does not seem to be that clear to us at this point, so we will simply point out some considerations that one should take into account when looking for a firm answer.

As shown in (39a), an overtly verbless question can be interpreted as if it contains the verb *talk*. It seems that such cases require a certain context, but that the latter is, at the same time, very often readily available. So in (39a), which is a question about the conversation itself, the context for *talk* is there by default. In (39b), on the other hand, the targeted topic is some distant event, which does not provide the required context, and an overt verb would have been necessary.

(39) a. O kom ti to?
about who you this
'Who are you talking about?'
b.*O kom je Gaber včeraj?
about who AUX Gaber yesterday
'Who did Gaber talked about yesterday?'

Similarly, (40) is felicitous only when checking this volume's table of contents. It seems, then, that these are most likely context-dependent cases of ellipsis. As the context is often there by default, it is no surprise that such cases are far from rare (cf. McShane 2000 for a discussion of Russian.).

(40) Joj, tadva bosta pa spet o svojih ničtih glagolih...
oh these-two will PTCL again about their null verbs
'Oh boy, these guys will again talk about their null verbs...'

As for the other frequently absent verb, *HIT* (cf. McShane 2000 for Russian), we do not wish to commit ourselves as to the ellipsis vs. null-verb nature of it, so we will simply put forth a few hints. On the one hand, one could attribute the absence of verbs in (41)-(44) to some sort of taboo-style ellipsis. Moreover, the array of possible verbal meanings in (41)-(44) ('hit', 'poke', 'spank', 'slap') may suggest that we are dealing with several different verbs, and hence with ellipsis. But on the other hand, unlike (39)-(40), such cases require no special context and may thus not be elliptical. Note also that the seemingly diverse possible verbal meanings are all from the same semantic class; and since—as we pointed out earlier—one may expect null verbs to be semantic primitives, we could perhaps reduce the variation in interpretation of the null element in (41)-(44) to something rather basic like 'affect (and possibly cause pain)', and thus account for these cases with a single null verb *AFFECT*. Nevertheless, in view of our discussion in section 6.2, an ellipsis account would be suggested also by the fact that agreement in (41)-(44) stays unrealized, regardless of the fact that it would have had a non-default/"meaningful" value (the same goes for *TALK* in (39)-(40)).

(41) Jona je Matijo na gobec.
Jona AUX Matija-ACC on mouth
'Jona **hit** Matija on the mouth (= **punched** Matija in the face).'

(42) Lina je Filipa z nalivnikom v uč.
Lina AUX Filip-ACC with pen into eye
'Lina **poked** Filip in the eye with a pen.'

(43) Te bom po nagi riti.
you-ACC will-1P on naked butt
'I'll give you a **spanking** on the naked butt.'

(44) Hišnik je sosedovega mulca okol ušes.
janitor AUX neighbor's kid around ears
'The janitor **slapped** the neighbor's kid once or twice.'

8. Conclusion

We hope to have shown that null verbs are real. We identified three null verbs in Slovenian: *GO*, *FEEL-LIKE*, *HAVE*. We claimed that these are separate null verbs, rather than a result of ellipsis of the otherwise overt verbs *go*, *feel-like*, *have*.

We have also shown that these null verbs do not share any kind of structural licensing, which led us to conclude that structural licensing of null verbs does not exist. Given that this might sound as a theoretical downside, we stressed that the reasons for structural licensing are actually theoretically dubious. The only thing that null verbs need is something to make them visible/recoverable/learnable, something to mark their presence in the sentence. Unlike licensing, simple *flagging* (a term due to van Riemsdijk) can and in fact should be different for different null verbs, if it is to be efficient.

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Franc Marušič
Stony Brook University
franc.marusic@guest.arnes.si
http://www2.arnes.si/~lmarus/

Rok Žaucer
University of Ottawa
rok.zaucer@guest.arnes.si

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Bracketing paradoxes and particle verbs: a late adjunction analysis

Heather Newell

It is well known that words like *unhappier* give rise to bracketing paradoxes (Pesetsky 1979, 1985; Kiparsky 1982; Sproat 1992; Lieber 1992; Hoeksema 1987, among many others): their phonological structure seems to be in conflict with their semantics. This paper will propose that the solution to this puzzle rests on the following generalization: all morphological bracketing paradoxes must involve a morphological adjunct. It is argued here that all morphological bracketing paradoxes involve one morpheme whose contribution to the word involves no projection of features.

1. Introduction

This paper concerns itself with two widely written about topics in the linguistic literature; the bracketing paradox, and the particle verb. These topics are related by the fact that there are two competing yet seemingly simultaneously necessary structures involved in the proper analysis of each.

Here let us briefly look at these necessary representations, leaving in-depth discussion for the remainder of this work. First, consider the bracketing paradox. A typical bracketing paradox can be exemplified by the word *unhappier*.

(1) a. [un [happier]]
 b. [[unhappy] er]

In (1a) we have the morpho-phonologically necessary structural representation of the word. It is well known that the comparative morpheme *–er* can only surface if the stem it attaches to is no larger than two syllables.[1]

(2) a. *beautifuller
 b. *intelligenter

[1] More in-depth restrictions (e.g. the phonological properties of the second syllable) are not relevant here.

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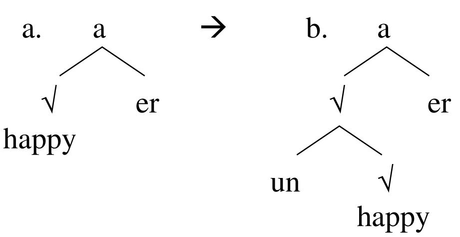
As the stem *unhappy* is three syllables long, it therefore cannot be the base to which *–er* has attached. Attachment to *happy*, however, obeys the robust phonological restriction on *–er* affixation.

In (1b) we have the semantically motivated structural representation. The meaning of *unhappier* is 'more unhappy'. The reading 'not more happy' — predicted by a step-by-step concatenation of the meaning of each morpheme in (1a) — is not a possible parse for this word.

The confound here is that each structure in (1) is required to explain one aspect of the construction of *unhappier*, yet each structure is blatantly at odds with the other, leading to the paradox.

This paper expands upon the proposal put forth in Nissenbaum (2000), namely that bracketing paradoxes dissolve under the assumption that certain morphemes may be late adjoined. The extension of the theory of late adjunction (Lebeaux 1988; Nissenbaum 2000; Fox & Nissenbaum 1999; Stepanov 2001) to X^0 elements is argued here to be inevitable within a realizational theory of morphology, such as Distributed Morphology (Marantz 1997, 2001; Halle & Marantz 1993, 1994, among others). This analysis invokes general restrictions on the ordering of the merger of syntactic elements (following Stepanov 2001) to account for the restrictions on and properties of bracketing paradoxes, which I claim favours this analysis over those that need extra machinery such as QR (Pesetsky 1985) or autosegmental structure (Falk 1991) to account for the same data.[2]

Specifically, I argue that the solution to bracketing paradoxes is as follows. The morpheme *un–* is a morphological adjunct. This adjunct status causes *un–* to be merged late, and allows its merger to a non-root node, as in (3b). Prior to the merger of the adjunct, we have the structure in (3a). Following Marvin (2002), the structure in (3a) constitutes a phase (c.f. Chomsky 1999), and is therefore submitted to the PF component, where the phonological restrictions on *–er* affixation are computed and met. Subsequent merger of *un–* inside this structure cannot alter the already established phonological relationship between the root and the comparative. Therefore neither the phonological nor the semantic restrictions on *unhappier* are violated in the course of its derivation.

(3)


This analysis rests on the proposal that morphological elements, such as *un–,* are merged by adjunction and therefore do not need to obey the cycle (Lebeaux 1998; Chomsky 1993; Stepanov 2001).[3] In the remainder of this paper I will argue that this is indeed the case, and that bracketing paradoxes can occur iff a structure involves a morphological adjunct.

We will also see how the above analysis solves the bracketing paradox invoked by nominalized particle verbs such as *herumgerenne* 'acts of aimless running', as seen in Müller

[2] Unfortunately, due to space restrictions, other analyses of bracketing paradoxes will not be discussed herein. I refer the reader to the literature cited.

[3] See also Bacharach & Wagner (2005) for an analysis of Brazilian Portuguese diminutives that relies on the notion of morphological adjunction.

(2003). Turning then to particle verbs in general, we will then see how this late adjunction analysis allows for a complex X^0 analysis of particle verbs, while avoiding the question of how one element of a complex head may excorporate.

Take the German *einflecht* 'insert', constructed of the verb *flecht* 'braid', and the particle *ein* 'in'. Here the idiomatic semantics of the particle verb seem to indicate that it should be treated as a word, as does the fact (under theories assuming a separate pre-syntactic morphological component) that it can be subject to further morphological processes.

(4) die **Einflechtung** des Buchstaben
the in.braid.ing of.the letter
'the insertion of the letter'

This word-like behaviour comes into question though, in cases (which are common) where the verb and the particle are separated syntactically.

(5) John **flechtet** den Buchstaben **ein**
John braided the letter in
'John inserted the letter'

Here we come up against the idea of Lexical Integrity (Di Sciullo & Williams 1987), which bans excorporation. If the particle and verb are a lexical item, or X^0, then they should not be able to separate in this fashion, and must therefore be a head (the verb) and a complement XP (the particle and any object present).

The above considerations lead us to a similar paradox involving particle verbs to the one seen above with *unhappier*. Examples such as (4) lead us to an X^0 structural representation of the particle verb, while examples such as (5) lead us to an XP analysis. As these two structural representations appear to be necessary, we are again dealt a structural paradox. Both the X^0 and the XP analyses of particle verbs seem necessary, but are inherently contradictory.

What I propose here is that both of the above paradoxes (the typical bracketing paradoxes, as well as the structural paradox involved with particle verbs) are a function of the syntactic derivational system. Once the method of constructing these words has been examined closely, the paradoxes disappear. The conclusions to be reached are

- that all Structural Paradoxes contain a late adjunct,
- and that no Structural Paradox can exist without a late adjunct.

Crucial to the analysis put forth here are the following assumptions. First, words are constructed in the syntax, not in a pre-syntactic morphological component (DM). Second, Late Adjunction is a robust syntactic operation (Lebeaux 1988; Stepanov 2001). Third, words, like phrases, are constructed in phases (Marantz 2001; Marvin 2002). Fourth, morphemes may only be late adjoined at an edge. This last assumption is Nissenbaum's (2000) Linear Edge Condition, applied at the word level, and gives us the impossibility of constructions like *happyuner*, as the late adjunct may not intervene between the morphemes in the previously spelt-out *happier*. The above allow us to postulate that morphemes can adjoin late to an edge at the X^0 level, in the same way that phrases can adjoin late at the XP level.

2. *Distributed Morphology*

Here I adopt the theory of morphology put forth initially in Halle & Marantz (1994) and Marantz (1997), namely Distributed Morphology (DM). DM holds that the terminal elements that enter into the syntax are the same elements that combine to form words. These elements may combine through operations in the syntax proper, or through lowering or merger in the syntax-phonology interface (Morphological Structure). Crucially for the proposals to follow in this work, vocabulary items within DM are not ordered linearly, nor specified with phonological features until MS/PF. This theory allows for both the intuition that morphemes are syntactic elements (6), and also for the fact that certain morphophonological phenomena (i.e. suppletion) may mask the one to one relationship between a morpheme and a syntactic terminal node (7).

(6) The king of England'**s** hat.

(7) He went to the store.

Let me refine here my assumptions about the DM model, and differentiate the notions of late lexical insertion, late merger, and the phenomenon of late adjunction proposed in this work. As mentioned above, lexical items within DM have no phonological form before they are realized at the PF interface. This late lexical insertion of phonological material to syntactic nodes is crucial to the current proposal, but is distinct from the phenomenon of late adjunction. Also, the notion that terminal elements may be inserted in the morphological component itself (post-syntactically) is a different notion from that of late adjunction of morphemes within the syntax proper. These Dissociated Morphemes, elements like Case, Agreement, Number and Gender may not be present in the narrow syntax, but are rather inserted at MS to '…meet universal and/or language-specific well-formedness conditions.' (H&M 1993:115). These elements may be thought of as being inserted 'late' into the syntactic structure, but are not the elements to be discussed in this paper. What will be examined in this paper is the phenomenon of adjoining elements counter-cyclically in the narrow syntactic component of the derivational system. These late adjuncts differ also in that they are not required by the system, they are not grammatical reflexes of a particular structural configuration, and the derivation does not crash should they fail to be inserted. Assuming that the syntax is computed in phases (to be discussed below in section 3.3), the timing of these three distinct 'late' operations can be schematized as follows.

(8) A timeline for insertion of Dissociated Morphemes, Late Lexical Insertion, and Late Adjunction

Phase 1: NS[4]

MS LF

Insertion of Diss. Morph.

Late Lexical Insertion

PF

In contrast to the two 'late' operations seen in (8), the late adjunction of morphological objects within the current proposal occurs in the NS, on a following phase. These late adjoined morphemes are then subject themselves to late lexical insertion at MS/PF.

(9) Phase 2: NS

Late Adjunction

MS LF

etc… to the completion of Phase n

Here late adjunction, either XP or X^0, is an operation whereby a syntactic object is merged into the phrase marker constructed at a previous phase. This adjunction is final in the ordering of events in the narrow syntax, and must be to a non-root node, following the argumentation in Stepanov (2001).

2.1. Late adjunction

Syntactic, as opposed to the above morphological, Late Adjunction was first proposed in Lebeaux (1988) to account for the adjunct/argument asymmetries in Condition C effects, seen in (10) and (11).

(10) a. *She$_i$ wants the picture of Seonaid$_i$.
b. *Which picture of Seonaid$_i$ does she$_i$ want?

(11) a. *She$_i$ wants the picture that Seonaid$_i$ likes.
b. √Which picture that Seonaid$_i$ likes does she$_i$ want?

The (a) examples above show typical Condition C violations, where the R-expression *Seonaid* is governed by the pronoun *she*, leading to ungrammaticality. In (10b) the movement of

[4] NS=narrow syntax, MS=morphological structure.

Seonaid to a position not c-commanded by the pronoun does not save the construction, however in (11b) this movement leads to grammaticality. This is argued to be due to the fact that the argument *of Seonaid*, but not the adjunct *that Seonaid likes*, must be merged with *picture* before movement. The adjunct is merged after movement, and therefore *Seonaid* in (11b, see the derivation in 12) is never c-commanded by *she*. In (11a) the adjunct is also merged late, but to a position c-commanded by the pronoun, causing ungrammaticality.

(12) Initial Merge: She does want which picture. →
a. $[_{CP}$[which picture$]_j$ [does$_i$ $[_{IP}$she t_i want t_j]]]
b. $[_{CP}$[which picture $[_{CP}$that Seonaid likes]$]_j$ [does$_i$ $[_{IP}$she t_i want t_j]]]

2.2. Lexical phases and linear edges

Another proposal in the DM literature is that morphemes are divided into root (lacking syntactic features) and functional (defined by semantico-syntactic features) morphemes. Roots are those morphemes traditionally thought of as exemplifying major lexical categories such as noun, verb and adjective – e.g. *cat, dog, run, jump, pretty, nice.* These morphemes within the DM theory have no category features, but rather their category is defined distributionally, by functional morphemes. A nominalizing head 'n' will be deterministically spelled out (a property inherent to functional morphemes) based on the content of its complement, where it may, for example, surface as *tion* in the environment of *destroy*, giving *destruction*, but as *cy* in the environment of *constant*, giving us *constancy*. Category defining heads such as these have been proposed in Marvin (2002) to be phase heads, in the same manner that the v(oice) and Complementizer heads are in Chomsky (1999).

What this proposal gives an explanation for is the fact that phonological and semantic opacity at the sub-word level are contained in the same domains. Consider (13).

(13) a. [twInkəlIŋ] 'act of twinkling'
b. [twInklIŋ] 'a short moment'

Marvin contends that the difference in sound/meaning between the above pair is caused by the difference in the number of phase heads/category defining morphemes present in each. At each phase, the complement of the phase head is sent to PF and LF, triggering interpretation and phonology in the following manner.

(14)	a. $[_{vP}[_v\varnothing\ [_{\surd}$twinkl]]]	→ PF schwa insertion **twInkəl** LF act of twinkling
	b. $[_{nP}[_N$ ing] $[_{vP}[_v\varnothing\ [_{\surd}$twinkl]]]]	→ schwa insertion/semantics of vP cannot be influenced at this phase **twInkəlIŋ**
(15)	[nP [N ing] [√ twinkl]]	→ PF syllabification of *twinkl* includes *ing*. No schwa insertion. **twInklIŋ** (cf.Marvin 2002:38)

In (14a) the root *twinkl* is merged with the little v head, here a phase head. This causes *twinkl* to be sent to PF and LF, undergoing phonological operations (schwa insertion) and semantic evaluation. In the following phase (14b), the little n head is merged and again the complement is sent to PF and LF. Further operations at the interface are not able to alter the previous output, and therefore the final result is a phonological form with schwa insertion intact, and a semantics based on the interpretation computed at the first phase, *an act of twinkling*. In (15) Marvin proposes that there is only one phase head, little n, and therefore only one cycle at the PF/LF interfaces. Here *ing* and *twinkl* are spelled out and interpreted together.[5] The environment for schwa insertion is bled, and the idiomatic reading, *a short moment*, is obtained.

This proposal is important here in conjunction with the aforementioned Linear Edge Condition put forth in Nissenbaum (2000). Nissenbaum proposes that anti-cyclic merger is only possible at an edge.

(16) Linear Edge Condition (LEC)
For any syntactic object *SO* accessed in an array, merge of new material is possible inside *SO* only at the linear edge. (Nissenbaum 2000: 201)

The status of this edge will be discussed further in section 6.3, but we can see here how the theory that words are created in phases forces the postulation of syntactically motivated intermediate phonological edges within words. It is these edges that will be important for the proper functioning of Late Adjunction at the X^0 level.

2.3. Summing the assumptions

Now, putting the above proposals together, I argue that we are led to expect late adjunction at the X^0 level. Assuming, following DM, that the atoms of syntax are also the atoms of morphology, any operation of phrasal syntax is in principle going to interact with word-formation, as the narrow syntax creates the input to MS.

Second, Late Adjunction is an operation active in the narrow syntactic component of the derivational system, and is therefore not expected to differentiate between XP and X^0 adjunction. Third, words are derived in a manner that creates X^0 internal PF edges. Assuming late or anti-cyclic adjunction to be constrained by the LEC, positions therefore exist within words to which Late Adjunction is possible. In the following section I will outline the diagnostics for a morphological adjunct, and in section 4 will argue that morphological late adjunction is indeed operative at the X^0 level, and can explain the apparent paradoxes discussed in the introduction.

3. What is a morphological (X^0) adjunct?

Before appealing to late adjunction to account for the paradoxes above, I must first define what it means to be a morphological adjunct. Here a morphological adjunct is any X^0 that is (1) not selected for and (2) whose contribution to the word it adjoins to involves no projection

[5] Note that Marvin's assumptions allow the head and complement to spell out together, unlike the proposals in Chomsky (1999) and Nissenbaum (2000). The exact mechanisms involved here will not be discussed in detail, but it will be assumed here that heads in lexical phases have a closer phonological relationship to their complements than in strong phases (v(oice)P, CP). The exact nature of this closeness will be the subject of further research.

of category features. Taking the case of the morpheme *un–* in *unhappy*, it can be argued that its contribution to the word as a whole is purely semantic and phonological, but not syntactic. It does not percolate any features to the root node upon affixation (17), but as with XP adjunction (18), the root node is an extension of the element adjoined to.

(17) $[_{\text{A}}$un $[_{\text{A}}$happy]]

(18) $[_{\text{VP}}$eat cake $[_{\text{VP}}$in the hallway]]

Examples of morphological adjuncts in English can be seen in (19). Examples of morphemes that cannot be adjuncts are given in (20).

(19) **un**happy, **re**apply, **mis**align, **up** chuck, **nuclear** physicist…..

(20) **en**rage, destruc**tion**, refus**al**, happi**er**, **man** eat**er** …..

Each of the bolded X^0s in (19) causes an iteration of the root node adjoined to, while in (20) each bolded morpheme either changes the category of the word -projecting its own label- or is selected for by the head it adjoins to, as is the case for *man* in *man eater*.

This distinction is proposed here to give us a cyclic vs. acyclic merger divide. Following Lebeaux (1988), I propose that these adjuncts have the ability to be merged late. Stepanov (2001) argues further that adjuncts must be merged late, although he also restricts discussion to phrasal adjuncts, and this extension will be adopted here and applied to X^0 adjuncts, giving us the following.

- Morphemes that project are merged cyclically
- Morphemes that do not project are merged acyclically

3.1. What is not a morphological adjunct?

The morpheme *in-* is one that, as it is being argued here that *un–* is an adjunct, one might also expect to be in the class of morphological adjuncts. *in-* appears to perform the same semantic function as *un–*, where the adjective *X* merged with acquires the interpretation *not X* (possible vs. impossible). It also appears to not project category features, merging with adjectives to produce adjectives.

The comparison of *–in* with *un–* however appears to break down in the realm of comparatives, the environment which is important here for demonstrating the late adjunct status of *un–*. *in-* merges only with Latinate roots, which generally do not take the synthetic comparative morpheme, even when they meet the phonological requirements (more inept vs * inepter). In the analytic comparative, *more* always transparently scopes over the negative morpheme, and there is therefore no bracketing paradox. For some speakers however, there is one example that can illustrate here the difference in adjunct status between *in-* and *un–*.[6]

The Latinate adjective *polite* may take the synthetic comparative, giving us *politer*. As this is a two syllable adjective, it should behave on par with the *happier~unhappier* example, should *in-* be a morphological adjunct. Contrary to expectations, if we are assuming *in-* to behave on par with *un–*, **impoliter* is not grammatical. I contend here that this is due to the

[6] Thank you to an anonymous reviewer for bringing the importance of the following example to my attention.

fact that *in-* does project category features, and therefore must be merged cyclically, necessarily bleeding the environment for insertion of the *–er* allomorph of the comparative.[7] Additional evidence for this conclusion comes from the phonological and distributional nature of *in-*. First, it is phonologically 'closer' to the root than is *un–*. The nasal in (21a) assimilates to the following consonant, while in (21b) it does not.

(21) a. intolerable vs. impolite
b. untrue vs. unpopular

Following Marvin's above analysis, this difference is argued here to be due to the fact that *in-* but not *un–* is spelled out in the same phase as its sister, and is therefore in the same phonological domain.

Also, *in–*, but not *un–*, is restricted to adjectival environments. The Latinate bound adjective *ept* may be prefixed with *in–*, giving *inept*, but the Latinate verb/noun *aid* cannot, **inaid*. *un–*, conversely, may affix to adjectives — *unhappy, unattractive* — or verbs — *untie, undo*. This difference follows naturally if we assume that *in–* projects an adjectival label, while *un–* does not.

(22) a. $[_A$ in$[_{\surd}$ polite]]
b. $[_A$ un $[_A \varnothing$ $[_{\surd}$ happy]]]

The above discussion illustrates the distinction between a true morphological adjunct and a morpheme that only appears to not project, because the category it projects happens to be the same as the category of its base. It is only a member of the class of true morphological adjuncts that may cause the appearance of a structural paradox in the discussion to follow.

4. All bracketing paradoxes contain a morphological adjunct

This section demonstrates how a proposal that incorporates late morphological adjunction causes bracketing paradoxes to dissolve. Three canonical bracketing paradoxes in the literature are shown to be caused by the presence of an X^0 adjunct.

(23) a. UNHAPPIER contains UN
b. UNGRAMMATICALITY contains UN
c. NUCLEAR PHYSICIST contains NUCLEAR

4.1. How an unhappier derivation can be happy

As claimed above, the morpheme *un–* is a morphological adjunct. It is therefore adjoined acyclically. This acyclic adjunction allows for (A) the phonological restrictions of the synthetic comparative to be met at the point of vocabulary insertion, and (B) the correct relative semantic scope of the negative and comparative morphemes.

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[7] For arguments leading to the conclusion that *–er* and *more* are indeed allomorphs, see Embick and Noyer (2001).

(24) A timeline for insertion of *un–*[8]

Phase 1/2: NS → merger of *happy* and *degree head*

MS LF

Insertion of Diss. Morph.

Late Lexical Insertion → selection of *-er* allomorph

PF → spellout of *happier*

(25) Phase 3: NS

Late Adjunction → acyclic merger of *un-*

MS LF

….

PF → spellout of *unhappier*

In the first phase involved in the derivation of *unhappier* we have the root *happy* and the category defining phase head *a.*

(26) a

a happy

Here the complement of *a* is sent to MS and PF, giving us the linear output [happy].

In the second phase, we have the degree head, and a phase head *Z*, the exact characterization of which is not important to the discussion here.[9] A possible phase head here is the v(oice) head, introducing the subject under comparison.

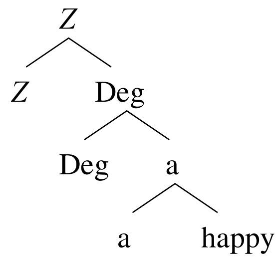
[8] The LF component of this derivation is not discussed herein, due to space limitations.

[9] The phase head here may in fact be the degree head. The only crucial point here is that the complement of the degree head be spelt out in a previous phase. If the mechanics of lexical insertion allow for the phonological shape of the complement to be 'seen' by the degree head before its lexical insertion occurs, then the first two steps here may be conflated, making the first stage in the derivation as in (i). This structure assumes that the degree head is a category defining head.

(i) a/Deg

happy er

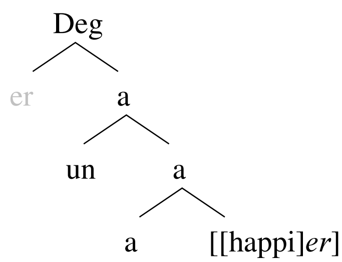
(27)



Here, at phase *Z*, the degree head undergoes morphological merger (following Embick and Noyer 2001), as its complement is of the correct phonological shape for vocabulary insertion of the synthetic comparative. The PF output is [[happi]er], where the inner bracketing is the output of the phase in (26). Note that this merger is purely morpho-phonological and involves no syntactic lowering (see 28). This is crucial for the correct LF interpretation of the construction. At LF, *–er* remains in a position that scopes over *un–*.

In the final relevant phase we have the acyclic morpheme *un–*. As *un–* does not project, it is not restricted to merger at the root node of the tree.[10]

(28)



(28) shows that *un–* has merged to the syntactic node dominating *happy*. The base position of the degree head remains in a position that scopes over the negative morpheme, while it is simultaneously phonologically interior to *un–*. The PF output at this phase is [un[[happi]er]], while the syntactic bracketing is the LF appropriate [[un[happi]]er]. The apparent bracketing paradox is therefore the result of the derivational nature of the PF system in conjunction with the late adjunction of *un–*.

4.2. How ungrammaticality is grammatical

Ungrammaticality is another widely cited bracketing paradox. The argument for its paradoxical nature is theory internal to Lexical Phonology. The theory of Lexical Phonology contends that the cyclic nature of individual affixes is dependent on their membership in a certain level of an affix hierarchy. Therefore, according to LP, cyclicity is not inherent in the computational system, but rather is a reflex of the (sequential) level of word formation in which the affix is merged.

The *ungrammaticality* paradox stems from the proposal that the affix *–ity*, as it affects the phonology if its complement (grammátical → grammaticálity), is a level 1 affix, and that *un–*, as it does not (grammátical → ungrammátical), is a level 2 affix. Lexical Phonology holds

[10] The question of whether *un–* must merge on the immediately following phase, or may merge at any subsequent phase is not addressed here. This is an issue that requires further research.

that level 2 affixes can never be attached to a base before level 1 affixes. This theory gives the following structure as necessary for *ungrammaticality*.

(29) $[_{N}$ un $[_{N}$ $[_{A}$ grammatical] ity]]

This structure, however, cannot be the correct one. *Un–* is generally assumed to not attach to common nouns, and the semantics, like with *unhappier*, is one where the suffix scopes over the prefix.

In Halle and Vergnaud (1987), and again in Light (1993), it is noted that *ungrammaticality* can have a derivation where both the semantic and phonological requirements are satisfied by the same structure:

(30) [[[un]grammatical] ity]

H&V introduce the proposal that it is not an affix's membership in a level of lexical derivation that determines whether cyclic phonological rules will apply on its merger. It is proposed that this cyclicity (or triggering of phonological rules) is inherent to the individual affixes themselves. Assuming that *un–* is not cyclic, and *–ity* is, H&V only have to assume that it is linear and not structural proximity that allows *–ity* to affect the stress of the root. Therefore *un–* may merge prior to *–ity,* not triggering stress shift on the root. Subsequent merger of *–ity* will then give us the correct scope configuration and obey all of the selectional restrictions of the affixes involved, while the affix is still in a configuration (linearly adjacent) where it may affect the phonology of the base it attaches to. Therefore under H&V's proposal, *ungrammaticality* does not give positive evidence of late adjunction, or of a bracketing paradox, for that matter.

Though this is a possible derivation, this appealing to linear order would not solve the paradox of *unhappier*. *–er* affixation is dependant on the phonological shape of the base it attaches to, and therefore if *un–* were to merge before the degree head the base would be three syllables long, and the *more* allomorph would be lexically inserted, giving us *more unhappy*. If H&V's analysis were to be extended we would expect *unhappier* to be ungrammatical.

I propose, in order to unify these two derivations, that it is instead the late adjunct status of *un–* that allows both the phonological proximity of *grammatical* and *–ity*, the correct semantic scope.

(31) a. $[_{N}$ $[_{A}$ grammatical] ity]
b. $[_{N}$ $[_{A}$un $[_{A}$ grammatical] ity]

In (31a) we see the input to the first phase, where *–ity* can influence the spellout of *grammatical*. In (31b), *un–* tucks in under the nominalizer, giving a structure that does not violate the selectional restrictions of *un–*, or the attested meaning. A unified analysis of both the *ungrammaticality* and *unhappier* paradoxes is therefore possible.

4.3. How to get a nuclear physicist out of a nutshell

The third and final well-known bracketing paradox in the literature to be discussed here is *nuclear physicist*. This paradox, like *ungrammaticality*, stems from the theoretical premise that morphemes need to be in a local relation to affect the phonology/allomorphy of their complement (Kiparsky 1982; Selkirk 1982; Bobaljik 2000, among others). Assuming allomorphy is conditioned locally, the affix *–ist* must merge with the root *physics* before compounding occurs, allowing the [fIzIs] allomorph to surface. That this variant is not derived by a purely (post lexical) phonological rule, but is rather phonologically conditioned allomorphy, can be shown with the minimal pair in (32).

(32) a. kissed [kIst] b. cyst [sIst]

The morphophonologically motivated structure of *nuclear physicist* is therefore the following.

(33) [nuclear [[physic]ist]]

This structure, however, clashes with the semantically motivated bracketing in (34).

(34) [[nuclear [physic]]ist]

The bracketing in (34) gives us the appropriate reading of the compound, 'the physics is nuclear, and the individual referred to studies/practices it'. The bracketing in (33) on the other hand, gives us the unattested reading 'there is an individual who studies/practices physics, and this individual is nuclear'.

This paradox is solved on par with the above two, where nuclear-being an adjunct, as it does not project nor is it selected for-is adjoined late to a non-root node.

(35) a. $[_{N}$ $[_{\surd}$ physic $[_{N}$ ist]]
b. $[_{N}$ $[_{\surd}$ [nuclear] physic $[_{N}$ ist]]

In the first phase (35a), including the root and the category-defining phase head *–ist*, the allomorphy of the root is determined locally at MS and is spelled out at PF. In the second phase the modifier adjoins anti-cyclically to *physic*, giving the correct input to the LF interface. Again, the phonological bracketing is at odds with the semantic bracketing, but this is due to the derivational nature of the word, and is not because the compound had two simultaneous and mutually exclusive structures.

This analysis predicts that bracketing paradoxes will never surface in the derivation of synthetic compounds. If the non-head of a compound is an argument of the head, it will not be able to be merged acyclically, making a suffix-prefix bracketing paradox in compounds like *truck driver* impossible.

5. Some previous analyses

It would be impractical to discuss all of the previous analyses of bracketing paradoxes in the literature here (Kiparsky 1982; Pesetsky 1985; Falk 1991; Spencer 1988; Stump 1991; Sproat 1992; Light 1991; to name a few). I will therefore discuss two representative proposals Pesetsky's (1985) Quantifier Raising solution, and Falks's (1991) autosegmental approach.

Pesetsky (1985), proposes that bracketing paradoxes of the type discussed above be solved by appealing to QR of the suffixes in question. Therefore a derivation of *unhappier* would be the following.

(36) a. $[_{A}$ un$[_{A}$ happi $[_{A}$ er]]]
b. $[_{A}[_{A}$ un$[_{A}$ happi $[t_{i\,A}]]]$ er$_{i}]$

In (36) the degree head merges first, allowing for the correct allomorph to be chosen, and the negative morpheme then merges outside the degree head. At LF, the degree head then undergoes QR, landing outside of the negative head, giving the correct semantics. There are two main problems with this account, both noted in Hoeksema (1987). First, the motivation for QR here is dubious. QR of elements like *some* and *every*, as in (37) is proposed to account for the fact that these elements can have either a low or a high reading.

(37) Some kid won every colouring contest.

In (37) we can have the reading where one kid won every contest (some>every), or the reading where every contest was won by some kid or another (every>some), depending on the LF landing sites of the respective quantifiers. In (36) however, the QR is mandatory, and there is only one possible reading, where *–er* scopes over *un–*.

Secondly, for paradoxes like *ungrammaticality* we must assume that selectional restrictions are only checked at LF, as the initial merger site of *un–* is to a common noun.

(38) a. [$_{?}$ un [$_{N}$ [$_{A}$ grammatical] ity]]
b. [$_{N}$[$_{A}$ un [$_{N}$ [$_{A}$ grammatical] t_i]] ity_i]

Although the claim that it is at LF where a violation of selectional restrictions would cause a crash is fairly uncontroversial, the motivation for the QR of *–ity* here, as it has no quantificational properties, is weak to non-existent. If *–ity* does not undergo QR, the derivation does not go through.

Others attempt to dissolve bracketing paradoxes by appealing to theories in which morphology is fundamentally different from syntax, and therefore structural bracketing is irrelevant. Spencer (1988) calls on backformation, Stump (1991) calls on paradigm uniformity, and Falk (1991) appeals to an autosegmental approach to morphology to eradicate paradoxes.

Falk proposes that all morphology is autosegmental, following McCarthy's (1979, 1981) work on Semitic languages. As morphemes are therefore linked to stems on a multidimentional segmental tier, brackets are claimed to be irrelevant for sub-phrasal elements. A paradox like *ungrammaticality* is proposed to have a structure like the following.

(39)
```
u n            i c a l
| |            | | | |
XXXXXXXXXXXXXXXXX
   | | | | | | |      | | |
   g r amma t          i t y
```

He contends that the autosegmental structure above ensures that no bracketing is possible within words, and there is therefore no morphological constituency. This structure allows for no morphological hierarchy, and therefore there can be no paradox between the morpho-phonological and semantic structures.

This analysis is obviously at odds with the syntactic account of Pesetsky, and with the Late Adjunction account espoused in this work. The unfounded leap that Falk takes, I contend, is that non-concatenative (autosegmental) morphology necessarily involves no hierarchical structure. Even assuming that the structures he proposes are the correct morpho-phonological representations, this does not entail that there be no hierarchical morpho-syntactic structure. If there are no hierarchical structures, it is unclear how scope relations are defined. Falk does not discuss *unhappier*, yet it is not touched upon how the autosegmental structure espoused by Falk could restrict the semantics of this word to 'more unhappy', without allowing the unattested 'not more happy'.

Furthermore, the proposal that words are constructed autosegmentally, while phrases are constructed hierarchically leaves open the question of how the possessive morpheme *'s* is concatenated with a phrase in (6). Falk's analysis predicts the unattested *the king's of England hat*.

Thirdly, he claims that an autosegmental morphology can account for the fact that '…sometimes the meaning of an affix is added to a part of the meaning of the word rather than the entire word.'(30). His structures, unlike the proposal put forth in the preceding sections, makes no prediction as to when these semantic anomalies will occur.

The proposal I espouse here is of the Pesetsky-class, syntax-saves type of account. It however, does not have to appeal to QR, or to a separate morphological computational domain. Although Morphological Late adjunction has not been discussed in the Late Adjunction literature, it is a cleaner extension than that of QR to non-quantificational elements, given that all bracketing paradoxes involve elements with adjunct-like properties, but not necessarily elements with quantificational properties. Given the generally assumed architecture of the faculty of language (Y or T model), along with the theory of Late Adjunction, it is unsurprising that there should be two conflicting structures for a word/phrase that contains an adjunct.

6. Extending the analysis: The particle verb

In this section I will endeavor to do two things. First, I will offer a solution to the particle verb bracketing paradox discussed in Müller (2003). I will show that late morphological adjunction, along with certain assumptions about the structure of nominalized verbs in German, dissolves the paradox seen below. In (40a) we see the surface phonological order of the morphemes involved, and in (40b) the necessary (under Müller's assumptions) LF bracketing.

(40) a. herum-ge-renn-e
b. [ge[herum-renn]e]

After showing how late adjunction solves the particle verb, as well as the unhappier-type paradoxes, I offer a novel solution to the long standing debate over whether particle verbs have the structure of a complex predicate, or of a small clause (section 6.3). Although these constructions are not bracketing paradoxes in the sense of *unhappier*, the analysis of particle verbs offered here falls out of the analysis of *herumgerenne* – an *unhappier*-type bracketing paradox involving a particle verb. Both the structural ambiguity of particle verbs, and the *herumgerenne* paradox are due to the late adjunction of particles.

It has been argued that some particle verbs must be phrasal, a term that I will use for all non-X^0 accounts (e.g. Wurmbrand 2000; Kratzer 1993; den Dikken 1992, 1993 among others). Kratzer, for example, notes that in German *un–* cannot affix to XP constituents, therefore all PVs that may be affixed with *un–* are considered to be X^0s (41a), while those that do not accept *un–* affixation are XPs (41b).

(41) a. das un-ab-geschickte Manuskript
the un off sent manuscript
'the manuscript that wasn't sent off'
b.*das un-weg-geschickte Manuskript
the un off sent manuscript
'the manuscript that wasn't sent off' (Haiden: syncom[11] case 117)

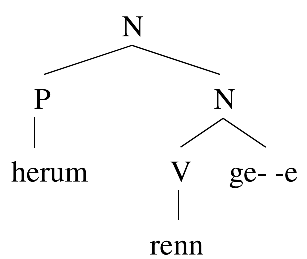
The delimitation problem (Ludeling 2001) surrounding particle verbs makes a cohesive analysis difficult, and I will therefore focus here on countering the argument that all particle verbs are phrasal, projecting a small clause. The most solid argument in the literature that this must be the case is due to the fact that the particle and verb may be separated in the syntax. Even those particles as in (41a), that accept *un*–affixation, will be separated from the verb under V2.

(42) Ich sendete das Manuskript ab
I sent the manuscript off
'I mailed the manuscript'

This, it is argued, is a slam-dunk argument against the proposal that particle verbs are complex heads. To allow for this data, proponents of the complex X^0 theory of particle verbs must in some way allow for excorporation of the verbal head. Here I will assume that excorporation is not possible (c.f. Baker 1988), yet will argue that morphological late adjunction gives us a possible X^0 account of particle verbs which avoids the issue of excorporation entirely.

6.1. A run around the herumgerenne paradox

Müller (2003) notes that the nominalizing circumfix *ge– –e* gives rise to a bracketing paradox in combination with a particle verb. The nominalization morphophonologically excludes the particle (where the particle precedes *ge–*), while the semantics of the nominalization includes (scopes over) the particle. The meaning of this construction is 'acts of aimless running', not the phonologically implied 'aimless acts of running'.

(43)


(Müller 2003: 3)

Müller contends that the structure above is predetermined (projected) by a verb that takes a particle, and that this semantic/structural encoding is what allows the interpretation given.

Here I contend that this construction only leads to a structural paradox if one assumes that *ge– –e* is a circumfix. It is only the assumption that *ge– –e* is a circumfix, projecting a single head, that forces the particle to be morphologically outside the nominalization. There is

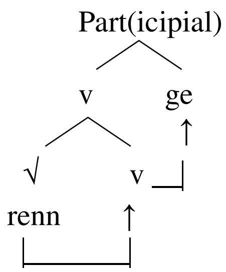
[11] http://www.univ-lille3.fr/silex/equipe/haiden/particle/case_117_vepa.htm

reason to believe that this is not the case. The prefix *ge–* is not restricted to nominalized forms, but is rather a participial prefix, found also in the participial *ge– –t* and *ge– –n* constructions.

(44) a. ich habe gebetet
I have prayed
'I have prayed
b. ich habe gesungen
I have sung
'I have sung'

Suppose that the prefix *ge-* were to merge with the verb, independently of the *–e* nominalizer.

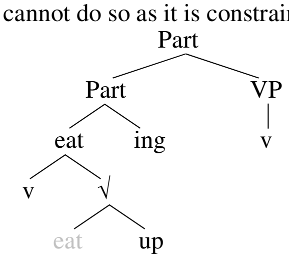
(45)



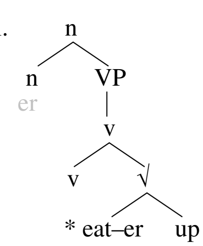
In (45) the verb and the participial head are merged. Now suppose that the participle has features that trigger raising of the verb.[12] Subsequently, the nominalizing head *–e* is merged. At this point, the particle may be merged to the initial merger position of the verb, allowing a structure where the nominalizating *–e* scopes over the entire particle verb.

[12] Assuming this to be correct allows an analysis of the difference in grammaticality between (ii) and (iii) below. If participial morphology triggers raising then the particle in (ii) can merge to the phonological edge, while allowing its selectional restrictions (attaches to verbs) to be met. In (iii) the syntactic edge and the phonological edge no longer match up. If we assume morphological lowering of the comparative (c.f. Embick & Noyer 2001) then the syntactic edge of 'eat' is the phonological edge of 'eater'. Further merger of 'up' confounds PF instantiation, as 'up' is in a syntactic configuration that requires spell-out at the right edge of 'eat', but cannot do so as it is constrained by the LEC.

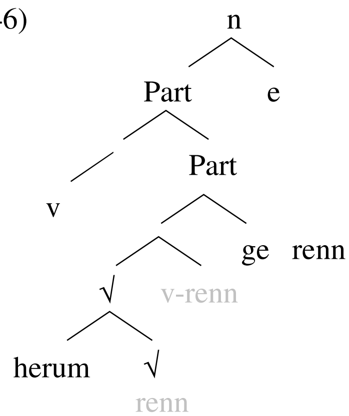
ii.



iii.

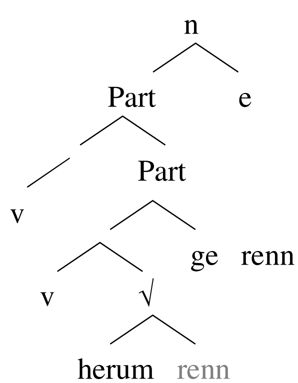


(46)



I contend that the particle is not adjoined to the position the verb has raised to, but rather to the initial merger site of the verb. The reasoning for this is as follows. An adjunct, being the type of object that does not project, has no formal features. If we assume that formal features are targeted for movement then we must assume that adjuncts cannot be moved (Stepanov 2001). An adjunct must therefore be merged to the point in a structure where it will be interpreted. If we assume that head movement reconstructs, then for the verb and particle to be interpreted as a head-adjunct structure, the particle must be merged to the trace of verbal head movement, as depicted in (47).

(47)



In (47) we can see the PF position of the verb in black. The LF position of the verb is in grey rather than black. The paradox is therefore resolved. The nominalizing morpheme does scope over the entire particle verb, while late adjunction explains the phonological ‘outsideness’ of the particle.

6.2. The structure of (some) particle verbs

As mentioned in the introduction to this section, I have the modest goal here of proposing that syntactic separation of the particle and the verb in particle verb constructions does not preclude a complex predicate analysis of such structures. The above analysis in 6.1, in addition to dissolving the nominalization paradox, allows for a derivation where the particle verb is a complex head, while explaining how inflection can intervene between the particle and the verb. Verb movement, followed by low late adjunction of the particle permits intervening morphology (and phrases), while maintaining an X^0 analysis. This observation will be expanded upon here, offering a solution to the debate over whether some particle verbs are complex predicates.

To recap, some particle verbs, by virtue of their idiomaticity and ability to undergo further morphological processes, have been argued to be X^0s, or complex predicates. The problem that this type of analysis brings forth is that subparts of X^0 elements are generally assumed to not be permitted to move independently in the syntax (see Matushansky (to appear) for a current proposal on the exact mechanism that bans such excorporation). Particle verbs, however, separate predictably and consistently, in environments like German V2.

(48)	John	**flechtet**	den	Buchstaben	**ein**
	John	braided	the	letter	in
	'John inserted the letter'				

(49)	die	**Einflechtung**	des	Buchstaben
	the	in.braid.ing	of. the	letter
	'the insertion of the letter'			

In (48) the verb has undergone typical German V2 movement, and the particle has been stranded in the VP domain. This separation is unexpected if the particle verb comprises a complex X^0. In (49) the fact that the particle and the verb together are (1) the base for a further morphological process (nominalization) and (2) are interpreted idiomatically (as they are in (48)) has, as stated above, been argued to be due to the X^0 nature of the particle-verb combination. (Booij 1990; Johnson 1991; Zeller 1997a, b, 1998; among others).

I argue here, based on the solution to the paradox in section 6.1, that particles are late adjuncts. This will allow for an account that maintains that particle verbs are complex X^0s, while easily explaining their ability to be syntactically separated.

6.2.1. Arguments supporting the XP (Small Clause) analysis of particle verbs

Let us now examine in detail the pro-phrase/Small Clause arguments with regard to particle verbs. In Section 6.3, to follow, I will show how the late adjunction analysis here can also account for the behaviour of particle verbs discussed here. The proponents of the small clause structure attack the pro-head camp (complex predicate, whether morphological or syntactic (including adjoined and incorporated)) with the following data. First, it is typical of particles that they are separable.

(50)	Peter	**lächelt**	*(das	Mädchen)	**an**.	
	P.	smiles	the	girl	at	
	'Peter smiles at the girl.'					(Zeller 1999:29)

As this is the case, the pro-head proponents need to answer the question of how the verb raises without the particle. In answer, proponents of particle verbs as complex predicates/heads in the morphology / lexicon loosen the restrictions on Lexical Integrity that disallow the separation and movement of any morphemes within a complex word. Another argument for the phrasal nature of particle verbs arises when we examine the positioning of inflectional morphology. Particle verbs are always inflected on the verbal head, even when this inflection will separate the particle and the verb.

(51) throw out → thr**e**w out *throw outed
play on → play**ed** on *play oned
anrufen → an**zu**rufen 'call up' zu=infinitive *zuanrufen

If the particle and the verb are a complex head, it is argued that we would expect inflection to surface as an affix on the entire particle verb complex, contrary to fact.

Thirdly, particles never influence the conjugation class of the verb. As can be seen above, the irregular verb *throw* remains irregular when the particle is present, and the regular verb *play* remains regular.

Finally, the Case of the object in particle verb constructions is always the same Case that is assigned by the simplex verb.

(52) Peter trinkt das Bier aus dem Glas (full PP)
P. drinks the beer from the glass
'Peter drinks the beer from the glass.'

(53) Peter trinkt das Bier aus (particle)
P. drinks the beer from
'Peter drinks up the beer.' (Haiden: syncom case 117)

All of the above are offered as evidence that the particle (phrase) is a complement of the verb, and not part of a complex head with the verb.

(54) [$_{VP}$ trinkt [$_{PartP}$ [$_{DP}$ das bier] aus]]

This structure allows for the separation of the verb and particle, and for the conjugation class facts, as they are separate heads. This separation explains why inflection separates the verb and the particle. The assumption that the particle does not assign case, and therefore its object must move to receive case marking from the verb explains why the particle never affects Case.

6.2.2 Problems with the XP analysis

This section will concern itself with the problems raised by an XP account of particle verbs, such as the one above in 6.2.1. It will not concern itself with arguing for an X^0 account of particle verbs, but will rather lead to an X^0 account that captures all of the facts in the preceding section, while encountering neither of the problems that follow here.[13]

First, as is noted in Ramchand & Svenonius (2002) the above structure falls afoul of the fact that the object of a preposition is uniformly interpreted as a ground, rather than a figure.

(55) I took the hat off my head
figure ground

In particle verb constructions, it is argued that the object must not be the object of the particle, as it may be interpreted as a figure.

[13] These are by no means the only problems with the XP account discussed in the literature. I restrict the discussion here to these two, as they are sufficient to show that PVs do not behave as a uniform morpho-syntactic class.

(56) I threw out my hat.
        figure

Secondly, a uniform XP analysis of particle verbs cannot account for the distinct morpho-syntactic behaviour of those particles that have X^0 properties. As noted above, Kratzer (1993) points out that some particles may accept *un–* prefixation, while others, even though they are semantically similar, may not. Similarly, Wurmbrand (2000) notes that some particles may be topicalized, while others cannot.

(57) a. [AUF]$_{PART}$ hat er die Tür t_{PART} gemacht
        [open]$_{PART}$ has he the door t_{PART} made
        'He opened the door'
     b.*[AUF]$_{PART}$ haben sie das Stück t_{PART} geführt
        [PART]$_{PART}$ have they the piece t_{PART} performed
        'They performed the piece' (Wurmbrand 2000:8)

Those that cannot are those that have an idiomatic interpretation in combination with the verb, leading to the conclusion that idiomatic particle verbs are more 'word like' (X' as opposed to XP, according to Wurmbrand), than non-idiomatic particle verbs. This distinction is not easily captured within a framework in which all particles are phrasal.

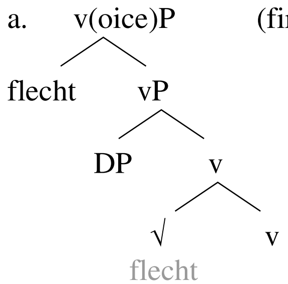
Data like the above leads one to question whether all particles can be considered to be heading phrasal constituents. The question therefore becomes whether non-XP particles can be analysed as X^0 elements that merge directly with the verb. Wurmbrand concludes that they cannot, following the generally assumed proposal that such complex X^0s cannot undergo separation in the syntax. In the following section I offer a solution to this problem, following the proposal in sections 1-3 that particles may be late adjoined, that allows an X^0 account of these particle verbs while avoiding the issue of excorporation.

6.3 Particle verbs are more complex heads than you might think

What I argue here is that the Complex Head Analysis overcomes all of the above problems when the particle is seen as a late adjunct. The non-nominal derivations where the verb is separated from its particle (V2) can be accounted for by assuming raising of the verb and late, low merger of the adjunct, just as in the *herumgerenne* derivation above.

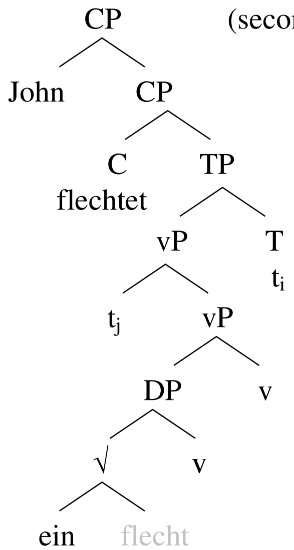
(58) [$_{CP}$John [$_{C}$flechtet] [$_{TP}$ den Buchstaben [$_{VP}$ [$_{V}$ein t_i]]]]
        John braid the letter in
     'John inserted the letter'

(59) a.



(first strong phase)

b. (second strong phase)



Here the verb merges with v^0, and the object DP, and then raises, eventually coming to be situated in C^0. Remember that I assume here that the verb later reconstructs to be interpreted. After the verb has undergone at least one operation of raising, the particle is merged. As this is the position where the verb is interpreted at LF, we then expect an idiomatic reading to be possible here. No special structure is needed to explain the apparent ability of the verb to excorporate, as the verb and particle are never in a structural position where they must be separated. This surface (as opposed to LF) separation allows for the fact that inflection and phrasal elements may intervene between the verb and the particle, and for the fact that the conjugation class of the verb does not alter with the addition of the particle. As the object of the particle verb is always the object of the verb, case assignment follows transparently, and the figure~ground distinction becomes no longer relevant. Finally, the X^0 status of the particle verb offers an easy solution to the *un*–affixation and topicalization facts.

Note that the particle must merge on the left so as to not violate the LEC. Merger to the right of the verb's copy would position the particle between the copy and the null v^0 head.[14] This structure would also derive the left-adjoined position of the particle in the nominalized forms. Interestingly, in English particles are (almost) uniformly found on the right. As the English vP is left-headed, this also falls out from the LEC. Whether this LEC-determined particle position is cross-linguistically valid will be left to further research.

7. Conclusion

Under the analysis laid out above, structural paradoxes are no longer paradoxical. There is no need at any one point in the derivation to posit two structural representations for these phenomena, but rather the phonological and semantic structures are defined separately, at the interfaces. The appearance of two necessary structures has been argued to be due to the cyclic nature of the syntactic derivational system, crucially joined with the theory that syntactic adjuncts may be late merged inside an already derived syntactic representation. This analysis

[14] This is of course assuming that German is right-headed below CP.

holds that all bracketing paradoxes contain a morphological adjunct, and therefore that no bracketing paradoxes will occur in constructions that do not involve adjunction.

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Heather Newell
McGill University
heather@punksinscience.org

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The dynamics of near-merger in accommodation

Jennifer Nycz

This paper presents data on the near-merger of low back vowels in American English, and shows that neither classical OT nor the variable rule framework correctly predicts the phonetic properties of this near-merger. Both types of analyses fail for the same reason: each can only describe categorical facts of variation. A new account of the near-merger facts is presented within the framework of nonlinear dynamics. In this model, constraints are modeled as competing attractors in an attractor landscape; this formulation allows us to model the grammar's interaction with context and account for the gradient variable phenomenon of near-merger.

1. Introduction: ways of dealing with variation in phonology

There are two main treatments of variation in phonological theory. Within the rule-based model of SPE (Chomsky & Halle 1968), there is the variable rule, which allows both linguistic and extralinguistic factors to probabilistically affect rule application (Labov 1969, Cedergren & Sankoff 1974). Each relevant factor favors or disfavors application to some extent, and this is quantified in terms of application probabilities for each factor.

In Optimality Theory (Prince & Smolensky 1993), constraints may be variably ranked to yield different outputs from the same input[1]. There are several variants on this theme, for example the cophonologies of Anttila (1997), the stochastic OT of Boersma & Hayes (2001), and the floating constraints of Reynolds (1994). All of these, however, operate in essentially the same way. Given two competing constraints C1 and C2, either C1 outranks C2, yielding one output, or C2 outranks C1, yielding a different output. OT analyses have mostly been concerned with linguistic constraints on variation, but extralinguistic factors may also be incorporated in a limited way, for instance by globally shifting faithfulness constraints upward in the rankings for more formal speech styles (van Oostendorp 1997).

Both variable rules and OT can be, and have been, used to model variation between discrete choices. However, they cannot easily model phonetically gradient variation. This paper will describe one such type of variation – the variable near-merger of the low back vowels /□/ and /□/ in speakers of American English – and show why this data cannot easily be accounted for using either variable rules or variants of OT which operate over discrete outputs. It will be argued that this phenomenon is one facet of the more general problem of

[1] Coetzee (2004) presents a novel way of handling variation in OT: in his formulation, constraint ranking remains fixed, but surface variants of an underlying form may be chosen from among the "loser" candidates which are harmonically ordered by this ranking. Like the other OT systems discussed here, however, this mechanism is limited to the comparison of discrete outputs.

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incomplete neutralization, which has been discussed at length in the phonetic and phonological literature. Ultimately, a model of this near-merger will be presented within the framework of nonlinear dynamics (as in Gafos 2003), and possibilities for future research will be discussed.

2. The data: synchronic near-merger of the low back vowels

The low back merger (i.e. merger of the vowels in the lexical sets exemplified by *cot* and *caught*) is a large-scale and rapidly spreading change in American English (Labov 1994). Speakers in large sections of the country do not distinguish between these vowels in production or perception, but the distinction remains robust in other areas, especially the Inland North and the Mid-Atlantic states. However, impressionistic data from the Mid-Atlantic region indicate that speakers in this area may be implementing a variable merger: speakers who natively possess the low back contrast sometimes produce their low back vowels distinctly, but sometimes seem to neutralize this distinction. This appears to be dependent at least in part on the merged or unmerged status of one's interlocutor. Someone from New York who ordinarily says [□□□] and [□□□] when speaking to other native New Yorkers may seem to say [□□□] and [□□□] when speaking to a transplant from California who does not share the contrast.

But are these vowels completely merging in the latter context? To examine the behavior of such speakers, a small lab study was carried out. Speakers from New York City who possess the low back vowel distinction were recorded in two contexts: first, conversing and completing tasks with an interlocutor who also has a two-phoneme distinction, and then later completing the same sort of activities with a different interlocutor who has a completely merged system. Acoustic analysis was completed using Praat (Boersma & Weenink 2004): F_1 and F_2 measurements were taken at the midpoint of all low back vowel tokens, and the results from one of the speakers, K, are presented in the table in (1) and the vowel plots in (2).

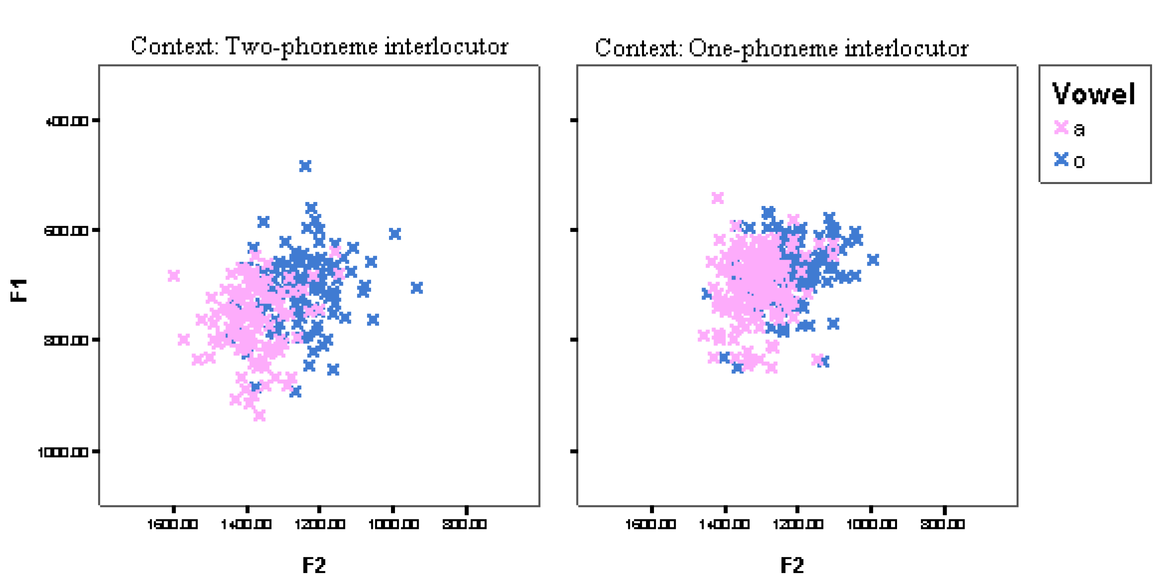
(1)

Context	Class		F_1 (Hz)	F_2 (Hz)
Distinct	□ (n=104)	Mean	766 (sd =65)	1378 (sd =77)
Speaker	□ (n=120)	Mean	708 (sd =66)	1247 (sd =93)
		Mean$_{/□/}$-Mean$_{/□/}$	58	131
Merged	□ (n=160)	Mean	697 (sd =59)	1312 (sd =66)
Speaker	□ (n=140)	Mean	669 (sd =53)	1217 (sd =79)
		Mean$_{/□/}$-Mean$_{/□/}$	28	95

Mean F_1 and F_2 values for the low back vowels produced by speaker K in two interlocutor contexts. The distance between the two vowels along each dimension is also calculated.

In fact, in both contexts, K's F_1 and F_2 means for the /□/ word class tokens versus the /□/ word class tokens were significantly different ($p<.05$, in independent samples t-tests), indicating that she continued to produce a contrast between the two vowels even while speaking with the merged speaker. However, K made *less* of a distinction in the merged speaker context: in this case, there is greater overlap between the realizations of these two categories, there is less distance between the mean F_1 and F_2 values for the two vowels, and the overall low back vowel space contracts.

(2)



3. Why neutralization rules don't account for this data

One possibility is that this data can be described in terms of a neutralization rule; Herold (1990) alludes to such a rule in her account of the merger's spread among speakers in Pennsylvania. An important point to note, however, is that while K has adjusted her output while speaking to the merged speaker, she did not simply switch from a fully distinguishing grammar to a fully merged one. Instead, she seems to have moved to an intermediate point, where the essential contrast between categories is maintained, but the realizations become less distinct phonetically.

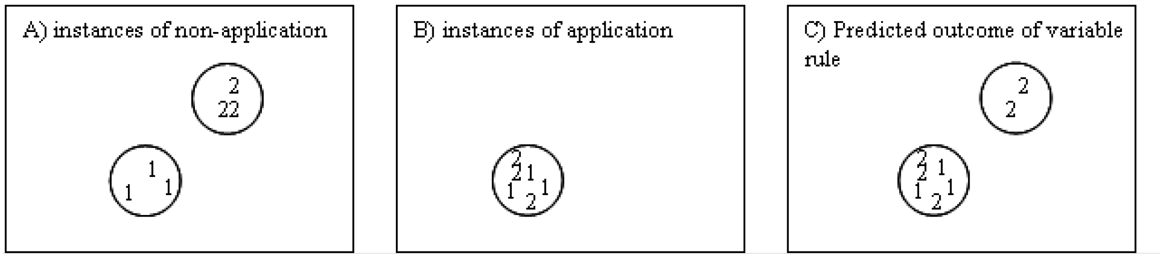
A neutralization rule cannot account for this behavior. Such a rule can only completely obliterate contrast: one vowel takes on the feature values of the other, essentially becoming that vowel for the purposes of phonetic implementation, and this should be reflected in an identical phonetic output.

A variable neutralization rule will also be inadequate, since it is limited to the categorical effects of application vs. non-application. This is illustrated in the diagram in (3). Some of the time, the rule does not apply, resulting in output like that in box (a). In such cases, the vowels in /□/ lexical set members such as *cot* are realized in the canonical '□ space', while /□/ set members such as *caught* have vowels which are realized in the '□ space.' The rest of the time, the neutralization rule applies, turning underlying /□/s into surface [□]s[2], which should then be realized in the □ space. This is shown in box (b). The overall output of the variable rule is simply a sum of the application and non-application cases. If speaker K is implementing a variable neutralization rule, surface realizations of underlying /□/s should occupy the same space as they would if no neutralization rule ever applied, while realizations of underlying /□/s should be spread over both the canonical □ space (in instances of non-

[2] Of course, it is also possible for /□/ to neutralize to [□], though this detail does not affect the argument given here.

application) and the □ space (in instances of application). Importantly, the overall low back space, and the two smaller spaces in which each vowel is realized, should remain stable. We do not expect to see the categories moving closer to one another in the vowel space, as we do in the data presented above.

(3)



The expected phonetic outcomes of a) contrast maintenance, b) neutralization, and c) a variable neutralization rule. Numeral *1*s indicate lexical items which belong to the /□/ word class (e.g. *cot, top*), and numeral *2*s indicate items from the /□/ word class (e.g. *caught, talk*).

Variation is handled differently in the OT framework. Here, variation between languages is the result of different constraint rankings; variation within languages and idiolects is accounted for in the same way. An OT analysis of the low back near-merger must involve the variable ranking of at least two relevant constraints: a markedness constraint favoring candidates which neutralize the contrast, and a faithfulness constraint favoring candidates which preserve the contrast. However, such a model cannot generate the type of gradient effects described above, *for the same reason* that the rule model cannot. In OT, two constraints C1 and C2 are always ranked with respect to each other such that C1 >> C2, yielding one discrete variant, or C2 >> C1, yielding another discrete variant. In the case of the low back vowels, either markedness will outrank faithfulness, resulting in identical outputs for the inputs /□□□/ and /□□□/, or faithfulness will outrank markedness, resulting in surface contrast. This is the OT counterpart of rule application vs. non-application: one may totally merge, or one may completely preserve contrast, but gradient approximation of two categories cannot be accounted for.

4. The general problem: incomplete neutralization

This phenomenon of near-merger is crucially not confined to the literature that self-identifies as sociophonetic. Many putative 'phonological neutralizations', on closer phonetic inspection, reveal themselves to be essentially cases of synchronic near-merger. One well-known example is syllable-final voicing neutralization, a salient phonological property of languages such as German and Dutch. Some representative data from German are shown in the table in (4). The words meaning 'association' and 'colorful' contrast underlyingly with respect to the voicing of their final obstruents. The traditional account of this pattern is that a neutralization rule applies to these obstruents in word-final contexts, causing the surface forms of both words to end in a voiceless stop. However, measurements of the phonetic properties of the resulting final voiceless obstruents (such as duration of the preceding vowel, duration of consonant closure, etc.) reveal that, in fact, the 'voiceless' surface obstruents which are underlyingly voiced are phonetically more voiced than the surface voiceless obstruents which have always been voiceless (e.g. Port, Mitleb & O'Dell 1981, O'Dell & Port 1983, Port &

Crawford 1989). Similar results have been found in studies of final-devoicing languages such as Polish (Giannini & Cinque 1978) and Catalan (Dinnsen & Charles-Luce 1984).

(4)

Underlying form	Surface form	
/□□□□/ ‘association’	[□□□□]	cf. [□□□□□□]
/□□□□/ ‘colorful(sing.)’	[□□□□]	cf. [□□□□□]

Neither rule- or OT-based mechanisms of neutralization as currently formulated are able to account for incomplete voicing neutralization, for the same reason that they cannot model the facts of low back near-merger: these mechanisms can only completely neutralize a contrast or completely maintain it. Moreover, as Dinnsen (1985) and others have pointed out, these facts are problematic for the traditional derivational view of phonology and phonetics. If a phonological neutralization rule yields two identical forms which are then passed on to phonetic implementation, phonetics is not supposed to ‘know’ to make differences in vowel length, consonant closure duration, etc. which correlate with the underlying voicedness of each obstruent. Port and Crawford ultimately conclude that, in German, ‘practical neutralization is a fact, but it is apparently not a rule’. Dinnsen and Charles-Luce, faced with similar data in Catalan, say that devoicing can be a rule, but this means that phonetic implementation rules that make reference to voicing must be ordered before the phonological neutralization rule. These pronouncements reflect the following problem: word-final devoicing is a qualitative fact about languages like German and Catalan which we would like to account for in the phonologies of these languages, but such placement is undermined by the quantitative facts, which partially flout complete neutralization in favor of preserving an underlying contrast.

5. The model: nonlinear dynamics

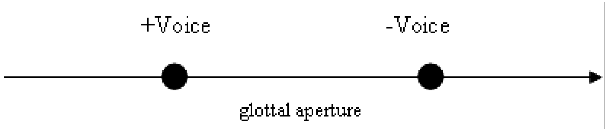
Gafos (2003) has described a model that is able to handle these types of facts. This model makes use of the mathematics of nonlinear dynamics, which is widely used throughout the natural sciences to model systems changing in real time (e.g., population growth and decay, economies, and aspects of motor coordination). This framework is now being applied in various ways to the study of cognitive systems such as memory, decision making, and language (see Port & van Gelder 1995 for a sampling of this research, as well as Benus 2005). Gafos uses this framework to model the dynamics of incomplete voicing neutralization described by Port & Crawford and others.

In this model, constraints on phoneme realization are modelled as *attractors* in a numerically-defined multidimensional state space. Each dimension reflects some continuous articulatory variable (such as tongue height or glottal aperture), and the entire state space encompasses all possible states of the system. Certain points in this space are attractors, reflecting preferred states of the system: that is, qualitative aspects of the grammar, such as the canonical realization of a given phoneme category. The figure in (6) illustrates this idea with a simple one-dimensional state space reflecting all the possible degrees of voicing[3]. The

[3] ‘Voicing’ is actually a multi-dimensional parameter of speech, incorporating several subparameters such as duration of closure, amount of glottal pulsing, etc. For simplicity’s sake, I illustrate the point with a one-dimensional space.

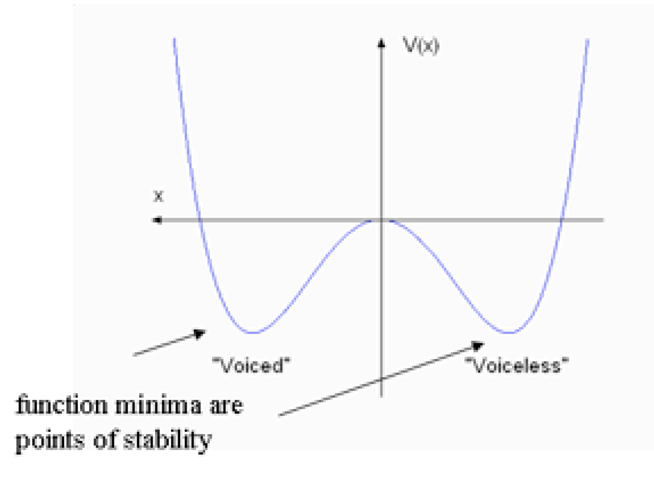
space contains two attractors, corresponding to the preferred values of voicing for voiced and voiceless obstruents.

(5)



A more intuitive way to represent this is shown in the figure in (7)[4], which plots the potential function V(x) that describes this attractor landscape. The x-values of the minima of the function correspond to points of stability (in this case, the preferred states of voicing and voicelessness) which are relatively impervious to noise. One way to think of this is in terms of a ball moving in the potential function. If one puts the ball in the "voiced" well and shakes it a bit, the ball will ultimately land back in the voicing well. If the ball is placed on the summit at the origin and then shaken, it will fall into one well or the other. This potential function thus provides a good model of categorical perception: there will be a range of values for voicing which are perceived as qualitatively voiced (i.e. a range of points for which a ball placed at any of those points will land in the voicing well), but once a certain part of the voicing continuum is reached, judgments will suddenly become unstable (i.e. the ball is likely to fall into either well). Another important aspect of the model is that the shape of the potential function reflects the stability of each attractor. A well with steep walls is associated with a more stable attractor, insofar as realizations of this category will show little variation. A shallower well will be associated with a less stable attractor: realizations of this category will show more variation.

(6)



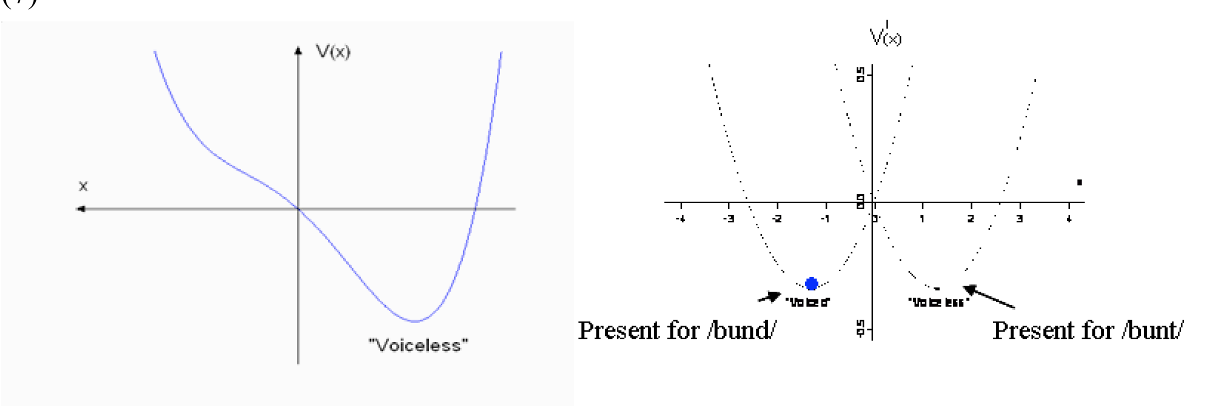
5.1. The model applied to incomplete voicing neutralization

In the case of German incomplete devoicing, there seem to be two different constraints at work, one similar to an OT markedness constraint ("Final obstruents are voiceless") and one

[4] Diagram in Section 5 reproduced from Gafos (2003)

corresponding to a faithfulness constraint ("Output obstruents voicing is faithful to the input voicing value"). As shown above, situating these OT-like constraints within a framework that evaluates discrete candidates will not yield the correct near merger output. Gafos, however, reformulates these constraints in terms of competing attractors in a continuous attractor landscape[5]. The lefthand figure in (8) shows the markedness constraint rendered in attractor form. Here we have a function with one stable point at the more voiceless end of the continuum, reflecting the coda devoicing rule in German. The faithfulness constraint will also be present as a potentially competing attractor in the state space. Given an underlying form /bund/, this attractor will be located at a more voiced value in the state space. Given /bunt/, the attractor will be at a value corresponding to a relatively voiceless value[6].

(7)

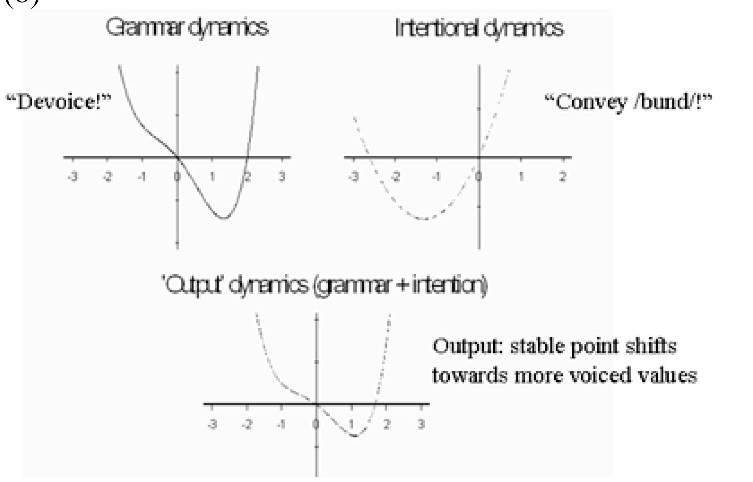


The easiest way to model the results of competition between the markedness and faithfulness attractors is by simply adding together the two potential functions. The result is a new function which has a stable point between that of the original two functions, as shown in the diagrams in 9. Here, the potential function describing the output has a minimum with an x-value which is slightly shifted towards more voiced values, in comparison to the potential corresponding to the markedness constraint which requires a certain level of devoicing.

[5] Gafos' terminology is different from mine. He refers to "grammar" and "intentions" rather than "markedness" and "faithfulness", respectively; I use the latter because these terms are likely to be familiar to the reader.

[6] While two faithfulness parabolas are plotted here on the same graph, only one will be present at a given evaluation, since only one underlying form (and one voicing value) is intended for a given utterance.

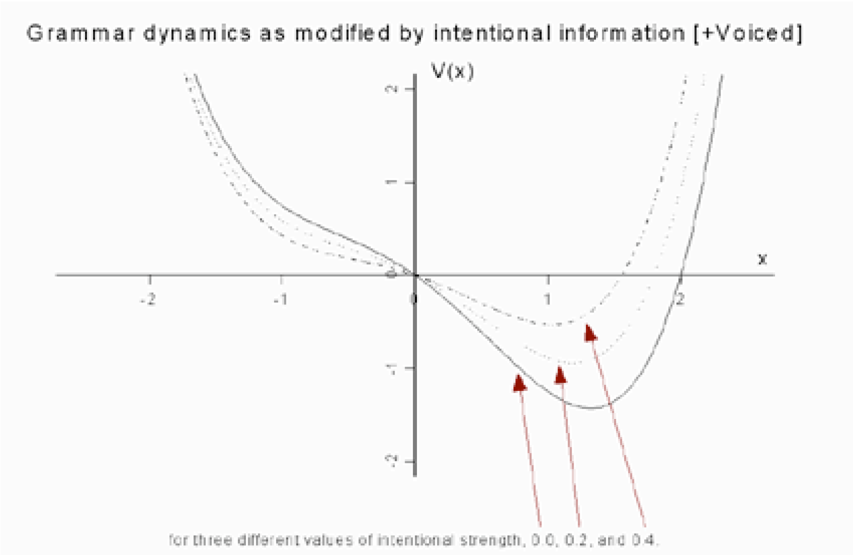
(8)



Adding the potentials that correspond to the markedness and faithfulness attractors results in an output potential bearing an intermediate voicing value: V(output) =V(mark) +V(Faith)

Gafos is also able to model the effect of pragmatic factors on the degree of incomplete neutralization. Port & Crawford (1989) describe a series of experiments in which minimal pairs such as German *bund* and *bunt* were produced by German speakers in several contexts. In one context, these forms were embedded in a running text such that speakers did not explicitly contrast the pairs. In another, the speakers read the pairs in contrastive sentences which semantically disambiguated the forms ("I said 'bunt' as in 'colorful', not 'bund' as in 'association'"). In the last context, speakers were instructed to read these forms in semantically-ambiguous contrastive sentences ("I said 'bunt', not 'bund'") to a German-speaking assistant, who took dictation. While Port & Crawford observed a significant difference between underlyingly contrastive stops in all of these contexts, the difference was most pronounced in the dictation case. There is an intuitive explanation of this behavior: when speakers had a greater intent to convey the underlying contrast (in this case, due to the presence of the assistant taking dictation), and could not semantically disambiguate the forms with additional words, their remaining option was to partially override the phonological constraint which obscures the distinction. Indeed, the degree of neutralization decreases as speakers' intent to convey the underlying form increases. Gafos incorporates these facts directly into the model by weighting each of the potentials in the output equation as shown in (9). If the speaker has a greater intent to maintain the contrast, the faithfulness potential will have more weight, with the result that coda obstruents will be even more voiced. Gradually increasing the weight associated with the faithfulness potential (Gafos' 'intentional dynamics') results in a gradual increase in the degree of voicing in the output.

(9)



Changing the values of the F and B coefficients in the output equation V(output) = BV(mark) + FV(Faith) changes the relative strength of each attractor, and thus the relative effect that each attractor has on a given output.

6. Modelling accommodation

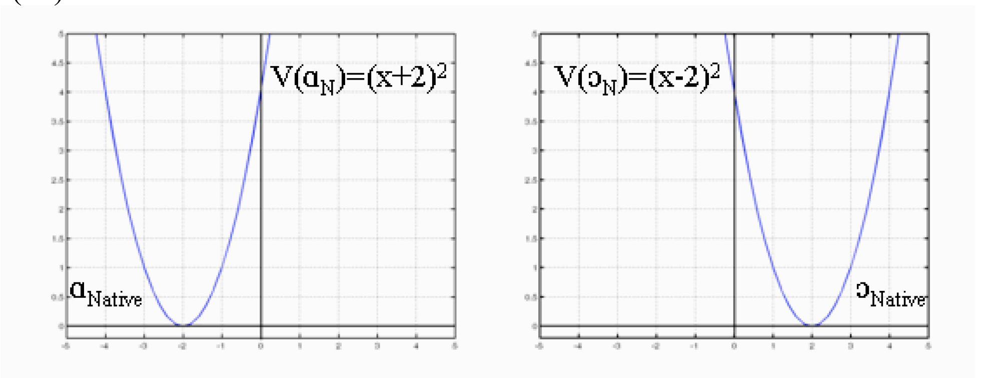
Gafos' model neatly accounts for the gradient effects of interaction between markedness and faithfulness constraints. As we know, however, the phonetic properties of linguistic output can also be affected by external input to the system: in the case of accommodation, this input consists of the forms produced by an interlocutor. In this section, I show how the attractor model can easily be extended to account for the effect of this input.

6.1 Identifying attractors

It is first necessary to identify the attractors of the system, corresponding to the observable qualitative states; I will illustrate this using the case of speaker K, presented in Section 2. K maintains two underlying vowel categories, /□/ and /□/. This means there will be an attractor corresponding to each of these vowels in the attractor landscape. When producing a particular lexical item, only one of these attractors will be present, reflecting the particular vowel present in that word. The figures in (10) show each of these attractors within a toy landscape; these are K's 'native' attractors, and the potential function used to describe each of them is a simple parabola[7]. These reflect how K will produce these vowels when under no particular influence from an interlocutor (in citation form, for instance).

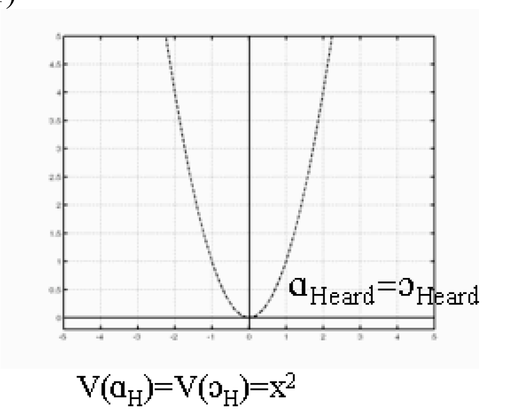
[7] The contrast between the low back vowels /□/ and /□/ is also in reality a multidimensional one, involving at least height and backness/rounding, as shown by the significant differences in F_1 and F_2 between these vowels. In this abstract model, only the relative locations of the attractors along the relevant dimension is important, though the equations for the arbitrarily-chosen parabola used are given in the diagrams.

(10)



The data show that K's productions vary in a way that is dependent on the productions of her interlocutor. We can incorporate this effect by positing "heard" attractors corresponding to the productions of K's interlocutor: there will be a "heard" attractor for /□/, reflecting how the interlocutor produces tokens of this vowel (as perceived by K), and a similar attractor for /□/ based on the same heard evidence. In the case of a merged interlocutor, the posited attractors will be very close if not overlapping in the state space, since such a speaker produces no distinction between the relevant word classes (11).

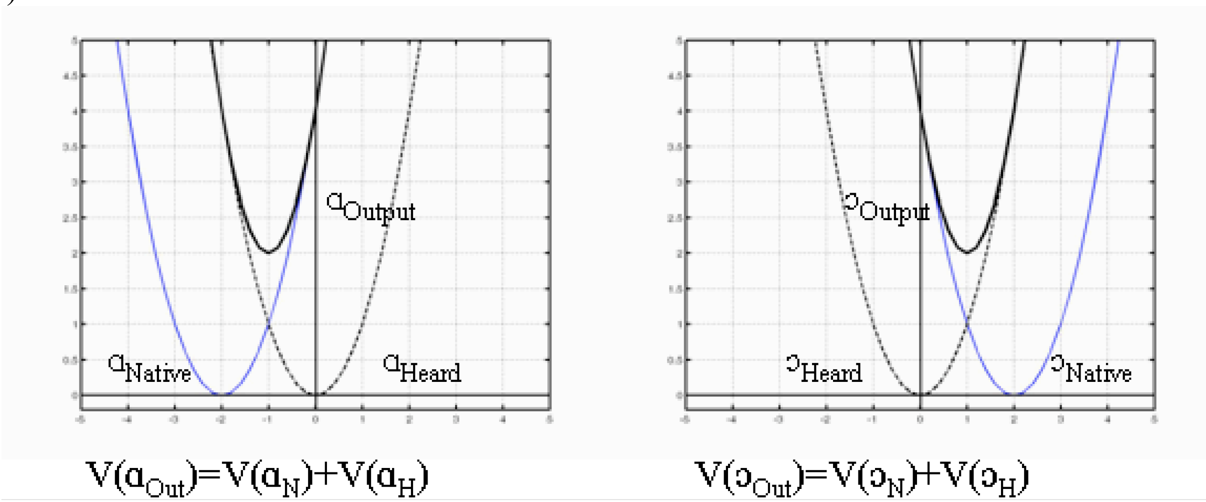
(11)



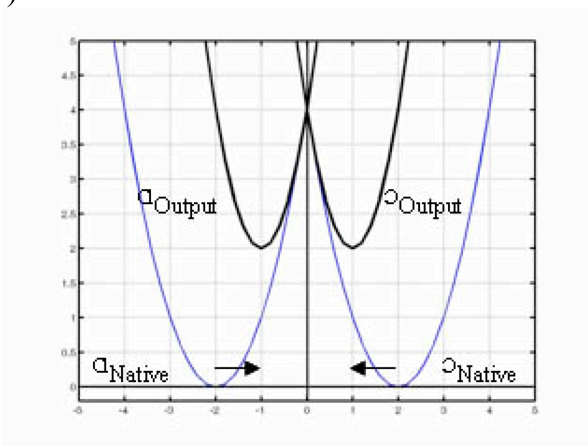
6.2 Competition

K's output for each vowel will be mediated by two constraints. One the one hand, there will be a pull to produce the relevant phoneme as given by the native system, and on the other hand, there will be a pull to approximate the productions of the interlocutor. The results of the interaction of these two constraints are described with the additive model of competition. For a production of *cot*, for instance, the function describing the native /□/ attractor and the function describing the heard /□/ attractor are added together, yielding an output potential which has an intermediate value as shown in the figures in (12). The main result of this competition will be that K's vowels, while they remain distinct in the context of the merged speaker, start to converge (13). This prediction is borne out by the data presented in Section 2.

(12)

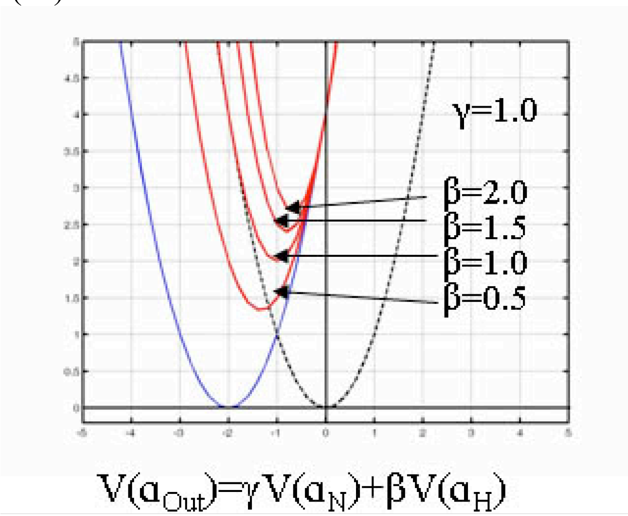


(13)



Of course, accommodation is not merely a matter of meeting an interlocutor halfway. Speakers accommodate to a greater or lesser extent, over long and short time scales. Over the course of the lifespan, developmental stages provide coarse ranges of weighting possibilities: while children are in one sense striving to be the ultimate accommodators during the language acquisition process, adults are less likely to pick up the speech patterns of those around them. Within a particular developmental stage, attitudinal factors will lead people to accommodate more or less between conversations, and even within conversations. The effects of developmental factors and attitude are united by and incorporated into the model via the type of weighting coefficients described here. As the figure in (14) shows, an increase in the weight of the heard attractor with respect to the native attractor (corresponding to some increase in the desire to move towards the interlocutor) will result in a realization that is even closer to this heard value.

(14)



7. Conclusions and directions for future research

This paper presented data on synchronic near-merger which cannot be accounted for by traditional mechanisms of neutralization, either in rules-based or OT-based models. Gafos' dynamics approach to the similar problem of incomplete voicing neutralization was introduced, and it was shown how this model can be extended to incorporate the gradient effect of interlocutor input on a speaker's output.

In addition to accounting for the data presented here, the dynamics approach to accommodation opens up several possibilities for future research. Most significantly, this approach offers a way of smoothly integrating grammatical and sociolinguistic constraints on language usage within one model, and accounting for their interaction and gradient effects. In the toy model presented here, speakers posit attractors on the fly during the course of conversation with a particular interlocutor. However, the model is crucially not limited to responsive behavior. As a large body of work beginning with Bell (1984) has shown, there is a significant initiative dimension to style shift: though speakers from Social Group X may not be present, speakers can convey solidarity with X through the productive use of socially-indexed linguistic variables. For example, work by Eckert (2000), Labov (1972), and Schilling-Estes (1998) has shown that raised variants of the diphthong /□□/ are indexed with various salient local identities, depending on location - Detroit "burnout" teenagers, fishermen on Martha's Vineyard, and natives of Ocracoke Island, respectively. For speakers who deploy this feature, the choice between non-raised and raised /□□/ is not binary: there is a continuum of variation between these poles, and greater degrees of raising correlate with stronger intentions to convey the relevant social meaning. These facts are straightforwardly accounted for by giving a greater relative weight to the "identity" attractors in a given production. The dynamics model will be especially adept at handling the interaction between multiple, possibly conflicting identity attractors, as well as the competition between these attractors and linguistic constraints: social motivations may pull one towards raising /□□/, but one can only do so to a certain extent if the linguistic context disfavors raising.

This approach also gives us a way to model gradient change in speakers' systems over time. Phonological categories are stable, such that one conversation with a speaker of a different dialect or language will not significantly alter one's native categories in the long run, but they are also flexible, such that repeated exposure to different productions can cause them to change. This model thus accounts for the sociolinguistic concept of a 'norm enforcement mechanism': if a speaker is embedded in a community of people who all speak a certain way, then categories will tend to stabilize towards 'average' productions of this community. Isolated exposures to different idiolects will cancel each other out as noise, but sustained exposure to a particular accent that is different will result in change.

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Jennifer Nycz
New York University
jennifer.nycz@nyu.edu
http://home.nyu.edu/~jrn218

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Phonetic reduction and categorisation in exemplar-based representation

Observations on a Dutch discourse marker

Leendert Plug

This paper explores the division of labour between the lexicon and phonetic implementation in exemplar-based phonological representation on the basis of a case study of reduction patterns associated with the Dutch discourse marker *eigenlijk*. A partial lexical representation of *eigenlijk* is proposed, in which reference is made to pragmatic and syntactic categories. The analysis is evaluated in comparison with previous accounts of similar reduction patterns.

1. Introduction

The notion that performance factors play a role in shaping phonological representations has long been controversial. In speech perception models based on traditional generative phonology (Chomsky & Halle 1968), establishing phonological forms from phonetic input is assumed to involve a great deal of filtering, leaving only non-redundant linguistic information to be stored in the lexicon (Halle 1997). Resistance to this position has recently gained impetus through the development in the field of psychology of an approach to lexical representation that explicitly rejects the traditional dichotomy between linguistic and extra-linguistic information in the speech signal. In this approach, commonly known as 'exemplar-based' (see the papers in Johnson & Mullennix 1997, as well as Bybee 2001 and Pierrehumbert 2001a; 2002; 2003), the memory encodes specific episodes of speech with a minimal amount of filtering. These episodes are segmented and the segments categorised — with reference to linguistic and extra-linguistic information — according to their phonetic similarity to existing lexical items. Rather than a list matching morphological units to single phonological forms, an exemplar-based lexicon is a 'multi-entry' network of category labels, each associated with a set of remembered tokens of the category; these remembered tokens are the 'exemplars' that give the approach its name.

The idea that the lexicon is composed not of minimally redundant, abstract representations, but of concrete memory traces of stretches of speech allows straightforward accounts of experimental findings that are difficult to explain under abstractionist assumptions, including the impact of extra-linguistic knowledge on performance in linguistic tasks (see Lachs et al. 2002 for

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an overview) and frequency effects on well-formedness judgements (Coleman & Pierrehumbert 1997, Frisch et al. 2000, Hay et al. 2003). In addition, it has major implications for the phonological treatment of phonetic variation. Under an exemplar-based view, variation is an integral part of lexical representation, rather than something that is generated in production and abstracted away from in perception. As such, an exemplar-based approach 'dispenses with the non-invariance "problem" at a stroke' (Docherty & Foulkes 2000:119).

1.1. Phonetic reduction

Still, even though non-invariance is considered unproblematic in this approach, the underlying question remains of what the relationship between stored and produced forms is. This question is particularly pertinent in the phonological treatment of phonetic reduction patterns. In much of the literature, reduction is considered to be primarily physiologically driven; it results from a general tendency of speakers to minimise articulatory effort, and occurs when speakers are under relatively few constraints to articulate clearly (Lindblom 1990, Kohler 1991). A recent example of this approach, in the framework of Optimality Theory, is Kirchner (2001): through the introduction of a family of effort-minimising constraints into the grammar, Kirchner allows any apparent instance of reduction to be explained in physiological terms. Some researchers, however, have questioned the explanatory adequacy of this approach. In particular, Simpson (2001) describes a recurrent phonetic pattern involving several apparent instances of segmental reduction associated with a particular grammatical structure in English. He argues that an account in terms of effort minimisation misses the point that through its distribution, the pattern carries grammatical information. In his own account, the phonetic pattern is phonologically represented as a template associated with the grammatical category.

The question here is what constitutes an input form in speech processing. If it is assumed that the input form of a stretch of speech is its citation form, as in most of the literature on reduction, any observed form that deviates from the citation form can be accounted for in terms of physiological constraints. If, on the other hand, it is assumed that apparently reduced forms are possible inputs in speech processing, because the contextual distribution of phonetic patterns forms the basis of their underlying representation, physiological tendencies such as effort minimisation play a much less prominent role in accounting for the patterns.

In an exemplar-based approach, any stored form can in principle be an input form in processing; citation forms have no *a priori* phonological status. Moreover, through their labels, exemplar sets are related directly to information at multiple levels of structure; for example, 'a recollection of the phrase *Supper's ready!* could be labelled "Mom" and "female speech", in addition to exemplifying the words and phonemes in the phrase' (Pierrehumbert 2001a:140). These characteristics would suggest a great potential for developing representations of the type that Simpson (2001) describes. At the same time, however, an exemplar-based model of speech processing must contain a phonetic implementation procedure for mapping perceptual exemplars onto motor commands in production. In this procedure, physiological tendencies such as effort minimisation may well play a role. So far, proponents of exemplar-based representation have discussed reduction patterns in terms of this phonetic implementation procedure; Bybee (2001) treats reduction patterns as 'automation' effects of repeated production, and

Pierrehumbert (2001a:147) models diachronic lenition processes using a 'systematic production bias', by which stored exemplars are produced slightly reduced, resulting in shifts over time towards exemplar sets in which more reduced are increasingly frequent. As such, the potential of exemplar-based models for representing (synchronic) patterns of variation in terms of lexical categorisation, and the general issue of the division of labour between lexical representation and phonetic implementation in an exemplar-based approach remain largely unexplored. This issue is the general topic of this paper.

1.2. Word form variation and categorisation

In her exemplar-based account of lenition processes, Pierrehumbert (2001a:145) states that 'we will not attempt to model the deeper causes which may figure in the choice amongst possible exemplars'. This paper discusses some of these 'deeper causes'; in particular, those which may figure in the choice amongst possible exemplars of a single word-level category.

It is well-known that some words are associated with multiple phonetic forms that occur in distinct contexts; these are sometimes called strong and weak forms. Some previous work on strong and weak forms seems amenable to interpretation in terms of subcategorised exemplar sets in a multi-entry lexicon. For example, Ogden (1999) proposes an analysis of strong and weak auxiliaries in English in the framework of Declarative Phonology. Instead of deriving various forms from a single representation, such as [hav], [həv], [əv] and [v] from /hav/, Ogden treats the forms as exponents of distinct subtypes of the type V[AUX]. His account is similar to that of Kaisse (1985), who analyses strong and weak forms of auxiliaries as separate lexical items; however, Ogden's declarative formalism allows him to index the close relation between the various forms of the verb through shared structure, so that their commonalities are reflected in their representations. This is broadly compatible with an exemplar-based account in which exemplars of the grammatical category HAVE are organised into labelled subsets on the basis of differences in distribution, as represented informally in Figure 1.

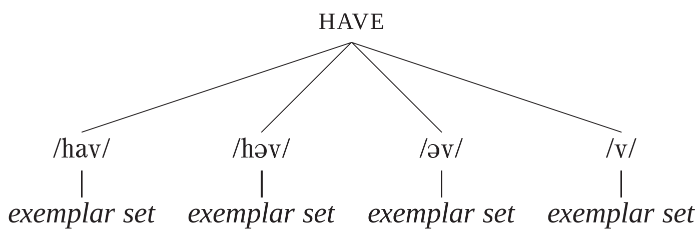


Figure 1: Strong and weak forms of *have*, following Ogden (1999)

Among the factors that determine the distribution of strong and weak forms are syntactic and pragmatic factors. For example, it has long been noted that English *that* is associated with different ranges of variation depending on its syntactic status as a pronoun (as in *That's nice*) or complementiser (as in *I know that I'm right*) (e.g. Berkenfield 2001; see Jurafsky et al. 2002 for similar examples). Moreover, Local (2003:326–328) observes that when *I think* is used as an interactional 'hedge', as in *they should be here by the time you come out next weekend I think*, it is often phonetically reduced to an extent that is not commonly observed when it has what Local calls 'lexical meaning', as in *I think that's interesting* (cf. Scheibman 2000 on *I don't know*). On the basis of these findings, Local (2003:326) suggests that 'Such phonetic discriminability of forms prompts the questions of whether "form" and "function" may be rather more closely linked than is usually thought, and of the uses that may be made of this link by the perceptual system'.

This paper suggests how we might begin to address these questions in an exemplar-based approach to phonological representation, on the basis of a case study of a complex pattern of phonetic variation, involving various degrees of reduction, associated with the Dutch discourse marker *eigenlijk*, in which both syntactic and pragmatic factors play a role. The case study is presented in Section 2. Section 3 sketches an account of the empirical observations in the representational framework developed by Bybee (2001) and Pierrehumbert (2001a; 2002; 2003), and Section 4 evaluates the account in comparison with previous work on similar reduction patterns.

2. *Observations on eigenlijk*

This section presents results of an investigation into the distribution of phonetic forms associated with the Dutch discourse marker *eigenlijk*, variously glossed as 'actually', 'in fact' and 'now that I'm thinking about it' (Ernestus 2000, Kemps et al. 2004, Mazeland 2004). The observations presented here are based on a selection from a corpus of 'casual' Dutch designed and recorded by Mirjam Ernestus between 1995 and 1996 (Ernestus 2000). The corpus contains speech by ten pairs of male speakers of Standard Dutch, mostly pairs of friends or colleagues, involved in several tasks. Recordings were made in a professional recording studio. The selected material comprises informal interviews which Ernestus undertook with each of the pairs, and one-to-one conversations between the two members of each pair on a range of topics — some suggested by Ernestus, others offered spontaneously. This data set amounts to approximately 10 hours of speech and contains 269 tokens of *eigenlijk*.

As pointed out by Ernestus (2000:140–141), *eigenlijk* is associated with considerable variation in phonetic form, both between speakers and within the speech of individuals. She presents the list of variants in (1), based on observations on over 400 tokens in a corpus including the data set used in the present study.

(1) [ˈʔɛixələk], [ˈʔɛixlək], [ˈʔɛixlk], [ˈʔɛixək], [ˈʔɛixk], [ˈʔɛik]

These transcriptions are evidently rather broad, but they accurately reflect that the range of variation with which *eigenlijk* is associated encompasses phonetically trisyllabic forms of the broad shape [ˈʔɛixələk], disyllabic forms of the shapes [ˈʔɛixlək], [ˈʔɛixlk] and [ˈʔɛixək], and monosyllabic forms of the shapes [ˈʔɛixk] and [ˈʔɛik]. The more detailed transcriptions in Table 1, made by myself on the basis of repeated listening and concurrent inspection of waveforms and spectrograms, show that the variation is not due only to preferences of individual speakers for a particular phonetic shape: these speakers use forms at either ends of Ernestus' 'reduction continuum'.[1]

The design of the Ernestus corpus controls for a number of factors that may be expected to have an impact on the variation: in particular gender (all speakers are male), age (most are in

[1]This is not to say that such preferences are not observed; see Section 4.

C	J	N	T
[ʔææ̝̠x̠əɫɤɡ]	[ɛ̰ɛ̠xəɫək]	[ɛ̠xl̥ɣ̟k]	[æ̰ɛ̠̞e̠̞xɣlɣ̟k]
[aɰ]	[ɛ̞ʒk̟̞ʷ]	[aɣ̥k]	[aɣx̟]

Table 1: Some attested forms of *eigenlijk* for speakers C, J, N and T

their thirties or forties), and social and regional background (all are highly educated and speak a variety of Dutch without strong regional characteristics). In the remainder of this section I will show that other factors can be distinguished; in particular, some of the phonetic variation associated with *eigenlijk* can be accounted for with reference to its pragmatic function and syntactic placement, and to general phonetic features of the utterances it occurs in. I focus on three particular pragmatic contexts in which *eigenlijk* is routinely used. These are described in the next subsection.

2.1. Three pragmatic contexts

From a semantic perspective, most tokens of *eigenlijk* in the data set mark some kind of contrast; in this respect, it is indeed similar to English *actually*, which often carries ‘counterfactual’ meaning (Clift 2001). [2] From a pragmatic perspective, we can distinguish a number of more specific contexts, or sequence types, in which speakers routinely use *eigenlijk*. I describe three here,[3] using the analytic terminology of Conversation Analysis (Sacks 1992, Drew 2004): sequences in which a contradiction or paradox is described (2.1.1), sequences in which an extended turn is closed prematurely or a multi-turn project abandoned (2.1.2), and sequences in which an elicitation is followed by a dispreferred response (2.1.3).

2.1.1. Describing a contradiction or paradox

An example of the first sequence type is given in (2), taken from Ernestus’ interview data. Prior to this fragment, T has been asked where he has lived after secondary school. In this fragment he explains why this is a difficult question for him to answer.

(2) Ernestus/Interview/S–T/14

```
1 T: (dus) ik ben eh gaan  varen, .hh toen was ik
     so    I  am  er to-go sailing    then was I
```
So I went er, sailing. At that time I was
```
2    al      vrij  veel van  huis af   dus eh wja  toen .hh
     already quite much from home away so  er well then
```
already away from home quite a lot so er, well, at the time—

[2] *Eigenlijk* also occurs in a number of contexts in which neither *actually* nor *in fact* would seem appropriate, as the gloss ‘now that I think about it’ (Ernestus 2000:141) would suggest. These are not further discussed here; in the examples below, ‘actually’ will do as a gloss.

[3] In other words, the account offered below is *partial*, covering about 25% of the tokens of *eigenlijk* in the data set.

```
3    officieel  was ik ingeschreven in eh- in vinkenveen:
     officially was I  registered   in er  in Vinkenveen
```
officially I was registered in er, in Vinkeveen
```
4    m:aar: ik woonde eigenlijk overal
     but    I  lived            everywhere
```
but I actually lived all over the place

T’s response to the inquiry about his whereabouts after secondary school is less than straightforward because as a shipper he was permanently travelling, despite being a registered resident in Vinkeveen. The contrast between his official and actual residence is made explicit in two turn construction units (TCUs, see Ford & Thompson 1996, Schegloff 1996) linked by *m:aar:*, with *eigenlijk* in the second TCU. The second TCU, *ik woonde eigenlijk overal*, functions as a refinement of the first; *officieel was ik ingeschreven in eh- in vinkenveen:* alone may occasion the incorrect inference that T lived in Vinkeveen. Notice, however, that the second TCU does not negate the first; both TCUs are presented as conveying accurate information, although the two pieces of information can be treated as paradoxical.

The data set contains 31 clear instances of this sequence type. In many of these, *eigenlijk* occurs in a TCU linked to a preceding or following TCU by *maar* ‘but’ or *terwijl* ‘while’, although examples with different structures are also found. One is partially represented in (3). L reports an assessment of a new local express tram.

(3) Ernestus/Interview/K–L/65

```
1 L: die  die  sneltram     in buitenveldert waarvan  dan
     that that express-tram in Buitenveldert of-which then
```
that, that express tram in Buitenveldert of which people
```
2    gezegd wordt van  ja .hhh ‘t  is eigenlijk een trei:n
     said   is    like well     it is           a   train
```
say well, it’s actually a train

The contrast here is between the vehicle’s official status — a type of tram — and its perceived status in terms of size, speed etc. — more like a train. Note that this *could* be rendered as a construction with ‘but’ or ‘while’: e.g. ‘It’s called a tram, but it’s actually a train’.

2.1.2. *Closing an extended turn or abandoning a multi-turn activity*

An example of the second sequence type is given in (4). Prior to this fragment, K has claimed that *bijna iedereen* ‘almost everyone’ of his work colleagues plays a musical instrument.

(4) Ernestus/Roleplay/K–L/316

```
1 K: eh:: (0.3) .hh ((name)) speelt piano
     er                      plays  piano
```
Er, ((name)) plays the piano,

.

((Several lines omitted, in which K mentions other colleagues and the musical instruments they play))

.

```
2    ((name)) (eh be)speelt eh: cello,
                er plays     er  cello
```
((name)) er plays er cello,
```
3    en  voor de  rest weet ik het eigenlijk niet maar
     and for  the rest know I  it           not  but
```
and for the rest I don’t know actually, but,
```
4    .hh d’r   zitten aardig wat  muzikale mensen
         there sit    quite  some musical  people
```
there are quite a few musical people there.

In line 1 K initiates a list of colleagues and their musical skills. He closes the list in line 3, with the claim that of the colleagues that he has not mentioned, he does not know if they are musical or not. This closing seems premature: firstly, the final-rise pitch contour associated with line 2 projects a further list item (see Caspers 1998; 2003); and secondly, in line 4, K downgrades his earlier claim that ‘almost everyone’ plays an instrument to the claim he has ‘quite a few’ musical colleagues. This revision can be related to an incongruence between the strength of K’s initial claim and the small size of the list he has managed to come up with (cf. Drew 2003 on exaggeration in interaction). In a similar example, speaker A is asked to list TV programs he regularly watches. After three items he projects a fourth with *en: eh::* ‘and er’, only to close the list with a TCU containing *eigenlijk*:

(5) Ernestus/Interview/A–B/25

```
1A:  .mmm ja   eigenlijk is dat  het wel zo’n   beetje
          well           is that it  DM  such-a bit
```
and er, well, that’s pretty much it actually

In several others, the TCU with *eigenlijk* abandons an activity pursued over multiple turns. For example, in the case of (6), H is being teased by his co-participants. He has repeatedly started up turns with *nee*, projecting disagreement (cf. Drew 1987 on ‘po-faced’ receipts of teases), but his turns have been interrupted by further teasing.

(6) Ernestus/Interview/D–H/46

```
1H:  nee (.) dat  eh: (2.3) nee eh: (d-) ehhh[ehe
     no      that er        no  er
```
No, that er, no er, ((starts laughing))
```
2D:                                          [((chuckling))
3H:  laat ook eigenlijk maar zitten
     let  DM            DM   sit
```
Actually, forget it.

Here H again projects disagreement with *nee* (line 1), but, at incoming laughter by D, abandons the activity of challenging the teases with a TCU containing *eigenlijk* (line 3). In doing so, H displays a reversal of his stance towards the teasing; while the sequence-so-far has suggested that H strongly disagrees with the teasing, the TCU with *eigenlijk* marks the issue as not worth pursuing.

The data set contains 15 clear instances of this sequence type. These are different from those described in Section 2.1.1 in interactional terms. In the examples in Section 2.1.1, *eigenlijk* is associated with the description of two states of affairs that are in some way contradictory or paradoxical. In interactional terms, the TCU with *eigenlijk* pre-empts possible problems of interpretation. As indicated above, this is achieved through a refinement rather than a correction of aspects of the surrounding talk. In examples such as (4) to (6), on the other hand, the TCU with *eigenlijk* marks an aspect of the same speaker's prior talk — a claim, a projection of further talk of a particular kind, a stance towards an activity — as inaccurate or unmotivated. As such, this second sequence type can be seen as an instantiation of the general practice of (self-initiated) self-repair (Schegloff et al. 1977, Schegloff 1997).

2.1.3. Dispreferred response

An example of the third sequence type is given in (7).

(7) Ernestus/One-to-one/C–E/150

```
1 E:  heb  je  verder  nog   wat       gedaan van de  week
      have you further still something done   of  the week
      Have you done anything else this week?
2     (0.5)
3 C:  eh:m d- j:::a wat  heb  ik gedaan (0.5) wat  heb  ik gedaan
      erm     well  what have I  done         what have I  done
      Erm, well, what have I done, what have I done?
4     (0.8) nou  niet veel ei[genlijk
            well not  much
      Well, not much actually
5 E:                        [nee:?
                             no
      No?
6 C:  nee de  dagelijkse routine: afgedraaid
      no  the daily      routine  taken-care-of
      No, taken care of the daily routine.
```

E's inquiry in line 1 serves as an invitation for C to offer a topic for further discussion. C's response is treatable as inadequate in that *niet veel* (line 4) does not offer an obvious candidate topic — and by rephrasing *niet veel* to *de dagelijkse routine afgedraaid* (line 6) C only reinforces the non-newsworthiness of his alleged activities. His response is indeed treated as inadequate by E, who following this fragment launches a new topic (data not shown).

C displays an orientation to the fact that his turn is treatable as an inadequate response in the design of the turn: it contains several features of a dispreferred turn type (see Pomerantz 1984, Schegloff 1988).[4] Most notably, C's response is delayed, it contains a variant of 'er' and a cut-off (*eh:m d-* in line 3), and the TCU with *eigenlijk* is prefaced by *nou* 'well' (see Mazeland 2004). This is a recurrent pattern, as can be seen in (8) and (9). In (8), P's claim of lack of knowledge in line 3, which denies the grounds on which to offer a fitted 'yes' or 'no' response to O's inquiry in line 1, follows a considerable pause. In (9), J's claim of a lack of strong opinion in line 3, which again denies the grounds on which to offer the type of response that the co-participant's

[4] Notice that 'dispreferred' is a structural notion, not a psychological one. That is, it refers to a set of turn design features, rather than the participants' presumed stance towards what is conveyed in the turns. See in particular Schegloff (1988) for discussion of this point.

turn is designed to elicit — in this case an agreement or a disagreement — contains long pauses and a cut-off (*i*-, line 3), and starts with *nou ja* ‘well’.

(8) Ernestus/One-to-one/O–P/1119

```
1 O:  en  daar  zit  nu  ook  de  hele  familie weer  bij? of niet
      and there sits now also the whole family  again with or not
      and again the whole family is with him, or not?
2     (0.5)
3 P:  weet ik niet eigenlijk
      know I  not
      I don’t know actually.
```

(9) Ernestus/One-to-one/J–R/07

```
1 R:  afijn  ik: merk   dat  jij het helemaal
      anyway I   notice that you it  completely
      Anyway, I notice that you’re entirely
2     met  mij eens   ben, hh[aha
      with me  agreed are
      in agreement with me ((laughs))
3 J:                         [n:ou ja ik (1.0) i- (.) ik heb
                              well    I               I  have
      Well, I—I don’t have
4     er    niet zo’n    uitgesproken mening  over eigenlijk
      there not  such-an outspoken    opinion about
      a very outspoken opinion on this actually.
```

The data set contains 16 clear instances of this sequence type. These are interactionally different from those described in Sections 2.1.1 and 2.1.2 in that here, in providing a response to an elicitation that is treatable as inadequatethe TCU with *eigenlijk* runs counter to assumptions underlying — and thus inferrable from — the *co-participant’s* prior turn.

2.2. Syntactic placement

Before we return to the phonetics of *eigenlijk*, an observation can be made on its syntactic placement in the sequence types described in Section 2.1. Like *actually* in English, *eigenlijk* can be placed in various positions in the clause. It has been shown that in the case of *actually*, ‘Syntactic alternatives ... are found to be selected by reference to interactional exigencies’ (Clift 2001:245); that is, it recurrently occurs in similar positions in similar pragmatic contexts. The details of the patterns do not concern us here, but the present investigation suggests that the placement of *eigenlijk*, too, is related to the sequence type it occurs in. With respect to the sequence types discussed above, the patterns are as follows.

In sequences describing a contradiction or paradox, described in Section 2.1.1, *eigenlijk* overwhelmingly occurs in clause-medial position. In the case of (2), an alternative structure of the clause with *eigenlijk* would be *maar eigenlijk woonde ik overal*, with *eigenlijk* directly following the conjunction *maar*, or *maar ik woonde overal eigenlijk* with *eigenlijk* in final position. All of these structures are strictly speaking grammatical, but those with *eigenlijk* in final position are not attested in the 31 examples of this sequence type. Similarly, in sequences of the type described in Section 2.1.2 *eigenlijk* mainly occurs in clause-medial position. In the 16 fragments of this type in the data set, no clause- or turn-final tokens of *eigenlijk* are found.

In the dispreferred-response sequences described in Section 2.1.3, on the other hand, *eigenlijk* recurrently appears in clause-final position: recall *nou niet veel eigenlijk* in (7), *weet ik niet eigenlijk* in (8) and *ik heb er niet zo'n uitgesproken mening over eigenlijk* in (9): all are clause-final (and turn-final), and in all three cases at least one alternative placement of *eigenlijk* would result in a grammatical structure: e.g. *nou eigenlijk niet veel*, *weet ik eigenlijk niet* and *ik heb er eigenlijk niet zo'n uitgesproken mening over*. In fact, Mazeland (2003:111–112) suggests that in the context of a dispreferred response, *eigenlijk* "typically" occurs in final position in the turn or TCU — and thus, in most cases, in the clause (cf. Ford & Thompson 1996). The present data set does not confirm this: five clause-final tokens of *eigenlijk* are found in 16 fragments. Still, the fact that clause-final tokens of *eigenlijk* only occur in one of the three contexts described here does confirm that the syntactic placement of *eigenlijk* is to some extent constrained by the pragmatic context it is employed in.

2.3. The distribution of phonetic variants

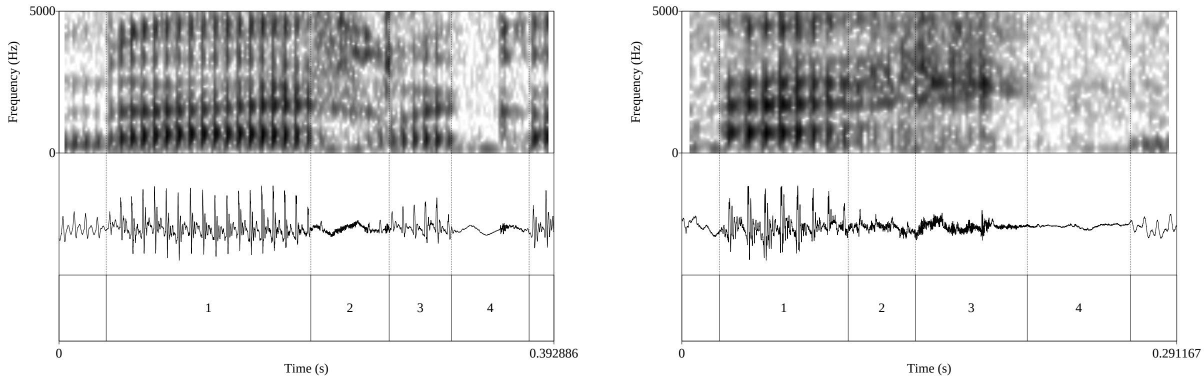
Having established that *eigenlijk* is used in interactionally distinct pragmatic contexts and that in these contexts it occurs in different ranges of syntactic positions, we now return to the phonetics of *eigenlijk*. The six broad phonetic shapes of *eigenlijk* transcribed by Ernestus (2000:140–141) are repeated in (10).

(10) [ˈʔɛixələk], [ˈʔɛixlək], [ˈʔɛixlk], [ˈʔɛixək], [ˈʔɛixk], [ˈʔɛik]

With respect to the distribution of variants of these broad shapes across the three pragmatic contexts described in Section 2.1, the following patterns can be noted. In the 31 sequences describing a contradiction or paradox, a wide range of forms of *eigenlijk* are observed; to be more precise, forms of all of the shapes in (10) except the broad shape [ˈʔɛixələk], with three delimitable vowel portions. Figure 2 presents segmented spectrograms and waveforms of two tokens of *eigenlijk* in this context; one of the broad shape [ˈʔɛixlk], attested in (2), and one of the broad shape [ˈʔɛixk], attested in another sequence of this type in the data set.

In the 15 sequences in which the TCU with *eigenlijk* marks the closure of an extended turn or the abandonment of a project pursued over multiple prior turns, the range of variation in the overall shape of *eigenlijk* is very different: 14 out of the 15 forms are of the broad shapes [ˈʔɛixk] or [ˈʔɛik]; the remaining one has the broad shape [ˈʔɛixək]. In other words, this context appears to 'favour' relatively reduced forms of *eigenlijk*. Figure 3 presents segmented spectrograms and waveforms of two tokens of *eigenlijk* in this context: one of the broad shape [ˈʔɛik], attested in (4), and one of the broad shape [ˈʔɛixk], attested in (5).

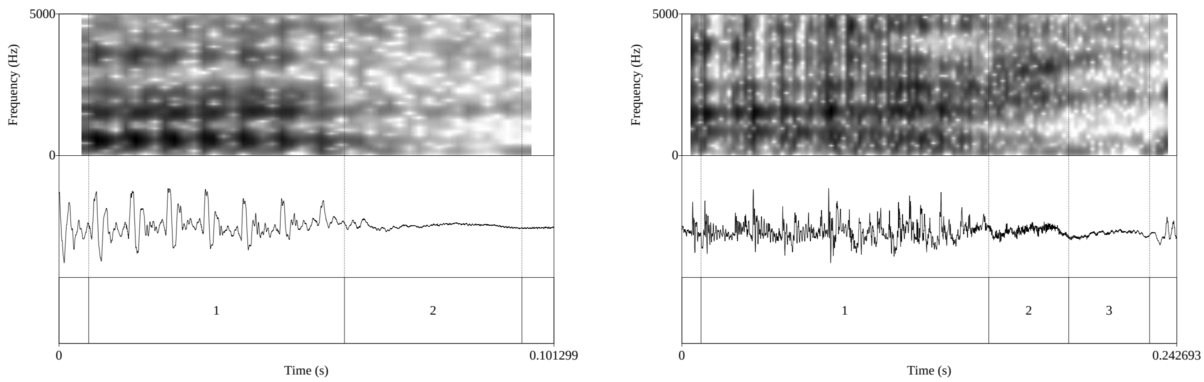
In the 16 dispreferred-response sequences the range of variation is different still. In this context, the majority of forms (12 out of 16) has at least two vowel portions and a lateral portion, and five 'canonical' forms, which are not attested in the other two contexts, are attested here. That is, most of the forms in this context are of the shapes [ˈʔɛixələk], [ˈʔɛixlək] and [ˈʔɛixlk]. Figure 4 presents segmented spectrograms and waveforms of two tokens of *eigenlijk*



(a) [ʔæɛ̞xl̞k]: 1 vowel, 2 dorsal frication, 3 lateral/vowel, 4 dorsal plosion

(b) [ʔæʁχk̚]: 1 vowel, 2 voiced dorsal frication, 3 voiceless dorsal frication, 4 dorsal closure

Figure 2: Segmented spectrograms and waveforms of two tokens of *eigenlijk* in a turn describing a contradiction or paradox; that in (2) above on the left



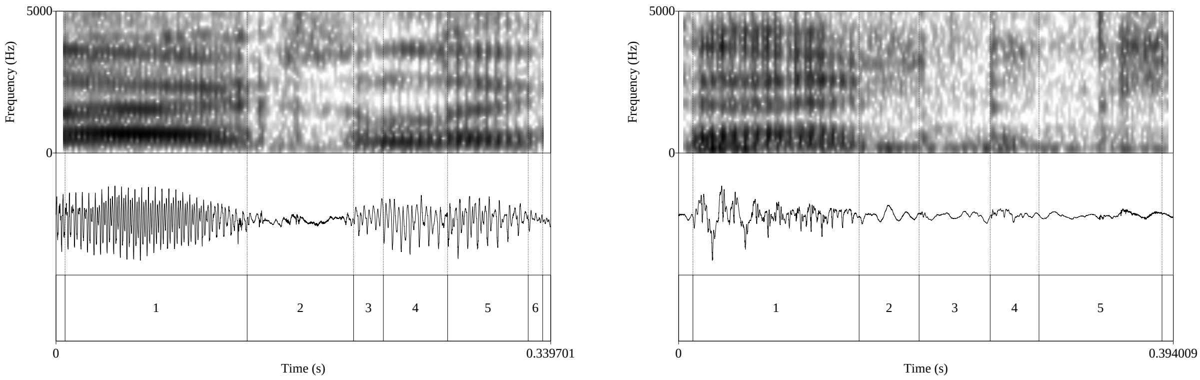
(a) [ɛ̞k̚]: 1 vowel, 2 dorsal closure

(b) [a̰æxx̞]; 1 vowel, 2 dorsal frication, 3 dorsal near-closure

Figure 3: Segmented spectrograms and waveforms of two tokens of *eigenlijk* in a TCU closing an extended turn or abandoning a multi-turn activity: that in (4) above (left), and that in (5) above (right)

in this context: one of the broad shape [ˈʔɛixələk], attested in (7), and one of the broad shape [ˈʔɛixlək], attested in (8).

Recall that in dispreferred-response sequences, the syntactic placement of *eigenlijk* is more variable than in the other two sequence types described here, with *eigenlijk* occurring in clause- and turn-final as well as initial and medial positions. Interestingly, of the five ‘canonical’ forms attested in this context, four are clause- and turn-final. Moreover, the remaining turn-final form in this context is P’s [ɛ̰ɛ̞χlək], which, if not exactly ‘canonical’ in shape, is not far removed from it either. These observations suggest that the syntactic placement of *eigenlijk*, especially in terms of its position in the turn, constrains its phonetic form, with turn-final tokens display-



(a) [æɛχələk]: 1 vowel, 2 dorsal frication, 3 vowel, 4 lateral, 5 vowel, 6 dorsal closure

(b) [ɛ̰ɛ̞χlək]: 1 vowel, 2 dorsal frication, 3 lateral, 4 vowel, 5 dorsal plosion

Figure 4: Segmented spectrograms and waveforms of two tokens of *eigenlijk* in a TCU closing an extended turn or abandoning a multi-turn activity: that in (7) above (left), and that in (8) above (right)

ing a narrower range of variation than turn-medial ones. A consideration of the entire data set confirms this: in turn-final position, only forms of the broad shapes [ˈʔɛixələk], [ˈʔɛixlək] and [ˈʔɛixlk] are attested — that is, only trisyllabic and disyllabic forms with a lateral portion.[5] The pattern observed here, then, involves an interaction between pragmatic context, syntactic structure and phonetic form: certain pragmatic contexts favour certain syntactic structures, which are associated with particular ranges of phonetic variation.

2.4. Wider phonetic patterns

The patterns in the phonetic variation of *eigenlijk* outlined in Section 2.3 are significant in their own right, but a more detailed consideration of the sequence types in which *eigenlijk* occurs suggests that they are part of wider phonetic patterns. In sequences describing a contradiction or paradox, the TCUs with *eigenlijk* do not appear to have recurrent phonetic characteristics. The 15 TCUs with *eigenlijk* which mark the closure of an extended turn or the abandonment of an activity pursued over multiple prior turns, however, are noticeably similar: all are fast relative to the prior TCUs, and most contain examples of ‘reduction’ phenomena throughout. By contrast, most of the dispreferred responses with *eigenlijk* are relatively slow and contain more ‘canonical’ phonetic forms throughout.

As an illustration of this difference, consider the transcriptions in (11) and (12), which correspond to examples (4) to (6) and (7) to (9), respectively.

[5] Ernestus’ (2000: 143) observation that ‘the subjects generally realize the suffix /lək/ as [k] only in the middle of Intonational Phrases’ may be along the same lines. A consideration of the mapping between turn and Intonation Phrase is beyond the scope of this paper, but the present investigation suggests that the distinction *final* vs. *non-final* is more significant than *medial* vs. *non-medial*: in turn-initial (and thus IP-initial) position, forms such as [aɣk] are attested.

(11) a. `en voor de rest weet ik het eigenlijk niet maar`
[ə̃fɔrəːsˈf̞ɛ̞kdːɛ̝k˺nit˺ma̞ɚ]

b. `ja eigenlijk is dat het wel zo’n beetje`
[ja̰æxx̞ˈɪsɑdz̞ʋɛl̝sɵ̃mbe̝e̞ç]

c. `laat ook eigenlijk maar zitten`
[la̠tɵgɛ̰e̝̰k˺mɐ̰ˈsɪ̰tʰ]

(12) a. `nou niet veel eigenlijk`
[na̠ɵnitˈfe̝eɫæɛχələk]

b. `weet ik niet eigenlijk`
[ˈʋee̞tɪk˺nitɛ̰ɛ̞χlək]

c. `ik heb er niet zo’n uitgesproken mening over eigenlijk`
[ʔɪkɛpən̠ʏtsʊnœ̠ɵtχˈsprokəme̠n̝ɪŋo̝vɽɛ̝̰ɛxələk]

The stretches in (11), all of which are TCUs which mark the closure of an extended turn or the abandonment of an activity pursued over multiple prior turns, are characterised by various reduction phenomena. For example, in (11a), a segmented spectrogram and waveform of which is given in Figure 5, *voor de rest* is not associated with three syllables, but with two: [fɔrəːs]; moreover, *rest* does not end in alveolar closure. Similarly, *weet ik* is associated with a monosyllabic form: [f̞ɛ̞k]; and the final alveolar closure in *niet* is unreleased due to the early onset of bilabial closure. In (11b), *dat* is not associated with initial plosion, the lateral gesture for *wel* is noticeably open, and *beetje* lacks a second vowel portion. In (11c), the transition from *ook* to *eigenlijk* is fully voiced, and *zitten* lacks a second vowel portion. The mean articulation rate across these stretches is 10.2 sylls/sec, as shown in Table 2, and in each case the stretch is noticeably fast with respect to prior TCUs: as seen in (4) to (6), each of the TCUs with *eigenlijk* is preceded by a stretch of speech containing regular pauses and ‘stretched’ segments.

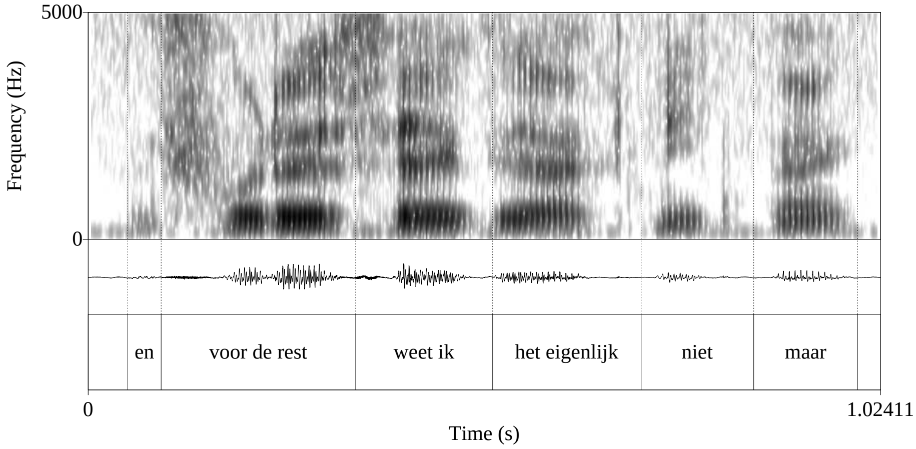


Figure 5: Segmented spectrogram and waveform of the stretch in (11a)

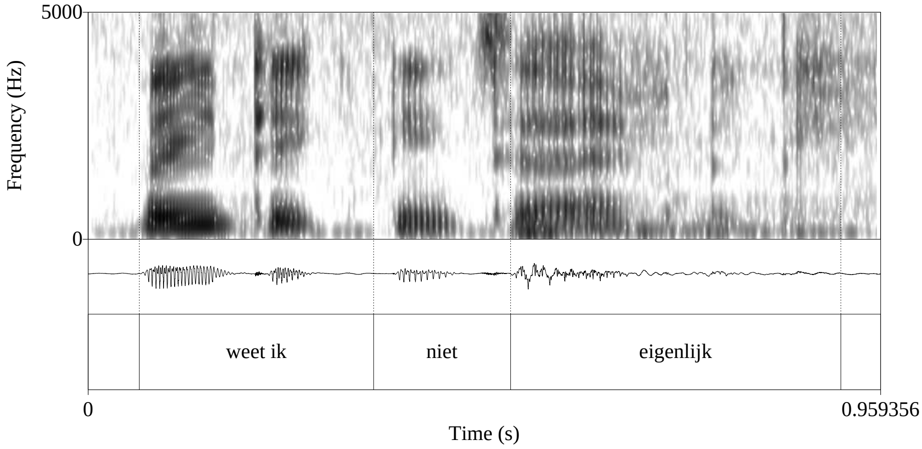


Figure 6: Segmented spectrogram and waveform of the stretch in (12b)

The stretches in (12), all of which are part of dispreferred responses, are phonetically much closer to ‘canonical’. Notice, for example, that the end of *niet* is marked by voiceless alveolar plosion in all three stretches, despite the potential for loss of release, voicing or deletion in these phonetic contexts. Notice also that while *weet ik* is associated with one syllable in (11a), in (12b), a segmented spectrogram and waveform of which is given in Figure 6, it is associated with two, separated by a tight alveolar closure: [ʋee̝tɪk̚]. The mean articulation rate across these stretches is 6.3 sylls/sec, as seen in Table 2, and in each case the response turn is slower than that of the prior elicitation. In the case of (12a), the elicitation — *maar heb je verder nog wat gedaan van de week*, see line 1 in (7) above — has a rate of 8.6 sylls/sec; in the case of (12b) — *en daar zit nu ook de hele familie weer bij of niet*, see line 1 in (8) above — 9.7 sylls/sec. In the case of (12c) — *ik: merk dat jij het helemaal met mij eens ben*, see lines 1 and 2 in (9) above — the sound stretch on *ik* disrupts the rhythm of the elicitation turn. The response is noticeably slower than *dat jij het helemaal met mij eens ben*, for which an articulation rate of 7.6 is measured.

Closing an extended turn or abandoning a multi-turn activity		Dispreferred response	
Stretch	Rate	Stretch	Rate
`en voor de rest weet ik het eigenlijk niet maar`	13.2	`nou niet veel eigenlijk`	5.7
`ja eigenlijk is dat het wel zo’n beetje`	8.3	`weet ik niet eigenlijk`	6.8
`laat ook eigenlijk maar zitten`	9.0	`ik heb er niet zo’n uitgesproken mening over eigenlijk`	6.3
Mean	10.2	Mean	6.3

Table 2: Articulation rate measurements for the stretches in (11) (left) and (12) (right), calculated by dividing the number of syllables in a canonical rendering of the stretch by its observed duration

2.5. Summary: Observations on eigenlijk

This section has shown that a consideration of the pragmatics and syntax of *eigenlijk* offers useful insights into the distribution of its phonetic variants, in that particular pragmatic contexts and syntactic placements are associated with particular ranges of variation in the phonetic shape of *eigenlijk*. I have further suggested that in the case of two of the pragmatic contexts discussed, the phonetic shape of *eigenlijk* is 'fitted' to its phonetic context; that is, these pragmatic contexts appear to be associated with phonetic features which span entire TCUs or turns. The next section discusses the phonological implications of these findings.

3. Towards an exemplar-based analysis

Given the wider phonetic patterns identified in Section 2.4 — in short, forms of the broad shapes [ˈʔɛixk] and [ˈʔɛik] occur in the middle of utterances that are overall fast, while forms of the broad shape [ˈʔɛixələk] occur finally in utterances that are overall slow — one might argue that the variation in the phonetic shape of *eigenlijk* can be explained with reference to speech rate and domain-final lengthening; this is what Kirchner (2001) does, for example. However, if our aim is to represent the speakers' knowledge of the patterns described here, this cannot be considered a complete account: the influence of syntactic and pragmatic factors must be represented at some level. In an exemplar-based approach, this level is that of the lexicon.

3.1. Syntax, pragmatics and categorisation

There are several reasons to hypothesise that syntactic and pragmatic factors of the type found in this investigation play a role in the categorisation of lexical items in an exemplar-based framework. With respect to the syntax, it is generally accepted that in speech perception, the incoming signal is segmented into chunks which correspond to syntactic domains of various sizes; these chunks are then matched against lexical representations. If parts of these domains are consistently associated with particular phonetic patterns, such as domain-final lenthening, it seems plausible that this information is represented at the lexical level, since it speeds up the segmentation and matching process (Pierrehumbert 2003).

With respect to the pragmatics, the pragmatic concepts referred to in the previous section, such as dispreferred response, sequence closure and turn-finality constitute structural units for turn-taking and sequence organisation in everyday interactive language use. Research in the field of Conversation Analysis has shown that language users constantly monitor and orient to this level of organisation in managing interaction (see e.g. Ochs et al. 1996, Couper-Kuhlen & Selting 2001). For example, the TCUs with *eigenlijk* that abandon an activity pursued over multiple turns are typically followed immediately by a co-participant's turn initiating topic change. The TCUs that are part of a dispreferred response, on the other hand, are often followed by further talk on the same topic. With reference to turn-finality, participants generally manage to time the starts of their speaking turns very precisely in relation to the co-participants' prior turns, to the extent that long breaks between turns are relatively uncommon and turns frequently start just before the end of the prior. Moreover, speakers may manipulate these features to prevent turn transition from occurring in the construction of multi-unit turns (Local & Walker 2004).

Furthermore, patterns such as those identified in the previous section are recurrent. In an exemplar-based approach, the categorisation of phonetic forms depends crucially on recurrent experience of particular associations between phonetic form and information at some other level. For example, patterns of allophonic variation lead to robust categorisation, since the evidence for such patterns — that is, for associations between segmental features and, for example, syllable structure — is highly recurrent, and an orientation to these patterns facilitates the parsing of the signal (Lindblom 1992, Pierrehumbert 2003). Recent work reported, for example, in Couper-Kuhlen & Ford (2004), has established a variety of recurrent associations between phonetic events and the sequential organisation of talk-in-interaction. The combination of recurrence and demonstrable participant orientation to the features involved constitutes empirical evidence for phonological categorisation in an exemplar-based approach.

Finally, in the case of *eigenlijk*, the occurrence of the word is itself associated with a particular range of pragmatic contexts, in a way that *the* or *John* are not. As a ‘discourse marker’, *eigenlijk* has a relational function, and as such it focusses attention on the particular pragmatic context it occurs in in a given instance. When for an item of this type, phonetic patterns can be associated with pragmatic information, an analysis in terms of lexical categorisation is particularly plausible.

3.2. Word-level representation

If we accept that the patterns identified in Section 2 are to be accounted for in terms of the lexical representation of *eigenlijk*, how can we conceptualise this representation?

A useful way of looking at an exemplar model of representation is in terms of a multi-dimensional perceptual map (Pierrehumbert 2002). Bivariate scattergrams such as F1–F2 vowel plots are two-dimensional examples of such a map. A vowel plot typically contains points relating to single tokens, organised into sets with category labels, referring for example to phonemes. An example is given in Figure 7. Here the circles represent statistical distributions of observed tokens, and the labels indicate what type of category the tokens are exemplars of — in this case phonemic categories. Under this view, exemplars can be defined as locations on the perceptual map, associated with labels according to their proximity to and shared behaviour with other exemplars.

Staying with phonemic categories for ease of exposition, in this framework ‘phonemes are sets of phonetically similar variants, and … these variants are clustered in groups, such that what we analyse as allophones constitute salient contextually determined prototypes’ (Bybee 2001:53). Figure 8 represents an exemplar set associated with the phonemic category /l/. Again, the circle encompasses a statistical distribution of observed tokens associated with the category /l/ — i.e. a range of remembered laterals. Let us assume that these variants are organised in such a way that ‘dark’ variants are on the left of the set and ‘clear’ ones on the right, for example with reference to F2 values. In many varieties of English, as well as Dutch, ‘clear’ and ‘dark’ laterals are distributed differently: ‘clear’ laterals are associated with syllable onsets and ‘dark’

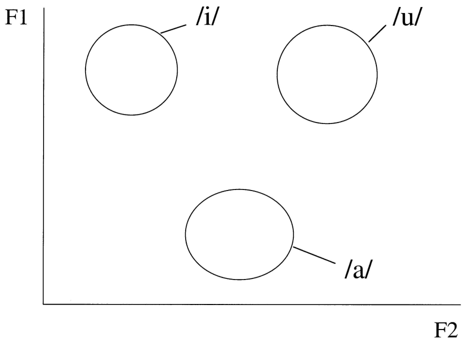


Figure 7: A two-dimensional map with category labels

laterals are associated with syllable codas. This pattern is represented in Figure 8 in terms of two labelled subsets of the set of exemplars associated with /l/.

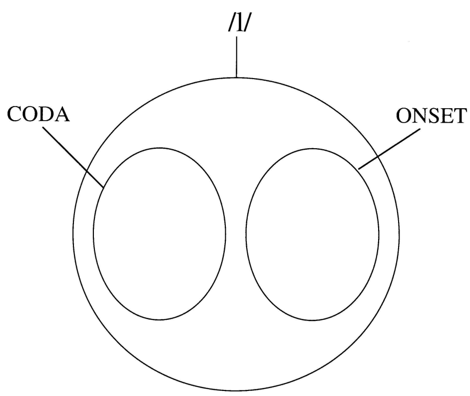


Figure 8: Allophony in an exemplar-based phonology

It is important to note that the labels of these subsets are not phonetic descriptions, as in a traditional generative statement of allophony of the type /l/ → [ɫ] / . . . . Rather, the labels are 'functional links to other levels of representation' (Pierrehumbert 2001a:140) — in this case ONSET and CODA refer to units of syllable structure, and /l/ refers to a term in an abstract (phonemic) system of contrast. The relationship between label and exemplar set is one of association, not derivation.[6] In language production, phonological processing consists of associating the most highly specified set of exemplars with the various structural positions. In this case, if a syllable coda is filled by /l/, the representation in Figure 8 specifies that an exemplar is selected from the set specified CODA rather than that specified ONSET.[7] In perception, matching an incoming

[6]This non-derivational approach to allophony is similar to that taken in Declarative Phonology, which treats allophony as 'the different interpretation of the same element in different structural contexts' (Coleman 1998:178).

[7]Again parallels with Declarative Phonology — and 'unification-based' frameworks in general (see Pollard & Sag 1994) — can be observed here: the procedure of matching structural units and exemplar sets in building linguistic structures may well be formalisable as a unification procedure.

lateral to remembered tokens on the map in Figure 8 provides structural information — that is, information about syllable structure — which facilitates parsing.

Let us now turn to *eigenlijk*. In Bybee's usage-based phonology, the main units of lexical representation are words and frequent phrases. Generalisations over smaller units, such as syllables and phonemes are assumed to emerge from these word and phrase representations in language acquisition, as they facilitate processing (see Lindblom 1992, Pierrehumbert 2003). Word-level representations can be conceptualised in the same way as phoneme-level representations. First consider Figure 9, which represents the relations between the categories distinguished in Section 2. There is the morphosyntactic–semantic category *eigenlijk*; the three syntactic categories (of placement in the turn)[8] INITIAL, MEDIAL and FINAL; and the three contextual, pragmatic categories CONT, CLOS and DISP, which refer to sequences describing a CONTradiction or paradox, TCUs marking the CLOSure of an extended turn or the abandonment of a multi-turn activity, and DISPreferred-response sequences, respectively. The category *eigenlijk* is, of course, associated with all other categories. Figure 9 further represents the observations that in DISPreferred-response sequences, *eigenlijk* occurs in all three syntactic positions, that this is the only one of the three pragmatic contexts in which *eigenlijk* occurs turn-finally, and that in TCUs marking the CLOSure of an extended turn or the abandonment of a multi-turn activity, *eigenlijk* only occurs in turn-medial position.

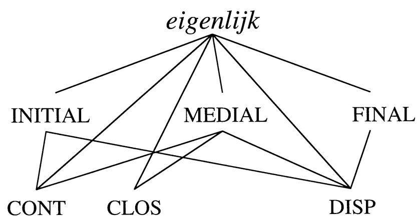


Figure 9: An exemplar-based representation of *eigenlijk*: category network

In an exemplar-based model, each of the combinations of associated features can in principle be associated with a set of exemplars. Figure 10 represents the main patterns described in Section 2 in terms of sets of exemplars associated with the categories in Figure 9. In Figure 10, the big circle represents a set of exemplars associated with the word-level category *eigenlijk*, organised along multiple phonetic parameters. Assuming (arbitrarily) that in Figure 10, highly reduced forms of *eigenlijk* are on the lower right side of the circle and 'canonical' forms are on the upper left side, the labels referring to pragmatic context and syntactic placement — here only FINAL, for clarity — can be associated with partly overlapping subsets of the overall set of exemplars of *eigenlijk*. The size of the circle roughly reflects the range of the variation, and the location reflects central tendency. For example, TCUs which mark the CLOSure of an extended turn or the abandonment of a multi-turn activity are associated with a relatively narrow range of variation centred around highly reduced, monosyllabic forms of *eigenlijk*, which also occur in sequences describing a CONTradiction or paradox, but not frequently in DISPreferred responses.

[8] I leave the relation between placement in the clause and placement in the turn aside here.

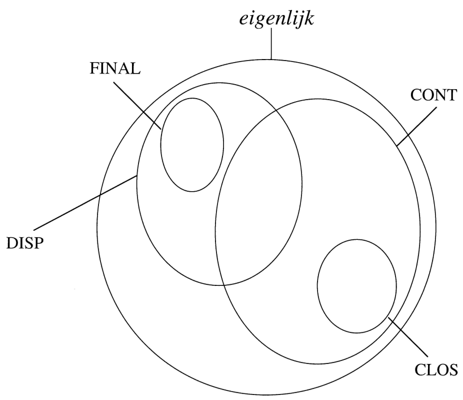


Figure 10: An exemplar-based representation of *eigenlijk*: labelled exemplar sets

Again, in production the labels function as pointers to the most appropriate subset of exemplars for a given word in a given context — syntactic, pragmatic or otherwise. In perception, matching an incoming signal to stored exemplars, with reference to the phonetic parameters of the perceptual map, also provides structural and contextual information through the labels associated with the map: in the case of *eigenlijk*, when a form such as [ɛk̚] is perceived, it is likely that in addition to *eigenlijk*, the labels CLOS and CONT will be highly activated, but FINAL and DISP will not.[9]

3.3. *Beyond the word: specification paths and schemas*

The representation in Figure 10 is schematic and partial, but it gives some impression of how a word-level representation may be conceptualised in an exemplar-based approach. The question we need to address now is how the wider phonetic patterns of which *eigenlijk* has been shown to be a part can be accounted for in this approach. To this end, let us return briefly to the representation of allophony in Figure 8. It will be clear that /l/ is not the only phonemic category that is associated with exemplar sets labelled ONSET and CODA: for example, aspirated and unaspirated voiceless plosives will be distinguished in a similar fashion. In these representations, ONSET and CODA can be seen as underspecified category labels; in the case of Figure 8 the full specification paths are /l/|ONSET and /l/|CODA, respectively.[10] Thus, all categories with the terminal path /*x*/|ONSET together define the system of contrast associated with

[9]Experiments have shown that when faced with a 'reduced' form, listeners often report hearing segments that are not apparently present in the signal; for example, when prompted, they report hearing /l/ in [ɛixk] (Ernestus et al. 2002, Kemps et al. 2004). On the face of it, this seems to provide evidence against the hypothesis that citation forms have no *a priori* status. Space restrictions permit a full discussion of these findings, but one way of accommodating them in an exemplar-based model is to hypothesise that in processing [ɛixk] in analysis tasks such as those used by Ernestus et al. (2002) and Kemps et al. (2004), the exemplar set of a word category is activated *as a whole*, with all of its associated phoneme labels, and that more highly specified subsets — e.g. DISP in the case of *eigenlijk* — are difficult to access out of context.

[10]The order of the category labels in the specification paths is important in a formal analysis, but does not matter much here.

the syllable onset, and all those with the terminal path /*x*/|CODA together define the coda system. These systems of categories with shared specification paths allow for generalisations to be made — for example, that aspiration is a feature commonly observed in syllable onsets, but not in codas, while for velarisation the opposite pattern holds.[11] According to Bybee (2001), these generalisations are stored in 'schemas' — 'emergent generalizations over complex representations' (Bybee 2001:39) — which exist alongside lexical representations and record associations between category labels and phonetic features that are recurrent across multiple lexical representations, such as the association between syllable onset and aspiration. These schemas add productivity to the model, in that they provide a template for the production of 'new' items — in the case of aspiration, of consonants that have not been previously heard in onset position.

We can apply the same analysis to the representation of *eigenlijk*: the labels of subsets are underspecified; for example, the full specification path of CLOS would be *eigenlijk*|CLOS. Together, all exemplar sets labelled *x*|CLOS define the overall phonetic characteristics of TCUs which mark the closing of an extended turn or the abandonment of a multi-turn activity. Generalisations over these sets are stored in schemas. For example, it can be observed that claims of lack of knowledge occur both in TCUs which mark the closing of an extended turn or the abandonment of a multi-turn activity and in dispreferred responses. Phonetically, these are quite different; they tend to be relatively reduced in the former, but relatively unreduced in the latter. If we assume that a phrase like *ik weet (het) niet* is a lexical unit (see Scheibman 2000), it is likely that its representation is similar to that in Figure 10, with DISP and CLOS associated with different subsets of the overall exemplar set. Together, *eigenlijk*|CLOS and *ik weet (het) niet*|CLOS allow for a generalisation as to the areas of exemplar sets — and thus the sets of phonetic parameters — with which this particular pragmatic context is associated. In turn, this generalisation, recorded in a schema, allows any other words or phrases used in this context to be associated with an appropriate phonetic form. The schema for the structure CLOS would contain this phonetic generalisation, as well as the generalisations that *eigenlijk* and claims of lack of knowledge routinely occur in this context; in other words, it would define a prototypical form associated with this structure, based on the accumulated experience of actual exemplars.

4. Discussion

The analysis of *eigenlijk* proposed in Section 3 is admittedly sketchy, and various questions remain to be addressed. For example, what are the phonetic parameters along which exemplar sets are organised?[12] Exactly what kind of category is that labelled *eigenlijk* in Figure 10? How can we conceptualise the 'schemas' referred to in Section 3.3? Is the representation of *eigenlijk* the same for all speakers? With respect to this last question, in a framework based on the notion that the lexicon is shaped by experience, it must be assumed that each individual language user has a unique lexicon. This raises a following question: if a speaker does not exhibit the full variation

[11] Again, parallels with Declarative Phonology are evident here: an exemplar-based framework fits well with the 'polysystemic' declarative approach of Coleman (1998) and Ogden (1999). See Hawkins & Smith (2001) and Hawkins (2003) for discussion.

[12] Closely related to this is the question of what constitutes phonetic similarity in this approach. See Coleman (2003) for an outline of a multi-parameter, spectral signal processing method that could help address this question.

pattern described here for *eigenlijk,* but instead shows a preference for a particular form across contexts in which other speakers show structured variation (as is the case for some speakers in the present data set), does this mean this particular speaker's lexical representation is less complex, or does it mean that he does not exploit the complexity of his lexical representation in production? After all, the categorisation of examplar sets facilitates perception, even if it is ignored in production — and language users clearly store a lot of knowledge of sound patterns that is used routinely in perception, but not so much in production: for example, knowledge of regional or social accents other than their own. In general, the relationship between production and perception is as yet ill-defined in the exemplar-based approach (cf. Docherty & Foulkes 2000).

These issues notwithstanding, the analysis has a number of promising features. To see these, let us compare the analysis briefly to a previous analysis of the phonetics of the German counterpart of *eigenlijk*, *eigentlich* (Kohler 2001). After describing the range of variation associated with *eigentlich* in the speech of a single speaker, Kohler (2001:8) asserts that

> In view of this large variability produced by the same speaker it is inconceivable from the point of view of a mental lexicon that these forms are different lexicalizations for this speaker which he accesses under different situational and contextual conditions. These forms must refer to the same lexical item in this speaker's mental lexicon, with phonetic adjustments under contextual and situational conditions, and statistical variation within the degrees of freedom in the synchronization of the articulatory components.

On the face of it, this assertion is incompatible with the analysis developed in this paper: on the basis of psychological experiments such as those reported by Lachs et al. (2002), the exemplar-based approach accepts the fundamental hypothesis that it is *not* inconceivable that different variants are different lexical items. Still, on closer inspection the difference between the two approaches is not so great. First, recall that in the analysis of *eigenlijk,* the exemplar sets labelled CONT, FINAL etc. are not completely separate: some of them overlap phonetically and all of them are part of the overall set of exemplars of *eigenlijk* — or in other words, all share the structural specification *eigenlijk*$|$*x*. In this sense, the variant forms *do* refer to the same lexical category at the word level; the difference with Kohler's approach is that other lexical categories 'intervene'. In a full analysis in Kohler's approach these additional categories, such as CONT or FINAL would of course be represented too, but at the level of phonetic implementation rather than in the lexicon.

Second, recall that the exemplar-based approach assumes that exemplars are organised along multiple phonetic parameters. Therefore, any lexical category associated with more than one exemplar is in effect associated with a range of variation along multiple phonetic parameters, rather than necessarily with single target forms. For example, given a representation of the allophony of /l/ as in Figure 8, the specification path /l/$|$ONSET points the user to a range of F2 values observed in tokens of this category. In articulatory implementation, this perceptual range is translated into a range of gestural settings between which — in the absence of interacting categories — variation is allowed.[13] As such, these ranges of parameter settings correspond

[13]Pierrehumbert (2001a) implements this through random selection of exemplars from sets that are not further

closely to Kohler's 'statistical variation within the degrees of freedom in the synchronization of the articulatory components'. Again, what sets the two approaches apart is not what categories are represented, but *at what level* they are represented: much of what in Kohler's approach is covered by phonetic implementation rules is covered by lexical representation in an exemplar-based model.

As indicated in Section 1.1, an exemplar-based model must incorporate a level of phonetic, at which perceptual representations are translated into motor commands. In much previous work, including that by Kohler, this level is a very complex one, at which general physiological constraints interact with highly detailed, language-specific, contextually motivated ones of the type 'in context *x*, implement *y* with feature *z*' (cf. Keating 1996). In an exemplar-based model, on the other hand, the level of phonetic — i.e. articulatory — implementation is relatively impoverished, containing only general physiological constraints: all context-bound regularities are accounted for in terms of lexical representations and schemas that express generalisations over these representations. The 'automation' effect of repeated production (Bybee 2001) and the notion of effort minimisation (Lindblom 1990) are examples of such physiological constraints, in the sense that these are general features of motor behaviour. Through shaping language production, these features may affect the nature of lexical representations, but importantly, their application is constrained by lexical representation, and they play no role in the *selection* of target forms or ranges of variation.

For example, in the case of *eigenlijk*, the occurrence of close to canonical forms in dispreferred responses does not necessarily mean that in this context, speakers do not minimise articulatory effort; rather, they minimise articulatory effort within the parameter ranges specified in the lexical representation of *eigenlijk*|DISP. Over time, this may result in shifting parameter ranges, as in lenition and grammaticalisation processes (Pierrehumbert 2001b, Krug 2001), but for any given speaker at any given time, the selection of these parameter ranges is independent of any physiological notions. Thus, an exemplar-based model incorporates functionalist principles, but is compatible with the stance, taken by Hale & Reiss (2000) and Ohala (2005) — against functionalist Optimality Theory accounts such as that of Kirchner (2001)—that these principles play no role in phonological, *cognitive* computation. From a methodological perspective, the central role of lexical categorisation in accounting for variation in an exemplar-based approach means that in investigating reduction patterns, the level of phonetic implementation is 'the last resort, the place to house those patterns which cannot be systematized in any other way', as Simpson (2001:38) proposes.

Of course, the simplification of the procedure of phonetic implementation comes at the cost of greatly increasing the complexity of the lexicon. However, as indicated in Section 1, this complexity is motivated by the need to account for the role of frequency in shaping linguistic patterns, and the interactions between linguistic and extra-linguistic knowledge; and it has provided valuable insights in areas in which traditional generative phonology and Optimality Theory fall short, such as language development (Stemberger 1992, Pierrehumbert 2003) and diachronic change (Bybee 2002, Beckman & Pierrehumbert 2003). Moreover, it has already been shown that an exemplar-based analysis of structured variation is relatively neutral with respect to production vs. perception. A relatively impoverished phonetic implementation procedure keeps

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categorised.

it that way: it allows an incoming signal to be mapped onto lexical representations almost directly. In a framework such as Kohler's, on the other hand, perception involves applying a very complex phonetic implementation procedure 'backwards' to arrive at a representation that can be matched with a lexical one — a process which may well require additional computational machinery (see Johnson 2003 for discussion). Future research will need to show whether or not the complexity of exemplar-based models is problematic from a computational and cognitive perspective. So far, computational implementations suggest that the 'head-filling-up problem' attributed to exemplar-based models is more apparent than real (Johnson 1997, Kirchner 1999, Pierrehumbert 2003). In order to make these implementations as realistic as possible, detailed empirical work is needed on the categorisation of ranges of phonetic variation in actual language use. This paper has been a contribution to this project.

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The role of intonation in floating quantifiers

Lisa Rochman

This paper will examine the role of focus structure and prosody in the determination of so-called floating quantifiers' (FQ) placement. Prosody will be shown to be the determining factor in the final position that the FQ occupies in the linear string. It will also be shown that focus structure plays a crucial role in determining whether or not a quantifier can float and in determining which position the FQ will occupy. It will be shown that the existing theories do not take these factors into account and subsequently fail to provide an adequate explanation for FQ placement.

1. Introduction

What determines the position floating quantifiers occupy in a sentence? The two mainstream approaches to this phenomenon can explain FQ placement to a relative extent, but do not provide a concise explanation for which of the several possibilities will be realized in a given sentence. In this paper I will account for the specific distinctions in FQ placement. Furthermore I will show that focus structure plays a role in the determination of an element's ability to be modified by a floating quantifier. In this paper I will persist in the nomenclature FQ simply for convenience sake, but I show that the categorization of which elements fall under this guise needs to be expanded.[1]

[1] In this paper the term floating quantifier is used for quantifiers that are not adjacent to the constituent they are modifying as well as to quantifiers that could be moved to non-adjacent positions. Therefore sentence initial quantifiers that could be floated will also be considered in this paper.

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2. Floating quantifiers

Floating quantifiers are elements that can have several possible locations in a sentence.

(1) a. The carpets have been cleaned
    b. The carpets have been all cleaned.
    c. The carpets have all been cleaned
    d. The carpets all have been cleaned
    e. All the carpets have been cleaned.

All theories regard (1c, d) as floating quantifiers. There is no apparent difference in meaning or scope in these sentences and the FQ can felicitously appear in either position.[2] Sentences (1a, b) are often given different interpretations. (1b) is frequently treated as different from FQ sentences. Sometimes it is treated as a completive adverb (Bobaljik 1995) while in other theories it is treated as an FQ (Sportiche 1988). The most controversial sentence is (1d), as we will see later it is this type of sentence that creates the greatest chasm in the two different approaches. Some theories consider (1d) to be the non-floated version of (1a-c) but essentially the same type of element, while other theories treat DP initial *all* as a different element completely. These theories consider DP initial *all* to be determiner quantifier (D-quantifier), and the floated *all* to be an adverb.

At this point it is crucial to point out that judgments of FQs vary widely. Except for sentences like (1c), there is seldom any consensus on the acceptability of a sentence. I return to this issue later as its significance of is one of the major effects that phonology has on FQ placement. In short, there is no one clear delineation of what an FQ is, nor in what position an FQ can appear in; minimally, it is a quantifier-like element (although even this point is contested) that seems to be modifying the DP, yet is located structurally below the subject.

It is important to understand that the addition of *all* has a significant effect on the sentence. (1a) can felicitously be uttered in a situation where there are 100 carpets and 95 of the carpets have been cleaned. Given the same scenario informants take (1b-e) to be infelicitous; as long as there is even one carpet that that has not been cleaned (1b-e) will be perceived as infelicitous. *All* has a maximizing effect. It maximizes the constituent it is attached to.

3. Previous approaches

There are two predominant approaches to quantifier float (q-float); the stranding approach and the adverb approach. In this section I will briefly sketch out the main aspects as well as the strengths and weaknesses of both of these approaches.

3.1 DP- trace approach

What has become the textbook approach to FQ placement was put forth by Sportiche (1988). Proponents of this approach take the DP and its modifier to form a single constituent giving the structure [Q NP] (Sportiche; Shlonsky 1991; Merchant 1996; McCloskey 2000).[3]

[2] See Tsoulas (2002) for a counter approach to this claim which takes FQ to be overt scope markers. Furthermore, scope differences do arise when there is another operator in the sentence.

[3] There have been several variations on the implementation of this idea and what exact position the Q is in and whether the Q is a head taking and NP as a complement or whether the Q is in a specifier position.

Sportiche, as a proponent of the VP internal subject hypothesis, takes this unit, the FQ+DP (then NP) to be base generated in Spec, VP. When the subject moves cyclically to Spec, TP the FQ can remain in the base or any intermediate positions while the rest of the DP continues to rise.

(2) All the boys should have eaten.
[[All [the boys t]] [should [t have [t eaten]]]]
(All) the boys (all) should (all) have (all) eaten.

FQs mark the position of DP traces. This theory takes FQs and their DP initial counterpart to be the same element stranded in the former case and non-stranded in the latter.

Since Sportiche put forth his theory in 1988, modified versions of this approach have been used to account for FQ placement cross-linguistically to relative degrees of success. One such example is Hebrew. Shlonsky expands on Sportiche's ideas and applies them to q-float in Hebrew. He proposes that quantifiers head their own projections (QP) and the head Q takes a DP as its complement. When the DP raises to SpecQP, on its way out of the QP en route to Spec TP, we get agreement.[4]

(3) Kol ha-yeladim ?ohavim le-saxek
all the children like to play
'All the children like to play.'

(4) Ha-Yeladim kul-am ?ohavim le-saxek
the children all-[3MPL] like to play
'All the children like to play' (Shlonsky 1991)

While the stranding approach is successful in many accounts there are several crucial issues that it cannot adequately account for. Represented in (5) through (8) are a few of the obstacles that dissuade acceptance of the stranding approach. In (5) the FQ is unacceptable in the theorized base position of the subject, contrary to what is expected.[5] In (6) the FQ is occurring in a position that the subject could not theoretically have occupied.[6] In (7) the FQ and the DP could not logically have formed a single constituent. And finally in (8) *all* in the base position of the subject leads to a different interpretation of *all* (I will return to this in the coming section).

(5) *The votes have been counted all. (Bobaljik 1995)

[4] An anonymous review pointed out that German has the exact opposite situation with *ganz* 'whole'. When it is not stranded it has agreement and when it is stranded there is no agreement.

[5] See Erteschik-Shir and Rapaport (2000) for theoretical approach to passives and unaccusatives that does not base generate them in object position.

[6] This has lead researchers to propose that in these situations there is not an FQ but a full DP. They claim this is supported by the fact that full DP can be substituted in these positions while in other floated positions this is not possible (see Doetjes 1992).

i. Ben, Mike and Sara arrived all at the same time.
ii. Ben, Mike and Sara arrived, Ben and Mike at the same time.
iii. *The children have Ben Sara and Mike seen the movie

(6) The magicians disappeared all at the same time.[7] (Bobaljik 1995)

(7) a. Seth, Pilar and Diana have all left in one car.
b. *All (of) Seth, Pilar and Diana have left in one car. (Bobaljik 1995)

(8) The carpets (all) have (all) been (all) cleaned.

There are also sentences where if the FQ and the subject formed a constituent the result would be semantically impossible.

(9) a. The boys were[$_{\text{cumulative}}$ numerous] and [$_{\text{distributive}}$ all eager to talk]
b. *All the boys were numerous and eager to talk. (Zamparelli 2000)

If the FQ in (9) is at any point construed with the subject, Zamparelli claims thus leads us to assume the possibility of sentences like (9b) which are completely ungrammatical.

The beauty of the stranding analysis lies in its convenience and unified approach. The fact that FQs appear in positions the DP passes through delivers a nice picture, but, unfortunately the data cannot support it.

3.2 Adverb Approach

The second major approach to FQs takes them to be adverbs/adjuncts. The FQ is adjoined to the left edge of the predicate whose subject they modify, and the FQ stands in an interpretive relationship to the DP (cf. Dowty and Brodie 1984; Bowers 1993; Baltin 1995; Bobaljik 1995). It was observed that FQs pattern with and behave like adverbs; both are subject to ordering restrictions, trigger semantic/syntactic effects and need interpretive rules.[8] Bobaljik takes the FQ to maximize the predicate to which the FQ is attached in relationship to the subject. The FQ and the DP do not form a constituent at any stage of the derivation. Pre-DP quantifiers are of a different sort, generally considered to be determiner quantifiers, than their 'floated' adverb counterpart.

The adverb approach is able to explain many of the cases that the stranding approach is unable to. For example, the stranding approach is unable to account for (7) where the DP and the FQ could not logically have formed one constituent; this sentence naturally falls in line with the adverbial approach.

(10) The children greeted the teacher all at the same time.[9]

PPs are predicates and the FQ can attach to the left edge of predicates. Additionally, this removes the problem of accounting for passives, unaccusatives and cases where the DP and the FQ could not logically have formed one constituent as was shown in examples (6) and (7). The problem posed by (5) for the stranding approach poses no problem for the adverb

[7] There is evidence that it is not the case that the FQ is marking the position where the subject originated although initially it may appear to be. Note that topicalization of the adverbial does not permit *all* to be left behind.

i. *At the same time, the magicians disappeared all.
ii. All at the same time, the magicians disappeared all. (Bobaljik 1995)

[8] See Dowty and Brody (1984) and Bobalijik (1995) for the specifics on these construals.

[9] This example was given to me by an anonymous reviewer.

approach. Sentence finally there is no XP for the adverb to adjoin to, therefore the unacceptability is expected.

While the adverb approach can successfully account for several issues that plague the stranding approach, it too has several major drawbacks. One of the strongest arguments against it is that in many languages FQ behave like DP-internal modifiers in that they agree with the head of DP in phi-features and case.

(11)	Strákun**um**	leiddist	oll**um**	í	skóla.	(Icelandic)
	The.boys. DAT.PL	bored	all.DAT.PL	in	school	
	'The boys were all bored in school.'					(Boeckx, 2001)

(12)	Diess**en**	studenten	habe ich	gestern	all**en**	geschmeichelt.	(German)
	These-DAT-PL	students	have I	yesterday	all-DAT-PL	flattered.	
	'I flattered all of these students yesterday.'						(Merchant 1996)

In (11) the DP *strákun**um*** agrees with the FQ *oll**um*** and in (12) the FQ bears case and phi-features that agree with the DP subject. If the FQ is an adverb, there is no obvious explanation for the nominal agreement, especially since other adverbs do not exhibit this type of agreement.

The adverb approach has another problem. As pointed out by Bošković (2004), Bobaljik's approach predicts parallel distribution for FQs and modal adverbs. This parallelism is not found. Frequently constituents can extrapose around adverbs as in (13) and the resulting structure while frequently slightly degraded is acceptable. This is not available when the adverb is an FQ as evidenced by (14). If FQs are adjoined to XP the same way as adverbs (left adjunction), then (14) should be an available option.[10]

(13) a. The men forgot their keys ?surely/accidentally/surprisingly.
b. The men surely/accidentally/surprisingly forgot their keys.

(14) a. The men all forgot their keys.
b. *The men forgot their keys all.

The adverb approach needs to be able to account for why (13a) is acceptable but (14b) is not. Furthermore, as pointed out by Bošković, FQs can attach to PP but sentential/modal adverbs (which are the type FQs are theorized to pattern like) cannot attach to PP. So if FQ are true adverbs then they should pattern like them.[11]

The adverb approach deals with FQ placement much more successfully than the stranding approach but still leaves many gaps.

[10] An alternative analysis, pointed out by an anonymous reviewer, for this construction could be that *all* is not allowed to right-adjoin while the adverbs in (13) can. This analysis though does not help to explain why the FQ, which is proposed to be a modal adverb, does not behave as other modal adverbs. In section 4.3 I will discuss a prosodic constraint that could account for why the FQ cannot occur finally.

[11] See Bošković (2004) for a more in depth critique on Bobaljik's parallelism between FQs and sentential adverbs.

4. A prosodic and f-structure approach
4.1 Overview

Existing approaches to floating quantifiers are unable to account for the specific position that FQs occupy. When there is a string of possible locations, these theories have neither prediction power nor explanation for why the FQ occurs in one position as opposed to another. Whether one follows the stranding approach or the adverb approach, one still must grapple with the lack of specification in these theories. In this section, I will show that the decision on which position the FQ will occupy is based on prosodic constraints and focus structure requirements. This prosodic data could feasible be adapted into either of the mainstream approaches and lead to a more comprehensive account of FQ placement.

4.2 Data compilation methods and sources

The focus of this research is to explain what determines which position the FQ will occupy when there are several possibilities. As I am interested in the actual usage of the language, nearly all data was obtained from spoken sources. Since the different types of sources are important, I will briefly discuss them.

The initial source of data came from informants who memorized a sentence and were recorded reciting it. This data was intended to capture the overall prosody of sentences with FQs. The second source of data came from recordings of native informants who were given contextualizing information and then questions regarding the context; the informants had to choose the answer that they felt best suited the question. The answer choices consisted of the different possible word orders for FQs. A recording was made of the informants reading the question and the chosen answer. This data was used to see what position was preferred depending on the focus structure and to see what pitch accents were associated with which f-structure roles and to see if there was any difference in the prosodic boundaries.

The third source was corpora, more specifically, The Santa Barbara Corpus (SBC) (Dubois et al. 2000) and the Variations in Conversation (VIC) corpus (Pitt et al. 2003). These two corpora provided the substance of the data. Corpora provide examples of freely generated contextualized speech, which were subsequently analyzed for f-structure, pitch, and boundaries. All sounds were analyzed using PRAAT speech analysis system (Boersma and Weenik, 1992)

In addition to the recorded data, 8 native speaking informants where surveyed in order to accumulate data on FQ placement in differing f-structures.

4.2.1 Focus structure

Focus structure affects word order. In free word order languages it has been shown that the information structure role of a constituent affects its position. Many languages are theorized to have structural focus positions (for Hungarian see Kiss 1998, for Hebrew see Belletti & Shlonsky 1995, for an overview on focus positions in Spanish, Italian and German see Büring 2003). While English is not a free word order language there are elements that exhibit relative freedom in their placement and it has been shown that in some cases focus structure affects the placement of these constituents (Dehé 2001 for verb particle structure, Büring 2003 and references therein). A one-to-one correlation between focus structure role and FQ placement is not expected except in the case of contrast because while FQs can be contrastive they cannot be topics or foci; they can only be associated with a topic or a focus.[12]

4.2.2 Contrast

When the FQ is contrastive and modifying the subject, it is highly favored to appear left adjacent to the DP, in sentence initial position.[13] This result, while surprising for English, is well-attested cross-linguistically. Numerous languages posit a contrastive position in the left periphery (Rizzi 1997, Dominguez in press). Speakers' preference for placing contrastive FQs in this position is unanimous in my experiments. The survey results showed unanimously that given (15a) or (16a) the preferred response was (b):

(15) a. Did any of the children see the movie?
b. All the children have seen the movie.

(16) a. Did all the children go or only some of the children?
b. All the children went.

In (15) there is contrast between the alternatives for *all* and in (16) there is overt contrast between *all* and *some*. Following the theory of focus structure put forth by Erteschik-Shir (1997) the fact that sentence initial *all* is contrastive is not surprising, since contrast is created by a focal element inside a topic.

(17) $[[\{\text{All}\}]_{foc}[\text{the children}]]_{top}$ $[\text{have } [\text{seen the movie}]]_{foc.}$
{most}
{some}
{none}

It is well known and accepted that *all,* along with most quantifiers, is usually prosodically highlighted; this is a type of focalization and subjects are default topics. In (17) the speaker is asserting that it is *all* and not an alternative to *all*. Obviously, context can change the reading, change the f-structure, but the default reading seems to be contrastive in these cases unless the speaker refrains from accenting *all*. Survey results were not the only confirmation for contrastive FQ being favored initially. Analysis of two corpora, Santa Barbara Corpus (SBC) and Variations in Conversations (VIC) and recordings of elicited speech show that frequently when *all* occurs DP initially it is marked by the L+H* pitch accent. Experimental work in English has associated contrast with the pitch accent L+H* (Pierrehumbert 1980; Hedberg 2002).

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[12] See Belletti (2003) for a quantifier stranding approach that incorporates information structure.
[13] When the FQ itself is contrastive, not the whole DP.

Figure 1

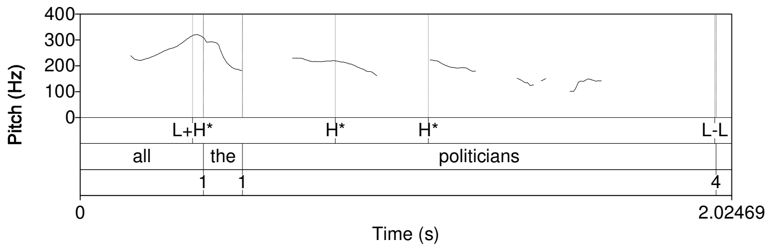
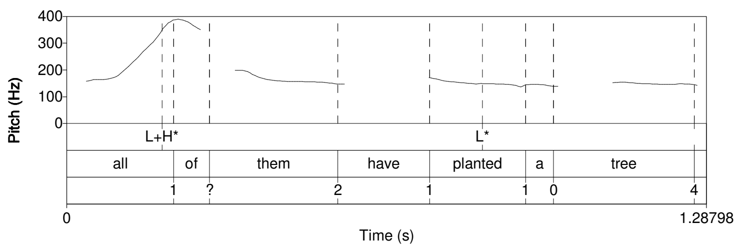


Figure 1 shows the contrastive pitch accent on *all*. [14] The context of the discourse illustrated that this was indeed a case of contrast.[15]

Figure 2



In figures 1 and 2, the L+H* pitch accent indicates that the FQ is contrastive. It should be pointed out that *all* can be contrastively pitch accented in the floated position and in such cases it will be interpreted contrastively. Therefore I propose that initial placement of the FQ is an optional way of marking contrast on FQs.

4.2.3 Topic/ focus associations

FQs themselves are not the topic or focus of a sentence; they are associated with a topic or focus.[16] FQs related to topics clearly prefer non-initial position. While it has been claimed that topics are usually not pitch accented in English my research has found that frequently non-pronominal subject topics are pitch accented as well as the FQ associated with topics.[17] Generally the pitch accent marking subject topic and the associated FQ pitch accent is H*. The relevance of this will be seen in section 4.3.2, where I discuss the role of prosodic incorporation.

[14] Following the ToBI guidelines utterance initial pitch accents should be marked L+H* only in cases of an unambiguous pitch accent type, in cases where the pitch accent type is not clear between H* and L+H* transcribers should choose the former (Beckman and Elam 1994). Therefore several initial FQ were transcribed as H*. In some cases duration was also taken into account as frequently the L+H* has a longer duration than H*.

[15] There were a few cases where the initial FQ was clearly not pitch accented contrastively. These cases require more analysis before any conclusions can be drawn.

[16] The exception to this is when the FQ replaces the subject of the sentence: ‘All came.’

[17] This finding is limited to sentences which contain an FQ as that was what was under investigation. Further research should be done to see if this finding is consistent in non-quantified sentences.

Figure 3

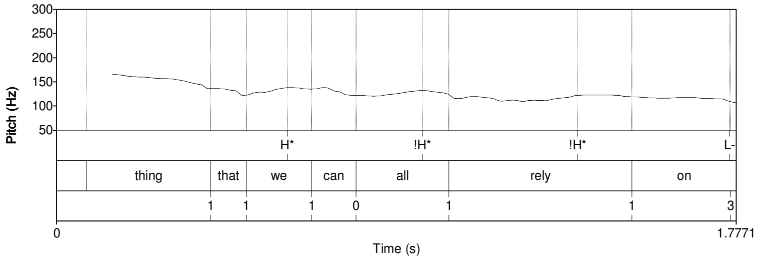


Figure 4

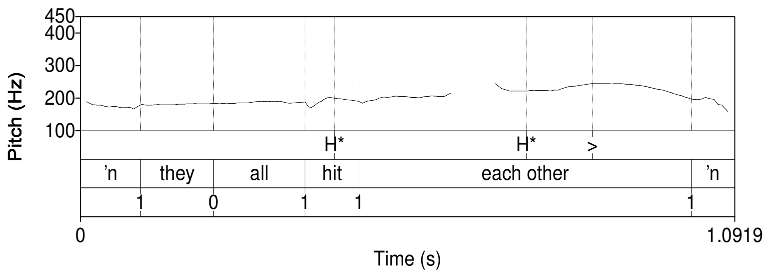
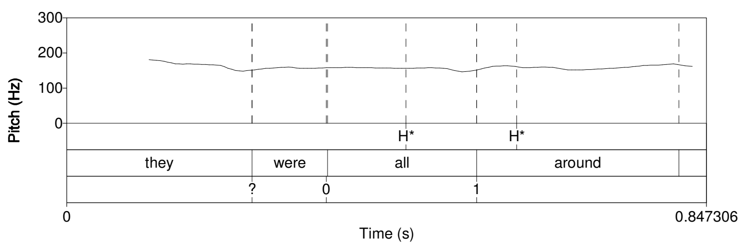


Figure 5



Figures 3-5 show that topic-associated *all* occurs to the right of the DP it modifies and can either be pitch accented or not. Initially, there appears to be no structural position that *all* favors: any position adjacent to a weak pronoun, auxiliary, or modal is fine, although in section 4.3.2 we will see that phonology determines which of these positions will be preferred.

FQs associated with foci do not seem to have a direct correlation to a specific position. There are prosodic events that indicate that an element might be focused. One indicator that appeared in several recordings with focus on the DP was a phrase boundary after the FQ, which corresponded to 3 on the ToBI break indices. This boundary following the FQ is not consistently present in cases where the DP is focused and there are very limited occurrences of full DP foci floating quantifiers. The case of full DPs floating quantifiers usually came from recited speech, therefore spontaneous speech with foci floating quantifiers is needed before any conclusions can be drawn. Further research is needed to see if this boundary is an indicator of focus. There also seems to be some tendency for floating FQ from topics as opposed to foci. I will return to this in section 4.2.4.

Evidently, there is a favored position for contrastive FQs. I certainly do not intend to claim that the FQ will obligatorily occur left adjacent to the DP whenever there is contrast. I do claim that the analysis of freely generated speech does show that speakers prefer this position for contrastive FQs. While an analysis of why initial position in many languages is favored for contrast is a theoretical question well beyond the scope of this paper I will though put forth two possibilities. Firstly, it could be a way to link the contrast back to prior discourse as seen in topicalization, which moves topics to SpecCP, and provides a link back to the prior discourse. The contrast is with a prior aspect of the discourse; by placing it initially it is easier to process the contrast. When *all* is related to a topic there is no need to refer back to anything outside the sentence because DP-modifying FQs are anaphoric to the DP they are associated with. There may be further phonological reasons, though: contrast is usually distinctly pitch accented, this high peak maybe be easier to produce sentence initially before the declination of the F0 begins.[18]

4.2.4 Further topic/focus associations

Information structure also seems to influence whether or not a DP can be modified by a floating quantifier. There seems to be a preference for topics to have floating quantifiers as opposed to foci. This preference may shed some light on other aspects of q-float including so called q-pro-flip and other cases of FQs associated with objects.

Pronouns with FQ in complement position can occur in either $DP_{PRONOUN}$+FQ or FQ+$DP_{PRONOUN}$ order. This variable order has been termed q-pro-flip, and it is a phenomenon unrelated to q-float.[19] This separation is justified on the grounds that q-float from complement position with a full DP is quite rare. If though this is looked at in terms of q-float we will see a pattern emerges. In (18) *all* can occur on either side of the object DP.

(18) a. The boss told all of them.
b. The boss told them all.

Example (19) illustrates that full DPs cannot float quantifiers when the DP is complement of a transitive verb.

(19) a. *John greeted the teachers all.
b. John greeted all the teachers.

Determination of which *pronoun*/*all* order will occur is quite problematic. Initially, there does not seem to be a connection between the order and f-structure. One may be inclined to claim the choice depends on whether the context requires a strong partitive as in (18a), or not as in (18b). When these data are looked at in the light of data from the double object construction and dative constructions, there seems to be more going on than just a partitive difference.

In order to understand object q-float we need to look at other cases of object q-float. Some full DP direct objects do allow quantifiers to float.

(20) a. John sold the books all to Mary.
b. John sold all (of) the books to Mary.

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[18] Although a counterclaim to this might be that the high peak is easier to perceive once the F0 has declined significantly, since the contrast between the peak and the baseline will be more significant.

[19] Maling (1976) described this phenomenon as pronouns obligatorily undergoing short movement to SpecQP, and termed it q-pro-flip.

It is well known that these constructions have different interpretations depending on whether the direct or indirect object comes first. Following Erteschik-Shir (1997), when the direct object occurs initially, the direct object will be the topic in the unmarked case. In the reverse order (indirect object preceding direct object), there is no such condition on the unmarked f-structure. So, in (21a) *the books* is the topic, while not necessarily in (21b).

(21) a. Mary sent (all) the books (all) to Peter.
b. Mary sent Peter (all) the books (*all).

(21b) has the implication that Peter received the books while (21a) has no such implication associated with it. In (21a) the FQ can float, while in (21b) floating is impossible unless additional material is added after the direct object.

(22) ?Mary sent Peter the books all at the same time.

At first it may seem that the problem is that *all* cannot occur sentence finally for prosodic reasons. While there is some truth to that claim (which I will discuss later), there are two indicators that this is not the sole explanation. First, *all* is prosodically phrased with the PP and not with the DP and the PP. This indicates that, structurally, the FQ is contained in the PP and not in the DP.

(23) a.…(the books)$_{IP}$(all at the same time)$_{IP}$
b. * …(the books all)$_{IP}$ (at the same time)$_{IP}$

If the FQ was a constituent of the DP this phrasing is unexpected. If one does not follow the stranding approach which takes the FQ and DP to be base generated as a single constituent, there is no reason that the FQ cannot attach to PP the same as it attaches to other XPs. Furthermore, informants only judged (22) as acceptable with focal stress on the PP. Focusing the PP renders *the books* a topic.[20]

Secondly, when informants were presented with the following questions, different answer choices were permitted.

(24) a. What did Mary send to Peter?
b. Who did Mary send the books to?

(24a) requires a direct object focus, while (24b) requires an indirect object focus. Informants chose non-floated *all* as the response in both (24a,b) but allowed floated *all* only in response to (24b). So when the direct object is a topic the floated order is possible while with focal direct objects the floating option is unavailable. There is an interesting parallel here. Recall that only pronouns allow FQ to float in simple transitive sentences.

(25) The man hates (all) them (all).

(26) The man hates (all) the pictures (*all).

[20] Unless there is more than one focus as in the answer to multiple wh-questions.

Pronouns represent familiar referents. Pronouns are anaphoric on something already in the discourse and therefore cannot be new information.[21] (Erteschik-Shir 1997) The unmarked/default case is one in which the subject is the topic and the object is the focus. There seems to be a parallel here between transitive cases and the double objects. This parallel can be further exemplified by the overwhelming informant intuition that (27), with the floated quantifier, can only be uttered felicitously with stress on the indirect object.

(27) Mary sent the books all to Peter.

Stress on the indirect object will focus the indirect object and the direct object will be the topic.[22] Erteschik-Shir (1979) proposed that the default f-structure for the word order (without the *all*) in (27) would have the direct object be the topic and the indirect object be the focus. Evidently, the FQ can occur within the focused constituent, but with direct objects it seems to be preferred only to modify topics.[23] More research is required in order to confirm or disprove this hypothesis, but given the data presented here I feel this is an approach that warrants looking further into it.[24]

F-structure has been shown in this section to play an important role in q-float. FQs that bear the f-structure role of contrast are favored initially. On the other hand, FQs associated with foci or topics are favored in non-initial position, with a preference for FQs to float from topics as opposed to foci.

4.3 The role of phonology

This section will explore the precise details of what determines the position of FQs within the maze of auxiliaries/modals. In (28), what determines which position *all* will occupy?

(28) The children (all) might (all) have (all) been (all) causing problems at the movies.

I claim that the position is determined by where the FQ can prosodically incorporate (PI) with another element without disrupting the prosody of the utterance. The idea that FQ need to prosodically incorporate is not new. McCloskey (2000) proposes that wh-quantifier float in West Ulster English (WUE), beyond the syntactic constraints, is further constrained by the requirement that the FQ prosodically combine with the verb. Sentences become progressively more degraded as more intervening material occurs between the verb and the FQ. McCloskey's data provides, as of yet, unrefuted evidence for the role of prosody in FQ placement.[25] Interestingly, my data shows that FQs PI with intrinsically weak elements, while PI in WUE takes place with lexical verbs. This provides further confirmation for the crucial role of language specific, perhaps more correctly dialect specific, phonology and prosody.

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[21] I am ignoring the deictic use of pronouns. Also, first and second person (speaker and listener) are naturally in the discourse they are obligatorily topics even if not directly stated previously in the discourse.

[22] Unless the sentence is an all focus sentence.

[23] I am using the term modify for convenience sake

[24] A connection between focus structure and q-float has been established in both Japanese and Korean, see Han 1999 and references therein.

[25] McCloskey followed a stranding approach and claimed the FQ could remain in any position the wh-phrase passed through as it cyclically moved to Spec, CP. If the FQ was in a position that was not prosodically optimal, the sentence would be drastically reduced in acceptability, but if the FQ occurred in a position that the wh-phrase had not passed through then the sentence would be completely unacceptable for the informants.

4.3.1 Prosodic incorporation

Prosodic incorporation is used more or less as a catch-all for cliticization, lack of disjuncture, fast/slurred speech etc... A precise classification of PI is needed before any claims can be made for its role in word order. The following definition of PI is based on an analysis of 20 utterances from the SBC and the VIC at different junctures.

(29) Prosodic incorporation in English
Two words highly co-articulated without final lengthening of the first constituent, no initial glottalization of the second constituent, possibility of a reduced vowel in either of the two constituents, one constituent of the newly formed prosodic unit can be pitch accented and the two words are auditorially perceived as one word (corresponding to a break index of zero within the ToBI framework).[26] (Cho 1999, 2001; Turk and White 1999; Beckman and Ayers)

Actually classification of instances of PI is quite difficult because frequently not all five criteria are detectable. In this research, I attempted to adhere to the definition in (29) as closely as possible. Having established what PI is we now need to see what it does.

4.3.2 The role of Prosodic Incorporation

FQs appear in positions where PI is possible. The elements that can PI with *all* are intrinsically weak elements, which include auxiliary verbs, modal verbs, pronouns and (although not intrinsically weak), in a few cases unstressed monosyllabic NPs.

In (30), based on the role of focus structure, the expectation is that, if the FQ is not contrastive, it will occur right adjacent to the DP giving either (30a) or (30b).

(30) a. The children **have all** seen the movie.
b. The children **all have** seen the movie.

Intuitively speakers consistently produce (30a). *Children* is an utterance initial disyllabic content word. A prosodic analysis of this utterance indicates that the DP is pitch accented and these are not traits that lead to phonological weakening. These conditions prevent *all* from PI-ing with *the children*, therefore this word order is not favored. Additionally, PI-ing of *all have* instead of *have all* is disfavored since *all* has no onset, and will favor positions where it can acquire an onset. In my experiments where informants were given a sentence similar to (30b) and (31a-c) to memorize and recite they unknowingly and consistently produced (30a) and (31a'-c').

[26] Other indicators of juncture include: silent or filled pauses, breathing, F0 movements, intensity variation, and voice quality (Carlson, Granström et al. 2002). Therefore, the presence of any of these indicates that PI is not occurring. It should be noted that co-articulation and vowel quality will be affected if the syllable is stressed, bears a pitch accent and by its level of sonority- degree of coarticulatory resistance is inversely proportional to the degree of sonority of the segments (Cho 1999).

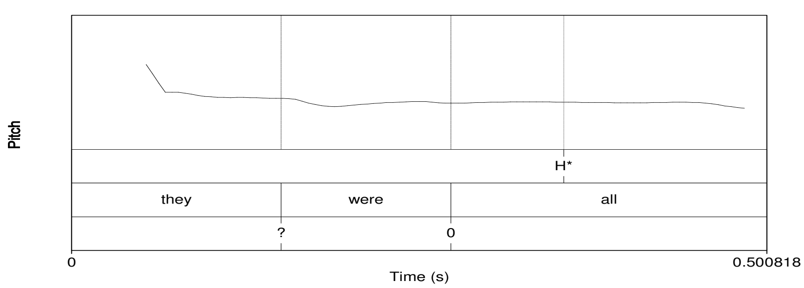
(31) Given:
a. The children all have probably seen the movie.
b. The children all should have seen the movie.
c. The children should all have seen the movie.
Produced:
a'. The children have all seen the movie.
b.' The children should have all seen the movie.
c'. The children should have all seen the movie.

This shows that speakers natural produce the phonologically optimal sentence and not the one they actually memorize.

FQ placement is apparently further constrained when (31c') is considered, which is favored over (31c). In (31c) the FQ occurs right adjacent to a modal and left adjacent to an auxiliary in a position that is evidently not the favored one. Furthermore the results of my survey show that the linear order of: *modal all auxiliary* was never the chosen word order. Given that in this position *all* acquires an onset and can PI the role of PI evidently needs further refinement. We need to determine what linear position *all* will occupy in a given string of possible elements that can PI with *all*.

An auditory analysis of recordings of (31b',c') clearly indicates that *should have* PIs. If *all* occurs right adjacent to the modal, it breaks up this prosodic unit, but when *all* occurs after *have*, then it can attach to the unit formed by *should have*. Survey and corpora results show that *modal+aux+all* is the preferred order for a string of modal auxiliary and FQ.[27] In cases without the modal and just a pronoun and an auxiliary, *all* is favored to appear where it can form a unit with the pronoun and auxiliary. In figure 6 the *pronoun+auxiliary+FQ* form a prosodic unit with *all* being pitch accented.

Figure 6



Having partially established the preferred word order given a string of auxiliaries/modals still left open is the question of why *been all* is not the preferred word order.

(32) The dogs have been all petted.

There is no reason to suppose that *all* cannot PI with *been* in (32). The phonological criteria are met; *all* can acquire an onset here and *been* is not pitch accented. Interpretively there is a difference. This position (when the subject is plural) leads to ambiguity in interpretation or to a completely different interpretation for many speakers (when the subject is singular).

[27] In some cases with a pronoun, modal and auxiliary the FQ is favored between the modal and auxiliary. I assume this has to do with the phonological weakness of pronouns.

(33) a. The dogs have been all petted.
= the dogs have been completely petted.
= each dog has been petted
b. The dog has been all petted.
= the dog has been completely petted.

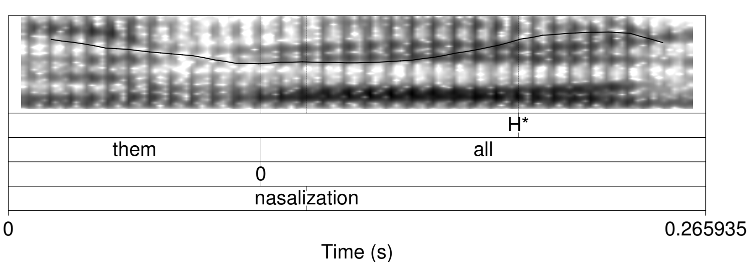
Note the singular DP in (33b), which could not possibly take *all*. This word order leads to a different interpretation. When *all* occurs following *been* before the main verb it gives a completive reading.

4.3.3 Utterance-final all

All cannot occur sentence finally unless it can prosodically incorporate. It has been shown that *all* prefers to PI with a weak element. This need is particularly strong sentence finally. In English in sentence final position there are two final tones, and intermediate phrase tone and a boundary tone (Beckman and Ayers 1994, Pierrehumbert 1980). These tones affect the meaning of the entire utterance as they are particularly important for the tune of the utterance. *All* seems to be unable to bear sentence final position where these tones are.[28]

In section 4.2.3 I discussed quantifiers which float from pronominal objects. In figure 7 the PI can clearly be seen. A careful analysis of the prosody shows that this construction is not in violation of the prosodic requirements; *them* and *all* PI, which process forms a prosodically stronger unit.

Figure 7



In this utterance *all* is highly nasalized, *them* is reduced to /ɛm/, only one constituent is pitch accented (*all)*, the perceived disjuncture is zero and there is no initial glottalization of *all*. Pronouns are weak and they PI with FQs and this strengthens the FQ; once the FQ has PI-ed it can occur sentence finally. Note that if the pronoun is stressed, which renders PI impossible, the sentence becomes infelicitous.

(34) a. #Mary hates THEM all.
b. Mary hates ALL of THEM

When there is a full DP (especially sentence finally where it is frequently pitch accented) PI will not be possible and the FQ cannot occur.

[28] The intermediate tone in English is linked to the last pitch accented syllable (the nuclear pitch accent) and spans until the end of the utterance, so the final element does not necessarily carry the tone. In spite of this *all* still seems unable to bear final position like other weak elements.

It has been shown that FQs position is heavily influenced by two main factors; focus structure and phonological constraints. Knowledge of the phonology at play here also helps clarify an additional factor plaguing theories on floating quantifiers; the lack of reliable judgments on the acceptability of sentences. Having fleshed out the role that phonology plays in these sentences we can see that the lack of reliability comes from whether or not the speaker/listener PIs the FQ. When the FQ is not PI-ed there will be a marked decrease in acceptability.

4.4 Incorporation of prosodic data into other frameworks

The phonological data discussed in this section could be cohesively incorporated to either of the two predominant FQ theories discussed in sections 3.1 and 3.2. For the stranding approach, this would entail that FQs can only be stranded in positions where PI is possible, whereas in cases of contrast FQs cannot strand. This would explain why (29a-c) are possible but not optimal. Syntactically, FQs can be stranded in any position the DP passes through but phonologically it is disfavored if they cannot PI, similar to McCloskey's proposal for WUE. In the cases of contrast one could investigate the possibility of some [+contrast] feature in English selected from the lexicon with the constituent, and the possibility of an optional XP encoding contrast. If the contrastive FQ does not check its [+contrast] feature, the sentence will be filtered out at LF.

To incorporate the phonological data into the adverb approach would mean allowing the FQ to attach as usual to any XP, but having the phonology filter out the cases where the FQ is not in a phonologically optimal location. Since FQs appearing in non-optimal positions results in degraded but generally possible sentences, I would propose an Optimality Theory style ranking of candidates. The only major obstacle to integrating these data into an adverb approach would be to account for the fact that contrastive FQs occur initially, since the adverb approach takes DP initial FQs to be of a different sort of element. This could perhaps be dealt with again through a strong [+contrast] feature. Alternatively, one could maintain that the two are different elements and the DP initial element more readily allows a contrastive interpretation.

5. Note

A word of caution is called for at this point. This is the start of a larger study that sets out to determine what elements like *all* are and how they get their position. Before any broad conclusions can be made or any generalizations put forth, *both* and *each* need to be analyzed from the same perspective as *all* was., since they differ from *all* phonologically. This work predicts that many of the differences in possible locations for the different FQs arise from differences in the phonology of these elements, and this claim requires investigation. Furthermore, analysis of q-float cross-linguistically needs to be carried out from a prosodic and f-structure perspective. Then and only then can we see the real picture of what these elements are.

6. Conclusion

This work sets out to fill in the gaps left by previous approaches to floating quantifiers. In doing so the role of focus structure and phonology are shown to be determining forces in q-float. This work shows that the role of prosody and f-structure cannot be sidelined. In fact phonology needs to be given a major role as it is quite evident that it is crucial to FQ placement. The broad ranges of possible FQ placements cross-linguistically indicate that each language needs to be evaluated prosodically in order to understand the FQ placement in it. The approach outlined here has the potential to not only offer an account of FQs cross linguistically but also to shed light on other phenomena such as modifier placement, adverb placement, topicalization, dislocation and extraposition that have evaded comprehensive syntactic treatments.

Lisa Rochman
Ben Gurion University
lisa@bgu.ac.il

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(More) readings of the German present perfect

Björn Rothstein

The paper argues for a single uniform meaning of the German present perfect in the spirit of an Extended Now theory (McCoard 1978). As only context fully disambiguates between the different readings of the present perfect, I propose an analysis in terms of Kamp & Reyle's (1993) discourse-based approach to tense. Temporal and rhetorical relations between tenses in a given text will be used to account for the different readings of the present perfect.

1. Introduction

In the literature, five major uses of the German present perfect have been identified (see Ehrich & Vater (1989) and others): the preterit reading[1], the universal, the existential, the resultative and the *hot news*. The last three are sometimes summarized as experiential readings. I call the experiential readings and the universal use perfect readings. Perfect reading is used in opposition to preterit reading.

The universal present perfect denotes a predicate that holds throughout the entire time interval introduced by the present perfect, stretching from a certain point in the past up to the present, see (1). The existential perfect asserts that the subject has a certain experience (see (2)). Nothing is said about a past up to the present reading. The *hot news* perfect reports an eventuality that just happened like in (3) and the perfect of result or resultative present perfect expresses the result of the underlying eventuality. It is only possible with telic predicates (see 4).

(1)	Ich	habe	Dich	schon	immer	geliebt.	(universal)
	I	have	you	PARTICLE	always	loved	
	'I have always loved you.'						

(2)	Ich	habe	*Forrest Gump*	dreimal	gesehen.	(existential)
	I	have	*Forrest Gump*	three-times	seen	
	'I have seen *Forrest Gump* three times.'					

[1] I shall speak of the preterit tense when I refer to a morphological preterit and of the preterit reading when I refer to the preterit use of the present perfect.

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(3) Ich habe gerade meine Prüfung bestanden. (hot news)
I have just my exam passed
'I have just passed my exam.'

(4) Ich habe meine Brille verloren. (resultative)
I have my glasses lost
'I have lost my glasses.'

Many analyses take the German present perfect to be ambiguous, having either a preterit (cf. 5) or a perfect meaning (cf. 6). In the preterit use, the present perfect is said to be always able to substitute for the preterit tense, see (7). This is not possible with the perfect use of the present perfect as in (8).

(5) Als Opa aus dem Krankenhaus zurückgekommen ist, feierten wir.
When grandpa from the hospital returned is celebrated we
'When grandpa returned from the hospital, we celebrated.' (preterit)

(6) Jetzt, wo Opa aus dem Krankenhaus zurückgekommen ist, (perfect)
Now where grandpa from the hospital returned is
feiern wir.
celebrate we
'Now that grandpa has returned from the hospital, we'll celebrate.'

(7) Als Opa aus dem Krankenhaus zurückkam, feierten wir. (preterit)
When grandpa from the hospital returned celebrated we
'When grandpa returned from the hospital, we celebrated.'

(8) *Jetzt, wo Opa aus dem Krankenhaus zurückkam, (perfect)
Now where grandpa from the hospital returned
feiern wir.
celebrate we

However, these accounts cannot explain why the present perfect cannot always replace the preterit tense. While (9a) allows for a simultaneous and an anterior reading of the embedded tense relative to the reference time of the matrix verb, (9b) only allows an anterior reading. In other words: (9a) has the readings that Fritz thinks at 8 o'clock that it is 8 o'clock or that he thinks so at a point in time later than 8 o'clock. (9b) has only the second reading. From an approach assigning two distinct meanings, a preterit and a perfect meaning, to the present perfect, we expect the present perfect always to be able to substitute for the preterit tense without any change of meaning. As this is not the case, the present perfect has not the same meaning the preterit tense has. Rather, the present perfect has a single uniform meaning covering both its perfect and preterit uses.

(9) a. Fritz dachte, dass es 8 Uhr war. (von Stechow 1999:98)[2]
Fritz thought that it 8 o'clock was
'Fritz thought that it was 8 o'clock.'

[2] The difference is already found in Latzel (1977:191).

b. Fritz dachte, dass es 8 Uhr gewesen ist.
Fritz thought that it 8 o'clock been is
'Fritz thought that it was 8 o'clock.'

The position defended here differs from the standard assumptions about the disambiguation of the present perfect readings (cf. Iatridou, Anagnostopoulou & Izvorski 2001; Musan 2002; Pancheva 2003). According to the standard view, there is either semantic or pragmatic disambiguation. But as the following example suggests, the disambiguation of the different present perfect readings is context dependent. In the context of (11), (10) has a resultative reading, as the looking for the glasses is interpreted as the result of having lost them. When followed by (12), (10) has a preterit reading as the glasses were found again.

(10) Ich habe meine Brille verloren …
I have my glasses lost

(11) Ich finde sie einfach nicht.
I find them simply not
'I have lost my glasses. I simply cannot find them.'

(12) … und heute Morgen erst wieder gefunden.
and today morning particle again found
'I lost my glasses. I have not found them before this morning.'

To account for this context dependence, I analyse the different present perfect readings in terms of a discourse-based approach to tense. Temporal and rhetorical relations between tenses in a coherent text will be used to account for the different readings of the present perfect.

The paper is organised as follows. In section 2, I discuss previous approaches to the perfect readings. Section 3 introduces the meaning of the present perfect and the approach to tense I assume. Section 4 shows the interplay of *Aktionsart*, adverbial modification and the perfect readings. In section 5, disambiguation by context is explained. Section 6 concludes.

2. Previous approaches to the perfect readings

There is an ongoing discussion whether the perfect readings should be distinguished semantically or pragmatically (for the former see Dowty 1979; Mittwoch 1988; Iatridou, Anagnostopoulou & Izvorski 2001; Pancheva 2003; for the latter McCoard 1978; Klein 1994). My contribution to the discussion is that the different readings have to be disambiguated by context.

Some arguments seem to favour a semantic distinction between the present perfect readings. The first one concerns topicalisation in English.[3] As various authors argue, a topicalised *for*-adverbial only allows for a universal reading while an inner sentential *for*-adverbial allows for both an existential and a universal reading (see Dowty 1979).

[3] This paper focuses only on German. For the cross-linguistic differences between the English and German present perfect, see Rothstein (in prep.).

(13) a. Véronique has been in Lyon for four weeks. (universal / $^{??}$existential)
b. For four weeks, Véronique has been in Lyon. (universal / existential)

However, this view has been challenged. Abusch & Rooth (1990) and Rathert (2004) argue that an existential reading is also possible with a topicalised *for*-adverbial. But Rathert (2004) mainly uses data from *google*. Therefore, she cannot claim that the data is from native speakers. Hence, more empirical research is needed in order to correctly analyse the readings of the present perfect with topicalised *for*-adverbials. Moreover, we cannot exclude that, if there are any meaning differences to be found between the English (13a) and (13b), it may be the case that these differences are due to other factors (such as topicalisation) than the meaning of the present perfect.

There is no reason to assume two distinct perfect meanings in German as topicalised and innersential *for*-adverbials allow for both the universal and the existential perfect.

(14) a. Véronique ist vier Wochen lang in Lyon gewesen. (universal / existential)
Véronique is four weeks long in Lyon been
'Véronique has been in Lyon for four weeks.'
b. Vier Wochen lang ist Véronique in Lyon gewesen. (universal / existential)
Four weeks long is Véronique in Lyon been
'Véronique has been in Lyon for four weeks.'

A second argument apparently favouring a semantic distinction between the perfect readings was, to my knowledge, introduced by Brugger (1997). In English (and in German), an existential present perfect behaves like a preterit tense when used as embedding tense in indirect speech. It allows for two readings: in (15), Mary can either be sick when John says that she is sick or she can already have been sick. The two readings are not available, if a universal present perfect embeds a preterit tense. The only reading the embedded preterit tense in (16) has, is that Mary was sick before John said that she was. This seems to favour a semantic distinction between the universal and the existential present perfect.

(15) John has said that Mary was sick.

(16) John has always claimed that Mary was sick.

Again, this turns out not to be an argument for a semantic distinction between the universal and existential perfect. If a universal present perfect embeds a preterit tense, it logically follows that the preterit tense must be interpreted with respect to the time of utterance, as the eventuality denoted by the universal present perfect still holds at the time of utterance. Thus, the preterit tense behaves as if it is embedded under a present tense (cf. 17). In both cases, a simultaneous reading relative to the time of the matrix verb is impossible.

(17) John claims that Mary was sick.

To sum up, there is no valid argument for a semantic distinction between the present perfect readings. Moreover, there is a strong argument against such an approach. The universal present perfect is only possible, when modified by certain adverbials such as *schon immer* 'always'.[4] (15), for instance, can never be a universal perfect as it lacks appropriate

[4] Compare Iatridou, Anagnostopoulou & Izvorski (2001:196fn) for English.

adverbials. (16), on the other hand, is a universal perfect as it is modified by *always*. One would expect from a semantic distinction between the different present perfect readings that the different uses should also be possible without special adverbial modification.

I therefore do not adopt a semantic approach. Instead, I claim that only a discourse based approach fully accounts for the perfect readings. Consider the following ambiguous example. It can have a universal reading and as such the speaker still loves his addressee at the moment of speech. But it can also have a second reading, an existential one, under which the speaker does not love the addressee any longer. Only context fully disambiguates. When preceded or followed by (19), (18) has a universal reading. In the context of (20), (18) is an existential present perfect.

(18) Ich habe Dich immer geliebt.
I have you always loved
'I have always loved you.'

(19) Du bist die Beste.
You are the best
'You are the best.'

(20) Aber nun geht es nicht länger mit uns.
But now goes it not longer with us
'But it can't go on between us.'

My approach differs from the approaches mentioned above in exploring this context dependence. But before looking closer to context, I give the meaning of the present perfect in the next section.

3. The perfect meaning

My approach to the German present perfect comes to this (cf. Rothstein 2005). I combine Reichenbach's (1947) approach to tense with an Extended Now-analysis (XN) of the perfect. Reichenbach distinguishes between three points in time. A sentence is uttered at the moment of speech (S). The eventuality denoted by the main verb obtains at the event time (E). To account for the pluperfect (and according to Reichenbach's view for all other tenses as well) a further point in time is needed, the reference time (R). (R) is the point in time relative to which (E) is located. Take for instance the following example.

(21) Als er nach Hause kam, hatte sie bereits gespült.
When he to home came had she already done-the-dishes
'When he came home, she had already done the dishes.'

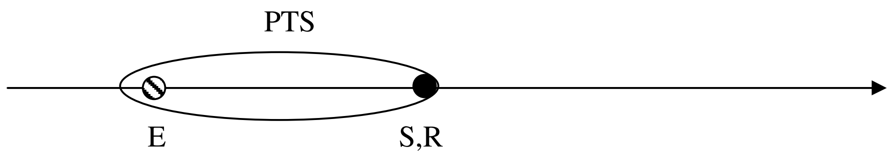
The time of doing the dishes is interpreted as being prior to the time of coming home. Hence, the event time of the pluperfect is evaluated relative to the event time of the preterit tense or in other words, the event time of coming home serves as a reference time (R) for the pluperfect sentence.

The meaning of the present perfect is analysed in terms of an Extended Now-analysis (XN). 'Traditionally', the XN is a time interval ending at the reference time set by the tense of the perfect auxiliary. Hence, the right boundary (RB) of XN is simultaneous to (R) of the tense of the auxiliary. The left boundary (LB) is underspecified. Somewhere within the XN is the event time (E) located (see McCoard 1978; Iatridou, Anagnostopoulou & Izvorski 2001). This will be represented by E $\subseteq$ PTS.

The German present perfect can be used as a future perfect. The most plausible reading (22) has is that the conference will not have ended before the moment of speech (S), but after (S) and prior to the time denoted by *morgen* ‘tomorrow’. The reference time set by the tense of the auxiliary can therefore be after (S), but not before (S). I represent this by R $\neg <$ S. To account for the future use of the German present perfect, the right boundary of RB cannot be at (S), but must end at (R). This will be represented by RB = R. As XN does not automatically end at the moment of speech, the interval the perfect introduces will be called in accordance with Iatridou, Anagnostopoulou & Izvorski (2001) *perfect time span* (=PTS). I represent the meaning of the German present perfect within Discourse Representation Theory (DRT) for reasons that will become clear in the following.

(22) Morgen hat die Konferenz bereits aufgehört.
Tomorrow has the conference already ended
‘The conference will have ended by tomorrow.’

(23) a.



b. Present perfect:[5]

S R E PTS
R $\neg <$ S PTS (LB, RB) E $\subseteq$ PTS RB = R

In the Extended Now approach, universal perfects are treated as perfects whose event time holds throughout the entire PTS including (R). But when it comes to universal perfects like (24), the traditional XN approach makes wrong predictions. As the context suggests, the ‘living in Germany’ can clearly not continue at the moment of speech.[6]

(24) Er hat schon immer in Deutschland gewohnt,
He has particle always in Germany lived
aber vor kurzem ist er nach England gezogen.
but before recently is he to England moved
‘He always lived in Germany, but he has moved to England recently.’

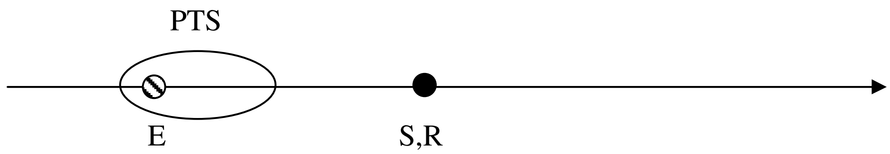
I therefore follow Pancheva & von Stechow (2004) who allow PTS to be separated from the reference time of the auxiliary. This has the advantage that universal perfects can be treated as

[5] (S) is an indexical discourse referent (cf. Kamp, van Genabith & Reyle 2004:75 for further discussion).

[6] As Rathert (2004:100) suggests, adverbs such as *schon immer* ‘particle always’ do not automatically include the present when modifying a perfect. Hence, the German universal present perfect is a perfect whose eventuality holds throughout the entire time interval introduced by the present perfect, but this eventuality does not necessarily hold at the present.

perfects whose event time holds throughout the entire PTS, but not necessarily at the moment of speech or more generally at the reference time set by the tense of the auxiliary. If I understand Pancheva & von Stechow (2004) correctly, they do not allow the left boundary and the right boundary of PTS to be simultaneous. I represent this by LB ≠ RB. As will become clear in the following, this is an important difference to my approach.

(25) a.



b. Present perfect:[7]

S R E PTS
R ¬ < S
PTS (LB, RB)
LB ≠ RB
RB <| R

My approach differs from Pancheva & von Stechow (2004) in the following point: the length of PTS varies due to the different readings of the German present perfect. In the default, the right boundary (RB) of PTS is simultaneous with the final subinterval of the event time (E). (RB) can be stretched to points in time later than (E) whenever this is necessary, for instance, in the context of certain adverbials or certain tenses. Moreover, I assume that the left boundary of the perfect time span is identical with the initial subinterval of the event time denoted by the present perfect. LB can also be stretched to points in time earlier than (E) when required by certain adverbials or context. Hence, the positions of LB and RB are not fixed, they are dynamic.

LB and RB can be identical, as with *Aktionsarten* lacking the subinterval property (such as *ankommen* ‘to arrive’) (E) is reduced to a single point in time. As in the default, LB is simultaneous to the initial and RB simultaneous to the final subinterval of (E), it follows that LB and RB can be identical. I therefore assume that the length of PTS and (E) are identical in the default.

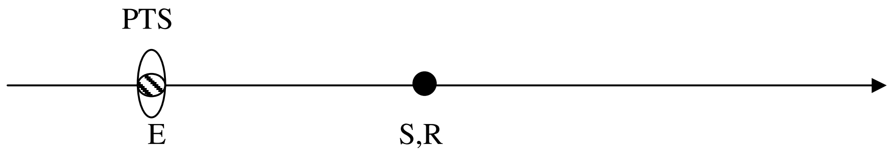
Evidence for this approach comes from examples with coordinated universal perfects. In (26), the studying and the working do not end simultaneously, although this seems to be required by the adverbial *gleichzeitig* ‘at the same time’. Therefore, the right boundary of PTS must be dynamic (cf. Rothstein 2005 and in prep. for further arguments). Presumably, the studying and the working did not begin at the same time as well. Thus, LB must also be dynamic.

(26) Er hat immer gleichzeitig studiert und gejobbt.
He has always at-the-same-time studied and worked
Aber dann hat er erst mit dem Studieren und dann mit
but than has he first with the study and then with
dem Jobben aufgehört.
the work stopped

[7] ‘RB <| R’ means that RB may be before R or touch it.

The meaning of the German present perfect I assume is therefore as follows.

(27) a.



b. Present perfect

S R E PTS
$R \neg< S$
PTS (LB, RB)
$RB <\mid R$
$E \subseteq PTS$

Let us now turn back to the readings of the present perfect. To distinguish the present perfect readings, Musan (2002) proposes pragmatic principles, but she almost exclusively analyses isolated sentences. Her principles can easily be overridden by context. To account for the present perfect readings, a discourse-based approach to tense will therefore be pursued.

Following Kamp & Reyle (1993), I therefore introduce a further point in time. The reference time point (Rtp) is used to account for the temporal ordering of events in texts: the preceding discourse serves as an Rtp with which the following tense form establishes an antecedent-anaphora relationship. The need for the Rtp becomes especially urgent with sequences in the pluperfect (see 28). The sequence starts with a preterit tense. The events (e_2) to (e_6) are temporally ordered. Fred first gets up, then takes a shower and so on. The correct temporal order of the events (e_2) to (e_6) cannot be given by referring to Reichenbach's reference time (R), since for the five pluperfects in (28) (R) is always the same: it is (E_1), the event time of Fred's arrival. Rtp resolves that problem: Rtp_2 precedes Rtp_3, which in turn precedes Rtp_4 and so on.

(28) Fred arrived at 10 (e_1). He had got up at 5 (e_2), he had taken a long shower (e_3), had got dressed (e_4) and had eaten a leisurely breakfast (e_5). He had left the house at 6:30 (e_6). Kamp & Reyle (1993:594)

To avoid terminological confusion with Reichenbach's reference time, I call Kamp & Reyle's (Rtp) (D)*iscourse time point*. The definitions are as follows.

(29) Reference time (R):
(R) is a point in time relative to which (E) is located.

(30) Discourse time point (D):
(D) is a point in time set by an antecedent discourse in relation with which the following event time establishes an anaphoric relation.

In the following, (D) will be used to make predictions for the present perfect readings.

The framework within which discourse relations between sentences are analysed here is DRT as elaborated by Kamp, van Genabith & Reyle (2004). The following example is an illustration:

(31) Peter betrat die Bar. Er bestellte einen Whisky.
'Peter entered the bar. He ordered a whisky.'

(32)

S p R_1 E_1 e_1
Peter (p)
$R_1 < S$
$E_1 \subseteq R_1$
$e_1 \subseteq E_1$
e_1: 'betrat die Bar' (p)

$$\left\langle \left\{ \boxed{\begin{array}{c} (D) \\ \rho\,((D),E_2) \end{array}} \right\},\ \boxed{\begin{array}{l} S\ x\ w\ R_2\ E_2\ e_2 \\ \text{'er' (x)} \\ \text{einen Whisky (w)} \\ x = p \\ R_2 < S \\ E_2 \subseteq R_2 \\ e_2 \subseteq E_2 \\ e_2\text{: 'bestellte' (x,w)} \end{array}} \right\rangle$$

In (31) and in its — somewhat simplified — representation (32), we find the discourse referents for the speech time (S), the event times (E_1) at which Peter enters the bar and (E_2) at which he orders a whisky. I follow Reichenbach (1947) by assigning the following meaning to the preterit tense: E,R < S. Hence, the first preterit tense sentence has the meaning $E_1,R_1 < S$ and the second $E_2,R_2 < S$. We then find the eventualities (e_1) and (e_2). Eventuality is used as a cover term for states, processes and events. (e_1) is the event of Peter entering the bar, (e_2) of him ordering a whisky. This is represented by e_1: 'betrat die Bar' (p) and e_2: 'bestellte' (x,w). (e_1) obtains at the event time (E_1) which is represented as $e_1 \subseteq E_1$. P stands for Peter, w for whisky and x represents the pronoun 'he'. The meaning of the two sentences is given in the two 'big' boxes. The temporal relation between these two consists of a presupposition of the second sentence. The presuppositional part is in the little box. This presupposition must be resolved in order to fix the temporal relation between the eventualities (e_1) and (e_2). The resolution of the presupposition consists of finding specifications for *(D)* and ρ. ρ is the temporal relation between the event time (E_2) and (D) that has to be linked by an anaphoric presupposition resolution to the event time of an element from the context. For the first sentence, there is no discourse context. I ignore here default rules for out-of-the-blue sentences. The relation between (E_1) and (E_2) is the relation of succession, so (E_1) must precede (E_2). (D) must therefore be resolved to (E_1) and ρ is a 'prior-to' relation. As (D) is resolved to (E_1) and p is specified as '<', we can now incorporate the presupposition into the representation of the second sentence. The final representation for (31) is as follows.

(33)

S p x w R_1 E_1 R_2 E_2 e_1 e_2
Peter (p)
$R_1 < S$
$E_1 \subseteq R_1$
$e_1 \subseteq E_1$
e_1: 'betrat die Bar' (p)
$E_1 < E_2$
er (x)
einen Whisky (w)
x = p
$R_2 < S$
$E_2 \subseteq R_2$
$e_2 \subseteq E_2$
e_2: 'bestellte' (x,w)

Kamp, van Genabith & Reyle (2004) define (D) as always referring to an event time, but it can also refer to other points in time. It is plausible to assume that in some cases, it is rather the result of an eventuality that serves as a (D) for a following tense, rather than the eventuality itself. In (34), (D) clearly does not refer to the result of having lost the glasses as the glasses were found again, while in (35) the glasses are still lost. It is therefore more plausible to assume that, in (35), (D) refers to the result of having lost them.

(34) Ich habe meine Brille verloren (preterit)
I have my glasses lost
und heute Morgen erst wieder gefunden.
and today morning particle again found
'I lost my glasses. I have not found them before this morning.'

(35) Ich habe meine Brille verloren. (resultative)
I have my glasses lost.
Ich finde sie einfach nicht.
I find them simply not
'I have lost my glasses. I simply cannot find them.'

(D) provides a useful tool to account for the present perfect readings. The present perfect has a preterit reading when the final subinterval of the event time of the present perfect serves as a (D) for another contextually given event time. Take, for instance, (36) as an example: the following sentence contains a preterit tense for which (E) of the present perfect serves as an evaluation time. As the event time (E) of the preterit tense is located before (S), (D) must also be located before (S), because the asking for Sandrine's hand precedes the wedding. (D) is therefore resolved to the event time (or more precisely to the final subinterval of the event time) at which Albin asked for Sandrine's hand.

(36) Albin hat um Sandrines Hand angehalten.
Albin has for Sandrine's hand asked.
Die Hochzeit fand im Juli statt.
The wedding took in July place.
'Albin asked for Sandrine's hand. The wedding took place in July.'

Let us now turn to the perfect readings of the present perfect. In (37), the present perfect sentence is followed by a sentence containing a present tense.

(37) Albin hat um Sandrines Hand angehalten.
Albin has for Sandrine's hand asked.
Die Hochzeit findet im Juli statt.
The wedding takes in July place.
'Albin asked for Sandrine's hand. The wedding will take place in July.'

Again, (D) of the second sentence must be resolved by context. This time, (E) of the following present tense is not before (S). The wedding is the result of having asked for Sandrine's hand. As the wedding has not already taken place, (D) is resolved to (S). This leads to the generalisation that, when (D) is not simultaneous to the final subinterval of (E), the present perfect has a perfect reading. Moreover, by assuming that the point in time to which (D) is resolved to be always the right boundary (RB) of the perfect time span PTS, we actually can restrict the setting of RB: RB is (D).

The contrast between (9a) and (9b) is resolved if the present perfect is analysed as a compositional tense consisting of a present tense and a past participle (cf. Rothstein 2004). (9a) and (9b) are repeated as follows.

(38) a. Fritz dachte, dass es 8 Uhr war. (von Stechow 1999:98)[8]
Fritz thought that it 8 o'clock was
'Fritz thought that it was 8 o'clock.'
b. Fritz dachte, dass es 8 Uhr gewesen ist.
Fritz thought that it 8 o'clock been is
'Fritz thought that it was 8 o'clock.'

The present perfect denotes a time prior to the present tense. A bound present tense only allows for a simultaneous reading relative to the reference time of the binding verb (see 39). A bound present perfect must therefore express a time prior to the time of the matrix verb (see 9b). It can only replace the preterit tense in a 'prior to matrix event time' relation. I argue that (D) is not sensitive to binding as a transformation from direct to indirect speech does not change the temporal order of the reported events. The order of embedded event times in (40) corresponds to the one in the non-embedded sequence of pluperfects in (28).

(39) Fritz dachte, dass es 8 Uhr ist.
Fritz thought that it 8 o'clock is
'Fritz thought that it was 8 o'clock.'

(40) Peter said that Fred arrived at 10 (e_1). He further reported that Fred had got up at 5 (e_2), had taken a long shower (e_3), had got dressed (e_4), had eaten a leisurely breakfast (e_5) and had left the house at 6:30 (e_6).

(D), however, cannot be resolved to points in time outside the time interval the perfect introduces. More precisely, (D) cannot be resolved to a point in time earlier than (E) and later than (R). Consider the following: the event time at which the wedding obtains cannot take a (D) that is prior to the moment in time when Albin asks for Sandrine's hand.

(41) Albin hat um Sandrines Hand angehalten.
Albin has for Sandrine's hand asked.
Die Hochzeit fand in Lyon statt.
The wedding took in Lyon place
'Albin asked for Sandrine's hand. The wedding took place in Lyon.'

Second, (D) cannot be later than (R). In (42), for instance, our party is simultaneous to (R) of the present perfect. It is not possible that (D) is later than (R).

(42) Jetzt, wo Albin zurückgekommen ist, feiern wir.
Now where Albin arrived is celebrate we
'Now that Albin has arrived, we'll celebrate.'

The emerging generalisation is as follows.

[8] The difference is already found in Latzel (1977:191).

(43) Restriction for (D) in the present perfect
(D) can either be resolved to (E) or to a point in time not later than (R).

In the following, the discussion of the perfect readings of the present perfect is kept rather shortly, since the various interactions between *Aktionsart*, adverbial modification and the perfect have been analysed in detail (cf. among many others Ehrich 1992; Iatridou, Anagnostopoulou & Izvorski 2001 and Musan 2002). But the full interplay between these three and context has, as far as I am aware, never been pursued seriously.

4. Aktionsart, adverbial modification and present perfect readings

Aktionsart has a strong influence on the readings of the present perfect (cf. especially Iatridou, Anagnostopoulou & Izvorski 2001). The universal present perfect is only possible from verbs having the subinterval property: from *states*, *activities* and maybe *accomplishments*. Consider the following example. The main verb of the matrix sentence is a state and, as such, it denotes duration.

(44) (universal)

Ich	habe	schon	immer	gewusst,	
I	have	particle	always	known	
dass	der	Mond	aus	Käse	ist.
that	the	moon	of	cheese	is

‘I have always known that the moon is made of cheese.’

In the following example, we have an activity verb. If we commit ourselves to the assumption that one can run for years without interruption, a universal perfect becomes possible. You maybe remember Tom Hanks as Forrest Gump who is running for more than three years through America. In the film, he does not know what he is running for. But, as he makes clear, universal perfects from activities are possible.

(45) (universal)

Forrest Gump	ist	schon	immer	gerannt.
Forrest Gump	is	particle	always	run

‘Forrest Gump has always run.’

It is not impossible to think of accomplishments in universal perfects. Consider the following.

(46) (universal)

Er	hat	von	1980	bis	jetzt	sein	Traumhaus	gebaut.
He	has	from	1980	until	now	his	dream-house	built

‘He was building his dream house from 1980 until now.’

If we think of finishing the house at the moment of speech, (46) is certainly a universal perfect.

The resultative present perfect is only possible from telic verbs (from achievements and accomplishments), because only these introduce what Parsons (1990) calls *target states.*[9]

[9] Parsons (1990:235) defines target states as follows: ‘It is important not to identify the Resultant-state of an event with its ‘target’ state. If I throw a ball onto the roof, the target state of this event is the ball’s being on the roof, a state that may or may not last for a long time. What I am calling the Resultant-state is different; it is the state of my having thrown the ball onto the roof, and it is a state that cannot cease holding at some later time.’

(47) Der Zug ist angekommen. (resultative)
The train is arrived
'The train has arrived.'

(48) Ich habe meine Brille verloren (resultative)
I have my glasses lost
'I have lost my glasses.'

In other *Aktionsarten*, the target state meaning of the verb is not lexically encoded. For instance, in the following example, there is no lexical target state implied. The fact that I am breathless is not derived from the meaning of 'to run', but (at least what concerns myself) from what we know about running.

(49) Ich bin auf den Bus gerannt. Deshalb bin ich jetzt außer Atem.
I am to the bus run. That's-why am I now without breath
'I have run to catch the bus. That's why I'm breathless now.'

(49) is therefore not a resultative perfect. Target states are represented as TARG (E), the time at which the target state obtains.

There are no such restrictions for the preterit, the existential and the *hot news* present perfect. They are possible with all types of *Aktionsart*. In the following, I treat the *hot news* reading as a special variant of the existential reading as the only difference between the two is that the former requires the eventuality of the main verb to occur in a recent past.

The relation between *Aktionsart* and the present perfect readings is summarized in table 1 where '+' indicates that the reading is available and '-' that it is not.

	Aktionsart			
	state	activity	achiev	Accomp
Universal	+	+	-	+
existential	+	+	+	+
resultative	-	-	+	+
preterit	+	+	+	+

Table 1: *Aktionsart* and present perfect readings

Adverbial modification further restricts the present perfect readings. The universal present perfect is only possible under certain adverbial modification (see Iatridou, Anagnostopoulou & Izvorski 2001:196f for English). In English, the adverbs requiring the universal reading are *at least since, ever since, always, for five days now*. Schipporeit (1971) states that adverbials such as *schon immer* 'particle + always', *schon oft* 'particle + often', *schon drei Jahre* 'for three years' and *noch nie* 'particle never' yield a universal reading of the present perfect. In (50), for instance, the speaker still loves his or her addressee at the moment of speech. The universal reading is not obligatory with *immer* 'always'. (51) is ambiguous between a universal and an existential reading.

(50) Ich habe Dich schon immer geliebt. (universal)
I have you particle always loved
'I have always loved you.'

(51) Ich habe Dich immer geliebt. (universal/existential)
I have you always loved
'I have always loved you.'

The interplay of *Aktionsart*, adverbial modification and the perfect readings is summarized in the following table. Again, '+' means that the reading is available. The '+' in obligatory adverbial modification means that the universal perfect is only available when modified by adverbials such as *schon immer* 'always' etc. The other readings do not require adverbial modification.

	Adverbial modification				
	VP: *Aktionsart*				Obligatory
	State	Act.	Ach.	Acc.	
Universal	+	+	-	+	+
Existential	+	+	+	+	-
Resultative	-	-	+	+	-
Preterit	+	+	+	+	-

Table 2: *Aktionsart*, adverbial modification and present perfect readings

A more detailed discussion of the interplay between the perfect readings and adverbial modification in German is found for example in Schipporeit (1971) and Musan (2002), so I do not develop this point any further.

5. Disambiguation by context

But this is not the full story. One can, for instance, not tell which reading the contextless (10) –which I repeat as (52)- has. As (53) and (54) show, (52) is ambiguous between a resultative and a preterit reading. In (53), the result of having lost the glasses is the reason why I am looking for them. In (54), the glasses were lost at some point in the past, but luckily found again. Thus, only context fully disambiguates between the readings of the present perfect.

(52) Ich habe meine Brille verloren.
I have my glasses lost
'I have lost my glasses.'

(53) Ich habe meine Brille verloren. (resultative)
I have my glasses lost.
Ich finde sie einfach nicht.
I find them simply not
'I have lost my glasses. I simply cannot find them.'

(54) Ich habe meine Brille verloren (preterit)
I have my glasses lost
und heute morgen erst wieder gefunden.
and today morning particle again found
'I lost my glasses. I have not found them before this morning.'

Context also decides whether the present perfect has an existential or a universal reading, if adverbial modification does not unambiguously trigger one of the two readings. An example is (55) that can be used as in (56) or (57). *Immer* 'always' does not obligatorily require a universal perfect. (56) is an existential and (57) a universal present perfect. Again, a discourse-based approach becomes necessary.

(55) Ich habe Dich immer geliebt.
I have you always loved
'I have always loved you.'

(56) Ich habe Dich immer geliebt, (existential)
I have you always loved,
aber nun geht es nicht länger mit uns.
but now goes it not longer with us
'I have always loved you, but it can't go on between us.'

(57) Ich habe Dich immer geliebt. Du bist die Beste. (universal)
I have you always loved. You are the best
'I have always loved you. You are the best.'

Before making generalisations, I give some examples of how the interplay between *Aktionsart*, adverbial modification, and discourse works in detail. (58) and (59) are the representations for (57). The presupposition resolution works like in (32) and (33), and it won't be explained here. From *Aktionsart*, only the existential and universal present perfects are allowed. The adverbial modification *immer* 'always' allows for both the existential and the universal perfect. As the present tense of the second sentence suggests that the speaker still loves his addressee, (D) is resolved to (E_1), denoted by the present perfect which must hold at (S). Only in the universal perfect does (E_1) hold at (S) and by substitution at (R). (57) is therefore a universal present perfect.

(58)

$$\begin{array}{|l|}\hline S\ x\ y\ R_1\ E_1\ PTS\ e_1 \\ \text{ich}\ (x) \\ \text{dich}\ (y) \\ R_1 = S \\ PTS\ (LB,RB) \\ E_1 \subseteq PTS \\ RB <\mid R_1 \\ e_1 \subseteq E_1 \\ \text{immer}\ (E_1) \\ e_1\text{: 'lieben' } (x,y) \\ \hline \end{array} \quad \left\langle \left\{ \begin{array}{|c|}\hline (D) \\ \rho\ ((D),E_2) \\ \hline \end{array} \right\} \quad \begin{array}{|l|}\hline S\ z\ b\ R_2\ E_2\ e_2 \\ \text{du}\ (z) \\ \text{die Beste}\ (b) \\ z = y \\ E_2 = R_2 = S \\ e_2 \subseteq E_2 \\ e_2\text{: 'sein' } (z,b) \\ \hline \end{array} \right\rangle$$

(59)

S x y z b R_1 E_1 PtS R_2 E_2 e_1 e_2
ich (x)
dich (y)
$R_1 = S$
PTS (LB,RB)
$E_1 = PTS$
$RB = R_1$
$e_1 \subseteq E_1$
immer (E_1)
e_1: ‘lieben’ (x,y)
$E_2 \subseteq E_1$
du (z)
die Beste (b)
z = y
$E_2 = R_2 = S$
$e_2 \subseteq E_2$
e_2: ‘sein’ (z,b)

(59) and (60) represent (56). It follows from *Aktionsart* and adverbial modification that the preterit reading, the existential and the universal present perfect are possible interpretations of the present perfect sentence in (56). *Lieben* ‘to love’ is a state and as such it cannot give rise to a resultative reading. *Immer* ‘always’ allows for both the existential and the universal readings (cf. Schipporeit 1971). As there is a present tense in the following sentence, which stands in a rhetorical relation with the preceding present perfect, this present perfect has a perfect reading (cf. Rothstein 2005). The present tense sentence suggests that the speaker and his or her addressee do not love each other any longer at the moment of speech. The universal perfect is therefore not possible. Only the existential reading is plausible. As there is no universal reading, (D) cannot be resolved to (E_1) of the present perfect, but to a point in time later than (E_1). (56), therefore, has an existential reading.

(60)

$S\ x\ y\ R_1\ E_1\ PTS\ e_1$
ich (x)
dich (y)
$R_1 = S$
PTS (LB, RB)
$E_1 \subseteq PTS$
$PTS <\!| R_1$
$e_1 \subseteq E_1$
immer (E_1)
e_1: 'lieben' (x,y)

$\left\langle \left\{ \boxed{\begin{array}{c} (D) \\ \rho((D),E_2) \end{array}} \right\} \right.$

$S\ w\ z\ R_2\ E_2\ e_2$
uns (w,z)
w = x
z = y
$E_2 = R_2 = S$
$e_2 \subseteq E_2$
nun (E_2)
e_2: 'nicht länger mit uns' (w,z)

$\rangle$

(61)

$S\ x\ y\ w\ z\ R_1\ E_1\ PTS\ R_2\ E_2\ e_1\ e_2$
ich (x)
dich (y)
$R_1 = S$
PTS (LB, RB)
$E_1 \subseteq PTS$
$RB = R_1$
$e_1 \subseteq E_1$
immer (E_1)
e_1: 'lieben' (x,y)
$E_1 < E_2$
uns (w,z)
w = x
z = y
$E_2 = R_2 = S$
$e_2 \subseteq E_2$
nun (E_2)
e_2: 'nicht länger mit uns' (w,z)

Let us now turn to an example for the resultative perfect reading. The DRSs for (53) are given in (62) and (63). First, the *Aktionsart* is an achievement. Thus, *Aktionsart* does not allow for a universal reading. Second, there is no adverbial modification. The existential, resultative or preterit readings are therefore possible, but not the universal. Third, the following eventuality from the present tense sentence establishes a rhetorical relation with the present perfect. *I simply cannot find my glasses* is interpreted as the result of *having lost them*. If he or she had not lost his glasses, he or she would not be looking for them. (D) is therefore resolved to TARG (E),[10] the target state of having lost the glasses.

[10] This does of course not mean that it is resolved to the target state of the event time, but to the time at which the target state obtains.

(62)

$S\ p\ b\ R_1\ E_1\ PTS\ TARG\ (E_1)\ e_1$
ich (p)
meine Brille (b)
$R_1 = S$
PTS (LB, RB)
$E_1 \subseteq PTS$
$RB <\!| R_1$
$e_1 \subseteq E_1$
$R_1 \subseteq TARG\ (E_1)$
e_1: 'verlieren' (b,p)

$\left\{ \boxed{\begin{array}{c} (D) \\ \rho\,((D),E_2) \end{array}} \right\}$

$S\ x\ y\ R_2\ E_2\ e_2$
ich (x)
sie (y)
x = p
y = b
$E_2 = R_2 = S$
$e_2 \subseteq E_2$
e_2: 'nicht mehr finden' (x,y)

(63)

$S\ p\ b\ x\ y\ R_1\ E_1\ PTS\ TARG\ (E_1)\ R_2\ E_2\ e_1\ e_2$
ich (p)
meine Brille (b)
$R_1 = S$
PTS (LB, RB)
$E_1 \subseteq PTS$
$RB = R_1$
$e_1 \subseteq E_1$
$R_1 \subseteq TARG\ (E_1)$
e_1: 'verlieren' (b,p)
$E_2 \subseteq TARG\ (E_1)$
ich (x)
sie (y)
x = p
y = b
$E_2 = R_2 = S$
$e_2 \subseteq E_2$
e_2: 'nicht mehr finden' (x,y)

It is now possible to give generalisations for the perfect readings. As we have seen so far, (D) of a following tense can be resolved to distinct points in time instantiated by a present perfect. As I claim, its resolution gives rise to the different present perfect readings.

As we have seen in section 3, the preterit reading arises if the final subinterval of the event time (E_1) of a present perfect serves as a (D) for another contextually given event time (E_2) and if (E_1) does not hold at (R). This is the case if (E_2) is before the moment of speech (see 36, which I repeat as 64). We represent this as RB (E) = (D) where RB (E) means that RB is the final subinterval of (E).

(64) Albin hat um Sandrines Hand angehalten.
Albin has for Sandrine's hand asked.
Die Hochzeit fand im Juli statt.
The wedding took in July place.
'Albin asked for Sandrine's hand. The wedding took place in July.'

If a point in time later than (E_1) of the present perfect serves as a (D) for another contextually given event time (E_2), this present perfect has an experiential reading. The experiential reading arises, if (E_2) is not before (S), cf. (37), which I repeat below.

(65) Albin hat um Sandrines Hand angehalten.
Albin has for Sandrine's hand asked.
Die Hochzeit findet im Juli statt.
The wedding takes in July place.
'Albin asked for Sandrine's hand. The wedding will take place in July.'

If (E_1) of the present perfect serves as a (D) for another (E_2) not being before (S), and if (E_1) holds at (R) and by substitution at (S), the present perfect in question has a universal reading. This has been illustrated with (57), which I repeat for reading convenience.

(66) Ich habe Dich immer geliebt. Du bist die Beste. (universal)
I have you always loved. You are the best
'I have always loved you. You are the best.'

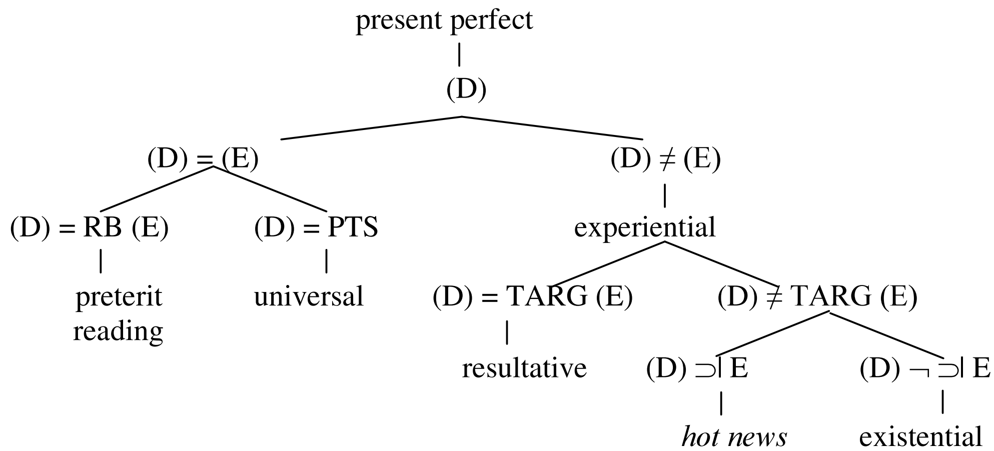
Hence, the universal and the preterit reading have in common that subintervals of their (E_1) serve as (D) for a contextually given event time (E_2). Only in the universal present perfect, a subinterval of (E_1) can hold at (S). In examples like (57)/(66), it is intuitive that not a subinterval of (E_1) serves as a (D) for (E_2), but rather the entire (E_1). As we defined the universal perfect as a present perfect whose event time holds throughout the entire PTS up or close to (S), we shall speak of the universal perfect as a perfect whose PTS serves as (D) for (E_2). This will be represented by (D) = PTS.

The *hot news*, the existential and the resultative present perfect were summarized as experiential readings. They have in common that no subinterval of their event time (E_1) serves as a (D) for an event time (E_2) from context. In the existential present perfect, a point in time later than (E_1) serves as a (D) for the contextually given (E_2). The *hot-news* perfect is analysed as a subclass of the existential present perfect, requiring its event time (E_1) to be located shortly before the moment of speech. As for all experiential readings, a point in time later than (E_1) serves as (D) for (E_2). (E_1) and (D) must be located quite close to each other. This will be represented by '$\supset|$' which stands for a vague temporal relation between two points in time being close to each other.

The existential and the resultative present perfect differ in that only in the latter the point in time which serves as a (D) for the contextually given (E_2) must be a point in time at which the target state denoted by the resultative present perfect holds. This is represented as TARG (E). In case of the existential perfect, (D) is not resolved to TARG (E).

The possible temporal positions of (D) are summarized as follows.

(67) the positions of (D) and the perfect readings



The possible interactions of *Aktionsart*, adverbial modification and discourse can now be summarized as follows (the *hot news* perfect is here considered as a special case of the existential perfect).

	(D): Discourse							
	Adverbial modification							
	VP: *Aktionsart*				Obligatory			
	State	Act.	Ach.	Acc.		(D) = RB (E)	(D) = TARG(E)	(D) = PTS
universal	+	+	-	+	+	-	-	+
existential	+	+	+	+	-	-	-	-
resultative	-	-	+	+	-	-	+	-
preterit	+	+	+	+	-	+	-	-

Table 3: Interplay of *Aktionsart*, adverbial modification and discourse

Note that not all combinations of (E), TARG (E) and PTS are possible. Theoretically, eight combinations should be available, but table 3 only contains four. For obvious reasons, it is impossible to refer simultaneously to the time at which an eventuality obtains and to its target state, because there is no target state if the eventuality has not culminated. Therefore, the target state is after the event time. For the same reason, it is not possible to refer simultaneously to the target state and PTS, because (D) = PTS was defined such that (E) holds throughout the entire PTS. Referring to the target state and PTS at the same time therefore means to refer to the target state and the event time and as we have seen, this is not possible. It is also not possible to refer only to the final subinterval of (E) and to the entire PTS at the same time, because this would lead to a contradiction. As there are only four possible combinations and four readings, the identification of the present perfect readings by context is unambiguous.

Let me briefly point out the reason why I insist on (D) and why I do not adopt approaches to temporal anaphors such as the one proposed by Lascarides & Asher (1993). (D) is a rather 'vacuous' notion, as it does not make predictions about when (D_1) precedes or follows a contextually given (D_2). (D) is a reflex of temporal and rhetorical relations tenses in a coherent text enter. But as (D) is a useful tool to make predictions for the present perfect readings, it actually becomes less 'vacuous'. As far as I can see, (D) is fully compatible with the assumptions about temporal progression made by Lascarides & Asher (1993). Moreover, it allows making very simple generalisations for the perfect readings.

6. Conclusion

In this paper, I claimed that only context fully disambiguates the present perfect readings. Contrary to standard assumptions made in the literature, a discourse-based approach to the present perfect readings has therefore been defended. It has been argued that the interplay of *Aktionsart*, adverbial modification and the setting of (D) by discourse fully disambiguates the different readings. The results of this interplay were summarized in table 3 and won't be repeated here.

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On an alternative to long A'-movement in German and Dutch

Martin Salzmann

This paper provides an analysis of an alternative strategy to A'-movement in both German and Dutch where the extracted constituent is preceded by a preposition and a coreferential pronoun appears in the extraction site. The construction has properties of both binding and movement: whereas reconstruction effects suggest movement out of the embedded clause, there is strong evidence that the operator constituent is linked to an A-position in the matrix clause; this paradox is resolved by assuming a Control-like approach that involves movement from the embedded clause into a theta-position in the matrix clause with subsequent short A'-movement. The coreferential pronoun is interpreted as a resumptive heading a Big-DP which hosts the antecedent in its specifier.

1. Introduction: restricted long A'-movement

It is a well-known fact about Standard German that long A'-movement is not available to all speakers. For many, the long extractions in (1), instantiating long wh-movement, long relativization, and long topicalization are ungrammatical.

(1) a. * **Wen$_i$** glaubst du, dass Petra **t$_i$** liebt?
who:ACC think you that Petra loves
'Who do you think that Petra loves?'

b. * ein Maler, **den$_i$** er glaubt, dass Petra **t$_i$** mag
a painter who:ACC he thinks that Petra likes
'A painter who he thinks Petra likes'

c. * **Den Maler$_i$** glaubt er, dass Petra **t$_i$** mag.
the:ACC painter thinks he that Petra likes
'The painter he thinks that Petra likes.'

It is frequently assumed that the distribution is best captured in terms of a North-South division, the speakers in the North rejecting long A'-movement, while those from the South make liberal use of it. Whether this is actually true has become difficult to verify due to the increased mobility in recent decades. What is certainly true is the fact that the dialects spoken in Upper German (Swabian, Bavarian, varieties of Swiss German) are more liberal. Even conservative descriptive grammars (like e.g. Weber 1965) list examples of long A'-movement (referred to as *Satzverschränkung* 'sentence interleaving'). It would therefore be little surprising if this dialectal background were to influence speakers when they (attempt to)

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speak the Standard language.[1] Whether this is actually true is something I will not try to verify in this paper. I will also not attempt to give an account of the lack of long A'-movement for many speakers. My concerns will turn out to be orthogonal to these facts.

Needless to say, the lack of long A'-movement constitutes a functional gap one would expect to be filled by alternative strategies. This is indeed the case. For wh-movement, there is the scope-marking construction, see e.g. McDaniel (1986) and Lutz et al. (2000).

(2) **Was** glaubt Peter, **wen**$_i$ du gestern **t**$_i$ getroffen hast?
what thinks Peter who:ACC you yesterday met have
'Who does Peter think that you met yesterday?'

The term alternative strategy might be somewhat misleading in this context because Scope Marking is also available to speakers that allow long wh-movement. Whether it is actually available in all varieties of German (including dialects) is unclear. Swiss speakers, for instance, can use this construction, but whether it is actually part of their dialect grammar is unclear; the use of the scope marking construction might simply be due to Standard German influence.

Another alternative strategy is represented by extraction from V2-complement clauses.

(3) a. **Wen**$_i$, glaubst du, liebt Petra **t**$_i$?
whom think.2s you loves Petra
'Who do you think Petra loves?'

b. **Den Maler**$_i$, glaube ich, mag Petra **t**$_i$.
the:ACC painter think I likes Petra
'The painter I think Petra likes.'

This strategy is possible for wh-movement and topicalization, but not for relativization. It is arguably available to all speakers of any German variety and probably the preferred construction. Therefore, it is strictly speaking only an alternative for speakers of restrictive varieties.[2]

There is a third "alternative", and this is the topic of this paper: In this construction, the preposition *von* 'of' precedes the (putatively) extracted phrase and a coreferential pronoun occurs in the dependent clause in the position of the (alleged) extraction site.

(4) a. **Von welchem Maler**$_i$ glaubst du, dass Petra **ihn**$_i$ mag?
of which:DAT painter think you that Petra him likes
'Which painter do you think that Petra likes?'

b. ein Maler, **von dem**$_i$ er glaubt, dass Petra **ihn**$_i$ mag
a painter of who:DAT he thinks that Petra him likes
'a painter who he thinks that Petra likes'

[1] Apart from speakers with a Swabian or Bavarian background, dialectal influence becomes more and more marginal in Germany, in most cases being restricted to pronunciation and particular lexical items. Many speakers do no longer learn a dialect as their native language, but a variety that is very close to Standard German. Things are different in Switzerland, where the first language acquired is a dialect. The Swiss version of Standard German is referred to as *Schweizerhochdeutsch* 'Swiss Standard German', and arguably shows more traces of the dialectal background of the speakers.

[2] However, both the scope-marking construction as well as extractions from V2 complement clauses do not cover the same range of verbs; both of them are incompatible with volitional and factive verbs, see McDaniel (1986) for scope marking and Müller & Sternefeld (1995) for V2-extraction.

c. **Von dem Maler$_i$** glaubt er, dass Petra **ihn$_i$** mag.
of the:DAT painter thinks he that Petra him likes
'The painter he thinks that Petra likes.'

This construction is also available to all speakers of German and its varieties and therefore not an alternative in the strict sense. However, there is one domain where it *is* an alternative, namely in the domain of relativization in the standard language: While sometimes claimed to be acceptable (Grewendorf 1988), I know of no speaker of Standard German that actually accepts (1b). Consequently, all that speakers of Standard German have at their disposal is (4b).[3] It is compatible with a wide range of matrix verbs.

The situation in Dutch is similar though not identical. First of all, the other alternative strategies do not exist. There is no Scope Marking in Standard Dutch and no embedded V2. The acceptability of long A'-movement is generally taken for granted, but at least in the domain of relativization and topicalization, there is a certain preference for the same alternative strategy as in German: The extracted constituent is preceded by a preposition, and a personal pronoun appears in the (alleged) extraction site.

(5) a. **Van welk boek$_i$** denk je dat Piet **het$_i$** leuk vindt?
of which book think you that Peter it cool finds
'Which book do you think that Peter likes?'

b. het boek **waar$_i$-van** ik denk dat Piet **het$_i$** leuk vindt
the book which-of I think that Peter it cool finds
'the book I think Peter likes'

c. **Van dit boek$_i$** denk ik dat Piet **het$_i$** leuk vindt.
of this book think I that Peter it cool finds
'This book I think Peter likes.'

The following sections are devoted to an analysis of this alternative construction in both languages.

2. Long-distance movement or binding?

At first, at least two options suggest themselves: on the one hand, one could take the functional similarity to long A'-movement seriously and claim that there actually is long A'-movement, albeit in disguise. The preposition would be inserted as a case-marker, and the coreferential pronoun would be a resumptive.

Alternatively, one could argue that the matrix PP is actually a complement of the matrix verb, and the pronoun in the dependent clause is bound. Both analyses have their advantages and disadvantages, and I will discuss them in turn.

[3] Dialects differ from the Standard language. Zurich German (cf. Salzmann in prep), for instance, allows long-distance relativization. Interestingly, however, long relativization requires resumptive pronouns in the extraction site while long wh-movement or topicalization does not.

2.1 Long-distance movement
2.1.1 Reconstruction

The major argument in favor of a long A'-movement analysis comes from reconstruction effects for both Principle A[4] and Variable Binding.

(6) a. das Bild von **sich**$_i$, von dem ich glaube, dass **Peter**$_i$ *es* sehr mag
the picture of self of which I think that Peter it very likes
'the picture of himself$_i$ that I think Peter$_i$ likes very much'

b. die Periode **seines**$_i$ **Lebens**, von der ich glaube,
the period his:GEN Life:GEN of which:DAT I believe
dass **keiner**$_i$ gerne *dar*an denkt, ist die Pubertät.
that no_one likes_to about_it thinks is the puberty
'The period of his$_i$ life I think no one$_i$ likes to remember is puberty.'

It seems thus as if the content of the antecedent is available at the position of the pronoun (italicized). This would be unexpected if the link between antecedent and pronoun were a mere binding relation.

2.1.2 Problems: unorthodox movement/chain

However, if a movement approach is taken, a number of problems arise.

i) The head (PP) and the tail (DP) of the chain would differ categorially.
ii) The role of the preposition is unclear; even if it is considered a case-marker similar to English *of*, it is unclear why the DP should need case because it is case-marked in the dependent clause already. It rather seems as if it receives two cases in violation of the usual wellformedness conditions on Chains.
iii) The preposition actually projects a PP so that movement would take place into a non c-commanding position.
iv) The use of the resumptive seems unmotivated: if there is long extraction, no resumptive should be necessary to rescue the derivation (as an intrusive pronoun, see Chao & Sells 1983).

2.2 Binding
2.2.1 There is a base construction

The first argument in favor of a binding approach comes from the fact that there seems to be a base construction for the alternative strategy where the PP is in situ.

(7) Ich hoffe **von diesem Buch**$_i$, dass **es**$_i$ ein Erfolg wird.
I hope of this:DAT book that it a success becomes
'I hope that this book will be a success.'

Even though this construction is a little odd for many speakers, it is certainly grammatical. And it clearly suggests that the PP is base-generated in the domain of the matrix verb, because

[4] It is important to note at this point that anaphors in German and Dutch cannot be used logophorically. Reconstruction effects for Principle A therefore do constitute important evidence for movement, cf. Kiss (2003). In the corresponding Dutch examples, the anaphor *zichzelf* is used.

movement to this position in the middle field from the subordinate clause is unlikely, given the fact that there is no scrambling across finite clauses in German (cf. Müller & Sternefeld 1993). So the most straightforward reason for why the DP/PP is there could simply be that it is base generated in that position and A'-moved in (4) and (5).

2.2.2 Island insensitivity

Another argument in favor of a binding approach is the apparent lack of boundedness: The antecedent can relate to pronouns within islands; the following examples illustrate this both for Complex NPs (with a relative clause) and Left Branch Extraction violations (islands appear in angled brackets).

(8) a. der Mann, **von dem**$_i$ ich denke, dass Marie <jedes Buch liest, das **er**$_i$ schreibt>
the man of who I think that Mary every book reads that he writes
'the man who I think Mary reads every book <that he writes>'
b. ein Mann, **von dem**$_i$ ich glaube, dass du <**seine**$_i$ Bücher> magst
a man of who:DAT I think that you his books like:2s
'a man whose books I think you like'

2.2.3 Semantics: theta marking, specificity and referentiality

Perhaps the strongest argument for a base-generation approach comes from semantics: The matrix verb clearly imposes semantic restrictions on the object of the preposition: It is necessarily referential/specific. For this reason, idiomatic subjects are ruled out. (9b) allows only a literal interpretation.

(9) a. Ich glaube, dass den Peter der Teufel reitet.
I think that the Peter the devil rides
'I think Peter is nuts.' (the devil rides X = X is nuts)
b.*Ich glaube **vom Teufel**$_i$, dass **er**$_i$ den Peter reitet.
I think of_the devil that he the Peter rides

The following examples show that only referential (but not amount) interpretations of quantifiers are possible, as in (10a). If a noun does not permit a referential reading, the sentence is out, as in (10b).

(10) a. **Von wievielen Patienten**$_i$ denkst du,
of how_many patients think you
dass der Doktor **sie**$_i$ morgen sehen will?
that the doctor them tomorrow see wants
'How many patients do you believe that the doctor wants to examine tomorrow?
(only referential reading, not amount reading)
b.***die vielen Kilos**$_i$, von denen ich glaube,
the many kilos of which I think
dass Peter **sie**$_i$ auf die Waage bringt
that Peter them on the scale brings
'the many kilos I think Peter weighs'

For the same reason, idiom reconstruction is blocked; the matrix verb simply cannot take a non-referential complement.

(11) * den Streich, **von dem**$_i$ ich sagte, dass wir **ihn**$_i$
the trick of which I said that we it
unserem Lehrer gespielt hatten, fand ich ziemlich brutal.
our:DAT teacher played had found I quite brutal
'I found the trick that I said we had played on our teacher quite brutal.'

One might object that these restrictions simply follow from the referential nature of the pronoun, which forces the antecedent to be specific/referential. The data discussed so far would therefore not constitute any evidence that a theta role is assigned in the matrix clause. The following contrast in meaning, however, suggests that a theta role is involved.

(12) a. Ich weiss von **jedem Holländer**$_i$, dass **er**$_i$ ein Fahrrad hat.
I know of every dutchman that he a bike has
'I know about every dutchman that he has a bike.'
b. Ich weiss, dass **jeder Holländer** ein Fahrrad hat.
I know that every dutchman a bike has
'I know that every dutchman has a bike.'

The two constructions differ with respect to evidentiality: the first example implies direct evidence, giving the (nonsensical) interpretation that the speaker has checked every single Dutchman for a bike. The second example has no such implication. The knowledge may simply be the result from statistics. I see no way to derive this difference from the definiteness of the pronoun and conclude that there is theta-role assignment to the matrix object.

2.2.4 Unboundedness vs. selection

We saw in (8) above that the construction is in principle unbounded and can violate any kind of island. If this is correct, it comes as a surprise that the following example is ungrammatical, if one assumes that long-distance movement from the embedded clause is all there is.

(13) *der Mann, **von dem**$_i$ ich mich freue,
the man of who:DAT I me be_happy
wenn ich **ihn**$_i$ sehe
if I him see
'the man who I'm happy when I see'

Interestingly, the example improves to full grammaticality once a matrix verb is chosen that is compatible with an *von*-PP. This clearly suggests that the PP is selected by the matrix clause.

(14) der Mann, **von dem**$_i$ ich glaube, dass ich mich freuen würde,
the man of who:DAT I think that I me be_happy would
wenn ich **ihn**$_i$ sähe
if I him saw
'the man who I think that I would be happy if I saw'

2.2.5 The "resumptive" behaves more like a pronoun

In German and Dutch, something peculiar happens if a pronoun referring to an inanimate antecedent is governed by a preposition. Instead of preposition + the regular pronoun, the whole complex is spelled out as a so-called pronominal adverb consisting of an element *da/daar* 'there' + adposition, the locative-like element replacing the regular pronoun.

(15) Ich habe Probleme **da**-mit.
I have problems there-with
'I have problems with it.'

Interestingly, the same holds for the alternative strategy if the trace of an inanimate antecedent is governed by P: The whole complex is spelled out as a pronominal adverb, just like in normal clauses.

(16) Das Zeugnis, **von dem$_i$** ich glaube, dass du sehr zufrieden **da$_i$**mit bist
the report of who I believe that you very satisfied there_with are
'the report who I think you are very satisfied with'

The symmetry goes even further: the pronoun can strand the postposition in both cases.

(17) a. Das Zeugnis, **von dem$_i$** ich glaube, dass du **da$_i$** sehr zufrieden[mit **t$_i$**] bist.
the report of who I believe that you there very satisfied with are
'the report who I think you are very satisfied with'

b. weil du **da$_i$** sehr zufrieden [mit **t$_i$**] bist.
because you there very satisfied with are
'because you are very satisfied with it'

It seems thus that the alleged resumptive behaves more like a pronoun than a spelled out trace.

2.3 Intermediate Summary

The evidence for either approach seems equivocal at this point. The semantics, the unboundedness, as well as the postposition facts seem to suggest a binding approach, whereas reconstruction favors a movement approach. We are thus faced with a paradoxical situation: reconstruction with a lot of evidence for binding, but not necessarily for movement. The key to a possible solution will actually come from another paradox, to be discussed in the next section.

3. A–A'-asymmetries: a further paradox

So far, I have mainly focused on the properties of the alternative strategy with the PP fronted. Interestingly, there are systematic asymmetries depending on the position of the PP. When it is fronted, the construction shows properties of A'-movement, when it is in situ, the properties are more reminiscent of an control-like A-relation between the antecedent and the pronoun.

3.1 Subject orientation

When the PP is in-situ, the coreferential pronoun must be the subject. Object or possessor orientation leads to ungrammaticality.[5]

(18) a. Ich will/glaube/hoffe **von Peter**$_i$, dass **er**$_i$ Maria heiratet.
I want/believe/hope of Peter that he Mary marries
b.*Ich will /glaube/hoffe **von Peter**$_i$, dass Maria **ihn**$_i$ heiratet.
I want/believe/hope of Peter that Mary him marries
c.*Ich will/glaube/hoffe **von Peter**$_i$, dass **seine**$_i$ Mutter gesund wird
I want/believe/hope of Peter that his mother healthy becomes
'I want/believe/hope of Peter that his mother will recover.'

Once the PP is in an A'-position, object (and possessor) orientation suddenly becomes possible.

(19) a. der Mann, **von dem**$_i$ ich will/glaube/hoffe, dass **er**$_i$ Maria heiratet
the man of who:DAT I want/believe/hope that he Mary marries
b. der Mann, **von dem**$_i$ ich will/glaube/hoffe, dass Maria **ihn**$_i$ heiratet
the man of who:DAT I want/believe/hope that Mary him marries
c. der Mann, **von dem**$_i$ ich will/glaube/hoffe dass **seine**$_i$ Mutter gesund ist
the man of who:DAT I want/believe/hope that his mother healthy is

3.2 Unboundedness/locality

With the PP in-situ, the pronoun must occur in the immediately subordinate clause.[6]

(20) * Ich glaube **von Peter**$_i$, dass du dich freust, dass **er**$_i$ Nicht-Alkoholiker ist.
I believe of Peter that you you be-happy that he non-alcoholic is

No such restriction is observed if the PP is preposed.

(21) der Mann,**von dem**$_i$ ich glaube, dass du dich freust, dass **er**$_i$ Nichtalkoholiker ist
the man of who I believe that du self are:happythat he non-alcoholic is

3.3 Intermediate summary

These observations lead to quite paradoxical conclusions: The in-situ construction is in some sense Control-like in that there is obligatory coreference between a matrix argument and the subject of the dependent clause. It is an A-like relation in that it is bounded and cannot skip intervening DPs. Once the PP is fronted, the construction has all the hallmarks of A'-

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[5] Marcel den Dikken (p.c.) has pointed out to me that object orientation becomes better with counterfactual modals like *zou moeten*/*müsste* 'would have to'. Such modification is not necessary in the A'-cases so that the resulting contrast is still clear. In what follows, I will ignore the effect of modals.

[6] Marcel den Dikken (p.c.) has drawn my attention to the fact that for this argument to go through it is crucial that the embedded verb is incompatible with a *von*-PP. Otherwise, one could argue that what goes wrong in (20) is not the binding but the scrambling from the embedded clause into the matrix clause, which is known to be impossible in German, cf. Sternefeld & Müller (1993).

movement: it is unbounded, has free orientation, and can skip intervening DPs. If the A'-like construction is based on the A-like one, these asymmetries are profoundly mysterious and unexpected. However, there is indeed strong evidence that there is just one basis for the construction: when the PP is fronted, the adposition can be stranded (in Dutch), showing that the P originates in the domain of the matrix verb (22b).

(22) a.

Het	boek	**waarvan$_i$**	ik **t$_i$**	denk,	dat	Piet	**het$_i$**	leuk	vindt
the	book	where_of	I	think	that	Peter	it	cool	finds

'the book that I think Peter likes'

b.

Het	boek	**waar$_i$**	ik	**t$_i$** **van**	denk,	dat	Piet	**het$_i$**	leuk	vindt
the	book	where	I	of	think	that	Peter	it	cool	finds

'the book that I think Peter likes'

Therefore, one cannot argue that a sentence like (22a) is derived by directly moving out of the embedded clause into the matrix Spec, CP (with the preposition inserted there for some reason); if there is movement it has to touch down in the domain of the matrix verb where the preposition originates. In the next section, I will try to propose a solution that resolves the A-A'-paradox by combining aspects of both the movement and the binding approach.

4. Combining the two: pseudo-control as movement

4.1 Pseudo-control vs. control

In my view, the probably most interesting property of this construction is the fact that there is obligatory coreference between a matrix argument and an argument in its finite complement clause. This is remarkable considering the fact that both Dutch and German otherwise restrict this type of obligatory coreference to subjects of nonfinite clauses, then referred to as control. That coreference is really obligatory is shown by the following example: a pure aboutness relation (such as part-whole between *PC* and *Computern*) is not sufficient, there has to be a coreferential pronoun in the complement clause.

(23) *

Von	**Computern**	glaube	ich,	dass	jeder	einen	PC	kaufen	sollte
of	computers	believe	I	that	everyone	a	PC	buy	should

'I believe of computers that everyone should buy a PC.'

Relating the construction to control seems therefore justified, even though pseudo-control (especially with the PP ex-situ) differs in important respects from regular control.

i) finiteness: coreference is with a DP in a finite complement clause
ii) subject orientation: the controlled DP is not necessarily the subject
iii) locality: the controlled DP is not necessarily found in the immediately subordinate clause
iv) grammatical relation: the controller is always a matrix object, never a matrix subject
v) the types of verbs found in this constructions form a completely different class, including epistemic, but also volitional verbs.

4.2 Pseudo-control as movement

There has been a lot of debate about the status of PRO within the Minimalist framework. The arguably strongest position was advanced by Hornstein (2000), who proposed that control is actually derived by movement: He assumes that the matrix verb has a theta feature that attracts the subject of the non-finite complement clause. Movement into theta positions is therefore legitimate, and the Theta Criterion in its traditional form is given up. This sort of approach has been rejected by many (Landau 2002; Culicover & Jackendoff 2001) on both conceptual and empirical grounds. As we will see below, much of that criticism does not affect the pseudo-control construction discussed here because its properties are significantly different. I will therefore ignore these objections and propose a movement account to pseudo-control as well. I will further assume that there is only one basis for the constructions; the differences that depend on the position of the PP follow from independent principles.

More concretely, I assume that the matrix verb has a theta feature that needs to be checked. This feature simply probes into the complement clause and attracts the closest DP. In case an operator feature is involved –as in the more A'-like cases- I make the uncontroversial assumption that matrix C has an operator feature (wh/rel/top). The following sections discuss the derivations of both the A-like as well as the A'-like cases.

4.2.1 A-like: no operator feature: PP in-situ

If no operator feature is involved, the derivation is straightforward: the matrix verb has a theta feature and probes into the complement clause. The embedded subject is the closest DP and is consequently attracted:

(24) $[_{VP}$ $\mathbf{DP_i}$ $V_{theta/case}$+P $[_{CP}$ C $[_{IP}$ $\mathbf{DP_i}$ $[_{VP}$ V]]]]

Ignoring the role of the preposition and possible double case-marking for the moment (but see below for discussion of these issues), the prediction is very clear: if no operator feature is involved, the embedded subject will always be the closest DP and will be attracted into the matrix clause. This straightforwardly captures the minimality condition and the subject orientation.

What about adjuncts higher than the subject? To the extent that they are found above IP in embedded clauses in German, they will not be attracted because they need no theta roles and cannot check theta roles (cf. Hornstein 2000:79).

4.2.2 A'-like: operator feature: PP fronted

Things are quite different if a DP has an operator feature. Following standard assumptions, it will undergo successive-cyclic A'-movement. Once it reaches the intermediate SpecCP, it counts as closest for the purposes of the matrix verb and will consequently be attracted (for questions about improper movement see below). This explains why it can skip possible intervening targets. So the DP moves to the matrix verb to check the theta feature, and eventually to SpecCP to check the operator feature:

(25) $[_{CP}$ $\mathbf{DP_{op}}$ C_{op} $[_{VP}$ $\mathbf{DP_{op}}$ $V_{theta/case}$+P $[_{CP}$ $\mathbf{DP_{op}}$ C … $\mathbf{DP_{op}}$ V]]]

4.3 Comparison: movement vs. binding

While the derivations sketched in the previous sections raise many questions, the proposed approach has a compelling advantage: it allows for a very natural statement of the coreference relations, whereas a binding approach would have to resort to a very unnatural statement.

Binding:

i) If antecedent in-situ: coreference with subject of directly embedded clause
ii) If antecedent A'-moved: coreference with any DP in the subordinate clauses

Movement:

i) Coreference with the structurally closest c-commanded DP

While the generalization under a binding approach seems arbitrary, the generalization under a movement approach is very straightforward. I take this to be strong evidence in favor of the approach advocated here. As mentioned before, this approach raises a number of intricate issues that will be addressed in the next section.

5. The technicalities

5.1 Movement to a non c-commanding position

So far I have ignored the preposition *von/van* 'of' in the matrix clause. Clearly, if it projects to a PP, movement out of the embedded clause would imply movement to a non c-commanding position. This is ruled out on most approaches to movement, except for those that accept Sideward Movement as in Nunes (2001). Given concerns about the power of such a type of movement, I will try to accommodate the proposed movement step within more conventional assumptions.

A first relevant observation is the fact that, as far as binding is concerned, there is c-command out of the PP: The following examples illustrate this for Principle C, variable binding and NPI-licensing.

(26) a. * Ich glaube von **ihm**$_i$ dass **Peter**$_i$ intelligent ist.
I believe of him that Peter intelligent is

b. Na 5 jaar in Nederland weet ik van **elke**$_i$ **Nederlander**
after 5 years in N. know I of every Dutchman
dat **hij**$_i$ een fiets heeft.
that he a bike has
'After 5 years in the Netherlands, I know of every Dutchman that he has a bike.'

c. Ik denk van **geen Nederlander**$_i$
I think of no Dutchman
dat **hij**$_i$ ook maar een euro zou verspillen
that he not even a euro would squander
'I believe of no Dutchman that he would squander even a single euro.'

In an attempt to resolve constituency conflicts, Pesetsky (1995) proposed that individual sentences have more than one phrase structure. For the purposes of binding, he assumes a Cascade structure in which PP-internal DPs actually c-command out of it.

(27) give [$_{PP}$ candy [$_{P'}$ to [$_{PP}$ none of the children [$_{P'}$ in any library]]]]

While this gives the desired result for the binding facts, it cannot be used to account for the movement step to a non c-commanding position because Pesetsky assumes a Layered constituency structure for movement where the P forms a constituent together with its complement.

Another possibility would be merging the preposition outside the vP as in recent work by Kayne (1998). However, one is then faced with the problem of how to get both linear order and constituency of P + DP right. If the DP moves to Spec, PP, it precedes P unless P undergoes further movement to some head. But then, P + DP do not form a constituent. The whole vP (the complement of P) would have to undergo movement to the specifier of the head where P has moved. The PP would then be stranded at the end of the clause, forming a constituent, but being in the wrong surface position. Clearly, the PP would have to undergo remnant movement to the left of vP to reach the correct surface position.

Most of these movement steps would be completely unmotivated except for restoring word order. I take such an approach to be utterly undesirable and non-explanatory. Instead, I propose to take the c-command relationship in (26) seriously. Even then, there is still a straightforward solution to the problem if one analyzes the preposition as a pure case-marker, as a realization of inherent case. There is some independent support for this from both languages, things being more transparent in German: the preposition *von* 'of' is used as a case marker inside DPs to replace the genitive. Genitive case is subject to special morphological licensing conditions in German (Gallmann 1998): Genitive on a noun is only licensed if it is morphologically realized on D (determiners, articles etc.) or A of the same DP. With bare plurals, however, this is not possible. As a last resort, the preposition *von* 'of' is inserted, assigns dative case to the DP and satisfies the Case filter or whatever regulates the distribution of DPs.

(28) a. * die Sorgen Mütter
the worries mothers
'the worries of mothers'

b. die Sorgen **von** Mütter-n
the worries of mothers-DAT
'the worries of mothers'

Even though there are good reasons to assume that *von/van* is just a case-marker, it is still not obvious how this is supposed to be handled given a Minimalist Framework. If one takes the Inclusiveness Condition (Chomsky 1995) seriously, simply inserting *von* in the derivation would be problematic unless one can make a case to relate it to *do*-support, which Chomsky (1995) claimed to be a language specific option allowed by the Computation. Instead, I prefer to treat *von* as part of the numeration. Following Bayer et al. (2001), I analyze prepositions as part of the extended domain of N, heading a KP. The DP is therefore base generated together with an extra KP shell and eventually checks the (inherent) case feature of the matrix verb. Clearly, a KP is incompatible with possible other (structural) cases the DP/KP has to check in the subordinate clause. This will be dealt with in the section on double case marking below.

Note incidentally that something similar seems to be happening in an exceptional raising construction in Irish, discussed in McCloskey (1984) and Stowell (1989).

(29) Is féidir **le** **Ciarán** [teach a cheannach]
cop.prs able with C. a_house to buy
'Ciaran can buy a house.'

Both authors agree that there is raising of *Ciarán* out of the embedded clause and that it is assigned inherent case (*le* is like *von* in our examples) by the matrix verb. If there is raising to object as claimed by McCloskey (1984), the construction would be very similar to pseudo-control. Even though this construction is highly marked, it is obviously made available by UG.

Finally, as pointed out to me by Marcel den Dikken (p.c.), such a movement might also be necessary for verbs that allow pseudo-passive in English. When used in their active form, one might expect covert object shift for case checking.

5.2 A-movement out of finite clauses (Tensed S Condition)

Another problematic aspect of the proposed derivation is A-movement out of a finite clause (hyperraising) in the control-like cases as sketched in (24) (it does not apply to the A'-cases with movement to SpecCP). All versions of Generative Grammar have more or less excluded such a derivation. In earlier models, it was the Tensed S Condition, an explicit constraint against moving out of it; in GB it was the binding theory that ruled out such movement because the subject trace could not be antecedent governed across a finite CP. Within the Minimalist Program it is no longer all that clear how these effects should be captured. A typical assumption is that elements whose uninterpretable (Case) features have been checked are not accessible for further operations, viz. the Activity Condition (Chomsky 1995 etc.). Applied to pseudo-control, one would have to stipulate that for some reason, DPs are not deactivated in this case. This would be difficult to implement because the embedded T does not stand in a direct relation to the matrix verb. While it is possible for a verb to subcategorize for a particular type of clause, it is usually not assumed that it also directly determines the type of T of the complement clause. Furthermore, Nevins (2004) convincingly shows that elements that have all their A-related features (case, phi-features) checked are still accessible for further A-movement (esp. EPP). A very clear example are quirky subjects which check their case within the vP and then move further on to the subject position to check the EPP. A compelling example are adversity impersonals in Russian, which show that even DPs that have received structural case are still accessible to further operations (Nevins 2004:8, his ex. 25).

(30)	Soldat	ranilo	puljami
	soldiers:ACC	wounded:PST.NONAGR	bullets:instr
	'The soldiers were wounded by the bullets.		

According to Nevins (citing Baylin 2003), the accusative phrase is in an A-position: it can bind the Spec-T-oriented anaphor *svoj* and it does not induce Weak Crossover violations. Moreover, we are dealing with a structural argument because it undergoes the genitive of negation, which inherent accusative does not. Since A-checking does not necessarily lead to deactivation, the Activity Condition is generally inadequate to capture the usual ban on A-movement out of finite clauses.

Alternative proposals have emerged in recent discussions about the copy raising construction: given the right complementizer, raising out of finite clauses is fine in English, German, Dutch and many other languages.[7]

[7] In case there is movement at all and not just binding between the subject and the pronoun. This is a contested issue, cf. Runner & Potsdam (2001) vs. Fuji (2004).

(31)	**Peter**	sieht	aus,	als	ob	**er**	müde	ist.
	Peter	looks	out	as	if	he	tired	is

‘Peter looks like he’s tired.’

Furthermore, in several languages, raising to object out of a finite clause is possible without an overt pronominal copy in the dependent clause, cf. Moore (1998) for a discussion of Turkish. There have been two useful accounts of the transparency of such complements.

i) The phase account: the complement clause is not a strong phase: Runner & Potsdam (2001), Nevins (2004)

ii) The minimality account: the C head of the complement clause does not have phi-features so that the MLC does not block raising: Fujii (2004)

On the phase account, everything inside the embedded CP remains accessible because the C head does not induce a strong phase: it would be the C-analogue of a defective (non-finite) T. This can be straightforwardly applied to pseudo-control: whereas a normal *that* does induce a strong phase, a *that*-clause selected in a pseudo-control configuration does not so that the subject can be extracted as proposed in (24). This would have to be stated in the lexical entry of the matrix verbs.

On the minimality account, *that* normally has phi-features, and by being closer to the matrix verb it blocks attraction of the subject. In pseudo-control and copy raising, the complementizer has no phi-features. As a consequence, attraction of the subordinate subject is possible.

So far it seems as though both approaches are equally successful. However, there is a potential further complication: as discussed below, I assume that movement from SpecCP to a matrix A-position is possible (in violation of the ban against improper movement) in order to derive the A’-like cases of pseudo-control. But if this is possible, one could think of a derivation where the subject of a finite *that*-clause moves first to SpecCP of the embedded clause, thereby reaching the escape hatch of the CP phase. Such a movement step might simply be triggered by the needs of a higher probe (T, v) to get its feature checked. On a phase account, this seems inevitable. On the minimality account, this problem does not arise because the C equipped with phi features blocks movement across it. It seems therefore that only a minimality approach can successfully restrict the possible types of raising.[8]

Still, given that the complementizer is the same in both cases, this solution is somewhat stipulative. However, there is one independent fact that might lend some credibility to it: In German, verbs that allow a V2 complement lose this property as soon as they are used in pseudo-control.

(32)	Ich	glaube,	**Peter**	ist intelligent.
	I	think	Peter	is intelligent

(33)	* Ich	glaube	**von**	**Peter$_i$**,	**er$_i$**	ist intelligent.
	I	think	of	Peter	he	is intelligent

This clearly suggests that despite the superficial similarity, the heads of the complements are different. Whether this can be used to derive the difference in transparency is unclear because

[8] A phase account supplemented with the minimality account would do as well, of course, but would be redundant.

normally it is the possibility of taking a V2 complement that correlates with transparency (bridge-verb property) and not the other way around. I will leave this issue unresolved here.

5.3 Improper movement

The movement step from SpecCP to a theta position within the matrix vP in the A'-like derivation violates the Ban on Improper Movement (BIM). Given a Hornsteinian framework, the BIM plays no role, its effects are derived differently. One possibility was already suggested in the previous section: raising out of a finite clause via the embedded SpecCP is in principle possible, but ruled out by minimality.[9] However, this does not have to mean that the BIM needs to be given up completely. What is special about the derivation at hand is that it involves intermediate landing sites whose status has generally become quite neutral within Minimalism, especially the role of SpecvP in strongly derivational frameworks (e.g. Epstein et al. 1998, Chomsky 1998 etc.). It is both the locus of object case checking and acts as a landing site for successive cyclic A'-movement. In other cases, improper movement still seems to be a useful concept. Müller (1995) for instance has argued that different types of A'-movement may not be mixed. For instance, scrambling (if analyzed as A'-movement) cannot be followed by wh-movement in a language like German. This accounts for the absence of scrambling across finite clauses (in German). These effects can still be derived if the BIM only penalizes movement between positions where strong/EPP features are checked. This certainly holds for the scrambling case. Once an A'-feature is checked, further movement to an A'-position is ruled out.[10] Assuming this is correct, we have an immediate explanation for the grammaticality of the following example.

(34)	Ich	weiss	von	**Peter$_i$**,	*was*	**er$_i$**	zum	Frühstück	mag.
	I	know	of	Peter	what	he	for	breakfast	likes
	'I know what Peter likes for breakfast.'								

Here, *was* 'what' has moved to the SpecCP of the embedded clause. According to the generalization in section 0, it should become the controller of the construction because it is the closest element to the matrix verb. However, this is not the case in (34). One way of accounting for this would be to rely on the distinction between final and intermediate landing site. Since the wh-item checks an A'-feature in that position (the embedded Spec, CP), further movement is prohibited. The closest mobile element now being the embedded subject, *Peter* is attracted and moves to the matrix vP. One may ask why there is no (defective) intervention as in.

(35) *How do you wonder who solved the problem?

Who blocks the attraction of *how* even though *how* has its feature checked and is no longer accessible for movement. So in other words, the reason why there is no intervention in (34) cannot simply be due to the fact that *was* has reached its final landing site for A'-feature

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[9] Claiming alternatively that the matrix verb simply selects a CP whose specifier is not an A'-position only works for movement out of the immediately embedded clause, but not for examples like (21).

[10] Clearly, something needs to be said about derivations involving a prolific left periphery. If movement to a focus projection proceeds via FinP, FinP would have to count as a neutral position. Similarly, wh-topics (if they exist) would require a special account.

checking. Rather, because the final landing site is an A'-position, it is only incompatible with further A'-movement, but can be ignored/skipped for the purposes of A-movement.

Note that this implies that A-checking has a different effect than A'-checking. A'-checking leads to deactivation of an XP, intervention is still possible, but only for A'-relations. A-checking, on the other hand, does not lead to deactivation, as we have seen in the case of copy raising and pseudo-control.

5.4 Double case-marking and resumption: Boeckx (2003)

There are still two unresolved issues.

i) Why is the copy in the dependent clause realized as a pronoun?
ii) How can a DP check two cases?

In what follows, I will show that both of these questions receive a straightforward answer given Boeckx' (2003) theory of resumption. There is no double case-marking, and the pronoun is a resumptive pronoun resulting from a base-generated Big-DP. At the heart of Boeckx' system lies a general constraint on Chains.

(36) *Principle of Unambiguous Chains* (Boeckx 2003:13): a Chain may contain at most one Strong Occurrence (Position where strong/EPP feature is checked)

Chains with more than one Strong Occurrence are frequent. They obtain for instance when a wh-object also undergoes movement for case checking. According to Boeckx such chains must be disambiguated in order to comply with (36). There are two strategies of disambiguation: the first consists in establishing an Agree relation between Strong Occurrences; the second in resumption, which is modeled as a Big-DP.

As for the Agree relation between Strong Occurrences (cf. Boeckx 2003:76), the concept is not fully made clear. It is certainly of a very abstract type. What seems clear is that such an Agree relation is only possible between probes that are sufficiently different. In the case of A-movement, this is usually not the case: there are just two finite Ts. In such a case, a different strategy, namely resumption, is necessary (see below). Not all C-probes can establish such an Agree relation. There are agreeing and non-agreeing ones, the former largely corresponding to phrasal operators, the latter to head-like/zero operators.

The second strategy is more straightforward: by forming a Big-DP and extracting the wh-phrase from its specifier, no ambiguous chain obtains: Case is checked by the whole Big-DP whereas the operator feature is checked by the antecedent in the Spec.

(37) $[_{CP}$ $\mathbf{DP_{op}}$ C_{op} V $[_{DP:Case}$ $\mathbf{DP_{op}}$ [D' D_{case}]]]

There are two chains altogether, one trivial chain consisting only of the Big-DP, and a non-trivial chain consisting of the copy inside the Big-DP and the copy in the operator position. Both chains satisfy (36) because they have only one Strong Occurrence each.

When we apply this approach to pseudo-control, we have two or three Strong Occurrences, depending on whether the PP is fronted or not. When the PP is fronted, C can establish an Agree relationship with the matrix case checking position to reduce the number of Strong Occurrences to two, which is still too much. To fully disambiguate the structures, resumption is needed, because two A-positions cannot establish an Agree relation between each other.[11] So it is again the Big-DP that checks the lower case whereas the antecedent inside the specifier moves on to receive case, check theta features and eventually check the operator feature on the matrix C.

(38) $[_{CP}$ $\mathbf{DP_{op}}$ C_{op} $[_{VP}$ $\mathbf{DP_{op}}$ $V_{theta/case}$+P $[_{CP}$ $\mathbf{DP_{op}}$ C … $[_{DP:Case}$ $\mathbf{DP_{op}}$ [D' D_{case}]] V]]]

So far I have assumed without argument that Case is actually a strong/EPP feature in Standard German/Dutch. This is not unproblematic because indefinite subjects can stay within the vP, and it is unclear to what extent there is movement for Case at all in these languages. However, at the same time, it is also a fact (e.g. Diesing 1992) that specific subjects and objects move out of the vP. This accords well with the observation made in section 2.2.3 that only specific DPs can satisfy the theta feature in pseudo-control. Assuming that the Big-DP headed by a pronoun is specific as well, it will undergo movement to a position where a strong/EPP feature is checked.[12] Therefore, all Case positions count as Strong Occurrences. The same holds for chains that terminate inside a PP, which according to Boeckx (2003:79) count as strong as well.

(39) **von Peter$_i$** glaube ich, dass ich mit **ihm$_i$** glücklich wäre.
of Peter think I that I with him happy were
'With Peter, I think, I would be happy.'

Coming back to the question of how to represent inherent case without violating the c-command condition on movement: Since the Big-DP checks a different case than the antecedent in its Spec, nothing rules out base-generating the antecedent with *von* in its extended projection, which will eventually be checked by the matrix V. The derivation then looks as follows.

(40) $[_{CP}$ $[_{KP}$ **von** $\mathbf{DP_{op}}]$ C_{op} $[_{VP}$ $[_{KP}$ **von** $\mathbf{DP_{OP}}]$ $V_{theta/case}$ $[_{CP}$ $[_{KP}$ **von** $\mathbf{DP_{op}}]$ C $[_{DP:Case}$ $[_{KP}$ **von** $\mathbf{DP_{op}}]$ [D' D_{case}]] V]]]

5.5 Move over merge?

The derivation sketched above violates the economy principle Merge over Move: why is it not possible to merge an object (from the numeration) directly into the matrix object position instead of moving an argument from the embedded clause? Violations of economy principles are only allowed if the more economical derivations do not converge. This is indeed the case in the situation at hand. Suppose instead of moving the closest DP, a different DP is selected from the numeration and inserted in the matrix object position. While this respects Economy, the antecedent of the pronoun will remain Caseless in such a derivation, and as a result the derivation crashes. Therefore, the less economical derivation emerges as the only possible solution.

[11] Under the assumption that C can establish an Agree relation with only one other Probe.

[12] If the antecedent subextracts from the Big-DP after it moved to the middlefield, one expects a CED violation, contrary to facts. A possible alternative derivation that avoids this problem involves first subextraction of the antecedent with subsequent remnant movement of the Big-DP to a position above the A'-moved antecedent (to respect Cyclicity), which in turn moves across the Big-DP.

5.6 Unboundedness/extraction out of islands?

Given the island insensitivity of pseudo-control discussed in section 0, a movement approach is confronted with properties usually absent from movement. It is a well-known fact that in many (but not all, cf. Boeckx 2003:108ff.) languages that employ resumptives, islands can be freely violated. There have been essentially two approaches. The predominant view is that in those cases, resumptives are only used to rescue an otherwise illicit derivation. This is referred to as intrusion (Chao & Sells 1983) or as true resumption (Aoun et al. 2001). Such derivations do not involve movement but base-generation of an operator in the operator position that binds a pronoun inside the island. The only approach to my knowledge that assumes movement out of islands is Boeckx (2003). His approach to resumption attempts to unify all types of resumption and treats resumption within islands on a par with resumption in non-island configurations. On his account, movement out of islands is possible under Match, but without Agree. More precisely, this means that islands can only be voided if the C-probe is a so-called non-agreeing complementizer, roughly a non-phrasal one. Given that the German operator elements are phrasal we do not expect that movement out of islands is possible. This is confirmed by the fact that there are no reconstruction effects into islands.

(41) a. * das Foto von **sich**$_i$, von dem ich glaube, dass du
the picture of self of which I believe that you
den **Mann**$_i$ kennst, **der**$_i$ es gemacht hat.
the man know who it taken has
Lit.: 'the picture of himself$_i$ that I think you know the man who$_i$ took'
b.?/??das Foto von **sich**$_i$, von dem ich glaube, dass du
the picture of self of which I think that you
dich freuen würdest, wenn **Peter**$_i$ es veröffentlichen würde.
self be_happy would if Peter it publish would

This shows that these examples require a different derivation than the non-island cases. Even though there is no difference on the surface, we find the usual contrast between apparent resumption (with movement effects) and true resumption (no movement effects). But what would that derivation look like?

Suppose we follow Aoun et al. (2001) in that true resumption involves Bind, meaning demerging the antecedent when it cannot move out of the island, merging an empty pronoun instead and putting the antecedent back into the numeration, merging it not until the matrix C-probe is introduced. This would derive the lack of island effects, but it would not explain why the operator phrase is also the controller. In fact, nothing in this derivation would guarantee that it becomes the controller, because any other DP could be merged to check the theta features of the matrix verb. Another problem is more general and holds for all derivational approaches to true resumption, i.e. approaches that fix the violation right away during the derivation: if the pronoun is inserted at the point where the DP attempts to move out of an island, one is faced with the fact that the pronoun is often not inserted where the violation occurs, but normally in the lowest case/theta position, as in the following English example:

(42) This is the **guy**$_i$ I was wondering < why Jane said that she liked **him**$_i$>.

On a derivational account, the antecedent *guy* would undergo successive cyclic A'-movement until it reaches the island boundary, i.e. up to either SpecCP of the lowest clause or SpecvP of *said* depending on what counts as a phase. In either case, no violation happens up to this point. Consequently, if the pronoun is inserted derivationally, one would expect it to surface in those positions.

(43) a. *This is the **guy**$_i$ I was wondering < why Jane said **him**$_i$ that she liked **t**$_i$>.
b. *This is the **guy**$_i$ I was wondering < why Jane **him**$_i$ said that she liked **t**$_i$>.

Since that is contrary to fact, the derivational account seems to be on the wrong track. Only with a lot of non-trivial look-ahead would it be possible to derive the desired result: once the argument is merged and its case is checked, the Bind operation would have to take place even though it is not clear yet at this point that the DP will eventually attempt to move out of an island. Clearly, this seems very unattractive.[13]

Instead, I would like to propose a more representational approach to true resumption. Suppose that island constraints are Bare Output Conditions, constraints on the LF representation, and not derivational constraints.[14] Consequently, the derivation proceeds freely, the operator phrase moves out of the island, ends up in the SpecCP of the complement clause of the matrix verb and will consequently be attracted and become the controller. Finally, it moves to the matrix SpecCP. Such a derivation explains why the antecedent necessarily becomes the controller in pseudo-control, but yet does not explain the lack of reconstruction effects. When chains are evaluated at LF, the locality violations are diagnosed. As a last resort, a pronoun can be merged to replace the copy of the antecedent. As a consequence, if something like *picture of himself* is replaced by *it* no binding will be possible anymore, the reading will be something like *John likes it*.

However, this still does not explain why the resumptive occurs in the lowest position, and why there cannot be reconstruction into those copies inside the island that are not covered by a pronoun. Consider an example with a reflexive, with all copies indicated.

(44) **the picture of himself** that I was wondering <why John [$_{VP}$ picture of himself assumes [$_{CP}$ picture of himself that Peter [$_{VP}$ picture of himself likes ~~picture of himself~~ → **it**]]]>.

So even if for some reason a pronoun is inserted into the lowest copy, there is another copy in the lowest clause that could be bound by *Peter*, and two in the *why*-clause where binding could be established with *John*.[15]

Clearly, to rule out any kind of binding, all other copies inside the island must also be somehow eliminated. It is not sufficient to stipulate that intermediate copies (traces) simply disappear (as in GB times, cf. Lasnik & Saito 1992) because that leaves us with no account for cases of binding in intermediate positions.

(45) Which picture of himself does John think that Peter assumes that Daniel likes?

Since *himself* can refer to *Peter*, binding occurs in an intermediate position. Therefore, intermediate positions are important and cannot just be freely deleted. I will not attempt to

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[13] To be precise, Aoun et al (2001) do not assume – at least not for Lebanese Arabic – that the overt resumptive is the element actually inserted. Rather, as stated above, it is an invisible pronoun whereas the visible resumptive is base-generated as the head of a Big-DP, so that the link between the overt element and the reparation of an island violation is given up. Nevertheless, as they state themselves, the demerging operation will have to target all copies within the island, clearly a non-trivial assumption.

[14] Since I assume that the MLC is a derivational constraint, wh-islands will no longer fall under it.

[15] Note that this also argues against a derivational account of binding, cf. Epstein et al. (1998).

derive the descriptively necessary steps here. From the point of view of locality, all copies inside the island are problematic. So somehow, they are all deactivated/deleted, to the exception of the lowest one which is replaced by a pronoun.[16]

5.7 Scrambling/pronoun fronting: when the subject is not closest

The approach to pseudo-control advanced here predicts that if for independent reasons the subject is not the closest element, other elements are eligible for control. Such a constellation is more likely to obtain in German than in Dutch because only German has scrambling across the subject. It is, however, difficult to determine whether there is scrambling at all because on the surface, all one sees is a pronoun, which tends to occur very high in the clause anyway. This means that the position of the pronoun might just as well be the result of pronoun fronting, which is not necessarily syntactic and thus does not form the input for the movement step to the matrix theta-position. Such sentences are perhaps a little better than the case where the object follows the subject, but they are still clearly worse than a regular case of subject control; their impact therefore remains unclear.

(46)	??Ich	glaube	**von**	**Peter**$_i$,	dass	**ihn**$_i$	Marie	**t**$_i$	mag
	I	believe	of	Peter	that	him	Mary		likes

More straightforward are cases involving unaccusative verbs with an additional argument that is generated higher than the nominative argument. In such cases, it seems indeed acceptable to have coreference with the non-subject argument, thereby confirming the prediction of the approach advocated here.

(47)	Ich	vermute	**von**	**Peter**$_i$,	dass	**ihm**$_i$	Maria	gefällt.
	I	suspect	of	Peter	that	he:DAT	Mary	pleases
	‘I suspect Peter likes Mary.’							

6. Further advantages of a resumption approach
6.1 Specificity – scrambling – big-DP

A Big-DP approach to resumption in the construction at hand is particularly reasonable given the observation in Boeckx (2003) that resumptives normally relate to D-linked antecedents. Even though the semantics of specificity in this construction do not necessarily derive from the presence of the pronoun but are rather imposed by the matrix verb, they are directly compatible with it.

6.2 Postposition stranding

Assuming a Big-DP structure for resumption makes the postposition stranding data discussed in 2.2.5 more tractable, since there is a pronoun available in the structure, which can be expected to behave like a pronoun.

[16] Or by an epithet, cf. Kroch (1981).

6.3 Opacity for extraction of other arguments

The movement analysis of pseudo-control makes an interesting prediction: if it is always the closest DP that is attracted by the matrix verb, every phrase with an operator feature that is to be attracted will also end up being the controller. Extracting the non-controller should be out. This is confirmed by the following example.

(48) ***Wen**$_i$ glaubst du von **Peter**$_j$, dass **er**$_j$ **t**$_i$ mag?
Who:ACC think you of Peter that he likes
lit.: 'Who do you believe of Peter that he likes?'

Such structures simply cannot be derived under the current analysis. Even more interestingly, the present analysis predicts that adjuncts can be operator-moved because they do not have phi-features and will therefore not be attracted by the matrix verb. Again, the prediction is borne out.

(49) ?**Wie**$_i$ glaubst du von **Peter**$_j$, dass **er**$_j$ das Problem **t**$_i$ lösen würde?
how think you of Peter that he the problem solve would
lit.: 'How do you believe of Peter that he would solve the problem?'

7. Conclusion

In this paper, I have provided the first analysis of an alternative to long A'-movement in German and Dutch. Its paradoxical properties (movement/binding) require a synthesis of ideas that takes the base position of the PP in the matrix clause seriously, while at the same time providing a means to model the reconstruction effects into the embedded clause. I have argued for A'-movement out of a finite clause to a theta position in the matrix clause. While controversial and technically not innocuous, the major advantage of this approach is that it straightforwardly derives the generalization in 4.3 according to which it is always the structurally closest element that becomes the controller. Under a binding approach, this generalization is lost. Even though the pseudo-control construction seems to be unbounded, it becomes clear upon closer scrutiny that different derivations are necessary to account for the local and non-local cases. Despite its initial appeal for unboundedness, a binding approach cannot account for the reconstruction asymmetries.

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Martin Salzmann
Leiden University
Leiden Center for Linguistics (ULCL)
m.d.salzmann@let.leidenuniv.nl
http://www.ulcl.leidenuniv.nl/index.php3?m=8&c=130

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Indefinites: an extra-argument-slot analysis

Hiroyuki Uchida

I propose an analysis of indefinites with a bound variable in the nominal restriction, which is based on Schwarzschild's domain restriction theory. The analysis avoids certain problems of Winter's Skolem function analysis. In contrast to Schwarzschild, I argue that the domain restriction's dependency on another quantifier is linguistically specified at LF.

1. Introduction

This paper discusses indefinite noun phrases in the form of *a (certain) woman* in the argument position of a verb, with special attention being paid to indefinites containing a bound variable in their nominal restriction.

It has been observed that the scope of strong quantifiers such as universal quantifiers is roughly clause bound, while the scope of indefinites is not constrained in this way.[1]

(1) a. Every teacher said that *a student* smoked at school. $\forall > \exists$, $\exists > \forall$
b. A teacher said that *every student* smoked at school. $\exists > \forall$, $*\exists > \forall$

(1a) has a reading which says that there is one student such that all the teachers said that the student smoked. This 'wide scope reading' of indefinites is problematic because the universal quantifier in the embedded clause in (1b) cannot take scope over the main clause. (1b) does not have the reading that says that for each student, a possibly different teacher said that the student smoked. Based on covert quantifier raising (QR) in May (1977), we might simply assume an exceptional long-distance movement only for indefinites (cf. Beghelli & Stowell 1996). But this would involve giving up the uniformity of QR as a syntactic movement. Rather than postulating an exceptional movement for indefinites, Reinhart (1997) uses Choice Functions, which can generate the reading that is roughly equivalent to the exceptional scope reading of indefinites.

However, Winter (2001) argues that neither the QR analysis nor the simple choice function analysis can explain one of the readings of the following sentence (cf. Winter 2001:116).

[1] ($\forall > \exists$) means that $\forall$ takes wide scope over $\exists$. See Carpenter (1997: 255) for the summary of typical scope islands for quantifiers in general and the exceptional behaviours of indefinites in this regard.

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(2) Every boy$_1$ who hates [$_{NP}$ *a* (*certain*) *woman* he$_1$ knows] will develop a serious complex.

(2) has a reading in which each boy develops a complex if he hates a certain woman that he knows, e.g. each boy's mother.[2] This reading is problematic because it is different from either the narrow scope reading of the indefinite over the universal, in which each boy develops a complex if he hates any woman that he knows, or the wide scope reading, in which there is one woman such that all the boys will develop a complex if they hate that woman.[3]

In order to explain this reading, Winter (2001) 'skolemizes' his choice function, which generates a reading in which a particular relation (e.g. the motherhood relation) holds for all the *boy-woman* pairs. Winter's analysis is empirically adequate, but because it is still a choice function analysis, it requires an existential closure operation on the choice/Skolem function variable. This operation, like an exceptional QR for indefinites, is not constrained by standard syntactic islands. If an alternative theory can explain the various readings of indefinites without assuming a syntactically unconstrained operation, that theory is preferable. Also, choice/Skolem function analyses make use of function variables to which we need to assign the choice/Skolem function property. This complicates the derivation of logical expressions from the lexical levels, and it is not clear whether the degree of complication is linguistically well motivated. Winter's analysis has another kind of problem. According to his analysis, the argument slot that a bound pronoun introduces into the logical form is not directly bound by the quantifier, which goes against the spirit of semantic compositionality.

In order to avoid these problems, I take an alternative approach. While adopting the basic idea of the domain restriction analysis of indefinites as in Schwarzschild (2002), I argue that indefinites are lexically equipped with an extra argument slot, which can be bound by a c-commanding quantifier in the sentence. The domain restriction is then dependent on this quantifier.

Based on this analysis of indefinites, I show how we can compositionally derive the logical form of a sentence containing an indefinite in a Categorial Grammar derivation. I use **g** and **z** operators in Jacobson (1999) and show how we can percolate the extra argument slot of the indefinite into a later stage of the derivation and then have it bound by a quantifier.

In Section 2, I explain the logical notations I use. In section 3, I explain the basic idea of choice functions. Section 4 introduces the main issue of this paper with Winter's solution. In section 5, I explain why I do not adopt his choice/Skolem function analysis. In section 6, I explain the basic idea of domain restriction analyses, and argue that indefinites have an extra argument slot. Section 7 formalizes this idea in a Categorial Grammar framework. Section 8 gives extensions and Section 9 gives a summary.

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[2] Following Winter, I use the word *certain* to facilitate this reading.

[3] The narrow scope reading of the indefinite is possible only without the word *certain*. (2) does not have the indefinite wide scope reading because the pronoun inside the indefinite is bound by the universal quantifier.

2. Semantic types of logical expressions

In this section, I describe my assumptions about the semantic component as well as the notation that I use for semantic representations. I use logical notations to represent the meanings that are paired with phonological strings. These logical expressions are compositionally derived through syntactic derivation. They represent the encoded meanings of phonological strings, which can be enriched further by pragmatic inferences outside the grammar module.

I use higher order logical expressions. Each logical expression has a semantic type. The basic semantic types are **e** for the expressions referring to individuals and **t** for propositions. Non-basic types are recursively defined as in (3b).

(3) a. **e** and **t** are basic semantic types.
b. If **a** and **b** are semantic types, **(a,b)** is also a semantic type.
(* I omit the comma between **a** and **b** if they are made up of **e** and **t**.)

Other than **e** and **t** in (3a), I use another basic type $\boldsymbol{\sigma}$ for a tense variable. I also introduce an underspecified type $\boldsymbol{\tau}$, which can be instantiated as one of the basic types.[4] I show the semantic type of a logical expression as a subscript (e.g. $\mathbf{woman'}_{\mathbf{et}}$ or $\mathbf{hate'}_{\mathbf{e(et)}}$) but for readability, I give the semantic types of some frequently used expressions beforehand, and keep on using these expressions with these semantic types unless otherwise specified. More logical expressions are introduced later. First, I assign types to variables.

(4) Variables
a. type e: ***x, y, z, m, n***
b. type (et): ***A**, **B***
c. type (e(et)): ***P***

I use English words as metalanguage to represent logical expressions. I attach a prime mark to **constant** logical expressions, as opposed to variables. Here are some of the constants I use in the paper.

(5) Constants
a. type (et): teacher′, student′, woman′, man′, boy′, girl′, smoke′
b. type (e(et)): hate′, love′, know′, respect′
c. type (t(et)): say′

3. Choice function

This section explains the basic idea of choice functions as background knowledge. A major motivation for the use of choice function is the exceptional scope taking of indefinites, as opposed to universal quantifiers, which do not show exceptional scope. Consider the sentences in (1) again, repeated here as (6a) and (7b).

[4] $\boldsymbol{\tau}$ co-varies with the type of the quantifier that binds the extra argument slot of indefinites. $\boldsymbol{\tau}$ is usually instantiated as **e**, because usually a quantifier over individuals (e.g. *every boy*) binds this argument slot. In section 8.2, however, $\boldsymbol{\tau}$ is instantiated as type $\boldsymbol{\sigma}$, because the tense operator binds this argument slot there.

(6) a. Every teacher said that a student smoked at school.
b. $\exists x[\text{student}'(x)\ \&\ \forall y\ [\text{teacher}'(y) \rightarrow \text{say}'([\text{smoke}'(x)]_t)(y)]]$

(7) a. A teacher said that every student smoked at school.
b. $*\forall x[\text{student}'(x) \rightarrow \exists y\ [\text{teacher}'(y)\ \&\ \text{say}'([\text{smoke}'(x)]_t)(y)]]$

The sentence (6a) has a reading that says that there is one student ***x*** such that for every teacher ***y***, ***y*** says that ***x*** smoked at school. Ignoring the tense, the wide scope logical form for the indefinite in (6b) represents this reading. However, if we change the positions of the indefinite and the universal quantifier, the corresponding wide scope reading for the universal quantifier is not available. (7a) does not have the reading (7b), which says that for each student ***x***, there is a possibly different teacher ***y*** who said that ***x*** smoked at school.

It has been observed that the scope of a quantificational noun phrase (QNP) cannot cross a tensed clause boundary (e.g. Fodor & Sag 1982:367-370, Reinhart 1995:3-4 and Winter 2001:82-85). (7b) suggests that universal quantifiers are subject to this locality constraint but (6b) suggests that the scope of indefinites is not. We could apply a long distance QR only to indefinites, but this strategy would involve giving up the uniformity of QR as a syntactic movement.[5]

For Reinhart (1997) and Winter (1997), the alleged exceptional scope reading of indefinites is derived by a totally different mechanism from QR, that is, choice functions.[6] A choice function applies to a set of individuals denoted by the nominal restriction and chooses a member from this set, if the set is not empty.[7]

(8) $\text{CH}'_{((et)e)t} \stackrel{\text{def}}{=} \lambda f_{(et)e}.\forall \boldsymbol{A}\ [\boldsymbol{A} \neq \varnothing \rightarrow \boldsymbol{A}(f(\boldsymbol{A}))]$ (cf. Winter 2001: 89)

In (8), ***A*** represents a nominal restriction set of type (et), like the set of students. A function ***f*** of type (et)e maps sets of individuals to individuals. We need to assign the choice function property **CH′** to the function ***f***, so that ***f*** maps a set of individuals to a member of the set. Note that without this restriction, ***f*** might map a set of individuals to an individual that is not a member of the set. In (9b) and (9c) below, the function ***f*** with the choice function property **CH′** chooses a student from the set of students, and the chosen student acts as the type e argument of the logical expression **smoke′**.

(9) a. Every teacher said that some/a student smoked at school.
b. $\exists f_{(et)e}[\text{CH}'(f)\ \&\ \forall x\ [\ \text{teacher}'(x) \rightarrow \text{say}'([\text{smoke}'(\boldsymbol{f}(\textbf{student}'))]_t)(x)]]$
c. $\forall x[\text{teacher}'(x) \rightarrow \text{say}'([\exists f_{(et)e}[\text{CH}'(f)\ \&\ \text{smoke}'(\boldsymbol{f}(\textbf{student}'))]]_t)(x)]$

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[5] Ideally, we should avoid a syntactic operation that is not subject to locality constraints. However, as I discuss in section 5.1, the existential closure that Winter applies to choice function variables is not subject to locality constraints either. I also agree with the comment made by an anonymous reviewer that there is a trade-off between accepting an exceptional QR only for indefinites and use of choice functions (a new complication to the theory).

[6] Reinhart uses both QR and choice functions to explain various readings of indefinites, while Winter explains all the readings using only choice functions. In this paper, I only discuss Winter's analysis.

[7] I ignore the empty set problem of choice functions. Because of this, I do not apply another function of type **(et)e → (et)t** to the function variable ***f*** to generate a generalized quantifier as Winter does. The difference does not influence my arguments against Winter's analysis.

(9b) means that there is a function ***f*** such that ***f*** is a choice function and for each teacher ***x***, ***x*** said that the student that ***f*** picks out smoked at school. Because the existential force associated with the function variable is outside the scope of the universal quantifier, ***f*** is the same function for all the teachers, and for all the teachers, it chooses the same individual out of the student set. This corresponds to the wide scope reading of the indefinite, though in choice function analyses, the indefinite does not move to a higher position to take wide scope. The idea is to leave the nominal expression *a student* and the function variable ***f*** in the base position of the indefinite noun phrase, while an existential closure is introduced at various positions in the structure that have scope over the in-situ function variable.[8] In (9c), the existential closure on the function variable ***f*** is introduced within the scope of the universal quantifier. This means that for each teacher ***x***, there is a possibly different choice function ***f*** involved. Because each ***f*** can choose a different student out of the student set, the identity of the student can co-vary with the teacher. This corresponds to the narrow scope reading of the indefinite.

In the next section, I introduce the main issue with Winter's solution.

4. Indefinites with a bound variable and Winter's solution

Winter (1997, 2001) argues that the definition of choice functions in (8) cannot explain one particular reading of indefinite noun phrases with a bound variable in the nominal restriction.

(10) a. Every boy$_1$ who hates [$_{NP}$ *a (certain) woman* he$_1$ knows] will develop a serious complex. (cf. Winter 2001:116)

b. For each boy ***x***, there is a (different) specific woman ***y*** among the women ***x*** knows such that if ***x*** hates ***y***, ***x*** will develop a serious complex.

(10a) has the reading (10b). In this reading, the woman involved can co-vary with each boy, but this is not the ordinary narrow scope reading. Which woman we choose for each boy is relevant to the truth condition. Each boy will develop a complex only if he hates a woman who falls under a specific relation to him, for example, his mother, not if he hates some woman or other whom he knows.

We need to clarify the strange 'specificity' in (10b), in which the woman is not just some woman or other but can still co-vary with each boy. We could define it in terms of a different specific woman for each boy, like Mary for Tom and Nancy for Sid. But Cormack (p.c.) says that if she forces herself to get this reading, it has to be the case that a fixed relation holds for every pair of a boy and a woman, like the relation between a boy and his mother. Winter (2004) assumes that the reading (10b) is defined in terms of a function that maps the set of women each boy knows to another function that maps each boy to a member of that set. In some contexts, this second function can be understood as the fixed relation holding for every pair of a boy and the woman for him, like the motherhood relation. In section 6, I adopt this assumption in a different framework from Winter's. In this section, however, I explain the

[8] Winter (2001) does not specify at what level of representation an existential closure applies. In this paper, I assume for convenience that it is introduced at LF. The function variable ***f*** is encoded with a phonologically null determiner head that selects the indefinite NP *a student* as its complement. The indefinite itself denotes just a set of individuals. The formulation is necessary for explaining different uses of indefinites (see Winter 2005:770 for details).

strange specificity rather informally. The woman is specific in that each boy has only one truth-conditionally relevant woman. That is, it is not just an arbitrarily chosen woman. But the relevant woman can still co-vary with each boy.

As Winter points out, neither the wide scope nor the narrow scope choice function logical form represent this reading with a type ((et)e) choice function.

(11) a. $\exists f_{(et)e}[\text{CH}'(f)\ \&\ \forall x[\text{boy}'(x)\ \&\ \text{hate}'(f(\lambda y.[\text{woman}'(y)\ \&\ \text{know}'(y)(x)])(x)] \rightarrow \text{develop\_a\_complex}'_{et}(x)]$

b. $\forall x[[\text{boy}'(x)\ \&\ \exists f_{(et)e}[\text{CH}'(f)\ \&\ \text{hate}'(f(\lambda y.[\text{woman}'(y)\ \&\ \text{know}'(y)(x)]))(x)]] \rightarrow \text{develop\_a\_complex}'_{et}(x)]$

(12) a. $\exists y[\text{woman}'(y)\ \&\ \forall x[[\text{boy}'(x)\ \&\ \text{know}'(y)(x)\ \&\ \text{hate}'(y)(x)] \rightarrow \text{develop\_a\_complex}'_{et}(x)]]$

b. $\forall x[[\text{boy}'(x)\ \&\ \exists y[\text{woman}'(y)\ \&\ \text{know}'(y)(x)\ \&\ \text{hate}'(y)(x)]] \rightarrow \text{develop\_a\_complex}'_{et}(x)]$ (cf. Winter 2001:116)

Neither the indefinite wide scope logical form in (11a) nor the corresponding classical indefinite wide scope logical form in (12a) represent the required interpretation. (11a) says that there is a choice function ***f*** such that for every boy ***x***, if ***x*** hates the individual ***y*** that ***f*** chooses from the set of women ***x*** knows, ***x*** develops a complex. Consider a context in which all the boys happen to know exactly the same set of women. In this context, the logical form in (11a) means that the function ***f*** chooses one and the same woman for all boys, and that if each boy ***x*** hates that woman, ***x*** develops a complex. Note that there is only one function ***f*** involved for all the boys in (11a) because the existential quantifier binding ***f*** takes wide scope over the universal quantifier. If the function ***f*** is one and the same, and the set from which ***f*** chooses an individual is one and the same, ***f*** chooses one and the same individual for all the boys. But the reading in (10b) implies that even if all the boys know exactly the same set of women, we should still be able to choose a different specific woman for each boy. For example, for each boy, we can choose his mother.

Neither the indefinite narrow-scope logical form of the choice function analysis, given in (11b), nor its truth conditional equivalent in the classical notation, given in (12b), represent the reading in (10b) either. These narrow-scope logical forms say that for each boy ***x***, if ***x*** hates a woman ***x*** knows, whichever woman it is, ***x*** develops a complex. This is the **exhaustive reading** of the indefinite. But (10b) says that each boy ***x*** develops a complex only if ***x*** hates a specially chosen woman among the women ***x*** knows.

As the classical logical forms in (12

(12) do not represent the reading (10b), the problem is not only for a choice function analysis. It is a problem for any analysis that explains the co-variation possibility of an indefinite solely in terms of the relative scope of the existential quantifier that is associated with the indefinite.

Winter solves this problem by re-defining choice functions as Skolem functions with flexible arities. For simplicity, I discuss a case in which the nominal restriction of the indefinite contains only one bound variable, as in (10a). Then the arity of the Skolem function is just one (the superscript on SK^1 indicates the arity).

(13) $\text{SK}^1_{((e(et))(ee))t} \stackrel{\text{def}}{=} \lambda f_{((e(et))(ee))}.\forall g_{(e(et))}\forall x_e\,[g(x)\neq\varnothing \rightarrow g(x)(f(g)(x))]$

The idea is that when a pronoun appears in the nominal restriction, the type of the logical expression for the nominal restriction is (e(et)), as in (14) for the nominal restriction *woman he knows* in (10a).

(14) $\lambda m.\lambda n.[\text{woman}'(n)\ \&\ \text{know}'(n)(m)]$

For the sentence in (10a), the function $\boldsymbol{g}$ in (13) corresponds to the logical expression given in (14), which denotes a function that maps each individual $\boldsymbol{m}$ to a set of women that $\boldsymbol{m}$ knows. If this $\boldsymbol{g}$ is applied to each boy $\boldsymbol{x}$, we get a possibly different set of women for each $\boldsymbol{x}$. The Skolem function $\boldsymbol{f}$ defined in (13) denotes a function that maps each (e(et)) function $\boldsymbol{g}$ to another function $\boldsymbol{f(g)}$, which in turn maps each individual $\boldsymbol{x}$ to a member of the set denoted by $\boldsymbol{g(x)}$. If $\boldsymbol{x}$ is a boy, $\boldsymbol{g(x)}$ denotes a set of women for the boy $\boldsymbol{x}$. Now, what happens if $\boldsymbol{g(x)}$ denotes one and the same woman-set for every boy $\boldsymbol{x}$. $\boldsymbol{f(g)}$ in (13) can still map each boy $\boldsymbol{x}$ to a different member of the woman-set denoted by $\boldsymbol{g(x)}$. In other words, even if $\boldsymbol{g(x)}$ denotes one and the same set of individuals, $\boldsymbol{f(g)}$ can still map each individual $\boldsymbol{x}$ to a different member of that same set. Let me show this point in Winter's logical form in (15) for the sentence in (10a) with the reading (10b).

(15) $\exists f_{(e(et))(ee)}[\text{SK}^1(f)\ \&\ \forall x\ [[\ \text{boy}'(x)\ \&\ \text{hate}'(f(\lambda m.\lambda n.[\text{woman}'(n)\ \&$
$\text{know}'(n)(m)])(\boldsymbol{x}))\ (x)\ ] \rightarrow \text{develop\_a\_complex}'(x)]]$ (Winter 2001, p.118)

The type (e(et)) function $\boldsymbol{g}$ in (13) is $\boldsymbol{\lambda m.\lambda n.[\text{woman}'(n)\ \&\ \text{know}'(n)(m)]}$ in (15). In a context in which all the boys know exactly the same set of women, this $\boldsymbol{g}$ function maps every boy $\boldsymbol{x}$ to the same set of women. However, even in this context, the function $\boldsymbol{f(\lambda m.\lambda n.[\text{woman}'(n)\ \&\ \text{know}'(n)(m)])}$ in (15) can still map each boy $\boldsymbol{x}$ to a different member of that same set of women. This is possible because of the highlighted second argument $\boldsymbol{x}$ of the function $\boldsymbol{f}$ in (15). In (15), this argument $\boldsymbol{x}$ is bound by the universal quantifier in *every boy* and consequently, we can choose a different woman for each boy $\boldsymbol{x}$. Notice that (15) still says that we pick out a specific kind of woman for each boy, rather than whichever woman it is in the set of women. The existential quantifier $\exists \boldsymbol{f}$ takes wide scope over the universal quantifier and there is only one function $\boldsymbol{f}$ involved for every boy $\boldsymbol{x}$.[9] The logical form does not lead to the exhaustive narrow scope reading as in (11b) or
(12b).

In summary, the apparent specificity in (10b) is explained in terms of the widest scope of the existential quantifier binding the function variable, which leads to the use of the same Skolem function for all the boys, but we can still pick out a different woman for each boy, because this Skolem function applied to the same set of women can still choose a different woman for each boy from that same set, because of the function's second argument $\boldsymbol{x}$, which is bound by the universal quantifier in *every boy*. In the next section, I explain two problems with Winter's analysis.

[9] The fixed function $\boldsymbol{f}$ leads to the fixed relation holding for all the *boy-woman* pairs, as in Cormack's reading on page 381. In order to get the narrow scope reading (in which each boy develops a complex if he hates any woman that he knows), Winter applies an existential closure in a position lower than the universal quantifier as well, implying that an existential closure can be introduced in structurally different places. See section 5.1.

5. Problems
5.1. Unconstrained existential closure

Winter uses a Skolemized function $\boldsymbol{f}$ as in (13) only for indefinite noun phrases with a pronoun inside the nominal restriction, to explain the strange reading as in (10b). The various 'scope readings' of indefinites are explained in terms of different positions at which an existential closure is applied to the function variable $\boldsymbol{f}$, whether the nominal restriction has a bound pronoun or not. For example, in (16), we can think of either the same girl for all the boys, or a possibly different girl for each boy, and Winter explains these readings by applying an existential closure in alternative positions, as in (16b) and (16c).

(16) a. Every boy said that Bob loves a girl.
b. $\exists f_{(et)e}[\mathbf{CH'(\boldsymbol{f})}\ \&\ \forall x[\mathrm{boy}'(x) \rightarrow \mathrm{say}'_{(t(et))}([\mathrm{love}'(\boldsymbol{f}(\mathrm{girl}'))(\mathrm{b}')]_t)(x)]]$ $\exists > \forall$
c. $\forall x[\mathrm{boy}'(x) \rightarrow \exists f_{(et)e}[\mathbf{CH'(\boldsymbol{f})}\ \&\ \mathrm{say}'_{(t(et))}([\mathrm{love}'(\boldsymbol{f}(\mathrm{girl}'))(\mathrm{b}')]_t)(x)]]$ $\forall > \exists$

However, the existential closure operation is no more structurally constrained than the exceptional scope movement for indefinites in QR based analyses. In

(1616b), closure is applied in a position outside the tensed clause where the indefinite is located, and in (17a) with the reading (17b), closure would have to be applied outside the complex NP in which the indefinite *a (certain) student* is placed.

(17) a. Every teacher over-heard [$_{NP}$ the rumour that a (certain) student smoked at school].
b. There is one student such that every teacher over-heard the rumour that he smoked at school.

The choice-function logical form in (18a) is claimed to represent this reading in a better way than the LF representation in (18b), which covertly moves the indefinite out of the complex NP island at LF.

(18) a. $\exists \boldsymbol{f}$ [CH′($\boldsymbol{f}$) & [every teacher over-heard [$_{NP}$ the rumour [that $\boldsymbol{f}$(student) smoked at school]]]]
b. [**some student$_1$** [every teacher over-heard [$_{NP}$ the rumour [that **t$_1$** smoked at school]]]]

However, it is questionable whether introducing an unconstrained existential closure operation just to explain the exceptional scope taking of indefinites is any better than assuming an unconstrained covert movement just for that purpose. Also, if we adopt the idea of Inclusiveness as in Chomsky (1995) and assume that all information comes from lexicon, we need to assume that the function variable $\boldsymbol{f}$ and the existential closure operator come from some lexical information as well. Remember that a mere existential closure over $\boldsymbol{f}$ is not enough; the function $\boldsymbol{f}$ has to have the choice function property denoted by **CH′**. We need an operation as in (19), where the existential closure is applied at the top of the logical form (the closure should alternatively be applicable somewhere within the scope of the universal quantifier as well, to derive the narrow scope reading of the indefinite).

(19) ECC ($\lambda f.\ \forall x$ [boy′(x) → say′([love′($\boldsymbol{f}$(girl′))(b′)]$_t$)(x)]) =
$\exists f_{(et)e}$[CH′(f) & $\forall x$ [boy′(x) → say′([love′($\boldsymbol{f}$(girl′))(b′)]$_t$)(x)]], where
$\mathrm{ECC}_{(((et)e)t)t} \stackrel{\text{def}}{=} \lambda Q_{((et)e)t}.Q \cap \mathrm{CH}' \neq \varnothing$. (cf. Winter 2001:131)

The details in (19) are not essential here, but the existential closure operator **ECC** has to introduce not only an existential quantifier binding the variable ***f***, but also the choice function property **CH′** of the function ***f***. If an analysis that does not use choice functions can explain the exceptional scope taking of indefinites, that analysis is preferable in that we do not need these extra mechanisms in the syntactic derivation of an interface logical form.

5.2 Compositionality problem

Another problem with Winter's analysis is that his Skolem function logical form can not directly mark the binding relation between a quantifier and the pronoun bound by it. In a classical logical form, a bound pronoun is represented by a variable bound by the quantifier, as in (20b).

(20) a. Every boy_1 said that he_1 smokes.
b. $\forall x$[boy′(x) → say′([smoke′(x)]$_t$)(x)]

In contrast to this, the external argument slot of the verb *know* in Winter's Skolem function logical form cannot be directly bound by the universal quantifier.

(21) *$\exists f_{(e(et))(ee)}$[SK^1(f) & $\forall \boldsymbol{x}$ [[boy′(x) & hate′(f (λn.[woman′(n) & know′(n)($\boldsymbol{x}$)])(x)) (x)] → develop_a_complex′(x)]]

The logical form in (21) is illicit because the first argument of ***f*** does not have the required type (e(et)); its type is (et). This means that we cannot let the universal quantifier bind the highlighted external argument slot ***x*** of the verb *know*, even though this argument slot corresponds to the bound pronoun *he*. Note that the following β reduction would be illicit in Winter's logical form in (15), repeated below as (23a), as it would collapse the two arguments of ***f*** into one (i.e. replacing ***x*** for ***m*** while deleting λ***m*** would be illegal in 15).

(22) ($\lambda m.\lambda n$.[woman´(n)&know´(n)(m)])(x) $\Rightarrow_{\beta\ \mathrm{red.}}$ λn.[woman´(n)&know´(n)(x)]

We cannot bind the ***m*** slot in this way either.

In Winter's logical form in (23a), the argument slot ***m*** for the bound pronoun *he* and the extra argument slot ***x*** of the Skolemized function ***f*** are set to denote the same individual only indirectly, through the definition of the Skolem function as in (13), repeated here as (23b).

(23) a. $\exists f_{(e(et))(ee)}$[SK^1(f) & $\forall x$[[boy′(x) & hate′(f ($\lambda \boldsymbol{m}.\lambda n$.[woman′($n$) & know′($n$)($\boldsymbol{m}$)])($\boldsymbol{x}$)) ($x$)] → develop_a_complex′($x$)]]
b. $\mathrm{SK}^1_{((e(et))(ee))t} \stackrel{\text{def}}{=} \lambda f_{((e(et))(ee))}.\forall g_{(e(et))}\ \forall x_e\ [\, g(x) \neq \varnothing \rightarrow g(x)(f(g)(x))]$

As we have already seen, ***f*(*g*)** used for the crucial sentence in (10a) denotes a function that maps each boy ***x*** to a member of the woman set denoted by ***g*(*x*)**. Technically, we could define the property $\mathbf{SK^1}$ in a different way so that $\boldsymbol{f(g)}$ maps each individual $\boldsymbol{x}$ to a member of the set denoted by $\boldsymbol{g(y)}$, where $\boldsymbol{x \neq y}$. If we applied this alternative definition to (23a), then, $\boldsymbol{m}$ and $\boldsymbol{x}$ would denote different individuals, contrary to the interpretation required by the bound pronoun *he*. In this sense, the interpretation of the bound pronoun *he* necessitates the definition of $\mathbf{SK^1}$ as in (23b). But in (19), it is the existential closure operator **ECC** that introduces the choice function property **CH′**. **ECC** would presumably be associated with the indefinite NP via the choice function variable $\boldsymbol{f}$, with or without the existence of a bound pronoun. It is not easy to modify the definition of **ECC** in such a way that the definition of the Skolem function property in (23b) is directly associated with the lexical information of the bound pronoun in the nominal restriction of the indefinite. Even if we could come up with a rule like that without violating Inclusiveness, the interpretational contribution of the bound pronoun *he* would still be different in the standard binding case as in (20) and in a case like (23a). Winter's logical form at least goes against the spirit of semantic compositionality, which predicts that the contribution of the bound pronoun to deriving the binding relation should be the same both for (20) and (23a).

Admittedly, the two points I have made are problematic only if we assume that the logical form is compositionally derived in a syntactic derivation following the Chomskian idea of Inclusiveness. If our primary concern is to explain the available readings of indefinites in an empirically adequate way, this might be less of a problem. But in this paper, I assume that compositional derivation of interface logical forms is an essential factor.

In summary, Winter's analysis not only requires the introduction of the choice/Skolem function property during syntactic derivation but also an unconstrained existential closure operation over function variables in the derived logical form. It is not clear whether this additional complication of the theory is linguistically well-motivated. The other problem I have discussed is that Winter's logical form cannot directly represent the binding relation holding between the quantifier and the pronoun bound by it. This poses a problem for semantic compositionality.

6. Domain restriction

In this section, I informally motivate a domain restriction analysis with an inherent argument slot for the indefinite, and argue that it solves the problems I mentioned in the previous section. The formal analysis is given in section 7.

First, I introduce the pragmatic domain restriction analysis proposed by Schwarzschild (2002) with one of its main motivations. Consider example (24).

(24) a. Every boy who hates a (certain) woman develops a complex
b. $\exists x[\text{woman}'(x)\ \&\ \forall y[[\text{boy}'(y)\ \&\ \text{hate}'(x)(y)] \rightarrow \text{develop\_a\_complex}'_{et}(y)]]$
c. $\forall y[[\text{boy}'(y)\ \&\ \exists x[\text{woman}'(x)\ \&\ \text{hate}'(x)(y)]] \rightarrow \text{develop\_a\_complex}'_{et}(y)]$

In (24a), when the domain of the set of women is pragmatically restricted to a singleton set, the assertion is made only about the unique member of the set. Thus, we can get the wide scope reading equivalent while assuming only the narrow scope linguistic meaning, given in (24c), where the pragmatic domain restriction enables us to talk about the unique woman.

Schwarzschild claims that the so-called wide scope reading is not a matter of the existential having wide scope (2002:298). Analyses that give exceptional quantificational scope-taking possibilities to indefinites assume that the indefinite *a (certain) woman* in (24a) can take scope over the matrix universal, but it is not obvious whether the so-called wide scope reading some native speakers get with this string can be captured by the wide scope logical form of the indefinite, given in (24b). (24b) is trivially true when there is an ***x*** such that ***x*** is a woman and no boy hates ***x***, even if there is another woman ***y*** such that a boy who hates ***y*** does not develop a complex. This wide scope logical form does not correctly represent the specific reading of (24a). What we want to capture instead is the non-arbitrariness of the choice of a woman. Each boy develops a complex only if he hates a specific woman, say, Mary; not when he hates some woman or other.

This is explained in the domain restriction analysis. If the domain is restricted to a singleton, the other members of the original set that are excluded from the domain are irrelevant. On the other hand, if the sentence is understood as an assertion about women in general, the domain is not restricted to a singleton set and we do not get the specific reading.

What happens if the domain is restricted to a singleton set that contains a woman that no boy hates? In that case, the sentence (24a) is simply true. Note that in this analysis, the woman no boy hates and the specific woman that is picked out by the indefinite *a (certain) woman* in this context have to be the same woman, because the domain-restricted set has only one member. So the above problem for the logical form (24b) does not arise. In an actual interpretation, it will be difficult to restrict the domain in this way. It is a pragmatic inference that decides to which member the domain is restricted and I assume that the pragmatic domain restriction is worked out on the basis of the linguistic meaning of the sentence and the relevant contextual information. This explains why in a normal context, it is difficult to restrict the domain in a way such that the meaning of the main clause: *Every boy…develops a complex*, becomes irrelevant in some sense to the truth condition of the whole sentence.

Unlike the choice/Skolem function analysis, the domain restriction theory does not require an existential closure operation or a function variable in a syntactic derivation of a logical form. This makes the syntactic derivation simpler. The existential quantifier is generated in-situ with the indefinite noun phrase, which does not take an exceptional wide scope. Because we interpret the indefinite quantificationally, we do not need a choice function variable either.

On the other hand, a challenge for the domain restriction analysis is the intermediate scope reading as in (25). Ruys (1992:101-102) and Abusch (1994:84-88) argue that an analysis that predicts that the exceptional wide scope taking of an indefinite always leads to the widest scope is wrong, based on sentences like (25). Their criticism is aimed at the lexical ambiguity analysis of indefinites in Fodor & Sag (1982), which gives the widest scope to a referential indefinite. The criticism is not meant to be against the domain restriction analysis. However, if the domain restriction analysis always gives the widest scope when the domain is restricted to a singleton, it is subject to the same criticism.[10]

(25) Every student discussed every analysis that solved a (certain) problem in Chomsky 1995. (cf. Reinhart 1997:346)

(25) has a reading that says that for each student ***x***, there is a possibly different problem ***y*** in Chomsky 1995, and ***x*** discussed all the analyses that solved ***y***. If the domain restriction to a singleton set is insensitive to other elements in the sentence, we predict incorrectly that whenever the domain is restricted to a singleton, *a certain problem* has to denote one and the same problem for all the students.

[10] Cormack & Kempson (1991) also mentions the existence of the intermediate reading, though unlike Ruys and Abusch, they take a pragmatic approach to explain this reading.

One way to solve this problem is to assume that the indefinite has an inherent argument slot on which the domain restriction is dependent. When this inherent argument slot is bound by the universal quantifier *every student* in (25), the domain restriction can be done differently for each student. Thus, we can pick out a different problem for each student.

The sentences in (26) (cf. Winter 2004:331) will fall under the same sort of explanation.

(26) a. Every student_1 admired a (certain) teacher – his_1 homeroom teacher.
b. A woman that every man_1 loves is his_1 mother.

(26a) suggests that the specificity of the teacher can be relativized to each student; each student can admire a possibly different specific teacher, and if this specificity is the result of a domain restriction into a singleton set, the domain restriction has to be made in a possibly different way for each student.

The so-called functional reading gives another argument for this inherent argument slot of indefinites. The co-indexed pronouns in (26a) and (26b) are a problem for a structural analysis of pronoun binding, because these pronouns are not within the surface c-command domain of the universal quantifiers. But if we assume that the indefinite has an inherent argument slot, which can be formally linked to the universal quantifier, then we can claim that the equality of the functional relation holding between the universal quantifier and the indefinite on the one hand and the functional relation between the universal quantifier and the noun phrase containing the pronoun on the other justifies the use of the pronoun in this way.[11] In the relevant reading of (26a), the sentence is true if and only if the function mapping each student to a singleton teacher-set for him is the same as the function mapping each student to a singleton homeroom-teacher-set for him. In the same way, we can explain the relevant reading of (26b) by assuming that the function mapping each man to a singleton woman-set for him is the function mapping each man to the singleton set containing his mother as its unique member.

Motivated by these considerations, I propose that indefinites have an inherent argument slot, which can be bound by another quantifier in the sentence, and which can make the domain restriction dependent on this quantifier.[12] Schwarzschild assumes that the dependency of the domain restriction is pragmatically derived without linguistic encoding, but I assume that indefinite noun phrases are lexically equipped with this extra argument slot, in order to compositionally derive the required dependency relations in the logical forms. I start with the sentence in (27a). (27b) represents the reading in question.

(27) a. Every boy_1 respects a (certain) man (– his_1 father).
b. $\forall x[\text{boy}'(x) \rightarrow \exists y[\text{sg}'(\text{man}')(x)(y) \wedge \text{respect}'(y)(x)]]$

In (27b), **sg′** is of type ((et)(e(et))) and it has three arguments: **man′**; ***x*** ; ***y*** in this order. **sg′** denotes a function that maps a set of men to another function which then maps each boy ***x*** to a singleton *man*-set.[13] That is, the function denoted by **sg′** maps the set of men to a possibly different singleton set for *each boy* ***x***. In other words, **sg′** enables us to restrict the domain of the *man*-set to a singleton set differently for each ***x***.

[11] Winter (2004) uses a similar argument to support his Skolem function analysis of indefinites.

[12] I do not discuss either a generic indefinite or an indefinite in a non-argument position, though I give some preliminary suggestion about the latter in terms of my proposal.

[13] In the formal section, I slightly change the type of the extra argument slot of indefinites. See (31e) and the following text.

Following Jacobson (1999), if the nominal restriction of the indefinite noun phrase has a pronoun in it, the semantic type of the logical expression for the nominal restriction is (e(et)), rather than (et), which is for a nominal restriction without a pronoun. In Winter's sentence (10a), repeated here as (28a), the nominal restriction *woman he knows* is paired with the logical expression $\boldsymbol{\lambda x.\lambda y.}$**[woman′($\boldsymbol{y}$) & know′($\boldsymbol{y}$)($\boldsymbol{x}$)]** of type (e(et)), where the pronoun *he* introduces an extra argument slot $\boldsymbol{x}$.[14] Because the type of **sg′** is of ((et)(e(et))), we cannot use a simple function application to merge the two expressions. We need to use a Geach Combinator (which we see shortly) to merge **sg′** with the nominal restriction. For lack of space, I do not show a derivation for this, but the idea is that the extra argument slot introduced by the pronoun can be percolated into a later stage of derivation separately from the inherent argument slot encoded with *a certain.* If these two extra argument slots are bound by the same quantifier, we get the reading in question: (10b). The normalized interface logical form in (28b) represents this reading.

(28) a. Every boy$_1$ who hates [$_{NP}$ *a (certain) woman* he$_1$ knows] will develop a serious complex.

b. $\forall x$[[boy´(x) & $\exists y$[sg´(λz.[woman´(z) & know´(z)(x)])($\boldsymbol{x}$)(y) & hates´(y)(x)]] $\rightarrow$ develop_a_complex´(x)]

The logical form in (28b) means that, given a set of women each boy $\boldsymbol{x}$ knows, we can map it to a different singleton set for each $\boldsymbol{x}$, even if every boy happens to know exactly the same set of women. In (28b), the highlighted second argument $\boldsymbol{x}$ of **sg´** marks the dependency of the domain restriction on $\boldsymbol{x}$.

The external argument $\boldsymbol{x}$ in the formula **know′($\boldsymbol{z}$)($\boldsymbol{x}$)** corresponds to the bound pronoun *he***.** In (28b), this $\boldsymbol{x}$ is also bound by the same quantifier that binds the highlighted $\boldsymbol{x}$, which is the second argument of **sg′**, but this does not have to be the case. These two argument slots can be bound by different operators. See the example (49) on page 397 for one motivation for this formulation. Notice that, unlike in Winter's logical form in (15), the binding relation between the universal quantifier and the bound pronoun *he* is directly represented in (28b).

As in Schwarzschild's analysis, the phrase *a certain* changes the set to a singleton set. This forces a specific reading, but this specificity can be relativized because of the inherent argument slot of the indefinite. The indefinite *a boy* without the word *certain* still has this inherent argument slot, but there is no linguistic singleton set requirement. We can still optionally restrict the domain to a singleton set by using pragmatics. Then the identity of this singleton set can be dependent on the inherent argument slot. But normally, the domain restriction relativization is not noticeable with indefinite noun phrases without *a certain* because the domain is usually not restricted to a singleton set with this type of indefinites. With this normal type of indefinites, the domain is usually restricted to a set that still contains several members. This is why we tend to get the exhaustive reading when this type of indefinites appears in the nominal restriction of a universal noun phrase. In order to restrict the domain to a singleton and get an exceptional wide scope reading,[15] we need a special pragmatic context. Some speakers never get an exceptional scope reading with the normal

[14] This logical expression is the same as (14) in Winter's Skolem function analysis. However, unlike Winter's Skolem function, **sg′** has an inherent argument slot, independent of the argument slot introduced by the pronoun.

[15] For convenience, I keep on using this expression, even though I follow Schwarzschild in that this reading is not a matter of quantificational scope.

indefinite *a boy*. I suppose this is because the existence of the more specific expression *a certain boy* blocks the application of the pragmatic domain restriction to a singleton set.

While the linguistic information introduces the domain restriction, how the domain is restricted in a particular use of such a sentence is a matter of pragmatics. I will not discuss the pragmatic process in detail. But roughly, when the indefinite *a certain woman* is used or when the indefinite *a woman* is interpreted specifically, the hearer assumes that the speaker must have some evidence in mind which supports the set being restricted to a singleton set. If the speaker knows who the singleton member of the set is, it counts as good evidence, and so the hearer often has the impression that the speaker must know who the singleton member is. The supporting evidence does not have to be a specific individual; it can be a specific relation. The linguistic meaning says that there is a certain relation holding between an element binding the inherent argument slot of the indefinite and the resultant singleton member of the woman set. A particular relation that the hearer takes the speaker to have in mind can count as a ground supporting the singleton domain restriction. It might be the son-mother relation as in (26b).

In this section, I argued that the indefinite is lexically equipped with an inherent argument slot on which the domain restriction is dependent. Unlike Winter's analysis, this theory does not require an existential closure in syntax. And the logical form directly represents the binding relation between the quantifier and the pronoun bound by it.

In the next section, I show a derivation of a logical form of a simple English sentence that has an indefinite NP in order to show how the inherent argument slot with the indefinite can be compositionally percolated until a later stage of derivation and then get bound by a c-commanding operator.

7. Formal analysis

7.1. Categorial Grammar and derivation of logical forms

Following Categorial Grammar theories as in Jacobson (1999) or Steedman (2000), I assume a Grammar derivation pairs a phonological string with a logical form. More specifically, each lexical item has three entries.

(29) lexical item: <*phonological form*; syntactic category; logical expression>

For example, the three entries for the lexical item *boy* are: <*boy* ; N ; $\text{boy}'_{\mathbf{et}}$>.

I follow Jacobson's notation for syntactic categories in Jacobson (1999). The functor category $X/_RY$ selects the category Y to the right and the result category after the merge is X. The category $X/_LY$ is merged with the category Y to the left, and the result is the category X**.**

There is a systematic mapping between syntactic categories and semantic types. But the mapping is not necessarily one to one. Both $S/_LNP$ for an intransitive verb (e.g. *smoke*) and N for a common noun (e.g. *boy*) correspond to the type (et). NP for *Tom* corresponds to the type e. I assume that referential noun phrases are lexically type e with the category NP, while quantificational noun phrases (QNPs) have a lexically higher order type with the corresponding syntactic category, which I show later.

Adjacent items are successively combined based on their syntactic categories, and when all the lexical items given by the lexical insertion are used up, a logical form is derived at the sentential node.

Categorial Grammar derivations should ideally be represented so that we can check how all three entries of lexical items are combined into bigger chunks, but for lack of space, I only show the derivations of syntactic categories and logical expressions. The resultant logical forms are the grammar–meaning interface representations, which will then enter into pragmatic inferences.

7.2. Derivations

I show a detailed derivation of a sentence in (30), which is simpler than Winter's sentence in (10a). For lack of space, I do not give a derivation of Winter's sentence in (10a), but I give a rough idea about how we can apply the system to that sentence at the end of this sub-section.

(30) Every boy loves a certain girl.

(31) a. *girl*: <*girl* ; N ; $\lambda x_{e.}\mathrm{girl}'_{et}(x)$>
b. *boy*: <*boy* ; N ; $\lambda x_{e.}\mathrm{boy}'_{et}(x)$>
c. *love*: <*love* ; $((S/_{L}NP)/_{R}NP)$ {or TV} ; $\lambda x_{e.}\lambda y_{e.}\mathrm{love}'_{e(et)}(x)(y)$>
d. *a*: <*a* ; $N^{U}/_{R}N$; $\lambda B_{et.}\,\lambda u_{\tau.}\,\lambda x_{e.}\,\mathrm{a}'_{(et)(\tau(et))}\,(B)(u)(x)$>
e. *a certain*: <*a certain* ; $N^{U}/_{R}N$; $\lambda B_{et.}\,\lambda u_{\tau.}\lambda x_{e.}\,\mathrm{sg}'_{(et)(\tau(et))}\,(B)(u)(x)$ >
f. *every* (Nom): <*every* ; $(S/_{R}(S/_{L}NP))/_{R}N$; $\lambda A_{et.}\lambda B_{et.}\,\forall x_{e}[A(x) \rightarrow B(x)]$>
g. *some**(Acc):<∅ ;$((S/_{L}NP)/_{L}TV)/_{R}N$; $\lambda A_{et.}\lambda P_{e(et).}\lambda x_{e.}\exists y_{e}[A(y)\ \&\ P(y)(x)]$>

The words to the left of the colons are the lexical items. Each lexical item has three entries as in (29). I have put elaborated lambda expressions such as $\boldsymbol{\lambda x.\lambda y.\mathrm{love}'(x)(y)}$, rather than the equivalent η reduced form, **love′**, in order to make it easier for the semantics to be checked.

I first explain the quantificational determiner entries, and then the indefinite entries. The determiner *some** in (31g) has a null phonological entry (∅ means null). This item is inserted into a syntactic derivation as a sister of the indefinite *a (certain) girl*. The reason I do not encode the existential quantifier in (31g) into the meaning of the indefinite article *a* itself is that an indefinite noun phrase can be interpreted non-existentially, for example as a predicate in the copula construction or as generic.

Whether I associate the extra argument slot of indefinites with *some** or *a (certain)* depends partly on whether we can get the dependent specific reading for an indefinite noun phrase in a non-argument position as well. Consider (32).

(32) a. Every boy mistakenly believed that Mary was a certain woman.
b. Every boy mistakenly believed Mary to be a certain woman.

Can we pick out a different woman for each boy with the indefinites in these predicative positions? Though the judgment is subtle, I understand that the identity of the woman can co-vary with each boy in (32), which suggests that we need to associate the inherent argument slot with *a (certain)*.

(31f) and (31g) are for the subject QNP and the object QNP respectively. TV in (31g) (and in (31c)) is used for notational convenience only, in order to represent the transitive verb category $((S/_{L}NP)/_{R}NP)$.

We need to explain an asymmetry between subject position and object position in terms of the domain-restriction dependency. For example, in (33), the domain restriction of the indefinite in the subject position does not seem to be able to be dependent on the universal quantifier in the object position so easily.

(33) a. A certain woman loves every boy.
b. *? For each boy ***x***, ***x*** is loved by ***x***'s mother (for example).

(33a) does not easily get the reading (33b). In the system that I show below, the extra argument slot of **sg′** associated with the indefinite *a certain woman* can only be bound by a quantifier that is merged later in the derivation. In non-Categorial grammar terminology, this means that the extra argument slot can only be bound by a c-commanding operator. The question is what happens when we apply to the universal quantifier *every boy* in (33a) a mechanism that is equivalent to QR to allow the universal to take scope over the subject position. But then we would expect a weak cross over effect when this universal NP 'crosses over' the extra argument slot introduced by the subject indefinite, if the universal binds this extra argument slot. It would be the same kind of effect as we observe in (34b)[16]

(34) a. Who does every boy_1 love? – His_1 mother.
b. ??Who loves every boy_1? – His_1 mother.

We would expect that (33b) as a reading of (33a) is comparable to (34b). That is, this reading would be difficult to get, but it would not be totally impossible. Some speakers of English do accept reading (33b) in the right context, which might support the hypothesis that the indefinite introduces an extra argument slot. I do not go into detail here for lack of space, but the interaction between the extra argument slot of indefinites and the scope-taking mechanism of strong quantifiers is certainly worth more research.

Getting back to (31e), the logical expression **sg′** for *a certain* is of the type ((et)(τ(et))), where **sg′** denotes a function I explained for (27) and (28). The type τ is an underspecified basic semantic type for the extra argument slot of the indefinite. This slot is usually bound by a quantifier over individuals (e.g. *every boy*) and so τ is usually instantiated as type e. But sometimes the tense operator might bind this argument slot, as we see in section 8.2. This is why I keep the type τ under-specified so that I can cover all the possible binders of the extra argument slot of indefinites. The expression **sg′(woman′)** is of type (τ(et)) and this denotes a function that maps an entity ***u*** to a singleton woman set for ***u***.[17] The singleton woman set can co-vary with ***u***, but because **sg′(woman′)** denotes the same function for every ***u***, we cannot simply map ***u*** to whichever singleton set it is. This explains why one fixed relation has to hold between each boy and the woman for him in the reading (10b) of Winter's example.

The extra argument slot ***u*** of the indefinite corresponds to the superscript U in $\mathrm{N}^{\mathrm{U}}/_{\mathrm{R}}\mathrm{N}$ in the syntactic category. U is normally instantiated as NP, but I keep it underspecified along with its semantic type τ for the reason I explained in the preceding paragraph.

The indefinite article *a* on its own is of type ((et)(τ(et))) and has the inherent argument slot ***u***, but unlike **sg′**, the expression **a′** does not assign a singleton requirement to the input set. Only when pragmatics restricts the domain to a singleton is the expression **a′(woman′)** interpreted as a function that maps an individual ***u*** to ***u***'s singleton set.

An explanation is required for the syntactic category with a superscript category: N^{X}, where X is used as a category variable for notational convenience. Jacobson (1999) assumes that a pronoun like *he* or *she* has the semantic type (ee): **λ*x*.*x***, denoting an identity function from individuals to individuals. The syntactic category of pronouns is $\mathrm{NP}^{\mathrm{NP}}$. $\mathrm{NP}^{\mathrm{NP}}$ is different from $\mathrm{NP}/_{\mathrm{L}}\mathrm{NP}$ or $\mathrm{NP}/_{\mathrm{R}}\mathrm{NP}$, though the three categories would have the same semantic type:

[16] I would like to thank an anonymous reviewer for pointing this out and for suggesting the examples in (34).
[17] I discuss the constant status of **sg′** in the sub-section 8.3.

(e,e). Because the syntactic categories determine a merge, we cannot merge NP^{NP} with an argument category NP, even though the semantic types of the two categories match. We need to apply a combinator to the functor category $X/_L NP$ or $X/_R NP$ first, before we merge the result with NP^{NP} as argument. If we want to percolate the super-script category till a later stage of derivation, then we apply Jacobson's Geach combinator **g** to $X/_L NP$ (or $X/_R NP$) to derive the functor category $X/_L NP^{NP}$ (or $X/_R NP^{NP}$).[18] If we want to bind (or identify) this super-script category with another argument category of the functor category (e.g. X in $X/_R NP$ might have another argument as in $(S/_L NP)/_R NP$), then we can apply Jacobson's 'binding' combinator **z**. The super-script category U of indefinites can either be percolated or bound/identified in the same ways.

I first show Jacobson's Geach combinator **g**. I use the underspecified super-script category U in the definitions of the **g** and **z** combinators for convenience.

(35) a. Syntax: $\mathbf{g}\,(Y/X) = Y^U/X^U$.
b. Semantics: If $\boldsymbol{f}$ is a function of type (a,b) then $\mathbf{g}(\boldsymbol{f})$ is a function of type ((u,a),(u,b)), where $\mathbf{g}(\boldsymbol{f}) = \lambda V_{(u,a).}[\lambda U_{u.}[\boldsymbol{f}\,(V(U))]_b]$. (Jacobson 1999:138)

Because I uniformly defined QNPs as functors over verbs, rather than treating QNPs as argument of verbs, I modify Jacobson's combinator **g**, so that it can be applied to QNPs.

(36) a. Syntax: $\mathbf{g^q}((X/_R(X/_L NP))/_R N) = (X^U/_R(X/_L NP))/_R N^U$,
$\mathbf{g^q}\,((X/_L(X/_R NP))/_R N) = (X^U/_L(X/_R NP))/_R N^U$,
where X is either $S(/_L...)$ or $S(/_R...)$, and U is some category.
b. Semantics: $\mathbf{g^q}(\lambda A_{et.}\lambda P^n{}_{e(e1\ldots(en,\,t)).}\,\lambda x_{e1}\ldots\lambda x_{en.}\,\exists x_e[A(x)\ \&\ P^n(x)(x_1)\ldots(x_n)])$
$= \lambda A^1{}_{\tau(et).}\lambda P^n{}_{e(e1\ldots(en,\,t)).}\,\lambda v_{\tau.}\lambda x_{e1\ldots}\lambda x_{en.}\,\exists x_e[A^1(v)(x)\ \&\ P^n(x)(x_1)\ldots(x_n)]$
(E.g., if we deal with a subject QNP, P^0 is of type (et) for $S/_L NP$.)

If we apply $\mathbf{g^q}$ to *some** in the object position, then we get the following.

(37) Syntax: $\mathbf{g^q}(((S/_L NP)/_L TV))/_R N) = ((S/_L NP)^U/_L TV)/_R N^U$

Semantics: $\mathbf{g^q}(\lambda A_{et.}\lambda P_{e(et).}\,\lambda y_{e.}\exists x_e[A(x)\ \&\ P(x)(y)]) =$
$\lambda A^1{}_{\tau(et).}\lambda P_{e(et).}\,\lambda v_{\tau.}\lambda y_{e.}\exists x_e[A^1(v)(x)\ \&\ P(x)(y)]$

The result category $((S/_L NP)^U/_L TV)/_R N^U$ in (37) percolates the extra argument slot in its first argument category N^U across the verb category TV onto the output category $(S/_L NP)^U$, when the QNP is merged with the transitive verb. In this respect, even though I percolate the extra argument slot of the nominal restriction by means of the quantificational determiner category, the operation still preserves the basic mechanism of Jacobson's original **g** combinator, which compositionally transmits this argument slot via the TV category.

I could have applied Jacobson's original **g** in (35) to the quantificational determiner *some**, so that an extra-argument slot of type τ, which is introduced by *a (certain)*, is percolated to the QNP level (i.e. $[_{QNP^U}$ *some**$[_{N^U}$ *a certain* $[_N$ *girl*]]]). Then I could have raised the type of the corresponding argument of the transitive verb so that the verb could take in a QNP as an

[18] A recursive use of the combinator is required to combine a function containing a pronoun with an argument containing another pronoun, like combining *his teacher* with *likes her husband* in *John₁ said that [his₁ teacher]₂ likes her₂ husband.* In my treatment of the indefinite, this corresponds to a sentence like *Every boy who hates a certain woman will have a certain problem.* I do not deal with a complex example like that in this paper.

argument.[19] After that, I could have either applied Jacobson's original **g** to this argument-raised verb to further percolate the extra-argument slot of type τ in the argument $\mathrm{QNP}^{\mathrm{U}}$, or I could have used Jacobson's original **z** combinator (which I explain later) on this argument-raised verb without modifying it, so as to bind this extra-argument slot at the next stage of the derivation. However, the original intuition about the super-script category U is that the category X^{U} behaves exactly like the category X in its combination possibilities with another category**,** except for the operations required to derive the binding/dependency relation between the lexical item that introduces this U category and the category that acts as the binder of this extra argument slot. The **g** and **z** operators are used specifically for fixing this binding/dependency relation, so it is architecturally understandable that the existence of an inherent argument slot triggers the use of these operators. But it seems odd to apply argument raising to a verb and change the argument-functor relation between the verb and a QNP just because of the existence of this U superscript category.[20]

On the other hand, the modifications of the **g** operator above and the **z** operator below do not really change the original definition of these operators. The basic idea of fixing the binding relation between subject position and object position through a mediating verb is preserved in my modifications. In that sense, the modified operators could be interpreted as simply an applicational variant of the original operators.

For Jacobson, a superscript category can technically be any syntactic category but I limit it to a category that originates as a superscript in a lexical category, like NP in $\mathrm{NP}^{\mathrm{NP}}$ for a pronoun *he* or U in $\mathrm{N}^{\mathrm{U}}/_{\mathrm{R}}\mathrm{N}$ for the indefinite *a* (*certain)*. The corresponding semantic types are **e** and $\boldsymbol{\tau}$, where $\boldsymbol{\tau}$ is a polymorphic type that is usually instantiated as type **e**, as we have seen.

With this modified Geach rule, the object QNP can then be merged with a normal transitive verb category and carry the extra argument slot over until the VP category gets merged with the subject QNP.

As I said above, I re-formulate Jacobson's binding operator **z**.

(38) a. Syntax: $\mathbf{z^q}(\mathrm{S}/_{\mathrm{R}}(\mathrm{S}/_{\mathrm{L}}\mathrm{NP})) = \mathrm{S}/_{\mathrm{R}}(\mathrm{S}/_{\mathrm{L}}\mathrm{NP})^{\mathrm{U}}$

b. Semantics: $\mathbf{z^q}_{((et)t)\,((\tau(et))t)} \stackrel{\text{def}}{=} \lambda Q_{(et)t.}\ \lambda R^1{}_{\tau(et).}\ Q(\lambda x.R^1(x)(x))$

e.g. we can get $\lambda R^1{}_{\tau(et).}\forall \mathrm{x}_{\mathrm{e}}[\mathrm{boy}'(x) \rightarrow R^1(x)(x)]$ for $\mathbf{z^q}$(*every boy*).

c. $\mathbf{z^0}$ Syntax: $\mathbf{z^0}\ ((\mathrm{S}/_{\mathrm{L}}\mathrm{NP})/_{\mathrm{R}}\mathrm{NP}) = (\mathrm{S}/_{\mathrm{L}}\mathrm{NP})/_{\mathrm{R}}\mathrm{NP}^{\mathrm{NP}}$

d. $\mathbf{z^0}$ Semantics: $\mathbf{z^0}_{\ (e(et))((ee)(et))} \stackrel{\text{def}}{=} \lambda R^1{}_{e(et).}\lambda f_{ee.}\lambda_{e.}R^1(f(x))(x)$

(c,d: cf. Jacobson 1999:132)

(38c) and (38d) are a particular instantiation of Jacobson's original **z**. $\mathbf{z^0}$ is for a transitive verb when there is one bound pronoun in the object NP. When we deal with an indefinite without any (bound) pronoun in it, I do not use the type (e,e) expression $\boldsymbol{f_{ee}}$ to derive the extra-argument slot of the indefinite. And as I explained before, when we merge a transitive verb with its object QNP, it is the object QNP that is the functor and the transitive verb is the

[19] See Hendriks (1987) for a system that uses argument raising, as well as argument lowering and value raising, to explain the scope ambiguity and some other phenomena.

[20] This is based on the assumption that a QNP is normally merged as a functor applied to a verb as its argument. See Dowty (1988) for a treatment of a QNP in an object position as a function taking in the verb category as an argument. Alternatively, I could have assumed that a QNP is normally merged as an argument of a verb, whether it appears in the subject position or in an object position. Then I could have used Jacobson's original combinators without modification. I leave this alternative formulation for further research.

argument of the QNP. So I modify **z** for the subject QNP.[21] An important point is that this binding operator is applicable only when the input argument has the super-script category U (or NP), as in the VP category with the superscript: $(S/_L NP)^U$. This means there is either a bound pronoun or the indefinite *a (certain)* in the nominal restriction of the object (Q)NP.

I show a derivation for (30): *Every boy loves a certain girl*. First I compose a nominal restriction set. At the end of a horizontal line, **fa** is forward function application. **ba** is backward function application. **D** means that I have omitted the derivation from the lexical level up to that stage of the derivation.

(39) Syntax:

$$\dfrac{\dfrac{\text{a certain}}{N^U/_R N} \quad \dfrac{\text{girl}}{N}}{N^U}\,\text{fa}$$

Semantics:

$$\dfrac{\dfrac{\text{a certain}}{\lambda B_{et}.\lambda u_\tau.\lambda x.\text{sg}'(B)(u)(x)} \quad \dfrac{\text{girl}}{\lambda x.\text{girl}'(x)}}{\lambda u.\lambda x.\text{sg}'(\text{girl}')(u)(x)}\,\text{fa}$$

Remember that u_τ corresponds to the superscript category **U** and this position is compositionally transmitted into later stages of the derivation until some element binds it. **sg′** is of type ((et)(τ(et))). At the last line of the semantic derivation in (39), the lambda expression $\lambda x.\text{girl}'(x)$ is η reduced to **girl′**. Both are of type (et) and they are logically equivalent.

(40) Syntax:

$$\dfrac{\dfrac{\mathbf{g^q}\ (\text{some*})}{((S/_L NP)^U/_L TV)/_R N^U} \quad \dfrac{\text{a certain girl}}{N^U}\,\text{D}}{((S/_L NP)^U/_L TV)}\,\text{fa}$$

(41) Semantics:

$$\dfrac{\dfrac{\mathbf{g^q}(\text{some*})}{\lambda A^1_{\tau(et)}.\lambda P_{e(et)}.\lambda v_\tau.\lambda z.\exists y[A^1(v)(y)\ \&\ P(y)(z)]}\,\text{D} \quad \dfrac{\text{a certain girl}}{\lambda u.\lambda x.[\text{sg}'(\text{girl}')(u)(x)]}\,\text{D}}{\dfrac{\lambda P.\lambda v.\lambda z.\exists y[\lambda u.\lambda x.[\text{sg}'(\text{girl}')(u)(x)](v)(y)\ \&\ P(y)(z)]}{\lambda P.\lambda v.\lambda z.\exists y[\text{sg}'(\text{girl}')(v)(y)\ \&\ P(y)(z)]}\,\beta\ \text{reduction}}\,\text{fa}$$

In (41), there are two applications of β reduction on the last line: v fills out the u argument slot and y fills out the x argument slot. The inherent argument slot u encoded with *a certain girl* is inherited as v, after the merge with the phonologically null existential quantifier *some**, through use of the Geach combinator $\mathbf{g^q}$.

Next, we merge this result with a transitive verb *loves*.

[21] In order to allow the first object to bind a pronoun in the following object position in a ditransitive verb construction, I would need to define **z** for an object QNP as well, while still disallowing an object QNP to bind a pronoun in the subject. The current definition correctly prohibits the subject quantifier from binding a pronoun in its own nominal restriction by using the **z** combinator.

(42) Syntax:

$$\dfrac{\dfrac{\text{love}}{TV} \qquad \dfrac{\textbf{g}^{\textbf{q}}\ (\text{some*})\ \textit{a}\ \text{certain girl}}{(S/_{L}NP)^{U}/_{L}TV}\,D}{(S/_{L}NP)^{U}}\,ba$$

(43) Semantics:

$$\dfrac{\dfrac{\dfrac{\text{love}}{\lambda m.\lambda n.\mathrm{love}'(m)(n)} \qquad \dfrac{\textbf{g}^{\textbf{q}}\ (\text{some*})\ \textit{a}\ \text{certain girl}}{\lambda P_{e(et)}.\lambda v_{\tau}.\lambda z.\exists y[\mathrm{sg}'(\mathrm{girl}')(v)(y)\ \&\ P(y)(z)]]}\,D}{\lambda v.\lambda z.\exists y[\mathrm{sg}'(\mathrm{girl}')(v)(y)\ \&\ \lambda m.\lambda n.[\mathrm{love}'(m)(n)](y)(z)]]}\,ba}{\lambda v.\lambda z.\exists y[(\mathrm{sg}'(\mathrm{girl}'))(v)(y)\ \&\ \mathrm{love}'(y)(z)]]}\,\beta\ \text{reduction}$$

Again, there are two applications of β reduction on the last line. Lastly, we let the subject quantifier bind both the $\boldsymbol{v}$ and $\boldsymbol{z}$ positions, by using the $\mathbf{z^q}$ combinator.

(44) Syntax:

$$\dfrac{\dfrac{\dfrac{\text{Every boy}}{S/_{R}(S/_{L}NP)}\,D}{S/_{R}(S/_{L}NP)^{NP}}\,\mathbf{z^q} \qquad \dfrac{\text{loves a certain girl}}{(S/_{L}NP)^{U}}\,D}{S}\,fa$$

In (44), the underspecified category U is instantiated as NP, and the concatenation is successful. In the same way, in (45), the underspecified argument slot $\boldsymbol{v}$ of type τ is filled out by the variable $\boldsymbol{m}$ of type e, which is then bound by the universal quantifier. The external argument slot $\boldsymbol{z}$ of the verb **love′** is also filled out by ***m*****,** which again is bound by the universal quantifier.

(45) Semantics:

$$\dfrac{\dfrac{\dfrac{\dfrac{\text{Every boy}}{\lambda B_{et}.\forall m[\mathrm{boy}'(m) \rightarrow B(m)]}\,D}{\lambda B^{1}_{e(et)}.\forall m[\mathrm{boy}'(m) \rightarrow B^{1}(m)(m)]}\,\mathbf{z^q} \qquad \dfrac{\text{loves a certain girl}}{\lambda v_{\tau}.\lambda z.\exists y[\mathrm{sg}'(\mathrm{girl}')(v)(y)\ \&\ \mathrm{love}'(y)(z)]}\,D}{\forall m[\mathrm{boy}'(m) \rightarrow (\lambda v.\lambda z.\exists y[\mathrm{sg}'(\mathrm{girl}')(v)(y)\ \&\ \mathrm{love}'(y)(z)])(m)(m)]}\,fa}{\forall m[\mathrm{boy}'(m) \rightarrow \exists y[(\mathrm{sg}'(\mathrm{girl}'))(m)(y)\ \&\ \mathrm{love}'(y)(m)]]}\,\beta\ \text{reduction}$$

The β reduced logical form in the bottom line in (45) says that for each boy $\boldsymbol{m}$, there is a possibly different singleton girl-set, and $\boldsymbol{m}$ loves the singleton member $\boldsymbol{y}$ of that set. For lack of space, I do not show the derivation for Winter's sentence in (10a), repeated here as (46).

(46) Every boy$_1$ who hates [$_{NP}$ *a (certain) woman* he$_1$ knows] will develop a serious complex.
(cf. Winter 2001:116)

The mechanism is essentially the same. The bound pronoun *he* is lexically interpreted as identity function of type (e,e) as in Jacobson (1999).

(47) *he:* <*he* ; NP^{NP} ; $\lambda x.x$>

The pronoun introduces another argument slot (which is of type e) on top of the one introduced by the indefinite *a certain* (which is of type τ). By using a Geach combinator, these two extra argument slots can be separately percolated to later stages of derivation and can be bound by either the same operator or by different operators (see section 8.1. for some motivation for this assumption). I leave the details for another paper.

In this section, I showed a sample derivation of a simple logical form based on my proposal. In the next section, I mention some extensions of the domain restriction analysis with an extra argument slot.

8. Extensions (Speculation)

8.1. Multiple binding

Jacobson's **g** combinator allows us to accumulate more than one extra argument slot into the output categories, to deal with multiple bound pronouns appearing in a sentence.

(48) Every father$_1$ [$_{VP}$ told [his$_1$ son]$_2$ [$_{CP}$ that he$_1$ would buy him$_2$ a present]].

At the derivational stage of the embedded CP, the composed logical form should be of the type (e(et)) with the syntactic category $(S^{NP})^{NP}$. One of the pronouns inside the embedded CP (i.e. *him*$_2$) gets bound before the matrix VP is completed, but by the matrix VP level, we have another bound pronoun and at that level, there are again two extra argument positions. After that, both of them get bound by the subject QNP *every father.* So nothing in this mechanism should stop the different extra argument slots introduced by the indefinite *a (certain)* and a bound pronoun remaining separate arguments until a later stage of derivation. Then the subject universal quantifier can bind both of them at the same time.

Do we need a 'wide scope' specific reading in which the extra argument slot introduced by the pronoun and the type τ argument slot with the indefinite *a (certain)* are bound by different operators in the sentence? Consider (49).

(49) Every psychiatrist says that every child$_1$ who hates a certain woman he$_1$ knows will develop a complex.

Does the relation between each child and the woman ***x*** have to be the same for all the psychiatrists? It is not easy to get the reading: *For each psychiatrist, there is a possibly different relation holding between each child and the woman concerned*, but this might be due to difficulty processing the complex sentence.

It is possible to formulate the theory in a way such that whenever some pronoun in the nominal restriction gets bound, the extra argument slot introduced with the indefinite also has to be bound. But I do not see a strong reason to add that extra condition, so I just assume that a further percolation of the indefinite argument across the universal *every child* in (49) is linguistically possible, but because it is pragmatics that actually restricts the domain within that linguistic information, relativizing the domain restriction both to a bound pronoun and to an inherent indefinite argument is quite difficult, as a matter of non-linguistic interpretation.

8.2. Wide scope indefinites: bound by the tense operator?

In order to explain the reading corresponding to the inverse scope reading of the indefinite, I need to have the extra argument slot of the indefinite bound by an element other than a quantifier in a QNP. One candidate might be the tense operator that can be higher than the subject QNP in the syntactic structure.

(50) a. Every boy loves a certain girl. (Inverse scope: *a certain* > *every*)
b. $\exists t_{\sigma}[\mathrm{G}'_{(\sigma,t)}(t)\ \&\ \{\forall x[\mathrm{boy}'(x) \rightarrow \exists y[(\mathrm{sg}'(\mathrm{woman}'))(x)(y)\ \&\ \mathrm{love}'(y)(x)]]\}_{(\sigma,t)}(t)]$[22]
c. $\exists t_{\sigma}[\mathrm{G}'_{(\sigma,t)}(t)\ \&\ \{\forall x[\mathrm{boy}'(x) \rightarrow \exists y[(\mathrm{sg}'(\mathrm{woman}'))(t)(y)\ \&\ \mathrm{love}'(y)(x)]]\}_{(\sigma,t)}(t)]$

However, the tense operator does not always take wide scope over the subject quantifier.

(51) a. Every kid ran.
b. A friend often came to see Tom in London. (cf. Carpenter 1994: 3)[23]

(51a) has a reading in which each kid ran at a possibly different time, and (51b) has a reading in which one and the same friend visited Tom many times. This does not necessarily stop us from using the tense operator to explain the wide scope of the indefinite over another QNP, as long as the tense operator can at least sometimes take the widest scope, but the issue requires further research in terms of the interaction of the scopes of QNPs and the tense or some other operators that can bind the extra argument slot of indefinites.

8.3. The constant sg′

The treatment of **sg′** as a constant expression needs some more consideration. In (52) below, the hearer is usually not expected to know the identity of the specific relationship that is supposed to hold between every pair of a boy and the man for him, even though the father-son relationship is a possible relation that the speaker can have in mind, as is shown in the parentheses to the right of the sentence.

(52) Every boy$_1$ respects a (certain) man (that is, his father$_1$).

The function denoted by **sg′(man′)** can map an individual ***x*** to the same singleton set that the function denoted by **λ*x*.the_father_of′(*x*)** does, where the second function maps an individual ***x*** to the singleton set that contains the father of ***x*** as its unique member. But this is not always the case. In a different context, **sg′(man′)** should also be able to denote a function that maps an individual ***x*** to the same singleton set that the function denoted by **λ*x*.the_maternal_grandfather_of′(*x*)** does. The functor **sg′** is like a constant in that it does not scopally interact with other quantificational elements, but it is like a variable in that its denotation is not rigidly fixed with regard to a model, as the denotations of standard constants are. I briefly discuss four candidate solutions to fix this problem.

First, it is not clear whether we have to assume that **sg′(man′)** and **λ*x*.the_father_of′(*x*)** are logically equivalent in order to enable them to denote functions that map the same individuals to the same singleton sets in some context. In the denotational definition of a function, two functions are identical if they map exactly the same inputs to exactly the same outputs. But a little modification might solve the problem. For example, we could modify **sg′**

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[22] **{ }(t)** is a notational device that shows that the logical expression in **{ }** is a function from a time ***t*** to a proposition**.** σ is a type for an expression denoting a tense. **G′** is some constant like **Present′, Past′**, etc.
[23] The page number is of the electric version. I have failed to find the page numbers of the journal version.

so that **sg′(man′)** denotes a function that maps an individual ***x*** to another function that maps a situation ***s*** to a singleton *man*-set for ***x*** in ***s***. The resultant expression **sg′(man′) (*x*) (*s*)** would then denote a singleton *man*-set that can co-vary with each person ***x*** and with each situation ***s***. The domain restriction of a nominal restriction set is hugely context-dependent, which supplies some motivation for assuming a situation argument of the domain restriction operator. But assuming an argument slot for a situation as well as the type τ argument slot makes the formalism even more complex, and requires further empirical justification. I could make the interpretation of **sg′** dependent on a situation after syntax, by using a formal semantic system as in Barwise & Cooper (1991). But I do not think that assuming another formal level of representation on top of syntax is well-motivated enough at the moment, even if it helps make the syntax simpler.

As a second solution, we could assume some logical expressions that act as a kind of place-holder for a constant expression, or to assume underspecified constant expressions, like arbitrary individuals in Fine (1985), though in the case in question, the expression **sg′** is not a basic type. Arguably, there might be more natural language expressions that should be treated as 'arbitrary constants.' But this requires further empirical justification. And this solution changes the basic definition of a logical language in some sense, which we might want to avoid if we can help it.

Thirdly, I could redefine **sg′** as a variable, say, **g**, and apply an existential closure to this variable only at the highest position of the structural representation, as in (53).

(53) $\exists g[\mathrm{singleton}'(g)\ \&\ \forall x[\mathrm{boy}'(x) \rightarrow \exists y[g(\mathrm{man}')(x)(y)\ \&\ \mathrm{respect}'(y)(x)]]]$
g: ((et)(τ(et))), singleton′: (((et)(τ(et)))t)

This existential closure operation is not introduced at an intermediate stage of a syntactic derivation and because of this, we could assume that this operation is introduced after syntax. This existential closure might be applied to all the variables that have failed to be bound by any operators in the syntax, for some reason connected with interpretation. But even if we justified the existential closure operation in this way, we would still need to associate the property denoted by **singleton′** with the existential closure operator, as we saw in (19), which might go against the spirit of semantic compositionality, as we have already seen.

The fourth candidate solution is to associate the super-script category and the inherent argument slot with the nominal restriction, rather than the expression *a (certain)*. The normalized logical form for (52) would then be as in (54), with the modified lexical entries.

(54) a. $\forall x[\mathrm{boy}'(x) \rightarrow \exists y[\mathrm{sg}_2'(\mathrm{man}_2'(x))(y)\ \&\ \mathrm{respect}'(y)(x))]]$
b. man_2: <*man* ; N^{U} ; $\lambda x.\lambda y.\mathrm{man}_2'(x)(y)$>
c. *a certain*: <*a certain* ; $\mathrm{N/_{R}N}$; $\lambda B_{et.}\lambda x_{e.}\ \mathrm{sg}_2'_{(et)(et)}(B)(x)$>
d. *a*: <*a* ; $\mathrm{N/_{R}N}$; $\lambda B_{et.}\lambda x_{e.}\ \mathrm{a}_2'_{(et)(et)}(B)(x)$>

The common noun *man* in (54b) is lexically given the category N^{U} and the type (τ(et)). As before, U is usually instantiated as NP and the type τ, as type e. Then we get the category and the type that are usually given to a relational noun such as *mother* or *father*. The logical expression $\mathbf{man_2'(\mathit{x})}$ denotes a set of men that is possibly different for each individual ***x***. The logical expression for *a certain* is now the functor $\mathbf{sg_2'}$ of type ((et)(et)), which denotes a function that maps this set of men to a singleton set of men, which is again possibly different for each individual ***x***. We need to apply a Geach combinator to (54c) before we merge the result with (54b), percolating the superscript category U and the extra argument slot $\boldsymbol{x}$ of type τ till a later stage of the derivation. In (54a), the extra-argument slot ends up being bound by the universal quantifier in *every boy*. Then we get the desired reading that says that for each boy $\boldsymbol{x}$, there is a possibly different singleton *man*-set and $\boldsymbol{x}$ respects the unique member of that set, e.g. $\boldsymbol{x}$'s father $\boldsymbol{y}$ in (52). The logical expression $\mathbf{a_2}'$ for the indefinite article *a* is just an identity function that maps a set of individuals to the same set of individuals, but we can still pragmatically restrict the domain of this set to a singleton. Then, because of the inherent argument slot associated with the common noun *man*, we can have the same dependent specific reading. As in (31g), the existential quantifier is associated with the phonologically null lexical item *some**. Thus, if the indefinite *a man* is placed in a downward entailing environment as in Winter's example (10a), and if the domain is not restricted to a singleton, then we can get the exhaustive reading, as we have already seen.

An interesting implication of this fourth solution is that the domain restriction dependency is no longer limited to indefinites. If common nouns are generally equipped with this extra argument slot, then the domain restriction applicable to other QNPs should also be able to be dependent on another quantificational element. This seems to be correct, as we can see for (55). The set of weak points would naturally be different for each player.

(55) Only those players who got rid of every weak point could play in the Major League.

Treating common nouns in general as if they were relational nouns might need more linguistic justification, but this fourth solution does not require any major modification of the formal use of logical expressions. Note also that nothing special has been added to the syntax. Both the **g** and **z** combinators are independently motivated to deal with bound pronoun interpretations.

I assume that the second and the fourth solutions are most promising. For the second solution, some extension of the definition of constant expressions might be independently necessary if we use a logical language as metalanguage to represent the cognitive meanings of natural language expressions. The fourth solution is better in that it does not make any major modification of the formal use of logical expressions. I leave the final decision for further research. In this section, I have considered some of the loose ends of my analysis. The next section gives a summary of the proposal.

9. Summary

This paper has given an analysis of an indefinite in an argument position of a verb. I adopted Schwarzschild's domain restriction analysis. When the domain of an indefinite nominal restriction set is restricted into a singleton set, we get the impression that the utterance is about a specific individual. But this specific individual can co-vary with some other element in the sentence. In order to derive the intermediate scope reading and the functional reading of the indefinite, I argued that the expression *a (certain)* has an extra argument slot of the under-specified type τ. If this slot is bound by a universal quantifier in *every boy*, the domain is restricted in a different way for each boy, which leads to a relativized specific reading.

By using Jacobson's **g** and **z** operators with some modification, I showed how this extra argument slot of an indefinite is compositionally percolated in a syntactic derivation and then gets bound by another element in the sentence.

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Hiroyuki Uchida
Department of Phonetics and Linguistics
University College London
uclyhuc@ucl.ac.uk

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