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Stem stress and peak correspondence in Dutch

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1. Introduction[1]

1.1 Background

It is a well-known observation that morphologically complex words 'inherit' phonological properties of their stems. Famous examples involve transderivational preservation of stress, which is involved in the analysis of secondary stress in English (Chomsky & Halle 1968), syncope in Palestinian Arabic (Brame 1974) and diphthongization in Spanish (Harris 1983). This paper will deal with the preservation of stem stress in Dutch complex words. Before addressing this specific topic, I will sketch the theoretical background of this paper, which involves a number of issues in the interaction of phonology and morphology.

The question of how 'transderivational' relationships come about has captured the attention of many linguists:

Q1: How do phonological properties of simplex forms carry over to morphologically complex forms?

In derivational theory (Chomsky & Halle 1968, Kiparsky 1982) the answer to this question involved the *cycle*: phonological rules apply to successively larger morphological domains. Cyclicity correctly predicts that a phonological property which is introduced on a smaller morphological domain is carried over to a larger domain. The cycle embodies the claim that phonological properties of derived words are *literally derived* from those of simpler words.

A major question that occupied cyclic phonologists is that of the definition of cyclic rule *domains*. Or, to put it more neutrally:

Q2: What morphological domains can be transderivationally related?

It was proposed already by Brame (1974) that cycled substrings must occur as independent *words*. In contrast to free stems, (bound) roots are not cyclic domains (cf. Kiparsky 1982). Evidence for this asymmetry between bound roots and stems came from various languages, such as Spanish (Harris 1983), Palestinian Arabic (Brame 1974), Warlpiri (Kiparsky 1988), and Malayalam (Mohanan 1989). The observation that only free stems are cyclic domains is a cornerstone of the theory of Prosodic Lexical Phonology (Inkelas 1989), according to which phonological rules apply within prosodic domains.

The third major question is related to the interface of phonology and morphology. It has been observed (for example Strauss 1983 on English) that affixation may be sensitive to *derived* phonological properties of its base, such as the stress pattern. The question arises how

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morphological operations may have access to effects of phonological rules applying to their sub-parts. Or, to state it more generally:

Q3: How can derived phonological properties of stems affect stem-based affixation?

In the cyclic theory of Chomsky & Halle (1968), all morphology was assumed to precede the phonology, incorrectly predicting that phonology-sensitive morphology may not occur. Lexical Phonology (Kiparsky 1982) allows for such situations by *interleaving* morphology and phonology. Phonological rules on the stem cycle precede affixation rules creating outer cyclic domains, hence their effects are 'accessible' to such affixation rules.

Standard Optimality Theory (Prince & Smolenky 1993, McCarthy & Prince 1993) cannot appeal to derivational cyclicity to capture transderivational relationships, since it is in essence a nonderivational theory.[2] Instead it has been proposed by various authors (Burzio 1994, McCarthy 1995, Benua 1995) that there exists a *direct* 'surface-to-surface' dependence of morphologically complex words on their bases.[3] This relation is called 'identity' and it is an instantiation of a more general 'correspondence' relation between morphologically related forms (including as sub-cases the relations between stem and affixed form, input and output, and base and reduplicant, McCarthy & Prince 1995). Output-to-output identity is enforced by sets of constraints which require that elements in one member of a pair must be identical to elements in the other member of the pair. As constraints generally are, identity constraints are violable, but violation must be minimal. This means that any divergence of a complex word as compared to its 'base' must be forced by some superordinate constraint of structural well-formedness.

The answers given by (non-derivational) correspondence theory to the three major questions stated above are significantly different from those of (derivational) cyclic theory. First, as we already saw, the derivational notion of cycle is abandoned in favor of surface identity. Correspondence theory predicts that only *surface* properties are transferrable from morphologically simple words to complex words. In contrast, cyclic theory does not make this prediction, since surface forms play no special role in this theory, as compared to forms in intermediate stages of the derivation. Second, correspondence theory *predicts* that only properties of free stems (and not those of bound roots) can be inherited by complex words, since free stems (but not bound roots) are output forms. In contrast, the status of stems as cyclic domains must be *stipulated* under cyclic theory. Third, with respect to the sensitivity of affixation to 'derived' phonological properties, correspondence theory predicts that this should be the case, under the assumption of *parallelism* - phonological and morphological constraints are ranked together in a single hierarchy. One might argue that parallelism is the counterpart of 'interleaving' of morphological and phonological rules in the derivational model of Lexical Phonology. However, parallel correspondence theory predicts a broader kind of sensitivity of morphology to phonology than is possible under interleaving Lexical Phonology. While interleaving restricts phonological sensitivity of affixation to properties that are present in the stem 'before' the affixation, the parallel model allows for sensitivity to the full range of output properties of the base plus affix combination (Kager 1996). This predicts that affixation may be blocked as a way of avoiding specific surface configurations.

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[2] Orgun (1994, 1996) has developed a declarative (*sign-based*) theory of the phonology-morphology interface that accounts for both cyclic and noncyclic effects, and is compatible with OT. It is well possible that the analysis presented in this paper can be restated equally well in Orgun's theory, an option that I will leave open for future research.

[3] Output-to-output correspondence can be seen as a incarnation of the traditional linguistic notion of paradigm regularity, developed as a formal part of grammar.

In this paper I will argue that correspondence theory is correct in all three respects, on the basis of an analysis of the interaction of stress and 'stem-based' affixation in Dutch. The main conclusions will be (i) that preservation of stress under 'stress-neutral' affixation is due to output-to-output identity, rather than to 'cyclicity', (ii) that 'stress-shifting' affixes are formally on a par with affixes that impose a 'stress condition' on their base, in the sense that 'stress shift' and 'stress conditions' are both strategies toward the same surface target, and (iii) that affix distribution and stress behaviour of different classes of affix are related in a way that cannot be captured in Lexical Phonology, while it follows naturally from parallel interactions of phonological and morphological constraints.

1.2 Stem stress and correspondence theory

Germanic languages such as Dutch, English, and German, have word-based stress systems which place the stress peak on a stem syllable, rather than on a suffix syllable. Consider the example below from Dutch, where the vertical lines indicate corresponding stress peaks:

(1)	[**á**nder]	'other'
	[ver- [**á**nder]]	'alter'
	[[ver- [**á**nder]] -lijk]	'alterable'
	[on- [[ver- [**á**nder]] -lijk]]	'unalterable'
	[[on- [[ver- [**á**nder]] -lijk]] -heid]	'unalterability'

This stem stress principle is usually referred to as 'stress-neutrality' of affixes. This reflects the observation that word-based affixes typically preserve the stress peak of the base: they cannot be stressed themselves, nor do they 'shift' the stress to another stem syllable.

This state-of-affairs changes under compounding, where multiple stems contribute their stress peaks to the construction: only one of these can be selected as the peak of the whole, which necessarily involves the loss of the other peaks:

(2)	[h**á**nd] [dóek]	'hand', 'cloth'
	[b**á**d] [[h**á**nd]-[doek]]	'bath', 'towel'
	[[b**á**d]-[[hand]-[doek]]]	'bath towel'

The same languages also have affixes which impose stress conditions on their bases, requiring the affix to be *adjacent to the stress peak* (main stress) of the word, which it must directly precede or directly follow. Affixal stress conditions go under different names in the literature (stress shift, stress attraction, stress sensitivity), reflecting the fact that conditions take effect with different degrees of forcefulness. Two common situations are:

Stress-shift: The affix 'actively' imposes its stress condition by 'shifting' stress of the base. An example is the Dutch adjectival suffix *-ig*, which shifts the stress peak of its compound base to the syllable directly preceding the suffix:

(3)	[nóod] [l**ó**t]	'distress', 'fortune'
	[[nóod]-[lot]]	'fate'
	[[[nood]-[l**ó**t]]-ig]	'fatal'

Correspondence of stress peaks between the derived form and its 'direct ancestor' base is broken here. But an indirect correspondence relationship still holds between the peak of the derived form and one of the stems (*lot*) that is the base-of-the-base.

Stress-blocking: The affix 'passively' imposes its stress condition by selecting bases that fulfill it: bases with final stress in case of a suffix, and bases with initial stress in case of a prefix. If the base fails to meet the stress condition, then the affix simply fails to adjoin: it is 'stress-blocked'. A suffixal example is (again) Dutch *-ig*, which imposes a condition of final stress on morphologically simplex bases (Trommelen & Zonneveld 1989):

(4)	a.	[moer**á**s]	'marsh'	b.	[p**í**as]	'clown'
		|			|	
		[[moer**á**s] -ig]	'marshy'		*[[p**í**as] -ig]	'clownish'

Again, peak correspondence is strictly enforced. Note that the suffix *-ig*, which shifts the stress peak in compound bases (3), is unable to shift stress in simplex bases (with a handful of exceptions which will be discussed). A prefixal example is German participle *ge-*, which requires a verbal base with initial stress, e.g. *ge-ság-t* 'said', but (**ge-*)*studíer-t* 'studied'.

This paper aims at modelling 'stress peak identity', stress-shifts, and stress-blocking as interactions of hierarchically ranked and violable constraints, on theoretical assumptions of Optimality Theory. This model attributes the situations in (1-4) to interactions of four types of constraints, requiring (a) that outputs preserve the stress peaks of their bases (this is minimally violated under compounding and stress-shift), (b) that stress peaks correspond to stress peaks in their bases (which is not violable in Dutch word-based affixation), (c) that specific affixes must occur adjacent to the stress peak (which triggers stress shifts), and (d) that outputs contain all affixes that are given in their inputs (which is violated under stress-blocking). Since affixation depends on the prosodic shape of the derived word, this adduces evidence for a *parallel* model of the phonology-morphology interface (rather than a '*serial*' model that interleaves phonology and morphology through level-ordering). I will show that this parallel model also accounts for linear ordering restrictions among word-based affixes, again on the basis of peak correspondence.

This analysis is embedded in theoretical assumptions of *Correspondence Theory* (McCarthy & Prince 1995). At the heart of this theory is the idea that linguistic outputs reflect a competition of two types of constraints: first, *well-formedness* constraints, which enforce pure phonological 'markedness', and second, *identity* constraints, which enforce identity between corresponding elements. The notion of *correspondence* is defined between pairs of elements in different strings, for example input and output:

(5) *I/O correspondence*: "Given two strings S_1 and S_2, *correspondence* is a relation $\Re$ from the elements of S_1 to those of S_2. Segments α (an element of an input string S_1) and β (an element of an output string S_2) are referred to as *correspondents* of one another when $\alpha \Re \beta$."

Correspondence constraints may require outputs to be 'faithful' to their inputs in various ways. The three main types of constraints that have been proposed thus far are:

(6) a. **DEPENDENCE**: Every element of S_2 has a correspondent in S_1.
b. **MAXIMALITY**: Every element of S_1 has a correspondent in S_2.
c. **IDENTITY(γF)**: Let α be a segment in S_1 and β be its correspondent in S_2. If α is [γF], then β is [γF].

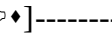
The original motivation for Correspondence Theory was to express parallellisms between 'input-output' faithfulness on the one hand, and 'base-output' identity in reduplication on the other hand (McCarthy & Prince 1995). Recently, correspondence has been extended to relationships between two output strings (none of which involves reduplication). (Burzio 1994, McCarthy 1995, Benua 1995). The relevant constraints require identity between the output form and its 'base': the word from which the output is morphologically 'derived'. In a non-derivational model, a 'base' can be characterized as a fully prosodized, independently occurring *word*, which is also *compositionally related* to the output (Kager forthcoming). In particular, the morphological and semantic features of the base must be a proper subset of those of the output. This definition predicts that an output may have more than one base, for example under compounding (7a), as well as in the case of affixed forms whose 'direct' base is itself affixed (7b):

(7) a. Output [[hánd]-[doek]] Base [hánd], [dóek]
b. Output [[ver-[ánder]]-lijk] Base [ver-[ánder]], [ánder]

From here on I will refer to the 'base-of-the-base' as an 'indirect' base.

Benua (1995) observes that English words derived by Class 2 affixes tend to display the phonological properties of their bases, even when they fail to meet the conditions under which these properties normally arise (Borowsky 1993). 'Over-application' of word-based phonology points to the conclusion that (Benua 1995:59): "Class 2 affixation is derived through an O/O correspondence with the unaffixed word". One of Benua's examples is the neutralization of lax front /  / and tense front /  / into [] in closed syllables, which is typical of New York and Philadelphia dialects of English, e.g. *pass* [], but *passive* []. In the present participle *passing* [], the same vowel [] appears as in its base form. Thus -Tensing 'over-applies' to *passing*, which itself fails to meet the syllabic context, since the relevant vowel appears in an open syllable. This over-application is attributed to pressure to maintain phonological identity between morphologically related forms:

(8)

	B/A-Identity	(**B**=Base, **A**=Affixed form)
	[]----------	[]
I/O-Faith	|	
	// (cf. *passive*)	

'Application' of tensing in the base form shows that the constraint banning [] from closed syllables dominates another constraint against tense low vowels such as []. The latter is also dominated by a B/A-identity constraint requiring identity between the affixed form and the base with respect to the feature [tense].

The proposal of the present paper is to extend Base-Output identity to *stress peaks* in the derived word and its base. The location of stress peaks of the base must be preserved in

the derived word, due to PK-MAX (B/O).[4] And conversely, the stress peak of the derived word must match some stress peak in the base, due to PK-DEP (O/B).

(9) a. **PK-MAX (B/O)**
Let α be a segment in B and β be its correspondent in O.
If α is the stress peak of B, then β is the stress peak of O.

b. **PK-DEP (O/B)**
Let α be a segment in O and β be its correspondent in B.
If α is the stress peak of O, then β is the stress peak of B.

These constraints express logically distinct requirements, even if (independent constraints require that) every word must have a unique stress peak. I assume that PK-MAX is violated by every base peak which is not preserved in the derived word. Conversely, a violation of PK-DEP occurs when the peak in the derived word fails to match any peak in any base. The distinction becomes empirically relevant in the case of a derived word which has multiple bases, for example in compounds. Here PK-DEP may be easily satisfied (the compound peak has only to correspond to a peak of *some* base). However, PK-MAX is clearly violated in compounds under the requirement that outputs must have *unique* stress peaks. Violation of PK-MAX necessarily follows since only one base (out of two or more that make up the compiound) can preserve its stress peak in the output. We will come across cases where this becomes relevant.

This pair of 'peak correspondence' constraints is related to the pair below, both due to Alderete (1995), who was the first to extend correspondence relationships to stress:

(10) a. **HD-DEP (I/O)**
The output prosodic head must have a correspondent in the input.

b. **HD-MAX (I/O)**
The input prosodic head must have a correspondent in the output.

HD-DEP (I/O) is violated by stressed epenthetic vowels (equating the notions *prosodic head* and *stress peak*), while HD-MAX (I/O) is violated by deletion of any vowel that is stressed in the input. Two important differences between Alderete's constraints in (10) and those of (9) are the following. First, Alderete's constraints require Input-Output identity, rather than Base-Output identity. A second, more important difference is that Alderete's constraints do not require correspondence of peaks between two strings, but only that the segment that is the peak of one string has another segment (not necessarily a peak) in the other string.

This paper is organized as follows. §2 addresses the phenomenon of stem stress in Dutch, covering various morphological constructions. This will result in a basic model that is tested for more complex constructions in subsequent sections. First, §3 concentrates on complex derived forms based on 'stress-neutral' adjectival suffixes, and demonstrates that the basic model of §2 accounts for their complete stress behaviour. Next, 'stress-shifting' adjectival affixes are discussed in §4. I will show that a simple extension of the basic model by an affix-specific stress requirement accounts for both stress shifts and stress-blocking. In particular, this will result in a generalized analysis of stress shift and stress blocking. Finally, §5 summarizes the argument, and compares the analysis to level-ordered models.

[4] Compare the use of the reduplicative identity constraint MAXIMISE in Kenstowicz (1995:415), militating against divergences in the stress peaks of base and reduplicant.

2. Stem stress in affixed forms and compounds

The types of Dutch morphology that I will discuss in this paper are all 'word-based'. This notion requires some clarification vis-a-vis the standard bifurcation of Dutch morphology into Class-1 and Class-2 morphology, and related lexical levels. Various criteria in the literature support such a distinction. Words derived by Class-1 affixes behave phonotactically (in terms of syllable structure and stress) as simplex words (Trommelen & Zonneveld 1989). Closely related to their phonotactic dependence, Class-1 affixes freely adjoin to roots, and require no independent words as their bases.[5] In contrast, a requirement of *word-size* bases is evident for Class-2 morphology, which is what I will focus on in this paper.

Word-based morphology in Dutch includes stress-neutral affixation (e.g. *-heid* in 1), compounding (e.g. *bad-hand-doek* in 2), and stress-shifting affixation (e.g. *-ig* in 3). Based on both accentual and distributional evidence, Trommelen & Zonneveld (1989) have argued that stress-shifting affixation is situated on a separate lexical level (Level-2) before stress-neutral affixation and compounding (Level-3)[6]. Their model will be discussed later in this paper. However, I will not accept this distinction into Level-2 and Level-3 beforehand, and start from the simpler assumption that all word-based morphology belongs to a single class. Finer distinctions between 'stress-shifting' and 'stress-neutral' affixation will be attributed to affix-specific stress conditions.

Word-based suffixes in Dutch belong to either of two lexical categories: nouns and adjectives.[7] Words derived by these suffixes have stem stress[8], as is shown by the choice of nominal suffixes in (11) and adjectival suffixes in (12):

(11)	a.	wáar-heid	'truth'	wáar	'true'
	b.	wándel-ing	'walk'	wándel	'to walk'
	c.	téken-aar	'draughtsman'	téken	'to draw'
	d.	spél-er	'player'	spéel	'to play'
	e.	vríend-schap	'friendship'	vríend	'friend'
	f.	ríjk-dom	'wealth'	ríjk	'rich'
(12)	a.	wás-baar	'washable'	wás	'to wash'
	b.	éer-zaam	'honourable'	éer	'honour'
	c.	wérk-loos	'unemployed'	wérk	'to work'
	d.	róod-achtig	'reddish'	róod	'red'
	e.	kóorts-ig	'feverish'	kóorts	'fever'
	f.	vróuw-elijk	'female'	vróuw	'woman'

Word-based prefixes occur in various lexical categories, although only verbal prefixes (and a single nominal prefix) are category-changing (Van Beurden 1987). Again, the stem is stressed rather than the affix:[9]

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[5] The question of how to account for with the stress properties of Class-1 affixes will be postponed to section 7.

[6] Together with inflection, which I will not discuss.

[7] Putting aside the improductive verbal suffix *-ig* (e.g. *stenig* 'to stone', *reinig* 'to clean').

[8] Stress-shifting *-ig* and *-lijk* will be dealt with in section 4. Four stressed nominal suffixes occur which are arguably word-based. Two are feminine suffixes, *-in* (*koningín* 'queen') and *-es* (*prinsés* 'princess'), while the other two are unproductive suffixes, *-ij* (*voogdíj* 'custody') and *-erij* (*loteríj* 'lottery'). These suffixes require brute-force accentuation, presumably by input specification plus top ranking peak faithfulness.

[9] Four nominal prefixes are consistently stressed, apparently counter-exemplifying the stem stress principle:

(13)	a.i	ver-wáter	‘water down’	wáter	‘water’
	a.ii	ont-hárd	‘soften (of water)’	hárd	‘hard’
	b.i	ge-lách	‘the laughing’	lách	‘to laugh’

Summarising, we have found that affixed words are characterized by ‘stem stress’. The explanation for stem stress that I will develop below is based on the observation that stems (but not affixes) occur as independent prosodic words. Stem stress reflects a Base-Output correspondence constraint requiring that stress peaks of the base be preserved in the output. This is PK-MAX (B/O), stated above in (9a).

PK-MAX(B/O) is a *violable* constraint; to find this out, we must turn to compounds. Compounds of lexical categories other than adjective (nouns in 14a, verbs in 14b) carry the stress peak on the leftmost stem:

(14)	a.i	[klém-toon]	‘accent’	a.iii	[[hánd-doek]-rek]$_N$	‘towel rack’
	a.ii	[kráak-been]	‘cartilage’	a.iv	[bád-[hand-doek]]$_N$	‘bath towel’
	b.i	[ráng-schik]	‘to rank’			
	b.ii	[snél-wandel]	‘to walk (fast)’			

The fact that compounds have a *single* stress peak (rather than two, or more) diagnoses a violation of PK-MAX (B/O), which requires that the stress peaks of every base be preserved in the output. The question is what causes this violation. I attribute the fact that compounds have a unique stress peak to a general constraint ruling out multiple peaks:[10]

(15) **UNI-PK**
Words must have a unique stress peak.

In order to take effect, this constraint must dominate PK-MAX (B/O).

If compounds are limited to a single peak, what determines the choice of base peak? All we need is a general constraint requiring initial stress (Prince & Smolensky 1993).

(16) **LEFTMOST**
Align (PrWd, L, peak, L).

Violations of this constraint will be counted by numbers of syllables from the right edge.

We are now in a position to rank all three constraints that were introduced so far:

(i)	a.	ón-zin	‘nonsense’	ón-mens	‘brute’
	b.	wán-klank	‘dissonance’	wán-orde	‘chaos’
	c.	wéer-slag	‘repercussion’	wéer-zin	‘repugnance’
	d.	óer-kreet	‘premordial cry’	óer-mens	‘primitive man’

I attribute obligatory stress on these prefixes to their special semantics. The prefixes *on-*, *wan-*, and *weer-* share a distinctly negative meaning aspect. Negation is linked to its stress peak status by some undominated constraint. Finally, the case of *oer-* is slightly less clear, but it may have enough independent semantics (‘primordial’) to be signalled accentually.

[10] This constraint is violable under highly specific conditions in Dutch, which are not fully understood yet, but appear to be semantic in origin. For example, adjectival compounds consisting of a head adjective preceded by a modifier of degree can be double-peaked, e.g. *réuze-léuk* ‘dead funny’, *bére-stérk* ‘strong as a bear’.

(17) UNI-PK » PK-MAX (B/O) » LEFTMOST

That LEFTMOST must be dominated by both other constraints can be seen in tableau (18) of a prefixed verb. The prefix yield the stress peak to the stem, even though it is 'leftmost' in the word. Both candidates (18b-c) that satisfy LEFTMOST are ruled out by the dominating constraints UNI-PK and PK-MAX (B/O):

(18)	Input: {ont-, hard} Base: [hárd]	UNI-PK	PK-MAX (B/O)	LEFTMOST
a.	☞ [ont-hárd]			*
b.	[ónt-hard]		*!	
c.	[ónt-hárd]	*!		

The ranking UNI-PK » PK-MAX (B/O) is motivated by tableau (19) of a compound verb. Two bases submit their peak for preservation in the output. But only one can become the output peak, because UNI-PK rules out multiple peaks (19c). Both remaining candidates (19a-b) have a single violation of PK-MAX, hence they are evaluated as 'equally ill-formed' by this constraint. Naturally evaluation is passed on to LEFTMOST, which selects (19b):

(19)	Input: {rang, schik} Base: [ráng], [schík]	UNI-PK	PK-MAX (B/O)	LEFTMOST
a.	[rang-schík]		*	*!
b.	☞ [ráng-schik]		*	
c.	[ráng-schík]	*!		

As a necessary step up to the discussion of adjectival affixes in the next section, we must become acquainted with the stress pattern of adjectival compounds. Examples in (20) show that the position of the stress peak in compounds is sensitive to lexical category. In contrast to nominal and verbal compounds (14), the peak is now on the *rightmost* stem (Visch 1989, Trommelen & Zonneveld 1989):[11]

(20) a. lood-vríj 'unleaded' d. vuur-vást 'heat-proof'
b. water-dícht 'waterproof' e. kleur-écht 'colour-fast'
c. rood-wit-bláuw 'red-white-and-blue' (the Dutch flag)

I assume that the location of the stress peak is due to the following constraint, a category-specific mirror-image version of LEFTMOST, which makes the maximally simple requirement that the stress peak in adjectives is 'rightmost':

(21) **ADJ-PK**
Align (Adjective, R, peak, R).

It will be clear that ADJ-PK dominates LEFTMOST. In sum, we now have the ranking:

[11] A class of complex adjectives (which are superficially adjectival compounds) have left peaks, e.g. *zée-ziek* 'sea-sick', *zín-vol* 'meaningful', *kléur-rijk* 'colourful'. Backhuys (1989) and Booij (1995) observe that the righthand constituents occur independently (*ziek* 'sick', *vol* 'full', *rijk* 'rich), but that they are better analysed as adjectival suffixes, since their lexical meaning has faded. That is, we analyse these morphemes on a par with adjectival affixes such as *-baar* and *-loos*.

(22) UNI-PK » PK-MAX(B/A) » ADJ-PK » LEFTMOST

In adjectival compounds, violation of PK-MAX cannot be avoided, since UNI-PK rules out any multiple-peaked candidates (23d). Right-hind location of the peak is due to ADJ-PK:

(23) Input: {[róod], [wít], [bláuw]}	UNI-PK	PK-MAX	ADJ-PK	LEFTMOST
a. ☞ [rood-wit-bláuw]		**		**
b. [rood-wít-blauw]		**	*!	*
c. [róod-wit-blauw]		**	*!*	
d. [róod-wít-bláuw]	*!			

Presence of ADJ-PK fails to change the previous evaluation of suffixed adjectives, since the option of right-hand stress is effectively ruled out by higher-ranking PK-MAX:

(24) Input: {[wás], -baar}	UNI-PK	PK-MAX	ADJ-PK	LEFTMOST
a. ☞ [wás-baar]			*	
b. [was-báar]		*!		*

The interesting question now arises as to which stress patterns emerge when compounding and adjectival suffixation combine in a single construction (e.g. synthetic compounds). That is, will the stress peak of the compound base be preserved ('stress-neutrality'), or will it be shifted to the rightmost stem ('stress-attraction')? This question will be taken up in §3.

3. 'Stress-neutral' adjectival suffixes

The discussion below will adduce more evidence for the role of peak correspondence in the stress patterns of morphologically comples adjectives. This discussion incorporates various generalizations on the stress behaviour of adjectival affixes that were stated by Trommelen & Zonneveld (1989). However, I will argue that the parallel OT model of the morphology-phonology interface captures these generalizations more straightforwardly than the 'multi-layered' serial interface of rule-based theory (assumed by Trommelen & Zonneveld).

The class of 'stress-neutral' adjectival suffixes in Dutch includes the following six:

(25) *-baar, -zaam, -end, -loos, -achtig, -s*

Trommelen & Zonneveld (1989) argue that the genuine diagnostic for the stress behaviour of these suffixes is provided by constructions in which they combine with two stems into a suffixed compound. We should be careful to distinguish (i) suffixation to an independently existing compound (cf. 26), from (ii) synthetic compounding, in which the pair of stems to which the suffix is adjoined fails to occur as an independent compound (cf. 27). These two constructions have different stress patterns, which is of course what we are interested in.

Let us begin with the first type of construction, suffixed compounds. Here the stress peak coincides with the peak of the embedded compound. A compound base may be a verb (26a), or a noun (26b):

(26)					
	a.i	[[ráng-schik]-baar]	'rankable'	[ráng-schik]	'to rank'
	a.ii	[[ráad-pleeg]-baar]	'consultable'	[ráad-pleeg]	'to consult'
	a.iii	[[húis-vest]-baar]	'lodgeable'	[húis-vest]	'to lodge'
	a.iv	[[hánd-haaf]-baar]	'maintainable	[hánd-haaf]	'to maintain'
	b.i	[[be-klém-toon]-baar]	'accentable'	[klém-toon]	'accent'

b.ii	[[méren-deel]-s]	‘for the greater part’	[méren-deel]	‘majority’
b.iii	[[stád-houder]-loos]	‘without a governor’	[stád-houder]	‘governor’
b.iv	[[kráak-been]-achtig]	‘cartilaginous’	[kráak-been]	‘cartilage’

This is clearly ‘stress-neutral’ affixation, preserving the stress peak of the compound base.

In synthetic compounds (which contain two independent words plus a suffix), the rightmost stem (a verb in 27a, or a noun in 27b) is stressed.

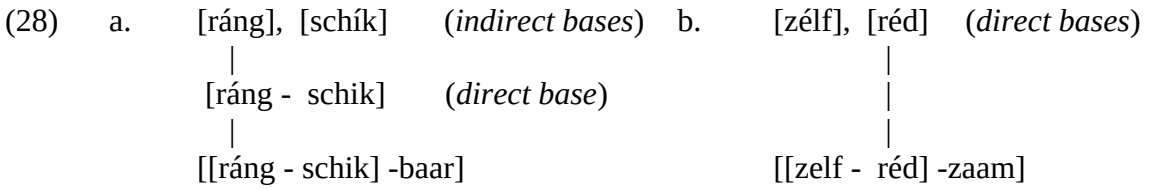
(27)				
a.i	[[zelf]-[réd]-zaam]	‘self-supportive’	[zélf] ‘self’, [réd] ‘support’
a.ii	[[zelf]-[wérk]-zaam]	‘automatic’	[zélf] ‘self’, [wérk] ‘operate’
a.iii	[[goed]-[lách]-s]	‘fond of laughing’	[góed] ‘good’, [lách] ‘laugh’
a.iiv	[[diep]-[gráv]-end]	‘penetrating’	[díep] ‘deep’, [gráaf] ‘dig’
b.i	[[gelijk]-[vlóer]-s]	‘on the ground floor’	[gelíjk] ‘equal’, [vlóer], ‘floor’
b.ii	[[bloot]-[vóet]-s]	‘bare-footed’	[blóot] ‘bare’, [vóet] ‘foot’
b.iii	[[buiten]-[áard]-s]	‘extraterrestrial’	[búiten] ‘out’, [áarde] ‘earth’

Trommelen & Zonneveld (1989) state the correct generalisation about these forms: that the ‘right-stem-strong’ stress pattern of synthetic compounds is directly related to the general right-strong stress pattern of bare adjectival compounds (20). Hence no specific stress shift rule is involved in the pattern of synthetic compounds.

As will be clear from a comparison of (26) and (27), the morphological differences between these constructions are reflected in their stress behaviour. In fact, all ingredients for a full explanation are readily available from the discussion in the previous section.

The suffixed compound [[*ráng-schik*]-*baar*] in (26a) preserves the stress peak of its compound base [*ráng-schik*]. This compound, in its turn, has a dual base, the pair {[*ráng*], [*schík*]}, each of which has its own stress peak. Maximally one of these stress peaks can be preserved as the peak of the compound, because of UNI-PK. The choice is made for the left peak by LEFTMOST. (Recall that the compound [*ráng-schik*] is verbal.)

(28)



In contrast, the synthetic compound [[*zelf-réd*]-*zaam*] in (21b) has a direct dual base, the pair {[*zélf*], [*réd*]}, of which it preserves only one peak.

First consider tableau (29) of the suffixed compound *rángschikbaar*. The definition of ‘base’ that I proposed earlier predicts that the direct base (*rángschik*), as well as both of its indirect bases (*ráng, schík*), may cause violations of PK-MAX. (This is not yet crucial in tableau (29) as the direct base is sufficient for the evaluation, but it will become important later on.) The evaluation proceeds as follows. Candidate (29a) has a violation of PK-MAX that is due to the non-preservation of the stress peak of the indirect base [*schík*]. Candidate (29b) has two violations, as it is unfaithful to two stress peaks: that of its direct base [*ráng-schik*], and that of its indirect base [*ráng*]. Finally, candidate (29c) is unfaithful to all three stress peaks. By gradient evaluation, PK-MAX selects (29a) as the optimal candidate before ADJ-PK even gets a chance of entering the evaluation.

(29) I: {rang, schik, -baar} B: [ráng-schik], [ráng], [schík]	UNI-PK	PK-MAX	ADJ-PK	LEFTMOST

a.	☞ [[ráng-schik]-baar]		*	**	
b.	[[rang-schík]-baar]		**!	*	*
c.	[[rang-schik]-báar]		**!*		**
d.	[[ráng-schík]-baar]	*!		*	

Now compare tableau (30) of a synthetic compound. Synthetic compounds crucially lack a compound base whose stress peak could have been relevant to PK-MAX. Candidates (30a-b) are therefore evaluated as equal by PK-MAX, both being unfaithful to one of both stress peaks in the dual base. The evaluation is passed on to the next-lower constraint in the hierarchy, ADJ-PK, which decides in favour of (30a).

(30) I: {zelf, red, -zaam} B: [zélf], [réd]		UNI-PK	PK-MAX	ADJ-PK	LEFTMOST
a.	[[zélf]-[red]-zaam]		*	**!	
b.	☞ [[zelf]-[réd]-zaam]		*	*	*
c.	[[zelf]-[red]-záam]		**!		**
d.	[[zélf]-[réd]-zaam]	*!		*	

In sum, adjectival synthetic compounds reflect a combination of the 'stem stress pattern' and the 'adjectival compound pattern', with the stress peak located on the rightmost stem.

So far I have referred to the adjectival suffixes under discussion as 'stress-neutral'. However, this terminology is not uncontroversial. Many analysts before Trommelen & Zonneveld (1989) have actually claimed that suffixes such as *-baar, -zaam*, and *-end* are 'stress-shifting' because of the stress patterns of constructions in which they adjoin to 'separable' verbs:

(31)	a.i	[[aan]-[tóon]-baar]	'demonstrable'	áan=toon	'demonstrate'
	a.ii	[[waar]-[néem]-baar]	'perceptible'	wáar=neem	'perceive'
	b.i	[[op]-[mérk]-zaam]	'attentive'	óp=merk	'notice'
	b.ii	[[mede]-[déel]-zaam]	'communicative'	méde=deel	'communicate'
	c.i	[[op]-[wínd]-end]	'exciting'	óp=wind	'excite'
	c.ii	[[in]-[léid]-end]	'introductory'	ín=leid	'introduce'

The alleged 'stress-shifting' behaviour is based on the stress patterns of separable verbs in a phrasal context, where the *particle* is stressed. Separable verbs display a strong-weak stress pattern in subordinate clauses (32a.i), where both parts may be separated by an infinitival marker (32a.ii), or an auxiliary verb (32a.iii). Second, a weak-strong pattern occurs in main clauses (32b), where the distance between the verbal part (in verb-second position) and the particle (stranded in clause-final position) is unbounded (Koster 1975):

(32)	a.i	... dat ik áan toon	'that I demonstrate'
	a.ii	... áan te tonen	'to demonstrate'
	a.iii	... áan zal tonen	'will demonstrate'
	b.	(ik) toon ('t) áan	'(I) demonstrate (it)'

Particle stress is not reducible to compound stress, which is restricted to word units that are joined both morphologically and phonologically. Trommelen & Zonneveld (1989) argue that

particle stress is *phrasal*, following the general stress pattern of VP (in which objects and other arguments are stressed, rather than verbs). This important insight paves the way for an analysis of *-baar* suffixations of separable verbs (31) which no longer involves 'stress attraction', but which runs parallel to that of synthetic compounds (30).

In my analysis, this insight is translated as follows. The *phrasal* nature of the stress pattern of separable verb renders it 'invisible' to PK-MAX, which accesses lexical prosodic units only. Note that if separable verbs were prosodic units in the lexicon, their separability would be a complete mystery, since syntax cannot undo Prosodic Word status. I therefore assume that separable verbs enjoy a status of lexical units only in a morphosyntactic sense, and crucially not in a prosodic sense. Accordingly separable verbs are prosodically analysed as dual bases, and their derivations as synthetic compounds.

We have not yet considered the behaviour of stress-neutral adjectival affixes with respect to bases which consist of a single suffixed word. Nothing happens here that we did not already expect: the generalization of stress-neutrality that we reached earlier still holds, and the stress peak in the derived word corresponds to that of the base:

(33)	a.	[[wáar-heid]-loos]	'truthless'	wáar-heid	'truth'
	b.	[[be-wég-ing]-loos]	'motionless'	be-wég-ing	'motion'
	c.	[[ver-wáar-loos]-baar]	'neglectable'	ver-wáar-loos	'neglect'

A tableau of *wáarheidsloos* is given in (34). It is a straightforward demonstration of stem stress, that is, the domination of ADJ-PK by PK-MAX:

(34) I: {waar, -heid, -loos} B: [wáar-heid], [wáar]	UNI-PK	PK-MAX	ADJ-PK	LEFTMOST
a. [[wáar-heid]-loos]			**	
b. ☞ [[waar-héid]-loos]		*!*	*	*
c. [[waar-heid]-lóos]		*!*		**
d. [[wáar-héid]-loos]	*!		*	

Next, consider adjectival compounds suffixed by a nominal suffix. The compound's stress peak is preserved in the affixed form (data from Trommelen & Zonneveld 1989:186):

(35)	a.	[[gast-vrij]-heid]	'hospitability'	[gast-vrij]	'hospitable'
	b.	[[vak-bekwáam]-heid]	'professional skill'	[vak-bekwáam]	'skillful'

This stress preservation follows from the current model:

(36) I: {gast, vrij, -heid } B: [gast-vrij], [gást], [vrij]	UNI-PK	PK-MAX	ADJ-PK	LEFTMOST
a. ☞ [[gast-vrij]-heid]		*	*	*
b. [[gást-vrij]-heid]		**!	**	
c. [[gast-vrij]-héid]		**!		*
d. [[gást-vrij]-heid]	*!		*	

So far we have not paid attention to affixations of polysyllabic bases, which in level ordering models provide the main diagnostic of stress behaviour of affixes. Not surprisingly we find that the adjectival suffixes under discussion are strictly 'stress-neutral'. The stress peak in the affixed word coincides with that of the polysyllabic base:

(37)	a.	schâduw-loos	'shadowless'	schâduw	'shadow'
	b.	brânie-achtig	'swanky'	brânie	'tumult'
	c.	Énschedee-s	'from Enschede'	Énschede	(place name)
	d.	ver-ántwoord-baar	'accountable'	ver-ántwoord	'account'
	e.	árbeid-zaam[12]	'laborious'	árbeid	'labour'

Again, this follows straightforwardly from the current model:

(38)	I: {schaduw, -loos} B: [schâduw]	UNI-PK	PK-MAX	ADJ-PK	LEFTMOST
a.	☞ [[schâduw]-loos]			**	
b.	[[schadúw]-loos]		*!	*	*
c.	[[schaduw]-lóos]		*!		**

To summarize: stem stress is due to PK-MAX, a correspondence constraint which dominates the category-specific stress constraint ADJ-PK, as well as LEFTMOST. Moreover, pre-stressing in adjectical suffixation is restricted to forms that have 'dual' bases, hence two input stress peaks. Genuine cases of 'stress-shift' will be considered in the next section.

4. 'Stress-shifting' adjectival suffixes

Dutch has a pair of adjectival suffixes, *-ig* and *-lijk*[13], that induce stress shifts in their bases. The morphological distribution of these affixes is governed by restrictions which previous researchers (Trommelen & Zonneveld 1989, and others) have attempted to derive from the layered lexicon. However, such attempts were seriously hampered by an ordering paradox.

The central observation that stood at the basis of all layer-lexicon analyses of stress-shifting suffixes is that these may only occur 'inside' stress-neutral suffixes:[14]

(39)	a.	[[méns-elijk]-heid]	'humanity'	[méns-elijk]	'human'
	b.	[[zóet-ig]-heid]	'sweeties'	[zóet-ig]	'sweet'

Conversely, stress-shifting suffixes never occur 'outside' stress-neutral suffixes, regardless of whether the stress peak of the base is shifted to the stress-neutral affix:

(40)	a.	*[[waar-héid]-elijk]	"truthful"	[wáar-heid]	'truth'
	b.	*[[zénuw-achtig]-lijk]	"somewhat nervous"	[zénuw-achtig]	'nervous'
	c.	*[[waarde-lóos]-ig]	"somewhat worthless"	[wáarde-loos]	'worthless'
	d.	*[[was-báar]-ig]	"somewhat washable"	[wás-baar]	'washable'

So far this distribution perfectly matches a two-layered lexicon model which has stem stress and 'stress-shifting' affixation at an earlier level than compound stress and 'stress-neutral' affixation. (As proposed by Trommelen & Zonneveld 1989, to which I will return below.)

[12] The form *herbérg-zaam* 'hospitable' (from *hérberg*, 'tavern') is the single counter-example to stress-neutrality.

[13] The suffix *-lijk* [●★&] has an allomorph *-elijk* [★●★&] whose distribution is governed by segmental conditions that are irrelevant to the present discussion.

[14] Observe that all examples involve nominal *-heid.* This is the only derivational suffix that is productive with adjectival bases.

The ranking paradox arises when we find that stress-shifting adjectival affixes freely occur outside compounds, where they shift the stress peak of the compound base:

(41)	a.i	[[nood-lót]-ig]	‘fatal’	[nóod-lot]	‘fate’
	a.ii	[[mis-dáad]-ig]	‘criminal’	[mís-daad]	‘crime’
	a.iii	[[voor-béeld]-ig]	‘examplary’	[vóor-beeld]	‘example’
	b.i	[[werk-wóord]-elijk]	‘verbal’	[wérk-woord]	‘verb’
	b.ii	[[grond-wét]-elijk]	‘constitutional’	[gróond-wet]	‘constitution’
	b.iii	[[ogen-blík]-elijk]	‘instantly’	[ógen-blik]	‘instant’

These are not merely exceptions: this list can be extended with dozens of similar cases. It has been observed by Trommelen & Zonneveld (1989:190) that the compounds which form bases of *-ig* and *-lijk* affixation have lexicalized semantics (many are abstract nouns), and are typically non-recursive. Accordingly they propose a lexical model in which compounds of this type are situated at an earlier level than recursive compounding:

(42) Level-1 Underived words (and Class-1 affixation)
↓
Level-2 *-ig, -lijk,* early compounds
↓
Level-3 stress-neutral (Class-2) affixation, compounds

However, by applying the same criteria of lexicalized (abstract-noun) semantics and non-recursivity, the *affixed* forms in (43), should also qualify as ‘early’ formations. They might thus be expected to be suitable bases for *-ig* and *-lijk* affixation, which is incorrect:

(43)	a.i	[schóon-heid]	‘beauty’	[schóon]	‘clean’	*[[schoon-heid]-ig]
	a.ii	[éen-heid]	‘unity’	[éen]	‘one’	*[[een-heid]-ig]
	b.i	[hóud-ing]	‘attitude’	[hóud]	‘hold’	*[[houd-ing]-lijk][15]
	b.ii	[dwál-ing]	‘error’	[dwáal]	‘wander’	*[[dwal-ing]-lijk]

Lexicalized abstract nouns based on *-heid* and *-ing* are abundant in Dutch morphology, but none allows *-ig* or *-lijk* affixation.[16]One may, as is always possible, stipulate some property of compounding in (42) which the affixes in (43) lack, in order to ‘explain’ the difference in stress conditions. But as far as I can see, this would amount to a purely diacritic marking. The single relevant *overt* property that the suffixes lack, but the righthand members have, is that the latter occur as independent words. This will explain differences in stress conditions between compounding and ‘stress-neutral’ suffixation without any additional assumptions.

I will present an analysis of these data which does not rely on the assumption that stress-neutral and stress-shifting suffixes belong to different lexical layers. Instead I simply

[15] Or perhaps **hóudinklijk*, by analogy to *koning* ‘king’ (simplex) - *koninklijk* ‘royal’.

[16] The only stress-neutral affix that consistently allows *-lijk* affixation is *-schap*:

(i) vríend ‘friend’ vríend-schap ‘friendship’ vriendscháp-elijk ‘friendly’
(ii) láng ‘land’ láng-schap ‘landscape’ landschápp-elijk ‘of the ...’

These data are problematic to both the layered-lexicon model and the correspondence model which is advocated here. (The word *schap* ‘industrial board’ is only vaguely related to the suffix in a semantic sense.)

assume that both kinds of suffixes are word-based. It then follows that stress-shifting suffixes {*-ig, -lijk*}, as any word-based affix, may freely adjoin to compound bases. The question can now be restated: what blocks stress-shifting suffixes after bases that contain stress-neutral suffixes? Intuitively, the solution must take into account the important fact that stress-shifting suffixes differ from stress-neutral ones in one crucial aspect: they must immediately follow the stress peak of the word. An affix-to-peak alignment constraint expresses this[17]:

(44) **SFX-TO-PK**
Align ({*-ig, -elijk*}, L, stress peak, R).
"The left edge of affixes {*-ig, -elijk*} coincides with the right edge of the stress peak."

SFX-TO-PK dominates the correspondence constraint PK-MAX (requiring that stress peaks of bases are preserved in the output). This is why we find stress shift in compound bases. But why is a stress shift to an unstressed suffix excluded? The intuitive idea is that shift to the second half of a compound base is allowed since this occurs an an independent word. In contrast, suffixes do not occur independently. We can formalize this idea by requiring that a derived word's stress peak should match a peak of some of its composing morphemes. This constraint is PK-DEP, repeated from (5b):

(45) **PK-DEP** (O/B)
Let α be a segment in O and β be its correspondent in B.
If α is the stress peak of O, then β is the stress peak of B.

As shown in (46a), a compound base offers a 'landing site' for the stress peak even when this is shifted: it is the righthand element of the compound, itself a prosodically independent word with its own stress peak. This correspondence relationship holds between the output and its indirect base [*lót*], rather than its direct base [*nóod-lot*]. In contrast no such 'landing site' occurs in suffixed bases, since the suffix is by definition prosodically dependent, hence has no stress peak. See (46b):

(46) a.

[nóod]	[l**ó**t]
|	¦
[nóod	-lot]
	¦
[[nood -l**ó**t] -ig]	

b.

[wáar]
|
[wáar-heid]
*[[waar-héid]-ig]

I therefore propose that the notion 'base' is *transitive*. More formally, if B is the direct base of an output form O, and B' is the direct base of B, then B' is also *indirectly* the base of O.

Let us now turn to the mechanism of stress-induced blocking. I will use a mechanism of morphological blocking which was introduced by Prince & Smolensky (1993): among the logically possible outputs of the Generator component (*Gen.*) is the 'null parse' ∅, which is equal to no analysis of the input at all. This 'null parse' may be selected as the optimal output, that is, preferred over non-zero outputs, when the violation of some constraint *C* is avoided even at the cost of unfaithfulness to the input morphology. The null parse implies a

[17] Alternatively, pre-accenting behaviour of these suffixes might be encoded in inputs by pre-specification in the weak position of a trochee, in combination with a constraint that enforces lexical feet (Inkelas forthcoming). However, we will see later in the discussion of prefixes that a mirror-image constraint of (36) is required, which would require iambic feet. Since evidence for iambic feet is totally lacking in Dutch, general considerations have lead me to use constraints rather than pre-specification. However, the issue may not been settled yet.

violation of the constraint M-MAX (47), a correspondence version of M-PARSE in Prince & Smolensky (1993:49):

(47) **M-MAX** (I/O)
Every morpheme in the input has a correspondent in the output.

Affix blocking constitutes a violation of M-MAX - the morphological null parse. Observe that both SFX-TO-PK and PK-DEP must dominate M-MAX since the null parse '∅' is preferred over both outputs in (48a-b):

(48) a. ∅ > *[[waar-héid]-ig] PK-DEP » M-MAX
b. ∅ > *[[wáar-heid]-ig] SFX-TO-PK » M-MAX

Regardless of whether stress is shifted (48a) or not (48b), any morphologically faithful output must violate some constraint whose violation is avoided by the grammar at all costs - even when this means silence.

The total ranking accounting for all effects of stress neutrality, stress shift, and affix blocking that were discussed so far is:

(49) UNI-PK, SFX-TO-PK, PK-DEP » M-MAX » PK-MAX » ADJ-PK » LEFTMOST

I have now introduced the relevant constraints, and argued for their ranking. This exposition will now be completed by tableaux of both crucial cases. First, tableau (50) of an affixed compound shows shows that M-MAX dominates PK-MAX, ADJ-PK, and LEFTMOST. There is a narrow win of candidate (50a), which violates PK-MAX, over its main competitor (50d), the null-parse candidate, which violates M-MAX. This tableau shows that M-MAX » PK-MAX:[18]

(50) I: {nood, lot, -ig} B: [nóod-lot], [nóod], [lót]	UNI-PK	SFX-TO-PK	PK-DEP	M-MAX	PK-MAX	ADJ-PK	LEFT-MOST
a. ☞ [[nood-lót]-ig]					**	*	*
b. [[nóod-lot]-ig]		*!			*	**	
c. [[nóod-lót]-ig]	*!					*	
d. Ø				*!			

Tableau (51) shows an unsuccessful attempt to provide a non-null output form for an input containing a suffixed noun *waarheid*, and the suffix *-ig*. This produces evidence for the ranking UNI-PK, SFX-TO-PK, PK-DEP » M-MAX. The optimal candidate is the null parse (51d), which is impeccable with respect to all constraints, except to M-MAX. However, all possible non-null competitors (51a-c) violate some high-ranked constraint.

(51) I: {waar, -heid, -ig} B: [wáar-heid], [wáar]	UNI-PK	SFX-TO-PK	PK-DEP	M-MAX	PK-MAX	ADJ-PK	LEFT-MOST
a. [[waar-héid]-ig]			*!		**	*	*
b. [[wáar-heid]-ig]		*!				**	
c. [[wáar-héid]-ig]	*!					*	

[18] Although it is not crucial here, I assume that the null-parse incurs no violation of PK-MAX, since it has no phonological content.

d.	☞ Ø				*		

Crucially, the null parse (51c) does not violate any of the peak correspondence constraints (in particular, PK-DEP) since it has no correspondence relation with the base.

We correctly predict that stress-shifting suffixes may freely adjoin to 'dual' bases in synthetic compounds (52a), as well as to separable verbs (52b), with prestressing behaviour in both cases:

(52)	a.i	[[los]-[líp]-ig]	'loose-tongued'	los 'loose'	lip 'lip'
	a.ii	[[groot]-[schál]-ig]	'on a big scale'	groot 'big'	schaal 'scale'
	a.iii	[[hand]-[tást]-elijk]	'palpable'	hand 'hand'	tast 'touch'
	a.iv	[[klaar]-[blíjk]-elijk]	'evident'	klaar 'clear'	blijk 'appear'
	b.i	[[in]-[háal]-ig]	'greedy'	in=haal	'fetch in'
	b.ii	[[na]-[láat]-ig]	'neglectful'	na=laat	'omit'
	b.iii	[[op]-[mérk]-elijk]	'remarkable'	op=merk	'remark'
	b.iv	[[aan]-[hóud]-elijk]	'sustained'	aan=houd	'keep on'

The only difference with affixed compounds (*noodlottig* etc.) is that the 'landing site' for a stress peak happens to be available in a direct base. But by transitivity of the notion 'base', this makes no difference to PK-DEP. The three different situations are portrayed in (53):

(53)	Affixed form:	[[nood-l**ó**t]-ig]	[[waar-héid]-ig]	[[los]-[l**í**p]-ig]
	Direct base(s):	[nóod-lot]	[wáar-heid]	[lós], [l**í**p]
	Indirect base(s):	[nóod], [l**ó**t]	[wáar]	
	PK-DEP:	satisfied in IB	violated	satisfied in DB

We also correctly predict a second environment in which 'stress-shifting' affixes are blocked. While stress-shifting affixes should freely adjoin to a morphologically simplex base that ends in a stressed syllable (54), the same affixes should be blocked with simplex bases that end in an unstressed syllable (55).

(54)	a.i	huméur	'temper'		huméur-ig	'moody'
	a.ii	venijn	'venom'		venijn-ig	'venomous'
	a.ii	schandáal	'scandal'		schandál-ig	'scandalous'
	a.iv	moerás	'marsh'		moeráss-ig	'marshy'
	a.v	pietlút	'niggler'		pietlútt-ig	'niggling'
	a.vi	kolóm	'column'	(twee-)	kolómm-ig	'(two-)columned'
	b.i	paradíjs	'paradise'		paradíjs-elijk	'paradisiacal'
	b.ii	natúur	'nature'		natúur-lijk	'natural'
	b.iii	fatsóen	'decency'		fatsóen-lijk	'decent'
	b.iv	publíek	'public'		publíek-elijk	'publicly'
	b.v	recént	'recent'		recént-elijk	'recently'
	b.vi	triomfánt	'triumphant'		triomfánt-elijk	'triumphantly'

(55)	a.i	ménthol	'menthol'	*mentholl-ig	'menthol-like'
	a.ii	cháos	'chaos'	*chaoss-ig	'chaotic'
	a.iii	Sódom	'Sodom'	*Sodomm-ig	'sodom-like'
	b.i	pélgrim	'pilgrim'	*pelgrimm-elijk	'pilgrim-like'
	b.ii	sátan	'Satan'	*satann-elijk	'satanic'

b.iii	júnior	‘junior’	*júnior-lijk	‘junior-like’

The stress-blocking context (55) was first observed by Trommelen & Zonneveld (1989), who note that it does not follow from a layered lexical model: “It is unclear to us why these suffixes impose this requirement; there have been times in phonology when such a situation was referred to as a ‘conspiracy’, with reference to work by Kisseberth (1970); however, naming some phenomenon does not amount to explaining it.” (Trommelen & Zonneveld 1989:189, my translation). In a constraint-based OT analysis, the nature of the ‘conspiracy’ is evident: the pre-stressing condition of these suffixes is respected at all costs, and so is the constraint that the stressed syllable must have a stressed correspondent in the base.

The pattern is simply predicted by the current ranking - the unstressed final syllable of the base is no proper landing site for the derived word’s stress peak - while preserving the base stress peak fatally violates SFX-TO-PK:

(56) I: {menthol, -ig} B: [ménthol]	UNI-PK	SFX-TO-PK	PK-DEP	M-MAX	PK-MAX	ADJ-PK	LEFT-MOST
a. [[menthól]-ig]			*!		**	*	*
b. [[ménthol]-ig]		*!			*	**	
c. ☞ Ø				*			

Examples presented earlier in (37) show that stress-neutral suffixes are freely allowed with bases of this stress type, e.g. *ménthol-achtig* ‘menthol-like. The null-parse can be succesfully avoided in this case since SFX-TO-PK is vacuously satisfied here, so that a candidate is available that satisfies both SFX-TO-PK and M-MAX.

Summarizing, we have connected ‘stress-shifting’ and ‘affix-blocking’ behaviour of suffixes. The generalization that this model captures is that any suffix that shifts the stress peak in compound bases, also imposes a stress condition on simplex bases; while any suffix that fails to shift the stress peak in compound bases, also fails to impose a stress condition on simplex bases.

The generalization that *-ig* and *-lijk* are blocked in context (47) seems hampered by a set of observations, which I will now discuss. Firstly, *-ig* and *-lijk* freely adjoin to bases whose second syllable contains schwa:

(57)						
	a.i	váder-lijk	‘paternal’	b.i	módder-ig	‘muddy’
	a.ii	ádel-lijk	‘noble’	b.ii	rímpel-ig	‘wrinkled’
	a.iii	ópen-lijk	‘public’			

Actually these data only confirm a generalization that was stated by Kager & Zonneveld (1986) and Kager (1989), that schwa in final syllables behaves ‘as if not there’ for prosody (for syllable phonotactics as well as word stress). If we assume that schwa is denied a grid position by some undominated constraint (which also explains schwa’s stresslessness), then the current statement of SFX-TO-PK suffices: the suffixes in (57) are linearly adjacent to the stress peak, *as defined on the grid*.

Secondly, a number of stress-shifting cases occur. A small set of words ending in a ‘superheavy’ syllable (CvvC or CvCC) allows for stress shift under *-ig* and *-lijk* affixation:

(58)					
	a.i	ármoede	‘povert’	armóed-ig	‘poor’
	a.ii	víjand	‘enemy’	vijánd-ig	‘hostile’

b.i	ámbacht	‘handicraft’	ambácht-elijk	‘craft (adj.)’
b.ii	bísschop	‘bishop’	bisschópp-elijk	‘episcopal’
b.iii	víjand	‘enemy’	vijánd-elijk	‘enemy (adj.)’
b.iv	líchaam	‘body’	lichám-elijk	‘bodily’
b.v	májesteit	‘majesty’	majestéit-elijk	‘majestic’
b.vi	ver-ántwoord	‘account’	verantwóord-elijk	‘responsible’

These words display compound behaviour, precisely matching their historical origins. There is no reason to consider them to be compounds in present-day Dutch, however. A tentative analysis may be based on stress allomorphy, e.g. {*víjand ~ vijánd*}. The proper allomorph (in nouns versus adjectival derivations) would then be automatically selected by the ranking ADJ-PK » LEFTMOST. An allomorph analysis is supported by a second tiny group of shifting cases, where shift to the final syllable is accompanied by vowel lengthening (historically this was a result of open syllable lengthening):

(59)	a.	hértog [ˈ]	‘duke’	hertóg-elijk	[□ˈ]	‘ducal’
	b.	mótor [ˈ]	‘motor’	motór-ig	[□ˈ]	‘of a motor’

This vowel lengthening has become completely unproductive in present-day Dutch, hence it requires an allomorph analysis on independent grounds.[19]

This completes the analysis of ‘peak-dependent’ suffixation, which I will summarise in the next section.

6. A summary of the analysis

Table (60) summarizes empirical findings with respect to the two classes of suffix:

(60)

	Base	**Affixed form**				
	Type	*Pattern-ig, -elijk*		*-baar,-zaam,-end,-s*		
a.i	Underived	[SW]	blocked		neutral	[SW]-sfx
a.ii	Suffixed	[S-W]	blocked		neutral	[SW]-sfx
a.iii	Compound	[[S][W]]	shifting	[WS]-sfx	neutral	[SW]-sfx
b.i	Two words	[S] [S]	pre-stress	[WS]-sfx	pre-stress	[WS]-sfx
b.ii	Separable V	[S] [W]	shifting	[WS]-sfx	shifting	[WS]-sfx

Findings are explained by my analysis as follows. First, all adjectival suffixes place stress on a stem syllable, rather than a suffixal syllable, due to high-ranked PK-DEP (B/A). Second, all outputs of ‘dual’ bases follow the General Adjectival Pattern (UNI-PK » PK-DEP (B/A) » ADJ-PK). Third, both types of suffixes differ only in outputs of single bases. More precisely, ‘neutral’ suffixes consistently respect the stress peak of the base, whereas ‘shifting’ suffixes stress the immediately preceding syllable, except when this has no stressed correspondent in the base: then the output is blocked. These possibilities are accounted for by the following sub-rankings:

(61) a. Shift: SFX-TO-PK, M-MAX » PK-MAX

[19] In the case of words ending in *-or*, this allomorphy is present at the level of a (semi-)suffix, e.g. singular-plural alternations *dóctor ~ doctóren*, *senátor ~ senatóren*, etc. Note that the end-stressed allomorph is selected when an unstressed suffix follows, while the initial-stressed allomorph is the isolation form. Booij (1997) argues that this is a case of phonologically conditioned allomorphy (cf. Kager 1996), which has a word-final trochee (the Dutch stress foot) as its target.

b. Neutrality: PK-MAX » ADJ-PK
c. Blocking: SFX-TO-PK, PK-DEP » M-MAX
d. Pre-stressing: PK-DEP » ADJ-PK

These sub-rankings are part of the integrated ranking (62), repeated from (49):

(62) UNI-PK, SFX-TO-PK, PK-DEP » M-MAX » PK-MAX » ADJ-PK » LEFTMOST

The following table ranks the constraints by pairs, and gives the relevant candidates:

(63)	a.i	PK-DEP » ADJ-PK	*wásbaar*	>	*wasbáar*
	a.ii	PK-DEP » M-MAX	Ø	>	*waarhéidig*
	b.i	SFX-TO-PK » PK-MAX	*noodlóttig*	>	*nóodlottig*
	b.ii	SFX-TO-PK » LEFTMOST	*noodlóttig*	>	Ø
	b.ii	SFX-TO-PK » M-MAX	Ø	>	*schóonheidig*
	c.i	M-MAX » PK-MAX	*noodlóttig*	>	Ø
	c.ii	M-MAX » LEFTMOST	*noodlóttig*	>	*nóodlottig*
	d.	PK-MAX » ADJ-PK	*rángschikbaar*	>	*rangschíkbaar*
	e.	ADJ-PK » LEFTMOST	*zelfrédzaam*	>	*zélfredzaam*

The final section will draw general conclusions, and also present a detailed comparison of the correspondence model and the layered-lexicon models.

7. Conclusions

I have argued that the preservation of stem stress in affixed forms is an effect of output-to-output identity, rather than of the derivational (cyclic) preservation of stress. In this analysis a crucial role is played by a set of correspondence constraints requiring 'identity' between a derived word and its morphological base, with respect to the position of the stress peak. The assumption that only output forms (free stems) are involved in a stress correspondence relation explains a number of behavioral differences between stems and stem-based affixes: the fact that affixes 'reject' stress in favour of stems, the fact that stress shifts apply inside compounds (but not inside affixed words), and the fact that stem-based affixation (but not compounding) may be blocked by stems with non-final stress. A Lexical Phonology model is not able to relate these properties in the same way as the correspondence analysis does. To back up this point, both types of analyses will now be compared.

I will now build the theoretical argument for the 'parallel' morphology-phonology interface of OT over the 'serial' level-ordered interface of Lexical Phonology (*LP*). In LP, phonology and morphology communicate by interleaving morphological and phonological rules in a layered structure. For example, let us assume a two-layered model of the Dutch lexicon in which word-based shifting suffixes (*-ig, -elijk*) are adjoined at Level-1 (the level at which root-based affixation takes place), while 'stress-neutral' suffixes (*-baar, -loos*, etc.) adjoin at Level-2:

(64)		**Morphology**	**Phonology**
	Level-1	*-ig*, etc.	Stem stress rule
	Level-2	*-baar*, etc., compounding	Adjectival and compound stress rule

On the phonological side of the model, the following stress rules:

(65) a. Stem stress rule (L1): 'Place the stress peak on the penult'[20]
b. Compound stress rule (L2): In $[X\text{-}Y]_{N,V}$ place the peak on [X].
c. Adjectival stress rule (L2): In $[X\text{-}Y]_{A}$ place the peak on [Y].

This model provides immediate explanations for three observations. First, the preservation of stress peaks by neutral (L2) suffixes in both simplex and compound bases (e.g. *schádu**w**-loos, ráng-schik-baar*). Second, the distributional restriction that L2 suffixes must occur inside L1 suffixes (e.g. **schoon-heid-ig*). Third, the stress shift induced by L1 suffixes in simplex bases (e.g. *vijánd-ig*) - which follows from the Stem stress rule. (Recall that such cases are rare.)

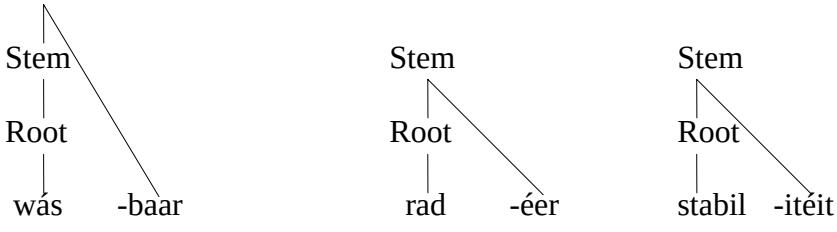
However, this level-based model runs into two problems, one empirical and another conceptual. The empirical problem is that it fails to explain why word-based L1 suffixes may occur outside compounding (*nood-lótt-ig*). Whatever solution is adopted (such that the output of L2 can be fed back into L1) immediately runs into the problem that Level-2 suffixed words are, incorrectly, predicted to undergo L1 affixation as well (**schoon-heid-ig*). The conceptual problem is that this model fails to relate two morphological blocking effects attested in word-based L1 suffixes: blocking after L2 suffixes and that after simplex bases that have initial stress (**menthol-ig*). The first blocking is attributed to level-ordering, while the second must be due to affixal stress conditions. The two-layered model thus fails to relate two properties of stress-shifting L1 suffixes which the peak correspondence analysis manages to unify: their pre-accenting condition on simplex bases, and their stress-shifting behaviour with compound bases.

Up to this point I have made no claims regarding 'genuine' Class-1 affixation. Dutch, like English and German, has a class of affixes (mostly of Romance origin) that prosodically integrate with their morphological bases, and with respect to stress behave fully like simplex words. For example, Class-1 affixes ending in a *superheavy syllable* (containing a long vowel plus consonant, Kager 1989, Trommelen & Zonneveld 1989) are regularly stressed:

(66) a. rad-éer 'erase'
b. stabil-itéit 'stability' (stabíel 'stable')

Such affixes, unlike word-based affixes, can take roots as their base (66a). In case the base is an independently occurring word, its stress properties are simply overruled (66b). This mode of affixation is clearly not stem-based, since its stress properties are completely different. The question is what causes this difference between both types of affixation. Although I will not offer a complete analysis of Class-1 affixation, I will make suggestions for a model that does not use level-ordering, but instead works on the assumption that Class-I affixes are elements adjoining to *roots*, rather than stems (Selkirk 1982). While word-based affixes (67a) produce a nested, *recursive*, stem bracketing, root-based structures are non-recursive at the Stem-level:

(67) a. b.i b.ii



[20] This statement of the stem stress rule is grossly simplified, but it suffices for present purposes.

If stem-stress (67a) is indeed a correspondence effect between Stems restricted to word-based affixation, as have argued in previous sections, then it is correctly predicted that root-based affixation (67b.i-ii) does not exhibit stress preservation effects. The analytic problem which must be solved is: what forces affixation to the root even when a Stem (an independent word) is available for affixation? To state it differently, how to exclude a recursive Stem analysis for *stabiliteit* (66b)? I attribute this to a constraint militating against self-embedded stem structure modelled after nonrecursivity constraints on prosodic categories (Selkirk 1995, Truckenbrodt 1995). This morphological nonrecursivity constraint must be to some extent affix-specific:

(68) NONREC$_{Stem}$
No Stem (affixed by *-eer, -iteit*, etc.) immediately dominates a Stem.

When undominated, this constraint prohibits specified affixes from adjoining to a Stem-size base, which have no other choice but adjoin to a Root-size base. In the case of *stabiliteit* this goes at the expense of violating a constraint STEM-MAX which requires that the Stem property of the base be respected.

(69)	I: {stabiel, -iteit} B: [$_{Stem}$ stabíel]	NONREC$_{PWd}$ *-iteit*	STEM-MAX
a.	[$_{Stem}$ [$_{Stem}$ stabíl] -iteit]	*!	
b.	☞ [$_{Stem}$ stabil -itéit]		*!

No Stem-size constituent [$_{Stem}$ stabíel] occurs in the optimal output analysis (69b). I assume that Output-to-Output correspondence constraints can only affect cases in which there is total morphological isomorphy between Base and Output (that is, both of the potentially related morphemes must be Stems).

To wind up, let us return to the three general questions with respect to the phonology-morphology interface that were raised in the introduction. The first question, of how to model the transfer of phonological properties of simplex forms to complex forms, can now be answered as follows. Transfer involves violable constraints, enforcing identity between pairs of morphologically related output forms. For example, the identity constraints that figured in the analysis of stem-based stress in Dutch enforce identity of stress peaks in a derived word and its base. Secondly, the question of which types of morphological domains are involved in transderivational relationships, is answered as follows. Only properties of freely occurring stems are carried over transderivationally, since identity constraints inherently involve pairs of output forms. Thirdly, it is predicted that 'derived' phonological properties of stems affect their potential for further affixation ('blocking'). This is due to parallelism, the interaction of phonological and morphological constraints in a single constraint hierarchy.

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