Recursion restrictions*[*]

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1. Introduction

Since recursion is a fundamental property of human languages, it is puzzling that we regularly find cases where recursion is expected to occur, but where it cannot. This paper focuses on the question how to understand such restrictions given current theoretical understanding. Building on Koopman and Szabolcsi (2000) and Koopman (2002), I will show that such restrictions are to be accounted for at the syntax phonology interface, when syntactic structures are transferred to phonology under late spell out models. The main thesis of this paper is that phonological properties can be "grafts" on the structure building *epp*, and can have the effect of reigning in recursion. The epp thus serves as a repository of the extremely finely grained knowledge speakers have of the phonological properties associated with local syntactic environments.

The paper will proceed as follows. Against a general theoretical background, and starting from morphological properties, I will argue that property that individual atoms of syntactic structure, commonly called LIs or heads, can impose various types of phonological properties on their second merged objects (formerly called Specs). Such properties should be located as part of the structure building epp of an LI, i.e. they depend and vary for individual atoms. One of these properties states the maximum size of phonological material allowed in specific location, as measured on the output of the syntactic derivation. The paper examines various cases of restrictions in the domain of verbal complexes, building on Koopman and Szabolcsi (2000) and Koopman (2000), and shows that the syntactic derivations provide the vocabulary on which the recursion restrictions are to be stated.

2. Theoretical background

The discussion in this paper is cast within a version of the Minimalist Program, and takes the following as point of departure:

(i) The basic atoms (LI) that enter into the structure building component (Bare Phrase structure, (Chomsky 1995) are *not* fully inflected lexical items but much tinier atoms. Syntax is fundamentally decompositional, and antisymmetric (Kayne, 1994). Syntactic atoms are tiny, regardless of whether they are semantically, or phonologically meaningful. This implies that syntactic derivations have considerably more depth than usually assumed.
(ii) There is a single computational engine for building structure. The difference between words, and phrases is one of output size, not one of module or atoms. There is no structure building in either post or pre-syntactic components.
(iii) Properties of LIs must be satisfied strictly locally (Sportiche 2005), i.e. under strict sisterhood. Merge (including external merge (base generation) and internal merge (Move)) is the only available mechanisms leading to satisfaction of lexical properties, i.e. to convergence. This paper assumes that Agree is not available for checking properties of lexical items (Koopman, 2006). At transfer, the highest copy is subject to phonological insertion.

[*] This paper was presented at the Recursion conference in Amherst, May 2009, and is a natural extension of Koopman and Szabolcsi (2000) and Koopman (2000). I would like to thank Tom Roeper and Peggy Speas for inviting me and making me revisit verbal complexes, and Chris Collins, Uli Sauerland, Ed Stabler, Dominique Sportiche and Anna Szabolcsi, for comments.

Given (iii), and the fact that lexical properties of LIs drive the derivations and determined which representations converge, it becomes crucial to establish what these properties are. Section 2.1 shows that syntactic atoms can impose very specific phonological requirements on their Spec, and that these should be considered as grafted on the structure building *epp.* These phonological properties can lead to restrictions on recursion. If phonological properties can be part of the *epp*, and if all lexical properties must be locally satisfied, any output that does not satisfy all lexical properties, including specific phonological properties, will lead to ungrammaticality.

I will show that phonological properties can be part of the epp by examining what a bare phrase structure account of morphological objects means, and ask how what is known about affixes should be represented. In particular, affixes can impose phonological restrictions on an element it merges with on its left. Such restrictions can lead to cases in which recursion is blocked or restricted. Since these phonological properties are properties of the second merged position (i.e. Spec), a natural proposal is to locate such properties in the *epp* of a particular LI. Once it is established such properties can be part of the epp of a LI, such properties should in principle be able to hold for *any* LI, given the single computational engine.

It is against this general background, that I will turn to the domain of verbal complexes in Dutch and Hungarian, building heavily on the syntactic derivations motivated in K&Sz (2000) and Koopman (2002) (we recast the complexity and splitting filters as phonological properties of the *epp*.) The domain of verbal complexes lends itself well to this investigation: we find restrictions in recursion, and micro and macrovariaton. The topic has been intensively studied in the languages under discussion, which restricts the possible analyses of the variability, and the factors that must enter into the account. The K&Sz (2000) syntactic derivations underlying the particular phenomena are highly determined, general and uniform, and yield non trivial results for Dutch, German and Hungarian. The syntactic derivations provide the syntactic vocabulary that allows relating the observed restrictions on recursion directly on the output of these syntactic derivations. They will be shown to be 1. sensitive to the presence (but not to the absence) of phonological material in a designated Spec at spell out, 2. sensitive to the depth of embedding of pronounced phonological material; 3. they can be sensitive to particular syntactic categories; 4. they are variable within a particular language or language area, and across languages and 5. recursions on restrictions can be found even when there is a very light surface phonological constituent (but crucially embedded in a large syntactic constituent), thus allowing to tease apart possible alternatives. In other words, the distributions are sufficient understood, and show sufficient variability both within the same language area as across languages as to inform theoretical options. Restricted recursion, though largely arbitrary, can be straightforwardly and quite simply accounted as arising from independently necessary properties. It is thus not a question of syntax or phonology, but rather a question of how these independently necessary properties interact. The present account allows incorporating finely grained phonological knowledge into structural syntactic properties, yielding a more complete view of how to account for an individual speaker's knowledge.

2.1. On the notion bound and the epp.

Under the single engine hypothesis, all word formation is syntactic: there is no theoretical difference between derivation, inflection, compounding, or syntactic phrase formation. This implies that properties traditionally taken to be morpheme specific are potential properties of any LI. It is thus important to consider the properties of "bound morphemes" and what these reveal about the general properties that LIs are expected to have. LIs can have phonological forms (for example T *–ed)*, or lack them, i.e. be silent, as English little v ([clean [$_{v}$]], or the root question Q

in English. As atoms, LIs merge in the spine with a constructed syntactic representation, its complement, satisfying selection. Bound morphemes must also merge with a particular category to their left, i.e. second merge of Spec. This merger is sanctioned by the *epp*, which allows structure building of a particular category (epp_{cat}).

LIs in general may require specifiers of particular category but don't need to do so *(i.e.* English *the*). In addition, though English finite T (or some head in the T region), and English D ('s) for example, both require a subject (epp_d), that position can be silent as a result of wh-movement (*who did they believe --- would sign this petition?*), or it may not be (**who did you like --'s brother*[1]). Some LIs can thus require that their specifier contain pronounced phonological material at spell out: this is basically what being bound means. Since the phonological material in English ends up to the left of the head (cf. Williams (1981) Right Hand Head Rule), I will I notate this property as [+PH]: i.e. $epp_{cat[+PH]}$, i.e. as a property that is "grafted" on the epp_{cat}. In other words, the *epp* can require not just the presence of a particular piece of structure, but also the presence of phonological material in that category at spell out.

(1) An LI can require +PH material in its Spec; this must be part of the *epp*

As is well known from the phonological literature, LIs (individual affixes) can impose a variety of phonological properties on their specs, like imposing the presence of a certain metrical structure, foot structure, syllable structure, or imposing minimal size requirements. English comparative *–er* famously merges with an A no larger than a light foot (*happy-er vs *yellow-er, *intelligent-er*); The form of Korean affixes regularly depend on the syllable structure of the element it merges with. Nominative case is *-i* after a syllable ending in a consonant, but *-ka* after a vowel. Sometimes affixes not only impose a minimum size requirement, say bisyllabicity, but importantly for the present paper, also a maximum size requirement (not more than a light foot, or a bisyllabic structure). These are all viewed as particular possible instances of [+PH]: the [+PH] property can be part of the epp, a property which I will refer to as being grafted on the epp. It serves as a repository of a speaker's fine knowledge of phonological properties characteristic of the local environment of that particular LI. [+PH] thus provides snapshots of phonological distributional properties in very specific local configurations. What other kinds of phonological properties do we observe beyond the ones mentioned above? Segmental properties do not seem to play any role (i.e. we do not seem to ever find affixes that can only occur if the onset starts with p), but structural phonological properties do (metrical structure, syllable structure, size properties do). In the remainder of this paper I will argue that one of the properties of [+PH] is a notion of maximum "phonological size" as measured on the local syntactic output. It is this very notion that plays a crucial role in restricting the possible outputs of syntactic derivations. Restrictions on recursion are to be understood as representations that fail to converge because they violate properties of lexical items, in particular the maximum [+PH] size requirement.

2.2.On maximum phonological size and restrictions on recursion

This section establishes the following, and sets the stage for the discussion of verbal complexes in section 3.

(2) (i) The $epp_{cat\ [PH]}$ can vary as to the maximum syntactic output size dominating the [+PH] forms ($epp_{[PH\ max:]}$) for an individual LI;
(ii) $epp_{cat\ [PH\ max]}$ lead to restrictions in recursion.
(iii) Different LI set different [+PH max]: this leads to complex syntactic surface patterns

[1] Some speakers of American English allow structures like these. For others, these are strictly impossible. This variation can be located to the properties of the epp [+PH].

The discussion starts with two English bound morphemes: past tense *ed* and adjectival *ing*, which both merge with a V constituent (though not necessarily the V head itself), and which must contain PH material at spell out, yielding structures like (3). (Bare phrase structure labeling will be adopted everywhere, except for cases where confusion might arise):

(3) a. $[_T[_V\ [_N$father] $[_v$e]] $[_T$ed]
b. $[_{\text{'ing'}}[_V\ [_V$melt] $[_v$e]] $[_{\text{'ing'}}$ing]

The constituent that $[_T$ed] merges with must be comparatively[2] small in size (something like a the traditional notion "word"[3] epp $_{V,\ +PH,\ size:[\text{"x"}]}$; *–ing,* however, may combine with a bigger structure:

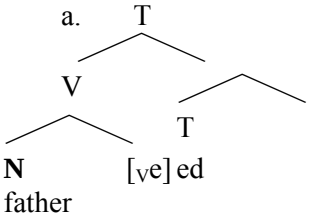
(4) a. *the person who [[[$_A$sad] $[_V$seem] ed]
b. [[[$_A$sad] $[_V$seem]] ing], (cf *goodlooking, foul smelling*)

This shows that syntactic (and phonological size) vary for different individual LIs. The English LI /'s/, a phrasal affix, requires epp, $_{D\ [+PH]}$ and does not care (much) about phonological size of its DP. As is well known, *'s* allows coordination of a DP in its Spec, which neither *ed* nor *ing* allow. English *'s* also allows for possessor recursion:

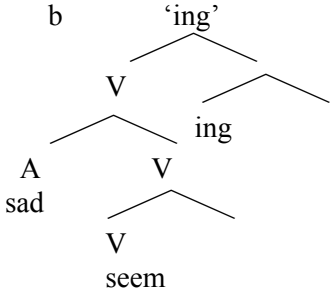
(5) a. *he $[_V$[close $[_v$e]] and $[_V$open $[_v$e]]]-ed the doors every day
b. * $[_V[_V$sad seem] and $[_V$crazy look]]-ing
c. $[_{DP}[_{DP}$The king of England [and $[_{DP}$the queen of France]]'s offspring
d. [John, [Mary [or [Bill]'s house]
e. $[_{DP}[_{DP}[_{DP}$my] father]'s friend]'s car]

Coordinated structures are basic recursive structures, embedding a node of the same type under the mothernode $[_x\ [_x\ \ ]$ [and $[_x\ ]]]$. (5a) and (5b) therefore illustrate contexts in which recursion fails, (5c, d) and (5e) where it does not. How exactly are (5a) and (5b) to be excluded? If we map these structure onto syntactic representations, we observe that the Spec positions of these LIs are only compatible with a very "shallow" syntactic structures, as measured by the node dominating phonological material:

(6) a.



b



If the attested[4] size in (6) also sets the maximal allowed size, (5a) and (5b) are immediately excluded: the number of nodes that dominate ph material in (5a) and (5b) necessarily exceeds the

[2] Comparatively, because we know from decomposition of the VP domain that such transitive structures are in fact syntactically quite large.
[3] Note that the notion 'word' does not have any special theoretical status, beyond the notion of a 'stable phonological and syntactic constituent'.
[4] It is not important what the exact syntactic representation is, but that that syntactic structure determines the maximum allowed size. Whatever that may be, coordination will further embed the dependent.

number in (6). I will notate this as [+PH] [*max]* with the "path" of nodes starting from the mother node to the lowest node dominating ph material (in boldface) to the mother node: T (past), $epp_{V\ [+PH]\ [max:\ [T>V>\mathbf{N}\ ]]}$. (5a) and (5b) therefore violate the epp [+PH [*max*] properties of T or *ing*, i.e. these are in the end excluded because they violate lexical properties. The max size setting effectively restricts the phonological and syntactic size and results in ruling out recursion or coordination. LIs which lack such a setting, or which allow a much bigger size setting (based on primary data), like English 's, allow recursion under coordination or otherwise.

The notion of max [+PH] size is specific to individual LIs: it varies for individual LI, as *ing* and *ed* show, and some LIs may lack any such restrictions. It must be set on the basis of primary data, and thus it is expected to vary between speakers and across regions. It certainly varies crosslinguistically. The size restriction of English *ed* is not shared for Japanese or Korean T, which allow coordination of the verbal constituents under it and behave more like phrasal affixes in this respect.

The same type of variation distinguishes English *'s* from the German head that licenses prenominal genitives. English 's allows recursion and coordination of the category in its Spec, but German does not. German prenominal genitives may contain only bare proper names genitives or pronouns (Longobardi 2001: 567) and disallow coordination of these. No such restriction holds for the lower postnominal genitive position suggesting this is a particular property of a D head on the left edge of the DP that introduces the genitive D, and not a property of genitive case itself.

(7) *Marias sorgfältige Beschreibung Ottos*
Maria's careful description of Otto

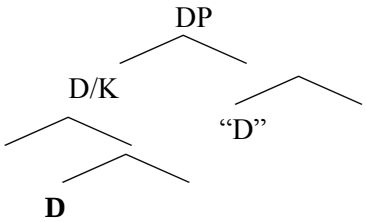
(8) *??Des Zeugens/*Dieser Frau/*Meiner Schwester / sorgfältige Beschreibung Ottos*
The witness'/ this woman's/my sister's /careful description of Otto

(9) * *[Marias und Susies] sorgfältige Beschreibung Ottos*
Maria's and Susie's careful description of Otto

(10) Marias sorgfältige Beschreibung des Zeugen/ dieser Frau/ meiner Schwester
Maria's careful description of the witness/this woman/my sister

As we observe, only those spelled-out Ds which are known to be associated with the D region, i.e. names and pronouns, survive the derivation. The attested forms have a very shallow syntactic output, as measured from the node dominating pronounced material to the top node. The epp [+ph max] setting for this particular German LI looks roughly like (11), (i.e. [+Ph, (max D/K>**D**)):

(11)



Thus, the examples in (8) violate the [+PH max size] of the epp of this LI, as the N need to be pronounced and will necessarily be further embedded. Similarly, coordination of names (9) or other recursions are excluded because they violate the max [+PH] properties of this particular German LI. It is expected that maximum phonological size can be set differently for different speakers and regions. Thus, an argument that there are varieties of German, or speakers of

German who accept such sequences does not invalidate the fact that there are speakers of German for who such recursion restrictions hold: it just shows that the [+PH max] can vary for individual speakers. Furthermore, variability in max seize is expected to correlate with distributional properties elsewhere in very precise ways for individual speakers, and studying such correlations thoroughly will be important in the future to understand the finer details of the syntactic representations.

Finally, max [+PH] size requirement can be 'grafted' on the epp of any LI, regardless of the height at which the latter enters the derivation. Indeed, if some LI is merged early in the derivation, it might be compatible with a small size because that is all that is present in the derivation at that point (assuming constituents are build up as in Kayne (2000, 2003, Sportiche, 1998, 2005) Koopman (2005)). Importantly though, size restrictions routinely show up for LIs that are generally taken to be merged *high* in the derivations, like particular Ds or Cs, as is the case for German prenominal genitives, or the root C that hosts verb second in Dutch for example.

2.3. When max size is set differently for individual LIs. English C T and V

Having different [+PH] max associated with individual LIs will yield visible distributional effects. Only those syntactic derivations will converge in which the max size that can dominate the phonological form is locally satisfied. Other well-formed syntactic outputs, including recursive structures will be 'filtered' out, because they will violate lexical requirements. This can be illustrated with the well known distributional properties of English modals, finite verb forms of have and be and main verbs.

English root questions require subject aux inversion, understood as T to C movement driven by a selectional property of the question C. This C is an instance of a bound morpheme (i.e. $epp_{T[+PH]}$), which itself lacks phonological expression. Translated into the properties of the LI that drives the derivation, yields an LI $C_{+Q,Root}$ with $epp_{T[+ph],}$ merging with C_{finite} as its complement. Within Bare Phrase structure, this epp property can in principle be satisfied by moving any constituent labeled T. Remerging what is traditionally called TP will not converge in English root- yes no questions however (though it might in superficial head initial languages with final question particles for instance). Instead, the English C_Q shows the effect of a size restriction, with the max size set of [+PH] set to: [Q> **V**>T]. Only Vs merged highest in the Cinque hierarchy (1999) will survive, i.e. the inherently tensed modals, finite verbs of perfect *have,* all finite instances of *be*, and the last resort auxiliary *do*. Thus only Vs in the shallowest syntactic possible output T structures survive in this environment. If English "main" verbs are always further syntactically embedded, they will simply never survive in this C environment. This is not unreasonable since they start out much lower in the clausal structure and follow adverbials. Main verbs are compatible with T however, as they only have to satisfy the [+PH] size requirement of the LI, T, which accepts a bigger [+PH] size. Other heads, share the properties of C_{+Q}, (i.e. Neg, Focus and C_Q), and hence show the same type of distribution. This view goes far towards capturing the distributional properties of the English C-T-V, locating much of the mystery as an indendently motivated and necessary property of the *epp*. Specific phonological knowledge, stored as part of the *epp* thus filters out otherwise perfectly well formed syntactic structures. These representations do not converge because they violate particular lexical properties of the epp.

Under the single computational engine, the full typology of *epp* properties could hold for *any* LI. In particular, any type of LI with an epp property could have [+PH, max] restrictions associated with it. Only then do we expect restrictions on recursion to show up. These are expected to vary between speakers (as primary data vary), regions, and between languages. If the argumentation so

far is correct, the distribution of where we find recursion and where we don't can be used to further investigate what exact form the phonological size restriction can take. And of course, we in turn find support for particular proposals for syntactic derivations, since these provide the vocabulary on which the relevant phonological properties can be stated. The remainder of this paper explores these issues for verbal complexes in so-called clustering languages, which provide a particular fertile ground for this investigation.

3. Verbal complexes: restrictions on recursion

We are now ready to tackle more precise questions about recursion. Given that restrictions on phonological insertion as just detailed exist, do we ever find cases in which syntactic derivations yield classical recursive output syntactic structures but where the specific +PH properties of a LI restrict the possible recursion? And if so, can we empirically distinguish between different accounts for when recursion is possible and when exactly it is excluded?
Such cases can be found in the domain of Dutch verbal complexes, where recursion of infinitives to the left is restricted to one cycle (K&Sz 2000, Koopman 2002). I will also discuss a variety of Hungarian, where it looks like recursion is restricted to two cycles, but not to three, a case which should be expected to exist under the current proposal.
In order to get to the relevant syntactic output structures, the discussion will need to become more technical and precise. Indeed, it is the output structures the syntax generate that yield insight in how to deal with particular gaps dealing with restrictions in recursion, as we have so far shown with simpler examples.

3.1. Dutch verbal clusters and recursion restrictions.

Dutch verbal clusters show restrictions on recursion of infinitives to the left but not to the right of the (finite) verb. The surface patterns are given below, with numbers referring to syntactic hierarchy (V1 selects (an infinitival) V2 ,V2 selects (an infinitival) V3 etc). The terminology K&Sz (2000) use to refer to such orders is indicated in italics. The basic idea for how to exclude recursion is simple: in all cases where recursion is excluded, this is because recursion violates a lexical property of the LI, in particular the maximal size [+PH] property which is grafted on the *epp*. In Dutch, it is category specific (refers to Inf) and thus keeps a pronounced Inf in a designated spec position syntactically shallow.

(12)	a.	V_2inf	V_1+T	…	zwemmen wil	*Inverted orders/Roll-up*
				….	swim.inf want+T	*2-1*
	b.	*V3inf V2inf	V1+T	*…	zwemmen willen zal	*3-2-1*
					swim.inf want.inf will	
	c.	*Vinf3	V1+T Vinf2	*…	zwemmen zal willen	*Climbing orders*
					swim.inf will want.inf	*3-1-2*
	d.		V1+T Vinf2 Vinf3	….	zal willen zwemmen	*English orders*
					will want-inf swim.inf	*1.2(-3)*

We focus on the patterns in (12a)- (12d)[5]. To the right of the finite verb there are no known restrictions on recursion (12d). Some clusters of four or five verbs become more difficult, but the judgments do not yield the sharp contrasts reflected in (12b and c).

The excluded patterns are exceptional, not just from a micro and macro comparative perspective, but also from an individual grammar's perspective. As Barbiers (2002) points out, the pilot study of the Sand project, which gathered syntactic data from Dutch dialect speakers (choosing speakers to maximize the distance with standard Dutch), has documented speakers that accept these patterns. As shown in K&Sz (2000), the excluded patterns surface routinely in similar clustering languages German and Hungarian (ignoring the position of the tensed verb in Hungarian). We illustrate this for the climbing patterns in (12c) which show up in all German *zu*-infinitivals and participles (*zu* patterns like V1from two cluster verbs on see K&Sz 2000), as well as in the IPP environment in Southern varieties of German (Den Besten and Edmondson, 1983; Wurmbrand 2004).

(13) a. *ohne singen zu wollen* V3 $V1_{zu}$ V2
without. sing.inf to want.inf
'without wanting to sing'

..singen hat wollen V3 V1 V2
.. sing.inf has want.inf
'…has wanted to sing'

The 3-1-2 pattern is also found in so-called neutral clauses in Hungarian (these are clauses that do not contain focus or negation):

(14) *Dolgozni fogok akarni* (K&Sz 2000: 74, ex (108))
work.inf will-1sg want.inf
'I will want to work'

We return to this Hungarian construction in section 3.3, where we analyze some (previously unanalyzed) data discussed in K&Sz 2000. In some Hungarian varieties, recursion might be restricted, not just for infinitives, but for any category that climbs in neutral clauses. Importantly, whereas in Dutch you can invert once, in this variety you seem to be able to invert twice but not three times, whereas in other varieties of Hungarian, inverting three times is fine.

The climbing pattern in (12b) is exceptional within the broader Dutch paradigm of complex verbs: only infinitival verbs disallow this pattern.

(15) a. … *op zal (willen) bellen*
up will (want.INF) call.INF

b. … *schoon zal (willen) maken*
clean will (want.INF) make.INF

[5] We leave the remaining two patterns out of consideration:
(i). * V1+T V3inf V2 ..*….zal zwemmen willen *Partial roll up*
will swim.inf want.inf *1 3-2*
(ii) * v2INF v1+T V3inf *… willen zal zwemmen *"Long head Movement'*
2-1- 3
See K&Sz (2000, p173) for further discussion on how to exclude these. Note that (ii) is not attested anywhere in the Dutch language areas, Barbiers, 2002.

c. … *piano zal (willen) spelen*
piano will (want.INF) play.INF

d. … *naar LA zal moeten vliegen*
to LA will must.INF fly.INF

e. … ge*schilderd zal (willen) hebben* V3/4)part V1 Vinf2 (V3)
ge. paint.PART will want.INF have.INF

f. *.. *schilderen zal willen (kunnen)* *V3Inf V1 Vinf2 (ok:1234)
paint.INF will want.INF be-able.INF

The 312 pattern turns out to be important in more than one way. It allows showing that it is syntactic category and not surface phonological form which is relevant, indicating that syntactic representations are a crucial part of the picture. Second, the syntactic output yields a phonologically light element embedded in a large syntactic constituent: the output is excluded because of the latter, not just because of pure phonological weight.
The next sections introduce just enough of the syntactic derivations to motivate the syntactic representations and show how the restrictions on recursion follow from the max size setting.

3.2. Basic derivations and underlying assumptions: recursion restrictions stated on recursion restrictions

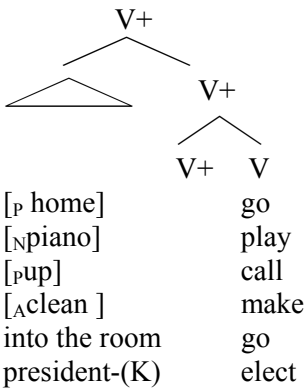
Dutch, German and Hungarian are 'clustering' languages. We lay out the particular ingredients of K&Sz that yield surface verb clusters in these languages, and discuss how the derivations unfold. This will allow us to concentrate on the output of the derivations, and on the main issue at stake: how to tackle the recursion restrictions, and what the role of the syntactic derivations in these is. In K&Sz's these very general syntactic derivations and the interaction of various complexity filters, and splitting parameters yield the particular surface patterns, and the different patterns in the three languages. These are rephrased and further developed in the current paper as phonology grafted on the *epp*. [6]

The first analytical ingredient puts verbal clusters in the broader context of complex verb formation. Verbal clusters are part of a much broader process of complex verb formation (yielding separable prefixes, verb particle constructions (cf Dutch: *opbellen* " up call" , *schoon maken* 'clean make.INF , *piano spelen* 'piano play.INF, small clauses (*naar huis gaan* 'to home go.INF' etc). Such complexes are omnipresent in the clustering languages in question. An important feature of such clusters is the fact that the two parts of the cluster are separable in the syntax of the languages in question yielding discontinuous constituents. (…op te bellen 'to call.INF up; .. *bel hem nu zeker niet op* 'lit. call him now certainly not up' 'Certainly don't call him up now'). K&Sz postulate a universal configuration for complex verb formation, and implement this by assuming there is a dedicated LI, one of the heads that make up verbs, which

[6] On why dependents are outside the clusters, see K&Sz 2000 p159. I assume all functional material is outside the smallest merged constituent (Sportiche 2005). If categorial features are merged in the spine, as widely assumed in distributed morphology, then starting Ns and Vs as roots will already force them to remerge, creating massive potential for discontinuous constituents at the earliest stages of the derivation.

we named V+ . V+ merges with V, and hosts a small clause predicate in its Spec. Satisfaction of the lexical properties of the LI V+ locally leads to configurations of the following type.

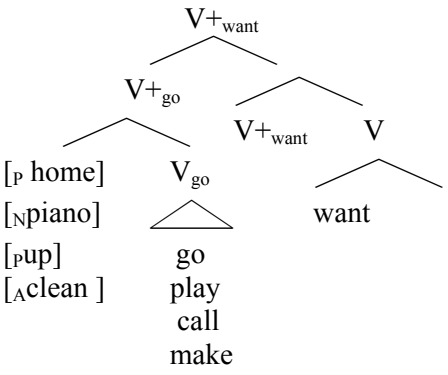
(16)



Any theory of syntax must build structures similar to the ones in (16), and account for the fact that it yields two syntactic surface constituents: the V constituent can be independently manipulated in the languages in question, and moves out from V+ in particular contexts, like verb second. This (problematic) process is known as excorporation. In the framework of this paper verb second is to be understood as the effect of a [+PH max size] property of the finite C.

A second ingredient is that verbs that participate in cluster formation must form complex verbs themselves, i.e. they attract a V+ constituent of the type in (16), and crucially not a V constituent.

(17)

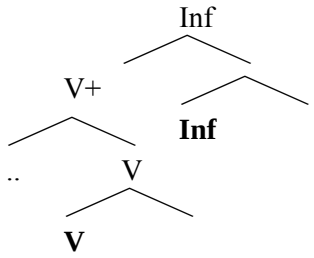


This sets K&Sz apart from other existing analyses of cluster formation, which in general restrict the analysis to a subset of clusters. We implement this by assigning a $epp_{[V+]}$ to the V+ portion of the clustering verb. Such constituents in fact can surface in German, or Hungarian, provided the embedded V finds a way to pick up the required morphological ending. How this happens is the third ingredient, and a major factor driving the surface variability of verbal complexes within a single grammar, as shown for Dutch in (12).

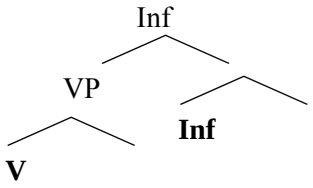
Clustering verbs typically select for different complement types: in Dutch, some combine with bare infinitives [V-en], some with *te* infinitives, some with both, some with participles etc. This raises several difficult questions: the first question concerns the infinitival ending itself. The adopted theoretical assumptions leave no other option than to treat INF as (at least) one structural atom, call it Inf, spelled out as *en* in Dutch. What are its lexical properties, where is the LI (Inf) merged into the derivation and how are the properties of INF locally satisfied? These questions are intimately related to the syntactic structure of an infinitival clause. A third question concerns how exactly the selectional property of the selecting verb is locally satisfied.

Let us start with the properties of the LI (Inf). It requires a phonological dependent verb as its sister, hence Inf, $epp_{V[+ph]}$. K&Sz (2000) assume it merges above V+ but below C(INF)[7]. There are two logically possible ways in which the *epp* of Inf can be satisfied: either the entire verbal complex remerges with Inf (18a), or V remerges with Inf (18b), stranding V+.

(18) a.



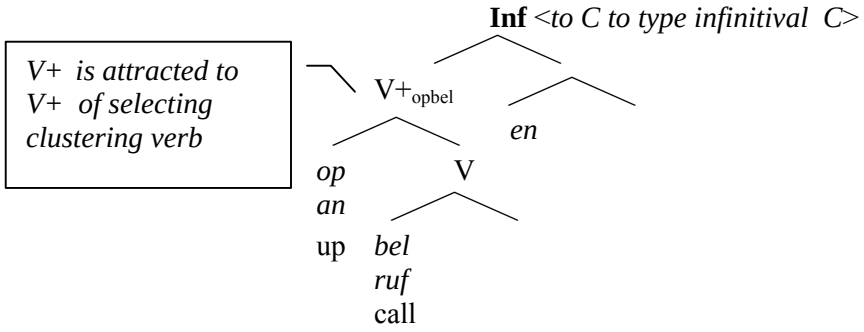
b.



Both options are part of the internal grammars of Hungarian, Dutch and German speakers. In German and Hungarian, Merging V+ with Inf (18a) seems to happen in most contexts, in Dutch, Merging V with Inf (18b). This structural variability has important ramifications, as discussed below, as it is one of the two factor that determines variability in surface orders and creates the false illusion of optionality.

Secondly, K&Sz (2000) take infinitival complements to be CPs (not CPs with all the fine properties of Rizzi left periphery) with a C head, which needs to be typed, i.e. "labeled" as infinitival. This forces a labeled Inf constituent to merge with C. In turn this allows the clustering predicates to satisfy their selectional property locally under external Merge.
Different surface constituencies result depending on whether the derivation builds on (18a) or (18b).

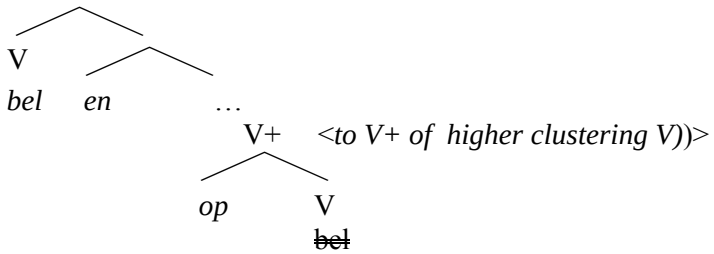
(19) *V+ moves to Inf* (18a) yields *(3)-2-1-surface orders, or 1-3-2 orders*



Either (18a or b) will move to label C. But since Inf cannot be stranded in (18a) , V+ must pied-pipe **Inf** to satisfy V+ of clustering predicates In other words, **Inf** must carry out the tasks of both V+ and Inf. However (18b) will lead to split constituency: V-Inf will show the distribution of the local infinitival CP, it will have done its job of labeling C. V+ however will show the distribution of the elements that attract it V+, i.e. V+ will appear to climb up, and hence show restructuring properties.

(20) Inf <*to CP*> This order will lead to 3-1-2 order

[7] See Koopman and Szabolcsi () for some boundary conditions that the merger of Inf must make allow.



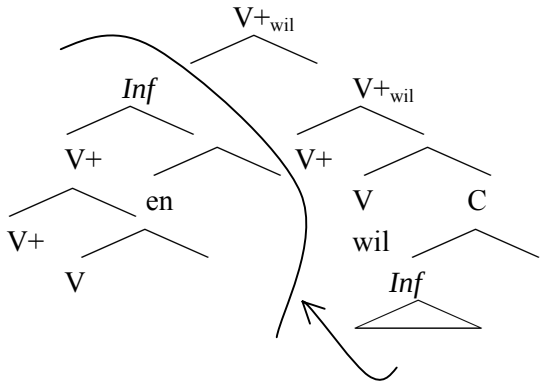
In this structure, Inf and V+ each carry out their own individual business.
An important consequence of this derivation is that on the surface the climbing V+ is phonologically light, but attracting it to V+ embeds it further syntactically, in predictable ways with each additional clustering predicate.

Table 1 shows the derivation for one cycle, starting from (18) and (20), from left to right, (the number 3 refers to the small clause part in V+). The last column details if recursion is expected to be in principle possible or not, and whether it is actually attested.

Table 1.		Inf to C	V+ to $V+_{want}$	CP to X[8]	linear order	(Inf) recursion possible P, and F (found)
a.	(18) [V+ V2]INF	[[V+ V]inf]C	[[V+ V]Inf] extracts from CP to $V+_{want}$		[3.2]-1	P yes F no
b.		[[V+ V]inf]C	[[V+V]Inf] pied-pipes CP to V+	yes	1-[3.2]	P no F no
c.	(20) [V]Inf ..V+	[[V]Inf] C… V+	V+ to $V+_{want}$	yes	3 1 2	P yes F yes

These steps are exemplified in (21), (23), and
) respectively. Each of these derivational paths results in a different surface order and surface constituency, and makes different predictions with respect to the possibility of finding recursive structures, as indicated in the rightmost column.

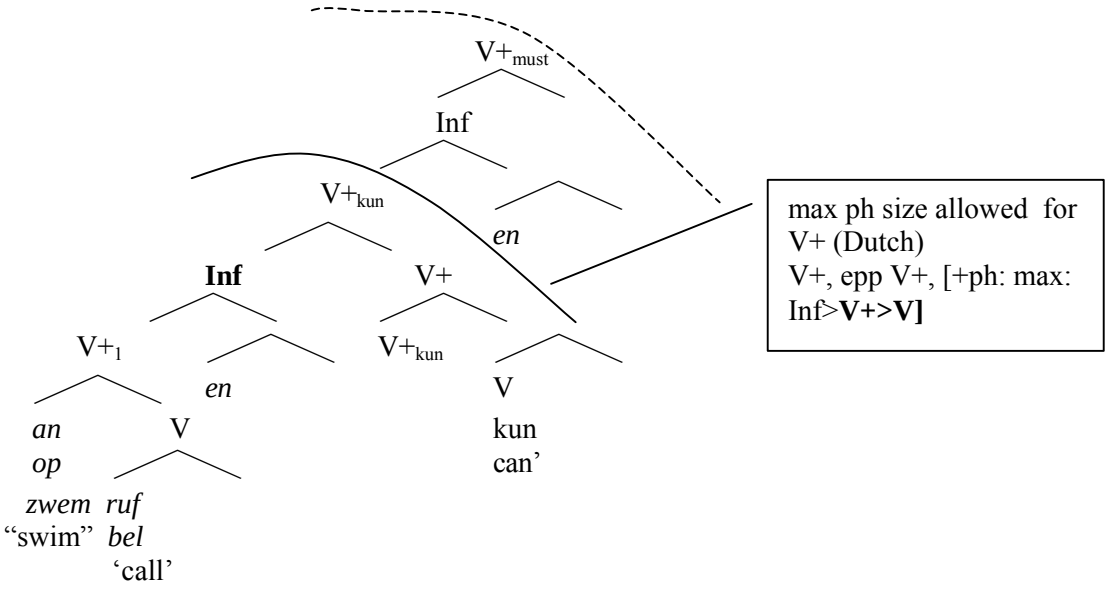
(21) a.V+ pied-pipes Inf to C; Inf extracts out of CP to V+: (V+ heads omitted)



[8] CPs in Dutch must follow the finite verb, and are clearly never in V+.

This will yield inverted strings (Dutch: *opbellen wil'* German: *anrufen wil,* Hungarian *haza menni akar(ni) 'home-go want.(inf*)) or in case V 'spans' both V+ and V '*zwemmen wil*' 'want to swim' In the syntactic output, the highest V+ contains +PH material, with the potential of finding effects of a max PH restriction. This is what we find on Dutch: the output in (21) is fine, but further embeddings are excluded, i.e. recursion is blocked. In German and Hungarian such outputs are fine. We show the output when another restructuring predicate merges with (22):

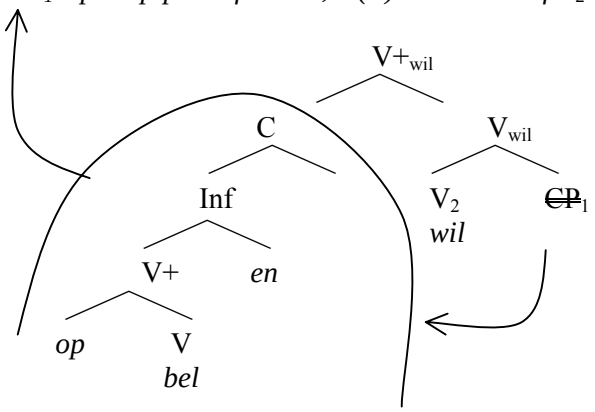
(22)



In Dutch, the maximum size of material contained in V+ is epp [+PH max [V+>**Inf>V**] as indicated. Recursion is blocked simply because it will result in a violation of the lexical properties of V+, more precisely the ph properties of the epp.
This raises a question: do we ever find a case in which the allowable size is set at the next cycle, as indicated by the dotted line above. If this were the case, two inverted infinitives would be allowed, but not three. We return to a possible Hungarian case in section 3.3.

The second possibility in Table 1 is for V+ to pied-pipe Inf and CP.

(23) *V_1+ pied-pipes Inf and C; C(P) moves out of V_2+ and distributes like other CPs:*



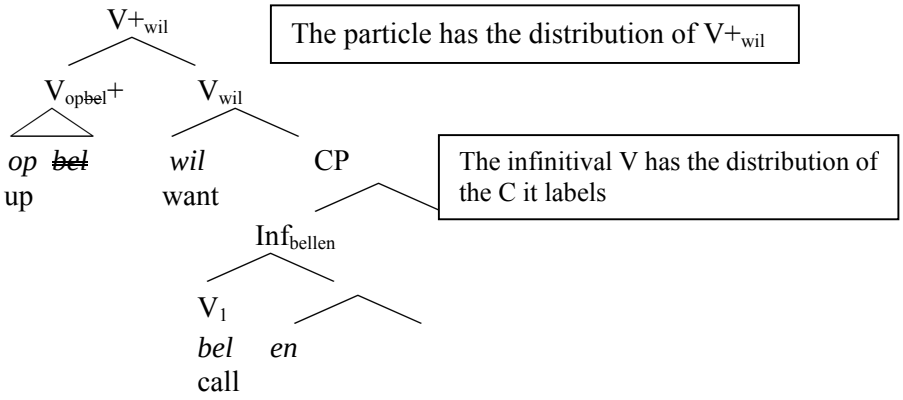
This derivation leads to English orders ('*wil opbellen' 'want to call up'*). CP moves out of Spec, V+want. (this will eventually result in the surface orders where the CP follows the finite verb in Dutch, and Hungarian). At the end of this derivation the V+ will contain no overt phonological

material at all. This is a perfect Dutch order, which shows that Dutch V+ tolerates a silent V+ (i.e. V+, $epp_{v+(+ph)}$). No phonological size effects are expected in this derivation. This looks correct as postverbal infinitives can be stringed together .. *zal willen kunnen laten zwemmen* ('will want to be able to make swim').

Now suppose there is a language that is just like Dutch but where the epp of V+ requires [+ph], i.e. the presence of phonological material in V+. The derivation in (23) will fail to converge, as lexical properties of V+ require the Spec to contain phonological material. German looks like a possible candidate, as it disallow *V1(fin) [$_{CP}$V2(inf)] orders (Wurmbrand 2004). This setting also predicts that in such cases (23) can in principle converge, as long as there is a derivation that results in spell out in V+, so as it can contain pronounced material to satisfy the epp property[9], i.e. climbing (V3-1-V2) orders could result in such varieties.

The third derivational path of Table 1 yields climbing, shown here for a particle:

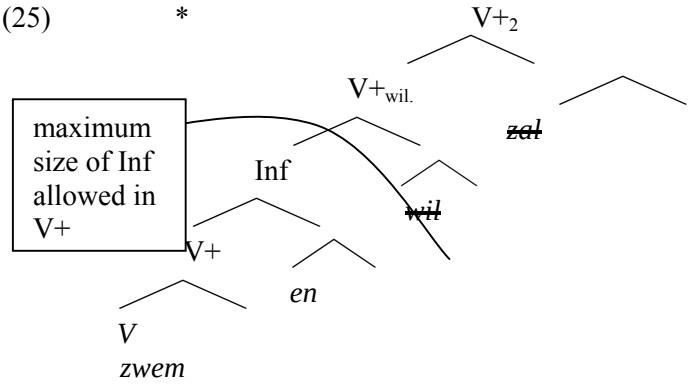
(24) *Climbing: V+ extracts from the infinitival CP to V+$_2$*



The particle or the small clause predicate "climbs", and shows the distribution of V+. The infinitive distributes like a CP: *op wil bellen= [[$_{VP+}$op ~~bellen~~]~~wil~~] wil [$_{CP}$ bellen].*

Embedding (24) under another clustering verb and continuing on the climbing path of Table 1, will yield a violation of the epp property of V+, as the Inf will exceed the max size allowed in V+ ***zwemmen zal willen.***

(25) *



[9] Cf In the IPP context in Southern German dialects , i.e. *singen hat wollen* 'sing.INF had want.INF, i.e. K&Sz (2000, p181-183).

V+s that do not contain Inf can and do happily survive in this derivation yielding clusters like: (cf: '.. *op$_5$ heb$_1$ willen$_2$ laten$_3$ bellen$_4$* "have wanted (to) make (John) call up (someone)) As expected 3-1-2- forms are possible in certain contexts in German and in neutral contexts in Hungarian.

This particular derivation yields an output that is syntactically complex, but phonologically light. It thus allows contrasting purely phonological analysis with the current syntactic one which claims that the phonological properties, whatever they may turn to be, must be stated in terms of the syntactic configuration.

Den Besten and Broekhuis 1989, and Broekhuis 1992 argue that Dutch 3-2-1 inverted infinitives are to be excluded for prosodic reasons. Den Besten and Broekhuis observe that inverted infinites must carry primary stress. Small clause predicates in Dutch must carry primary stress as well. Only one primary stress is possible before the finite verb, where small clause predicates must occur. The general V3 V2 V1 pattern of (12b) is excluded since both infinitives should be stressed, but this leads to a prosodic clash Dutch (primary stress is indicated by an acute accent and underlining the stressed syllable):

(26) *<u>schíl</u>deren <u>wíl</u>len zal
paint.INF want.INF will
'will want to paint'

This prosidic account does not carry over to 3-1-2 strings however, since there is only one inverted infinitive before the finite verb, hence no prosodic clash:

(27) * <u>schíl</u>deren zal willen
paint.INF will want.INF

Broekhuis 1992 tentatively proposes that such strings are to be excluded by a "parsing" constraint, which is caused by the "mixing up" of infinitives. It is implausible that such strings are difficult to parse, given the extremely common and varied V(part) V1 V2 strings in Dutch (*<u>opgebeld</u> zal hebben, lit. up-called will have, 'will have called up' overkomen zal zijn 'lit: happen will be, will have happened'*). Since (27) is non-converging, it is of course difficult to parse. This is not because of parsing difficulties, but because of the lack of converging derivations, as lexical properties of V+ in particular the epp$_{v+\,[+ph,\,max]}$ properties are violated.

Note that a Den Besten and Broekhuis's type proposal places the burden of explanation on prosodic constraints. Prosodic constraints are not incompatible with the present proposal, as long as they reflect phonological properties that can be attributed to the *epp* of a specific LI. The following minimal pair is important in this respect, as it shows the relevance of the syntactic representation. For certain Dutch verbs, the infinitival and participial forms are identical. Yet, such form still yield a strong exclusion when the form is a syntactic infinitive, but are basically fine when it is a participle (though the English order seems preferred).

(28) a. Dat hem dit toch (*overkomen) zou moeten/ zou moeten overkomen!
that him this PART overcame will have-to /will have-to overcome
'That something like this could happen to him'

b. Dat hem dit toch ?overkomen zou zijn / zou zijn overkomen!
that you this PART overcome would be
'That something like this could have happened to you!

This shows that purely surface prosodic patterns cannot rule out such data. At the very least, syntactic categories must be taken into account. Of course, under the account pursued in this paper, the contrast between (28a) and (28b) is entirely expected, and independently of the actual phonological form.

3.3.Hungarian neutral clauses: embedding twice but not three times?

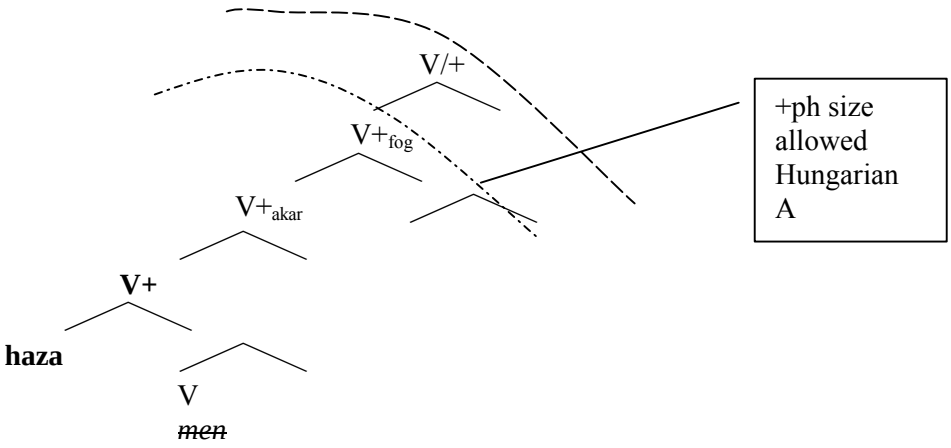
The considerable variability found in verbal complexes raises the question if we ever find cases in which recursion is restricted, where the max phonological size is set to a bigger size than it is in Dutch, but to a smaller size than it is in German or Hungarian. Indeed, if the [+PH] size was allowed to be slightly larger as indicated in the dotted line in (22), it would yield the effect of allowing at most two recursions, but not three. This would mean one could invert once or twice but not thrice.

K&Sz (2000, p.124) discuss one piece of data that in fact exactly seems to exactly fit this pattern. In the contexts of verb orders found in restructuring contexts, K&Sz (2000, p.124) point out differences between Hungarian speakers in the climbing orders, for which we were unable to offer an account. These data came up when we tried to evaluate Cinque's (2005) proposal that restructuring predicates are merged as functional heads in contexts where restructuring has visibly occurred. -- climbing contexts in Hungarian --, but as main verbs when restructuring has not occurred, possibly the English orders in Hungarian (the latter proposal was part of Cinque's original proposal, but abandoned in the (2005) publication). Testing this prediction ran into an immediate difficulty: some Hungarian speakers simply "do not accept climbing across two infinitives, regardless of their relative order", as shown in (29). (K&Sz p.124 (31) and (32)).

								Hungarian "B"	Hungarian "A"
(29)	a.	Haza	fogok	akarni	menni		4-1-2-3	OK	OK
		home	will-	want.inf	go.in				
		'I'll want to go home'							
	b.	Haza	fogok	akarni	kedzeni	menni	5-1-2-3-4	OK	*
		home	will.I	want.inf	begin.inf	go.inf			
		'I'll want to begin to go home'							

It turns out that these speakers are from the Szeged area, which is singled out in the questionnaire study of Szendrői and Tóth (2004) as an area which differs from other varieties of Hungarian with respect to verbal clusters. Within the perspective of the current paper this pattern immediately suggests the effects of the workings of a +ph max property of the LI V+ epp for speakers that do not accept (29b): interestingly, this time not sensitive to the category infinitives, as in Dutch, but just to the depth of embedding PH material in V+. Comparing the good case with the excluded one, yields the following structure for the accepted (29), with two embeddings (home go ~~will want~~ *will>want> home-go*), but crucially, the next cycle will yield the structures in (29b), (home ~~go begin want~~ *will>want>begin>home-go*):

(30)



If correct, this leads to predictions about the correlations we expect to find. Restrictions on recursion come about as a special [PH] property of the *epp*. These should show up only in case where V+ is filled. Applying this to Hungarian, where all speakers seem to allow the three possible orders (in different contexts), leads to the expectations of the following patterns, from largests to smallest, for three verb clusters with V3(inf) distributing like V+/V.(Of particular relevance are the predicted c patterns of Hungarian "A".)

(31) a. If V1 [V3 V2] is OK. *then* OK: V3 V1 V2 *and* OK V1 V2 V3
b. If V1 [V4 V3 V2] is OK *then* OK: V4 V1 V2 V3 *and* OK V1 V2 V3 V4
c. **If V1 [V4 V3 V2] is *** ***then* * : V4 V1 V2 V3** ***and* OK V1 V2 V3 V4**

With particle verbs (*haza menni*: 'home go.inf'), neither full roll-up, nor climbing should be available, but English orders should in principle be OK:

(32) a. If V1 [4-V3 V2] is OK. *then* OK: 4 V1 V2 V3 *and* OK:V1 V2 4-V3
b. If V1 [5-V4 V3 V2] is OK *then* OK: 5 1 2 3 4 *and* OK:V1 V2 V3 5-V4
c. **If V1 [5-V4 V3 V2] is *** ***then* OK: *V4 V1 V2 V3** ***and* OK:V1 V2 V3 5-V4**

At this point, the actual correlating patterns per speaker have not been investigated, but the following data are suggestive enough to warrant further inclusion. Szendrői and Tóth (2004) in their questionnaire study find that speakers in this particular region neither allow climbing nor 4 verb inverted clusters, as expected. While English orders show improvement, they conclude that they should not be accepted either, and state that "speakers of this region seem to have a general aversion to verbal clusters". This conclusion seems to go directly against the predictions of the present approach, which predicts that the English orders should be acceptable, or, at least, markedly improve over the two other options. While clearly further research is needed, the data from their questionnaire do point in the predicted direction however, and, if we evaluate these data against a background of their general findings, they might even be consistent with the predictions above.

The questionnaire data (on a three point scale) show a 100% rejection of climbing and inverted orders, but 20% improvement or acceptance of the English order (Figure 10, p.). This goes in the direction of this paper, though it looks like a slight effect. It seems to be hard to predict what percentage is expected for the English orders however, if we look at the acceptance rates of such cases in their overall study. Throughout the Hungarian region, there was a very high number of negative answers for 3 or 4 verb clusters in the English orders (40% no, 30% maybe, 30% yes) with inverted orders jumping to (60% no; 20% yes 20%). Given the fact that speakers

in the region in question start out with 100% no for inverted and climbing orders, a 80% no, (20% maybe+yes) might well be all that is expected for English orders. Interestingly, throughout the Hungarian region, the acceptability rates of the three orders with 3/4 clusters follow the predictions: full roll up inversion is consistently judged worse than climbing orders, with English orders judged most acceptable, as expected from the thesis in this paper. Max phonological size must be measured on the output of syntactic structures, with fully inverted structures the biggest phonological and syntactic size, climbing structures next on the scale and English structures lightest. The data so far thus look like an excellent candidate to support the claims make in this paper, while final conclusions of course will have to await further investigation. It looks like this is an excellent candidate for an experimental syntax investigation.

4. Conclusion.

This paper focuses on the question how to understand recursion restrictions given current theoretical understanding. It argued that such restrictions are to be accounted by independently necessary phonological properties that can be "grafted" on the structure building *epp*. These have the effect of reigning in recursion in cases where recursion is restricted. We discussed in particular cases in which recursion is restricted in the domain of verbal complexes, where specific syntactic derivations provide the vocabulary to account for the particular idiosyncratic cases that can be found. The epp thus serves as a repository of the extremely finely grained knowledge speakers have of the phonological properties associated with local syntactic environments. If the paper is on right track, recursion restrictions are expected to be restricted to particular syntactic configurations. They are expected to vary in different regions, as the [+PH, max sixe] must be set on the basis of primary input data. While the paper focused on the [PH, max] restrictions, and their relation to recursion, this study can start to make some sense of the data reported in Bresnan and Ford (2009). Bresnan and Ford (2009) in their study of double object construction in American English and Australian English varieties find that speakers of each variety have different probabilistic knowledge of the constructions that corresponds to corpus data (where available). Importantly, in Australian English (but not in American English), the length and phonological weight of the first object in the double object construction plays an important role. Within the present paper, this suggests the effects of the finely grained [+PH] properties associated with the *epp* of the LI hosting the first object, this time not reflecting an absolute size restriction, but rather the statistical knowledge which can be directly associated with the [+PH] properties associated with the epp, i.e. with particular phonological shapes. Thus, the [+PH] properties grafted on the epp might very well the exact location where such knowledge is represented and stored.

Appendix. A linearization account**.** *[maybe delete? I deleted another section: an extension to doubl-ing]*

Koopman (2002) discusses different alternatives in detail, and extends the analysis to Engish double-ing. We add here a short discussion of Richards (2006) linearization account.
In an unpublished manuscript (2006), Norvin Richards proposes a general constraint on linearization, which imposes distinctness of linearization of categories within the same phase, a kind of modern incarnation of the OCP. Adapting parts of Kayne's (1994) LCA, his proposal has as effect that two categories within the same phase cannot be spelled out, because they would yield a conflicting linearization statement. He applies this to a number of different phenomena (distinct markings on DPs, the doubl-ing filter (Ross, 1972, but see Koopman 2002 for a proposal along the lines in this paper). Applied to Dutch, this proposal would prohibit the linearization of two infinitives within the same phase, but not across a phase boundary. Richards (2006) is easy to

adapt to Dutch, given the syntactic analysis developed in K&Sz (2000) and outlined here. It would allow an understanding of this nagging problem why Dutch infinitives are sensitive to recursion, but participles or other categories not. Indeed, inverted infinitives are in the same V+ constituent (hence within the same phase), but infinitives in the VT1 Vinf2 Vinf3 order are each in CP, hence separated by a phase boundary $[_C V_{inf} [_C V_{inf.}$. This would allow an understanding that Inf is subject to the restriction on recursion but other categories are not, which under the account in this paper is purely a historical accident. This proposal only does this well, but does not extend (easily) to any of the other observed patterns. It will not straightforwardly extend to exclude the 3 1 2 pattern with infinitives in Dutch. (**zwemmen wil kunnen*), as here the infinitive does not appear to be in the same phase as the selecting infinitive, at least not at the end of the derivation. Nor will it allow a simple understanding of what happens with Dutch speakers that allow such patterns, or with German and Hungarian speakers. Quite generally, it leads to the problem of how to understand languages that allow inversions of this type. Given that Richards needs K&Sz (2000) to understand Dutch, the problem is how to allow German and Hungarian which allow surface constituents of this type, with a small constituent combining on the left of, and showing similar distributional behavior. Richards proposal would perhaps force a double structural analysis where preverbal infinitives in German and Hungarian can be in their own CPs or within smaller constituents, but this would loose all the basic insights of K&Sz's analysis, and the hope to account for the finely grained patterns that individual grammars allow. Hungarian only the smallest structures can continue to invert; CPs are bigger and never in V+. It will have nothing to say about the Hungarian cases where it seems you can invert twice but not three times, and where the restriction on recursion does not seem sensitive to a particular category. And finally, it will have nothing to say about other cases of restrictions on recursion, and the general notion of +ph size that is independently needed, and that seems widely applicable.

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