Multiple constraint-rankings in Polish[1]

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1. Introduction

Optimality Theory proposes that constraints are universal, minimally violable and ranked in a language-specific way. Different grammars result from differences in constraint-ranking, a hypothesis that allows cross-linguistic typological issues to be stated in a straightforward way[2]. What happens when we encounter exceptions to the general phonological patterns? Are these exceptions to be expressed directly within the constraint-ranking, either by allowing morpheme-specific constraints to interact with more general ones within a single constraint-ranking, or by postulating multiple constraint-rankings? Or do we assert that constraints are inadequate of capturing exceptional phonological patterns, leaving little else to do but to assume such patterns in some shape to be part of the input (e.g. underlying representation, lexicon)? In other words, how do we account for morpheme-sensitive phonology within Optimality Theory? This is the main question of this paper.

Inkelas, Orgun, Zoll (1994) propose the following divisions in describing phonological patterns. Regular and subregular patterns are accounted for by distinct constraint-rankings (or cophonologies). The motivation for postulating a distinct constraint-ranking is productivity: cophonologies may be set up only if they are productive, e.g. morphologically[3]. In other words, constraint-rankings are postulated if two criteria are met: the regularity is supported by evidence from alternations and the class of morphemes belonging to the regularity is definable on independent grounds. Nonproductive phonological patterns may not be attributed to a separate constraint-ranking and are captured via prespecification of the phonological input.

The classification of regular, subregular and exceptional patterns in phonology seems to be less crisp than suggested in Inkelas, Orgun, Zoll (1994)[4]. In this paper I compare different strategies with respect to such fuzzy phonological patterns. In contrast with Inkelas, Orgun, Zoll's hypotheses I want to show that (i) due to the well-known tradeoff between phonological input and set of procedures or constraints, many positions may be taken, i.e. there appears to be no principled reason that decides which strategy is favourable above other ones[5];

[1] I want to thank Toni Borowsky, Jan Don, Chris Golston, Beth Hume, Sharon Inkelas, Uwe Junghanns, René Kager, Sylvia Löhken, Orhan Orgun, Wim Zonneveld and the audience of GGS 1995 at Jena for discussing various aspects that have found their way into this manuscript. "Multiple constraint-rankings in Polish" will appear as the third chapter of my forthcoming PhD-thesis, titled "Cycles, Relics and Scars". I will adress several objectives in this thesis. First, I aim to investigates the intimate relationship between the instrument of phonological cycle and any procedural model of phonology, which includes Cyclic Phonology, Lexical Phonology and theories of Prosodic Phonology. Second, I discuss more declarative perspectives on the phonological cycle, with special attention to Optimality Theory (OT). Third, within the framework of OT a number of declarative alternatives for core cyclic phenomena are provided, which includes analyses of Polish, Sanskrit and French. In chapter 1 the phonological cycle is introduced and motivated. OT is outlined in chapter 2; due to its declarative nature, cyclic phenomena are either irrelevant or extremely troublesome for OT. I propose a functional marriage between OT and Monotonic Cyclicity to overcome these attitudes with respect to cyclicity. Chapter 3 discusses the role of morpheme-sensitive phonology in OT; I argue against a derivational account of such phenomena, based on evidence from Polish vowel-zero alternations. In chapter 4 an OT approach on French phonology is given. Chapter 5 discusses nonderived environment effects in Sanskrit from an OT-perspective.

[2] Prince & Smolensky (1993:chapter 6) on typology in terms of different constraint-rankings.

[3] This is termed as the Alternation Criterion in Inkelas, Orgun, Zoll (1994), with a clear connotation to previous proposals formulated in Kiparsky (1973) among others.

[4] Inkelas, Orgun, Zoll (1994) proposal must be seen as a methodology to stop proliferation of cophonologies.

[5] Of course, we can rely on notions such as predictability, elegance of grammatical theory or statistical motivations. Notice, however, that these aspects are basically statements about the assumed phonological theories themselves.

(ii) vowel-zero alternations in Polish phonology as an example of a fuzzy phonological pattern is best analyzed in a model with multiple constraint-rankings that are motivated on the basis of distinct morpheme-sets.

The issues of prespecification and underspecification in phonological theory are important in a non-trivial way. Elsewhere I have argued that any procedural model of phonology assumes some sort of representation that forms the input to a set of procedures[6]. Prespecification and underspecification of phonological representations may be considered as distinct but related aspects of the dichotomy between phonological input and set of procedures or constraints. I have little to say about underspecification theories and Optimality Theory here; except that the most harmonic candidate selected by Eval should be fully specified for all phonologically relevant information, i.e. temporary underspecification must be resolved[7]. Thus it really makes no difference whether some aspect of phonology is absent from the underlying representation and provided by virtue of a Fill-violation, or appears to be present in the input but invokes underparsing. For discussion on underspecification theories the reader is refered to the insights of Mohanan (1991), Steriade (1994) and especially Inkelas (1994) and Smolensky (1994).

Prespecification, or lexical listing of phonological information as a theoretical concept resembles underspecification to a large degree, as the other side of the same coin. We hypothesize that an underspecified phonological input is guided by principles of predictability[8]. The fact that some element behaves in an unpredictable way forces by opposite reasoning some kind of prespecification of the phonological input. Many autors have considered the above line of argument as correct; for further discussion on the prespecification method see Kiparsky (1993), Inkelas & Cho (1993), Zoll (1993) and Inkelas, Orgun, Zoll (1994), among others. As stated above, Eval selects the most harmonic candidate which is phonologically fully specified and it is irrelevant whether or not this optimal output contains prespecified material as part of the underlying structure. The issue of lexical listing of phonological material is of some interest to the interplay between phonological input and set of procedures (or constraints), but crucially not in determining the most harmonic phonological output. Optimality Theory remains silent on the tradeoff between input versus set of procedures or constraints. We can choose to prespecify phonological information in the input and have Faithfulness constraints dealing with the listed information, ranked among other constraints, or we may account for the phonological behavior directly in the set of constraints themselves. In the latter case unpredictable phonological patterns are related to individual morphemes or to sets of morphemes and therefore constraints must be able to refer to them, for instance in a grammar that has multiple constraint-rankings or in a system that allows morpheme-sensitive constraints, conflicting with more general constraints.

While tentatively concluding that the prespecification method to exceptional phonological patterns is always available (and perhaps necessary), I describe phonological patterns in terms of constraints that are ranked differently, i.e. a grammar may exhibit multiple constraint-rankings, in contrast with the option to have morpheme-sensitive constraints under the hypothesis 'One grammar One ranking'[9]. There are a number of related issues involved, which will be discussed separately.

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[6] See Verhijde (forthcoming), *Cycles, Relics and Scars*, PhD-thesis, chapter 2.
[7] Consider Smolensky (1994) on the impossibilities of computing the most harmonic condidate by Eval if underspecified information is allowed in the output.
[8] Steriade (1995) mentions the notion of Lexical Minimality: underlying representations must reduce to some minimum the phonological information used to distinguish lexical items. The notion originates in Halle (1959) and Chomsky & Halle (1968).
[9] Any nonlinguistic connotation is thought of as existing in the mind of the reader only.

First, I give some motivation with respect to multiple constraint-rankings over morpheme-sensitive constraints. As I demonstrate, the differences between these two approaches are less interesting than their similarities; both concepts use some notion of morpheme-set that allows for distinctions.

Second, if we deny the methodology outlined in Inkelas, Orgun, Zoll (1994) to postulate multiple cophonologies, then how do we justify a distinct constraint-ranking? In addition, we like to know exactly what it means to have more than one constraint-ranking. Constraints in Optimality Theory are highly conflicting in nature; therefore it must be the case that multiple constraint-rankings are always conflicting with each other. For example, are multiple constraint-rankings available that account for phonological patterns of derived words?

Finally, as I mentioned above, the familiar tradeoff between phonological input and set of procedures or constraints has been extremely influential in generative phonology, at least since Chomsky & Halle (1968). Optimality Theory as a more declarative approach to generative phonology may improve our understanding of the above interplay of input versus constraint-set, on the condition that it receives a non-derivational interpretation. To put it differently, any (pseudo-)derivational extension of the Optimality Theoretical framework will fail exactly in the tradeoff-theme. Examples of such extensions are, for instance, the introduction of cyclicity (Kenstowicz 1994) or the theory of correspondence relationships between input and output (McCarthy & Prince 1994, McCarthy 1995, Orgun 1994, 1995; Inkelas 1995).

The paper is organized as follows. An Optimality Theory overview of possible strategies with respect to morpheme-sensitive phonology is presented in section 2. I will focus on two issues here, namely phonology that is sensitive to individual morphemes or a particular set of morphemes, and multiple constrant-rankings within a single grammar. Vowel-zero alternations or yers in Polish phonology are the subject of section 3. As I will demonstrate, within Optimality Theory it appears to be irrelevant whether or not yers are represented as part of the phonological input; instead reference to a specific set of morphemes mst be made, which requires a distinct constraint-ranking. In section 4 the proposal is elaborated upon with references to other aspects of Polish phonology. Some remarks are discussed in section 5.

2. Morpheme-sensitive phonology

Leaving the prespecification method aside for the moment, the interplay of constraints and specific morphemes may be captured basically in two opposite ways. Either we allow constraints to become less universal by incorporating morpheme-specific information directly into them, or we maintain the hypothesis of universal constraints and allow for multiple constraint-rankings within a single grammar. In other words, we may choose to increase the complexity of constraints (section 2.1.) or to extend the number of constraint-rankings (section 2.2.). But first the notions 'morpheme' and 'set of morphemes' have to be clarified[10].

I consider a morpheme in the first place as a minimal meaningful element, in the structuralistic tradition that goes back to Bloomfield (1933). Of course, many different views may be positioned as to what the notion 'meaningful' means. In a given context a morpheme is considered to be a composite element that exhibits a number of distinct characteristics, such as semantic structure, grammatical function or phonological form. These

[10] My assumptions concerning morphemes and sets of morphemes are largely similar to the views discussed in Spencer (1991:4-8), although (i) I implicitely assume allomorphy to arise from constraint interaction and (ii) I do not discuss the topic of suppletion.

properties and their various combinations make up individual morphemes. While selecting a specific characteristic it is possible to group specific morphemes together as sets. In other words, a set of morphemes may be seen as a temporary and artifical generalization across individual morphemes that illuminate (at least) a single linguistic property.

The following examples illustrate the informal view given above. Prefixes are a set of morphemes that share the property that they are concatenated at the left edge of another set of morphemes (such as stems or roots). Nouns are a morpheme-set that may be characterized by the property of their grammatical function. As research from Siegel (1974) to Fabb (1988) indicate, suffixes in English may or may not be described as divided into two different sets of morphemes (or classes), largely depending on hypotheses concerning their distribution and phonological make-up. In principle any linguistic property can be isolated across individual morphemes to create a morpheme-set.

In addition, sets of morphemes may be thought of as containing more than a single linguistic property. It is here that the notion of a well-defined morpheme-set becomes less well-defined or fuzzy. An illuminating example is given in Itô & Mester (1994) in which Japanese morphemes, traditionally divided into four contrasting morpheme-sets (or strata), are analyzed as being constructed from a large number of interactive phonological constraints. Similar idiosyncratic morphological information like [+Latinate] in English (Chomsky & Halle 1968) or [Learned] in French (Walker 1975, Dell & Selkirk 1978) may be captured as single linguistic properties that divide morphemes into sets, but could perhaps be reduced to other characteristics, as it seems to be appropriate in the Japanese case.

2.1. Complexity of constraints

The introduction of Generalized Alignment (McCarthy & Prince 1993a) in Optimality Theory allows a direct reference to sets of morphemes and, according to some researchers, to individual morphemes. Generalized Alignment has been proposed as a way to capture effects of constituent-edges in phonological and morphological theory[11].

(1) **Generalized Alignment**

Align(Cat1, Edge1, Cat2, Edge2) $=_{def}$

$\forall$ Cat1 $\exists$ Cat2 such that Edge 1 of Cat1 and Edge 2 of Cat2 coincide

Where: Cat1, Cat2 $\in$ PCat $\cup$ Gcat; Edge1, Edge2 $\in$ {Right, Left}

As McCarthy & Prince suggest, PCat and GCat consist of sets of prosodic and grammatical (morphological or syntactic) categories provided by linguistic theory. The set of prosodic categories includes at least elements such as PrWd, F, σ, μ and segmental (featural) information such as Place features or Tone. With respect to grammatical categories a more restricted set of choices is proposed, namely MWd, Stem, Affix and Root.

[11] In essence the theory of Generalized Alignment is not limited to any specific phonological or morphological subtheory, as it is indicated in McCarthy & Prince (1993a:81).

Alignment interacts with other constraints in a language-specific constraint-ranking. A familiar example from Tagalog may be illustrative here. In Tagalog, the affix *-um-* wants to be concatenated as close as possible to the left stem-edge, provided that its final nasal consonant is not syllabified into coda position. Thus, whereas prefixation is preferable, infixation occurs under domination of the constraint NoCoda (McCarthy & Prince 1993a:79; dots represent syllable boundaries).

(2) *-um-* Infixation in Tagalog

u.ma.ral		'teach'
su.mu.lat	* um.su.lat	'write'
gru.mad.wet	* um.grad.wet	'graduate'

McCarthy & Prince account for this pattern via two interacting constraints. First, the wish for leftmost position is attributed to Align($[um]_{Af}$,L,Stem,L), satisfied in the output *umaral*, but minimally violated in *sumulat* and *grumadwet*. Due to the dominance of the prosodic constraint NoCoda possible alternatives such as * *umsulat* and * *umgradwet* are less harmonic[12].

The general schema of Alignment is provided by Universal Grammar. However, this need not be true for the possible arguments PCat and GCat. The theory of Generalized Alignment in itself does not provide a principled method to limit possible candidates, because this largely depends on available theories of prosodic and grammatical structures. Lack of restrictedness on the argument set allows for any kind of coincidence between prosodic and morphological information. Consider the following examples of alignment between prosodic and grammatical categories below.

(3) a. ALIGN(STEM, R, σ, R) (McCarthy & Prince 1993a)
in Axininca Campa, Lardil, Hebrew, Bedouin Arabic, Kamaiurá

b. ALIGN(STEM, L, PRWD, L) (McCarthy & Prince 1993a)
in Axininca Campa, Lardil, German, Polish, Malay-Indonesian, English

c. ALIGN(STEM, L, FT, L) (Kager 1994)
in Sibutu Sama

d. ALIGN(STEM, R, FT, R) (Kager 1995)
in Estonian

e. ALIGN(ROOT, L, PRWD, L) (Rowicka 1994)
in Polish

f. ALIGN(μ_H, R, MWD, R) (Zec 1995)
in Neo-Štokavian dialect of Serbo-Croatian

g. ALIGN($[PRWD]_{INF}$, R, [NUCLEUS], R) (Féry 1994)
in German

[12] Notice that NoCoda is violated once in the correct output candidate *sumulat* and twice in *grumadwet*. It appears to make a difference whether a constraint is addressed to in a nonderived or a derived form. McCarthy & Prince (1994) discuss this unexpected property that emerges from the very mechanisms of constraint interaction used in Optimality Theory.

All alignment constraints cited above are attested and proposed for various reasons. However, there are some remarks with respect to the interaction between phonology and morphology.

2.1.1. Morpheme-sensitive constraints

The use of the grammatical category $[um]_{aff}$ in the Tagalog Alignment constraint is confusing. McCarthy & Prince (1993a) undoubtely assume a distinction between GCat=Affix and a specific member of this category -*um*-. Due to the line of their argument it is necessary to show the behavior of an affix that ends in a consonant; only here the conflict with NoCoda becomes apparent. Consequently, the Alignment constraint is not morpheme-specific, because it does not refer to individual morphemes such as -*um*-.

Does Optimality Theory allow constraints to refer to individual morphemes or only to sets of morphemes? As pointed out in Russell (1995), it all depends on the definition of morphemes. It is perfectly plausible to view morphemes as *objects* of linguistic analysis, e.g. as representations that may be processed upon. Differences between morphemes can be contributed to differences in representations. This clearly emphasizes the prominence of phonological input.

The introduction of morpheme-specific constraints into the above representational approach suffers from two disadvantages. First, concerning the tradeoff between input and set of procedures (or constraints), it is redundant to add constraints that refer specifically to individual morphemes, hence burden both input and constraint ranking[13]. Second, it is not clear how to *rank* a constraint that refers to an individual morpheme. To illustrate this point consider an example from Inkelas (1994). Here several morpheme-specific Alignment constraints are used to capture the exceptionality of nonneutral morphemes in Turkish stress patterns[14]. Thus she proposes ALIGN(*mE*, L, σ', R), ALIGN(*Iyor*, L, σ'/Ft, L) and ALIGN(*penJere*, R, Ft, R) to account for the pre-stressing suffix /-*Me*/, the initial-stressed suffix /-*Iyor*/ and the penult-stressed root /*peJere*/, respectively. Notice that these Alignment constraints should outrank other constraints responsible for the (sub)regular stress assignment. However, the exceptional behavior of these morphemes is thus encoded twice, as individual arguments of the Alignment constraints and as a result of their ranking position.

As pointed out in Russell (1995), the opposite view is to treat morphemes as (clusters of) constraints, which specify what kind of properties the phonological representation must have. This approach is mainly developed in theories of Declarative Phonology, but has also been suggested within the Optimality Theory framework[15]. Russell illustrates this approach with an example of Nisgha coronal coalescence that may be accounted for in terms of a number of Alignment constraints that refer to sets of morphemes, such as the 3sg marker.

The position I am assuming here is that several individual morphemes may share any intelligible property which group them together as a set of morphemes. I do not see any motivation to limit possible criteria for the formation of morpheme-sets, which is in contrast with the position taken in Inkelas, Orgun, Zoll (1994). Below I discuss their objections against a similar unrestricted view to describe patterns in phonology.

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[13] As pointed out to me by Jan Don, personal communication.

[14] "In the Alignment constraints we will invoke for exceptional stress, a morphological category - really, a specific morpheme - is aligned with a foot or a stressed syllable", i.e. ALIGN(morpheme$_i$ Edge$_i$ σ'/Foot, Edge$_j$) (Inkelas 1994:22).

[15] Theories of Declarative Phonology include Bird (1990), Scobbie (1991) and Russell (1993), examples of a declarative approach towards Optimality Theory are Russell (1995) and Hammond (1995).

I hypothesize that these sets of morphemes, instead of individual morphemes, function as categories of constraints, viz. Alignment constraints. Consequently, the possibility that constraints can refer to individual morphemes should be excluded.

2.1.2. Sets of morphemes

A possible set of morphemes can be defined with reference to Inkelas, Orgun, Zoll (1994), especially regarding their objections to allow separate cophonologies for nonproductive phonological patterns and exceptions[16]. Inkelas, Orgun, Zoll discuss data from Turkish phonology, which contains an example of a productive pattern in stress (Sezer stress), a nonproductive pattern in vowel harmony (Labial Attraction), and a case involving exceptionality (of a regular segmental rule of Coda Devoicing). Based on the Alternation Criterion as mentioned above, only Sezer stress is morphologically active, thus is captured within a distinct cophonology. Why are both Labial Attraction and Coda Devoicing exceptions denied a separate cophonology?

Labial Attraction is a root-structure constraint. If a vowel /a/ is followed by a labial consonant and a high back vowel, respectively, then that high vowel must be round, i.e. /u/. Inkelas, Orgun, Zoll refer to these patterns as /aBu/ sequences. The examples cited below are taken from their article.

(4) a. Some roots that obey Labial Attraction

karpuz	'watermelon'	
sabun	'soap'	
Habur	(place name)	

b. Some roots that disobey Labial Attraction

kapI	'door'	
KalamIS	(place name)	
tavIr	'attitude'	

c. Labial Attraction does not apply across morpheme boundaries

kitap	'book'	
kitab-I	'book-Accusative'	*kitab-U

Within Optimality Theory, the constraints responsible for Labial Attraction must have at least two properties. Labial Attraction is not active in derived environments. This suggests that we have here a case in which the active constraints need to be sensitive to a set of morphemes, namely roots. In addition, they must make reference to a separate group within these roots. In other words, it seems to be unpredictable whether or not a root shows Labial Attraction[17].

Coda Devoicing applies in a straightforward fashion to Turkish syllables. Inkelas, Orgun, Zoll (1994) show that plosives in coda position are devoiced. Voiceless obstruents do not alternate. Some examples are given in (5).

[16] A cophonology is defined in Inkelas, Orgun, Zoll (1994:5) as a ranked set of (universal) constraints. Here it is assumed that distinctions in phonological patterns may be attributed to distinct cophonologies, irrespective of how such cophonologies are structured.
[17] Orgun (1994) demonstrates that less than 75% of the roots that contain an /aBu/ environment actually show Labial Attraction.

(5) a. Coda Devoicing on voice obstruents

/kitab/	kitap	'book' (nominative)
	kitap-lar	'book-plural'
	kitap-tan	'book-Ablative'
	kitab-i	'book-Accusative'
	kitab-a	'book-Dative'

b. No Coda Devoicing on voiceless obstruents

/devlet/	devlet	'state' (nominative)
	devlet-er	'state-plural'
	devlet-i	'state-Accusative'

(6) Exceptional behavior of some roots to Coda Devoicing

/etüd/	etüd	'etude'
	etüd-ler	'etude-plural'
/katalog/	katalog	'catalog'
	katalog-dan	'catalog-Ablative'

Again it seems that the constraints which are responsible for the absence of Coda Devoicing in forms like *etüd* must refer to a separate set of morphemes.

Inkelas, Orgun, Zoll investigate if it is possible to capture the phenomena of nonproductive patterns (e.g. Labial Attraction and exceptions to Coda Devoicing) in a similar way as to productive patterns (e.g. regular stress and Sezer stress). They propose distinct phonological patterns to be a consequence of having multiple cophonologies; morphemes are subjected to these cophonologies[18].

(7) a. Productive Sezer stress

- Cophonology A: enforces Sezer stress - place names, derived, underived, borrowings
- Cophonology B: enforces word stress - all other words

b. Nonproductive Labial Attraction

- Cophonology C: enforces Labial Attraction - some roots
- Cophonology D: enforces no Labial Attraction - all other roots, plus derived forms

c. Coda Devoicing exceptions

- Cophonology E: enforces root-final coda devoicing - some roots
- Cophonology F: enforces no root-final coda devoicing - all other roots

The authors point out that defining phonological patterns by postulating different cophonologies for each individual pattern raises five objections, which I present as questions below.

[18] Notice that the approach outlined in Inkelas, Orgun, Zoll (1994) presupposes morphemes to be objects of phonology, i.e. representations that can be processed upon.

1. **Indeterminacy**: How do we classify morphemes that do not meet the structural description of the constraint that is reponsible for a separate cophonology?
2. **Uninteresting cophonologies**: How do we avoid establishing separate cophonologies to observed regularities that are applicable to all morphemes?
3. **Astronomical cophonology proliferation**: If one constraint may be suitable to set up a distinct cophonology, thus dividing the morphemes of the language, and if a morpheme may be subjected to several cophonologies, then how do we restrict the number of cophonologies of the language?
4. **Heterogeneous morphemes**: Are morphemes assigned exclusively to a single cophonology, i.e. how do we avoid violation of a distinctive constraint with respect to a morpheme?
5. **Heterogeneous words**: Are derived forms assigned exclusively to a single cophonology, i.e. how do we avoid violation of a decisive constraint with respect to a complex word?

On the basis of possible answers to these objections Inkelas, Orgun, Zoll (1994) propose to use (some form of) prespecification of Labial Attraction and Coda Devoicing exceptions. My aim is to show that this is not a necessary conclusion. The five objections are valid only within a particular view on Optimality Theory. By means of an alternative perspective, it will be shown that the objections are not as troublesome as they appear to be at first glance. There are two assumptions which may be interpreted in a different way, thereby providing an escape from prespecification.

First, I do not agree with the assumption expressed in Inkelas, Orgun, Zoll (1994) that the observed phonological patterns differ on single constraints only. Optimality Theory does not use inviolable constraints, but allows constraints to be dominated under certain conditions[19]. Instead of being the result of single constraint, it is assumed that any phonological pattern may emerge from a number of competing and conflicting constraints. For instance, Inkelas, Orgun, Zoll (1994) argue that on the basis of the derived form *tambura-m-dI* 'stringed instrument-1sg.poss-Past', we cannot decide whether or not it is subjected to Cophonology C, enforcing Labial Attraction, whereas nonderived *tambura* may belong to Cophonology C. However, exactly these phonological patterns are to be expected in an Optimality theoretic framework where the effects of constraints may be obscured[20]. Therefore, objections concerning Indeterminacy, Heterogeneous morphemes and similar words do not seem to be correct.

Second, it is true that within a framework that interpretes morphemes only as representations the problem of cophonology proliferation arises. A single morpheme may obtain membership of numerous cophonologies, each of them describing a single aspect of the phonological representation. Inkelas, Orgun, Zoll are right as they claim that this does not lead to extremely interesting phonological insights. However, the shift from a merely object-oriented view of morphemes to a more constraint-oriented one makes the whole question about proliferation redundant. In other words, I assume that constraints and their relative rankings are also

[19] Optimality Theory differs from other declarative phonology theories in the use of 'soft' constraints, i.e. constraints that need not be surface-true. In a slightly different way McCarthy & Prince (1994) discuss this theme, named as the Fallacy of Perfection (or FoP).
[20] The pattern of *tambura-m-dI* illustrates also another aspect of Optimality Theory, namely the occurrence of more unmarked structure in morphologically derived environments. Consider McCarthy & Prince (1994) on this phenomenon.

actively involved in describing the phonological representation of morphemes[21]. The objections regarding cophonologies are thus valid only from a particular point of view.

This eliminates the essence of the critique of Inkelas, Orgun, Zoll (1994) on establishing cophonologies for nonproductive and exceptional patterns. Notice that it does not remove the prespecification method from the grammar, as lexical listing of phonological information is always available as a last resort option. However, morpheme-sensitive phonology may be properly expressed by means of multiple cophonologies, exploiting constraints that are sensitive to any kind of morpheme-set.

2.1.3. Ranking and morpheme-sensitive constraints

Constraints in Optimality Theory are ranking in a language-specific order. How can we observe activities of morpheme-sensitive constraints in the ranking? I discuss two analyses that show Alignment constraints which have particular sets of morphemes as their arguments. In Kager (1994) Alignment constraints that are sensitive to word, stem and root morphemes govern the distribution of main stress and secondary stress. In Golston (1995) the phonological characteristics of roots and words are expressed in terms of Alignment. Notice that the constraints refer to specific morphemes such as stem and word which are part of a hierarchical structure. More concretely, due to the Alignment format we know that it is the phonology at the edges of these morphemes that is refered to. However, what happens if the phonological patterns at a similar edge are distinct? How does Optimality Theory account for these phenomena in derived forms?

Kager (1994) observes that stress in Sibutu Sama[22] is sensitive to morphological structure. Main stress is strict penultimate, whereas secondary stress in unprefixed words is initial.

(8) Stress in unprefixed words in Sibutu Sama

bissála	'talk'
bìssalá-han	'persuading'
bìssala-hán-na	'he is persuading'
bìssala-han-kámi	'we are persuading'

Kager proposes binary trochaic feet to account for the data. Main stress is distributed by ALIGN(PrWd, R, Ft, R) and dominates another Alignment constraint which is responsible for initial secondary stress. In prefixed words multiple secondary stresses are observed.

(9) Stress in prefixed words in Sibutu Sama

a.	màka-bissála	'able to talk'
	pìna-bìssalá-han	'to be persuaded'
	màka-pàgba-bissalá-han	'able to cause persuasion'

[21] Notice that I do not abandon the idea that morphemes may be seen as representations, merely that I do not see an absolute opposition between the two approaches.

[22] Sibutu Sama is an Austronesian language spoken in the Southern Philippines. Kager (1994) makes reference to the work of Allison (1979).

b. kà-pag-bissála 'able to talk to each other'

tà-pag-bìssalá-han 'the thing able to be spoken about'

ALIGN(Stem, L, Ft, L) explains the distribution of initial stress both on the stem and on prefixes (analysed as derived stems). In other words, whenever there is a stem, its left edge should coincide with the left edge of a stress foot. Notice the nice interaction between alignment of main stress (e.g. to the prosodic word edge) and alignment of secondary stress (e.g. to the stem edge). In (9b) there are three possibilities for application of ALIGN(Stem, L, Ft, L), twice at the prefix edges and once at the innermost stem edge. Due to FT-BIN, not every possible edge may coincide with a stressfoot. Kager assumes that the constraint ALIGN(Foot, L, PrWd, L) or ALL-FT-LEFT is responsible for the observed patterns.

However, Sibutu Sama also exhibits a fluctuation of secondary stress in prefixed words, which forces the introduction of another Alignment constraint: ALIGN(Root, L, Ft, L). The examples of the variation are given below.

(10) Variable secondary stress in Sibutu Sama

a. pà-missalá-han ≈ pa-mìssalá-han

'instrument for speaking'

pàg-bissalá-han ≈ pag-bìssalá-han

'the thing spoken about'

b. màka-pag-bìssalá-han ≈ màka-pà-bissalá-han

'able to persuade them'

tàpag-pa-bìssala-hán-bi ≈ tàpag-pà-bissala-hán-bi

'you (pl.) are able to make them persuade someone'

The root is interpreted as the innermost stem morpheme. For a better understanding of the issue involved, a more detailed account of the argument is necessary. First, note that ALIGN(Root, L, Ft, L) and ALIGN(Stem, L, Ft, L) will describe a similar pattern in cases of unprefixed words. The constraint ALL-FT-L is active in prefixed words, while it must dominate ALIGN(Root, L, Ft, L). To see why this is so, consider the tableaux below (see Kager 1994:7; morpheme boundaries indicated with square brackets, foot structure with round brackets, dots as syllable boundaries).

(11) Ranking argument between ALIGN(Stem, L, Ft, L) and ALL-FT-L

/ka-pag=bissala/	ALIGN(Stem, L, Ft, L)	ALL-FT-L	ALIGN(Root, L, Ft, L)
☞ [(kà-pag)=bis.(sá.la)]	**		*
[ka-(pàg=bis).(sá.la)]	**	KA !	*
[ka-pag=bis.(sá.la)]	***!		*

Notice that the two top candidates have a tie at ALIGN(Stem, L, Ft, L) and here ALL-FT-L is decisive. However, in the words that show fluctuation the constraints ALL-FT-L and ALIGN(Root, L, Ft, L) are violated in turns and it is only in these words that the Alignment constraint that refers to the root morpheme is motivated. Kager therefore assumes that in Sibutu Sama two opposite rankings are active, (i) ALL-FT-L >> ALIGN(Root, L, Ft, L) and (ii) ALIGN(Root, L, Ft, L) >> ALL-FT-L.

(12) Ranking argument between ALIGN(Root, L, Ft, L) and ALL-FT-L

/pa=missalahan/	ALIGN(Stem, L, Ft, L)	ALL-FT-L	ALIGN(Root, L, Ft, L)
☞ [(pà=mis).sa.(lá.han)]	*		*
☞ [pa=(mìs.sa).(lá.han)]	*	PA !	
[pa=mis.sa.(lá.han)]	**!		*

The Alignment constraint that is sensitive to the root morpheme is dominated by a similar Alignment constraint on the stem morpheme. Its consequences will never be observed, except under special conditions (e.g. preceded by a monosyllabic prefix); then it may compete with other constraints.

Optimality Theory predicts that constraints, including morpheme-sensitive constraints, may be dominated. Whether we are able to observe the activities of a morpheme-sensitive constraint does not only depend on the kind of constraint, but crucially also on its position in the constraint-ranking.

Golston (1995) discusses phonological properties of roots and words in Sanskrit[23]. Verbal roots are monosyllabic and bimoraic. The bimoraic condition [μμ] may be captured as consisting of a single Foot. Then the constraints that reflect these properties are ALIGN(Root, σ) (or ROOT=σ) and ALIGN(Root, R, Ft, R). Some examples of possible roots are given below.

(13) Verbal roots in Sanskrit

aj	'drive'
gam	'go'
sta:	'stand'
band^h	'bind'
sa:d^h	'succeed'

Sanskrit phonology exhibits a number of neutralization phenomena word-finally. Consonant clusters are resolved, obstruents are devoiced, deaspirated and depalatalized.

(14) Neutralization word-finally in Sanskrit

a.	dant]$_{Rt}$	-	dan]$_{\omega}$	'tooth'
b.	jambh]$_{Rt}$-		jamp]$_{\omega}$	'chew up, cush'
c.	vac]$_{Rt}$	-	vak]$_{\omega}$	'voice'

[23] Golston (1995) crucially argues against multiple constraint-rankings in a language if constraints are allowed to make reference to (the edges of) specific morphemes.

Golston assumes that Alignment constraints can take *Feature specifications as their arguments[24]. The word-final neutralization facts follow from ALIGN(Wd, R, *CC, R), ALIGN(Wd, R, *LAR, R) and ALIGN(Wd, R, *HIGH, R) respectively.

What happens in derived forms that contain both a root and a word? Golston demonstrates that Sanskrit phonology may be properly described with the above mentioned constraints, that refer to different morphemes. The constraint-ranking is given below, the Alignment constraints that are sensitive to the word morpheme are abbreviated as in Golston (1995).

(15) Constraint-ranking of Sanskrit

ROOT=σ, ALIGN(Root, R, Ft, R), Parse >> $*Hi]_{\omega}$, $*LAR]_{\omega}$, $*CC]_{\omega}$

The role of the Parse constraint is crucial here: phonological material that is contained within the root morpheme is properly parsed, except in the situation that the right edges of root and word morphemes are the same. In that case the word-sensitive Alignment constraints become active and neutralization emerges.

Kager (1994) and Golston (1995) demonstrate analyses which refer to constraints that are sensitive to morpheme-sets. These constraints signal two aspects, namely (i) the existence of specific morphemes such as stem or root and (ii) the phonological pattern linked to such morphemes. Now what exactly does it mean to have morpheme-specific constraints ranked among other constraints? It seems that the position of these constraints with respect to other constraints presents an argument for conflicting constraint-rankings within a single phonology. In other words, a phonological system which has constraints that refer to sets of morphemes equals a model that makes the conflict in ranking position more explicit, by having multiple constraint-rankings.

Consider for instance constraint ALIGN(Root, L, Ft, L) (Kager 1994) which is dominated in virtually all contexts in Sibutu Sama, but whose activity can be observed under certain circumstances only. As pointed out in Kager, the root morpheme is actually nothing more than the innermost stem morpheme. Thus any violation of ALIGN(Stem, L, Ft, L) properly includes a single violation of ALIGN(Root, L, Ft, L). Now recall that it is the activity of another constraint, namely ALL-FT-L, that introduces the interesting phonological variation patterns. Under the influence of the root morpheme a bifurcation in the constraint-ranking occurs, i.e. ALL-FT-L is dominated and dominates ALIGN(Root, L, Ft, L). It all depends on the fact whether the root morpheme is available as a grammatical category for Alignment. To explain the fluctuation of secondary stress in Sibutu Sama we need two competing constraint-rankings.

Sanskrit phonology as outlined in Golston (1995) has to be accounted for in a similar way. We can observe that the featural distinctions at right edges of root and word differ dramatically, which is expressed in a set of Alignment constraints that refer to word-final position. Golston uses the Sanskrit case as an argument in favor of a single ranking, with morpheme-sensitive constraints. However, what is actually expressed is a phonological system that exhibits multiple rankings, motivated by the different phonological patterns at the edges of distinct morphemes.

[24] *Feature constraints are part of Don't Associate constraints, consider discussion of this particular group of constraints in Prince & Smolensky (1993). I think that the Alignment constraints that show the neutralization effects in Sanskrit are in fact better understood as NonAlignment constraints, i.e. Don't Align.

If it is true that the use of morpheme-sensitive constraints expresses the fact that there are instances of competing and conflicting constraint-rankings, then why should we not explicitely refer to multiple constraint-rankings? Such an approach has the advantage that it may decrease the complexity of constraints in Optimality; the consequences that follow from constraints that refer to sets of morphemes may be captured by a model that uses more general constraints active in several rankings. At the same time the disadvantage is that the decrease of complexity of constraints tends to run parallel to the increase of complexity in constraint-rankings.

2.2. Complexity of constraint-rankings

Constraint-rankings explain the phonological patterns of a language. If different patterns are correlated with different morpheme-sets, then we may want to express these distinctions more directly by postulating multiple constraint-rankings. In this section I demonstrate that (i) by their very nature, constraint-rankings must always conflict with each other, and (ii) consequently, we need to determine possible relationships between competing constraint-rankings. My aim is to offer a consistent view on the interaction that occurs in systems with multiple rankings.

2.2.1. Conflicting constraint-rankings

As has been observed by a number of researchers, it is usually the case that rankings within a single language tend to differ minimally. For instance, with respect to stress in Manam[25], Buckley (1994) motivates several constraint-rankings that are sensitive to morpheme-sets. Buckley assumes that the morphemes (or morphological levels) root, prefixed form, word and clitic form in Manam are interacting with ranked constraints. Each morpheme level is associated with a separate constraint-ranking. Below I give a rough and incomplete overview of the constraints involved[26].

(16) Constraints active in Manam (incomplete)

ALIGNHD	- ALIGN(PrWd, R, Head(PrWd), R)
FTBIN	- Feet are binary under moraic or syllabic analysis
*CLASH	- Clashing feet (stresses on adjacent syllables) are prohibited
FTONSET	- A foot must have either a phonological or a morphological onset
WDINTEG	- "Integrity of word constituency which is established at the previous level is respected"

In (17a-c) I focus on the differences in constraint-rankings as outlined in Buckley (1994:33-34)[27].

[25] Manam is an Austronesian language which is spoken in some parts of Papua New Guinea. Buckley (1994) refers to work of Lichtenberk (1983).

[26] I choose not to give an extensive overview of all constraints that are proposed in Buckley (1994), which would certainly provide a better understanding of Buckley's ingenious analysis, to which I refer for more details. For my argument, however, it is necessary only to show the ranking distinctions of relevant constraints.

[27] I do not take into account the indiosyncratic ranking for AP suffixes at the word level, nor the inherently stressed suffixes or roots.

(17) Multiple constraint-rankings in Manam

a.	Root level:	FTONSET, *CLASH	>>	ALIGNHD
	Word level:	ALIGNHD	>>	FTONSET, *CLASH
b.	Prefix level:	FTONSET	>>	ALIGNHD
	Word level:	ALIGNHD	>>	FTONSET
c.	Clitic level:	WDINTEG	>>	FTBIN
	Word level:	FTBIN	>>	WDINTEG

It must be clear that conflicting rankings are a necessary consequence of having multiple constraint-rankings within a single language. The abstract overview above illustrates the situation in Manam with respect to stress assignment, but any phonological system that exhibits more than one ranking invokes competing constraint positions. How do we relate multiple constraint-rankings to each other?

2.2.2. Serialism versus parallelism

There can be only two options for constraint-rankings to be related to each other. In a derivational approach we assume a relationship in terms of some linear ordering principle between distinct rankings. For instance, on the premise that there is a hierarchical structure of stems and words, we propose to order a stem constraint-ranking to precede a word constraint-ranking. Serialism has several important consequences, which I will discuss first. In a nonderivational approach constraint-rankings are not derivationally linked in any conceivable way. Due to the fact that constraint-rankings are always in conflict with each other, there is no automated outcome within a nonderivational view on the topic of priority between stem or word ranking. Parallelism is discussed in the remainder of this subsection. It is my aim here to argue against a serial and in favor of a parallel view on multiple constraint-rankings.

Buckley (1994) proposes that different levels are related in a derivational way[28]. Each morpheme level corresponds to a distinct constraint-ranking; its output is formed by a separate application of Gen. The output of one level is the input of another level, which resembles a kind of cross-level serialism. Although there are no derivational devices within Optimality Theory, the interaction between different constraint-rankings is assumed to be derivational.

In the tableau presented below the interplay between word level ranking and clitic level ranking is demonstrated[29]. Due to the dominant position of PARSEFT any stress foot that is part of the input of the clitic level must be in the output candidate. Only in the case of unfooted material a new foot is allowed[30] (while abstracting away from various important elements of Buckley's analysis, especially the influence of FTBIN and ALIGNHD, I indicate clitic boundaries as '=', square brackets indicate word level footing and round brackets signal clitic level foot structure).

[28] Other proposals are McCarthy & Prince (1993b), McCarthy (1994), Cohn & McCarthy (1994). Kenstowicz (1994) suggests that Gen may be applicable in a cyclic fashion, which would explain stress patterns in Indonesian, Polish and Shanghai Chinese.
[29] This tableau is adapted and adjusted from the one given in Buckley (1994:13).
[30] Buckley (1994) argues that the position of the constraint ParseFt describes the tendency for structure preservation in Manam and at the same time allows effects that formerly were attributed to the Free Element Condition (Prince 1985).

(18) Clitic level ranking in Manam

input: wa[búbu], =a	PARSEFT	PARSESYLL
☞ wa[búbu]=a		**
(wà [bu) (bu]=a)	*!	

input: [bága]lo, =a	PARSEFT	PARSESYLL
☞ [bàga] (ló=a)		
[bága]lo=a		**!

All serial approaches towards multiple constraint-rankings known to me assume that phonological information established by Eval at a previous constraint-ranking influences the choice of input candidates for the next constraint-ranking[31]. There are striking similarities with the prespecification method mentioned in section 1 above. For instance, in an analysis of Turkish stress patterns Inkelas (1994) demonstrates that the output of the Sezer cophonology forms the input to the word cophonology. If a word contains a Sezer stem, the foot structure parsed at the stem constraint-ranking forms part of the input to the word constraint-ranking. Of course, other constraints at the word ranking will interact with the prespecified metrical structure.

As mentioned above, Optimality Theory and prespecification method do not have much in common. On the condition that Eval selects an optimal candidate that is phonologically fully specified, it does not make much difference whether or not the input candidates are prespecified for some kind of phonological information (or underspecified for that matter). Prespecification of intermediate phonological stages can easily be traced back to its origin, namely as an aspect of the familiar tradeoff between input and set of constraints (or procedures).

In fact, as the analysis of vowel-zero alternations in Polish will show, there appears to be a redundancy in a phonological system that postulates multiple constraint-rankings and states serialism to relate these rankings. In section 3 I present two competing analyses of Polish yers within Optimality Theory. Yers may be part of the underlying representation (e.g. as prespecified phonological information of some form) or inserted under conditions such as syllabic well-formedness (e.g. as epenthesis into final consonant clusters). I will demonstrate that the phonological patterns that follow from both assumptions are the same, which is an exciting result. However, the crucial observation is that yers or the absence of consonant clusters are part of the stem cophonology, whereas consonant clusters or the absence of yers are part of the word cophonology in Polish. Hence, in this case it is redundant to use a prespecification method, because it follows from the distinction between stem and word constraint-ranking. I like to extend this conclusion to the claim that any serial approach to multiple constraint-rankings pretends to do more than it actually does.

If serialism is incorrect, then how do we relate different rankings? I want to propose a nonderivational approach to this problem. To explain the mechanism involved I adopt the nonderivation model of Monotonic Cyclicity as developed in Orgun (1993, 1994)[32].

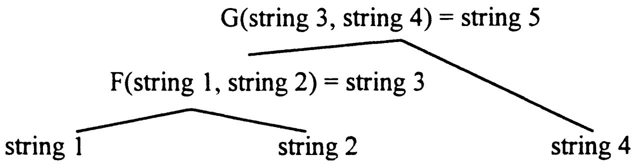
Monotonic Cyclicity as a model of phonology-morphology interaction is first proposed in Orgun (1993) to explain various cyclic effects in Turkish. Morphologically complex words are attributed with phonological

[31] Orgun (1995) proposes a novel extension of Correspondence Theory as described in McCarthy & Prince (1994). He states that Eval relates two strings, which are usually an input and an output. Faithfulness constraints FILL and PARSE are replaced in the new framework by constraints that specifically relate input and output, namely CORRESPOND and MATCH.

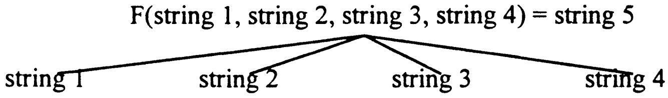
[32] There are great similarities with unification based theories (e.g. work of Gazdar et.al. 1985, Pollard & Sag 1992, Fillmore & Kay 1993) as well as with theories of Declarative Phonology (e.g. Bird 1990, among others).

constituent structure trees, such as given in (19) below. Each node of the structure represents a function of the nodes it immediately dominates. A node contains a complete phonological string, segmental and metrical structure included[33]. The following representations indicate that cyclic and noncyclic effects are available.

(19) a. Binary branching structure (cyclicity)

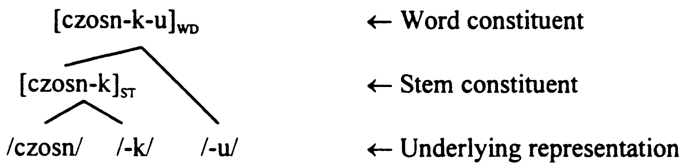


b. N-ary branching structure (noncyclicity)



An example from Polish may be illustrative. In (20) the phonological structure of the word *czosnku* 'garlic' (gen.sg) is given. I distinguish stem and word morphemes; the diminutive affix *-k* actively selects for a stem, while inflectional affix *-u* concatenates with a word.

(20) Morphological derived word from Polish



Note that affixes are represented as partial constituent structure trees and that affixation is interpreted as unification. In other words, affixation is an important means to activate a specific constraint-ranking[34].

I assume that Optimality Theory may provide different constraint-rankings that correlate with different constituents. In deviation from, among others, Inkelas (1994, 1995) I propose that Eval checks all constraint-rankings in parallel and simultaneously, selecting optimal candidates for each ranking that is activated. Due to the fact that constraint-rankings are in conflict with each other by default, it is predicted that what counts as an optimal candidate for one ranking surely does not need to be most harmonic for another, competing ranking. I hypothesize that beforehand there are no predictions available with respect to the exact output; this differs on a language-specific basis. However, the situation is not as unrestricted as it appears. Polish phonology offers a nice testing ground for a number of phonological patterns that are expected to occur in a parallel Optimality framework, while at the same time it proves that serialism of any kind is incapable to account for the facts.

[33] Terminal nodes of the tree are interpreted as the underlying strings supplied by morphemes, see Orgun (1993:9).
[34] Inkelas (1989) proposes to treat affixes as incomplete constituent structure, which makes it possible to view affixation as a process that actively creates new prosodic structure. A similar observation is made in Borowsky (1993).

Summary: I have shown that constraints in Optimality Theory may be sensitive to particular sets of morphemes, excluding the possibility to have constraints that refer to individual morphemes. Then it was argued against the hypothesis that nonproductive patterns and exceptions are denied separate cophonologies (e.g. constraint-rankings), leaving them as prespecified items. Instead, any kind of morpheme-set must be available as arguments for constraints. Two analyses that use morpheme-sensitive constraints gave evidence for the possibility to express this sensitivity to morphemes in a more direct way, namely by postulating multiple constraint-rankings within a single grammar. While discussing different constraint-rankings, I pointed out that due to their nature rankings must always conflict, which leaves open the question how to relate these competing constraint-rankings. I have argued against cross-level serialism within Optimality Theory and have offered a preliminary nonderivational approach to this problem.

3. Vowel-zero alternations in Polish phonology

The argument of this section concerns the behavior of the vowel-zero alternations or yers in Polish phonology. Previous attempts to account for this fuzzy phonological pattern can be grouped under two headings. Either we assume yers to be part in some shape of the underlying representation, or we assume that yers arise as a result of epenthesis, triggered by well-formedness conditions on mainly syllable structure. The first direction of research I will call the Underlying Representation approach to Yers, abbreviated as URYER. The second line is termed NOURYER, the abbreviation of the No Underlying Representation approach to Yers. I briefly show in section 3.1. some proposals with respect to both approaches. Many generative phonologists have been working in either uryer or nouryer and a large number of proposals exist that exclusively show URYER or NOURYER to be correct.

Optimality Theory shows that this issue is irrelevant, which seems to be a surprising consequence. In section 3.2. I present both analyses in terms of constraints and their ranking to prove this point. Instead, what is crucial for an adequate analysis of Polish yers is the recognition that there are two competing constraint-rankings in Polish phonology, which effects can be observed in different environments. Crucially, yers belong to the stem level constraint-ranking, whereas huge consonant clusters are part of the word level constraint-ranking. I use the model of Monotonic Cyclicity (Orgun 1993, 1994) as the framework in which the two conflicting constraint-rankings will operate. However, I demonstrate that only a nonderivational relationship between stem and word constraint ranking is capable of explaining the Polish facts.

Thus, I argue that the case of Polish yers as analyzed in this paper presents two important views on the theme of morpheme-sensitive phonology within Optimality Theory. First, fuzzy phonological patterns may be captured by means of distinct constraint-rankings. Second, multiple constraint-rankings may be related to each other in a nonderivational way. The following facts represent an overview of Polish vowel-zero alternations. Yers are denoted as capital E, as is common in Slavic literature.

(21) a. Noun inflection:

Neuter nouns	Nom.sg.	Gen.pl.
'apple'	jabLko	jabLEk
'box'	pudeLko	pudeLEk

'writing-table'	biurko	biurEk
'window'	okno	okiEn
Feminine nouns	Nom.sg.	Gen.pl.
'spring'	wiosna	wiosEn
'daughter'	córka	córEk
'mother'	matka	matEk
'aunt'	ciotka	ciotEk
Masculine nouns	Nom.sg.	Gen.sg
'boy'	chLopiEc	chLopca
'dog'	piEs	psa
'lion'	lEw	lwa

b. Derivational suffixes:

-k- (diminutive)	sarna 'roe-deer'	sarEnka
-n- (adjectival)	krfi 'blood' gen.sg.	krEvny 'relative'
-sk- (adjectival)	diabwa 'devil' gen.sg	diabElski
-stw- (nominalizing)	bLazna 'clown' gen.sg	bLazEnstwo

c. Prefixes (cf. Rowicka 1994)

ve+ss+aC 'suck in'	vEssem (1st sg. Pres)	vsYsaC (Sec.Imp.inf)

3.1. URYER versus NOURYER

The basic assumption are that yers are part of the phonological input (underlying representation, lexicon). All things being equal such an element will surface; but other conditions may prohibit the realization of yers. The following table lists some URYER proposals.

- Gussmann (1980) assumes a tense/lax distinction on [+high] vowels in underlying representation, plus a procedure Lower that either shifts high lax vowels to [e] in proper contexts, or deletes such vowels.
- Rubach (1984) proposes a similar distribution of [+high] vowels in UR, but divides the original procedure Lower into a procedure that alters such vowels to [e] in a cyclic manner and a procedure Yer Deletion that erases stray (high) vowels.
- Spencer (1986) argues for a distinction of specified and unspecified V-slots in UR. He sets up procedures that fill in segmental information in the course of the derivation and allows for special conditions like extrametricality on certain V-slots.
- Rubach & Booij (1990a,b) assume yers to be represented as floating feature matrices in underlying form. They have a procedure Yer Vocalization that links floating information to skeletal tier in certain contexts, together with a general procedure of deletion elsewhere.

- Szpyra (1989, 1992) argues in favor of a distinction of specified and unspecified root nodes, while she proposes procedures that provide segmental material in proper contexts and a procedure of deletion elsewhere.

The motivation for any URYER approach is that the occurrence of yers is not predictable, thus needs to be stipulated or prespecified in the input (cf. Szpyra 1992).

(23)	a.	kopEr	'dill' (nom.sg)	-	kopr-u (gen.sg)
	b.	kopr-a	'copra' (nom.sg)	-	kopr (gen.pl)

A number of researchers have seen that prosodic aspects may be relevant in the realization of yers, but other (non-phonological) factors govern these prosodic considerations. The URYER analysis abstracts away from such additional factors by allowing a difference in the phonological input.

The basic assumption of the NOURYER approach is that yers are not represented in underlying form, thus there is nothing that may surface, unless other conditions, especially syllable well-formedness, force the insertion of yers. The following researchers have proposed an epenthesis analysis.

- Both Gorecka (1988) and Czaykowska-Higgins (1988) assume that there are no yers in underlying form. Epenthesis is triggered due to two Coda constraints: on Sonority Sequencing Parameter and on coocurrence of two sonorant segments. The exceptions to Coda constraints are found in word-final position only.

The motivation for the NOURYER approach is that there are constraints on possible codas which are active in Polish phonology and they determine the position of yers. But unfortunately other conditions (e.g. phonological and/or non-phonological) interact with these constraints (cf. Szpyra 1992).

(24)	a.	walk-a	'battle'	-	walEcz-ny	'brave'
	b.	folwark	'farm' (noun)	-	folwarcz-ny	'farm' (adj.)

(25)	a.	wiosL-o	'oar' (nom.sg)	-	wiosEL (gen.pl)
	b.	pas-L	'he pastured'		* pas-EL

(26)	a.	miot-L-a	'broom' (nom.sg)	-	moit-EL (gen.pl)
	b.	miót-L	'he swept'		* miót-EL

In (25b, 26b) we can see the labiovelar glide as the preterite marker, in (26a) it functions as a nominalizing suffix. Notice that the contexts are similar in segmental and syllabic perspective.

Vowel-zero alternations as depicted above thus appear to be unpredictable on base forms, but quite regular in certain derived words. The strategy I suggest here is to locate the unpredictable property as part of the morphological structure instead of viewing it as a phonological characteristic. More concrete, base forms that exhibit yers can be viewed as a distinct morpheme-set, apart from the morphemes that do not show this phonological pattern. In other words, the phonology of Polish must be able to refer to this separate morpheme-set. If we focus on the vowel-zero alternation the distinct morpheme-set appears to extend also to derivational structures, while the contrasting set of morphemes may be grouped with inflected forms.

3.2. Multiple constraint-rankings in Polish

Vowel-zero alternations in Polish reveal a complex interaction between phonology and morphology. With respect to the phonological aspects, something needs to be said about syllable structure and statements on well-formedness of codas. With respect to the morphological side, the distinction between stem constituents (e.g. derivation) and word constituents (e.g. inflection) appears to be relevant. My hypothesis regarding the interaction between phonology and morphology is that the stem level exhibits different phonological characteristics than the word level. More concrete, yers seem to be part of the stem level phonology, whereas consonant clusters at word-edges are part of word level phonology. The following morphological complex forms will be used in my argument.

(27) Morphological structures of [sarEn] 'roe-deer' (gen.pl), [sarna] (nom.sg)

(28) Morphological structures of [sarEnka] (nom.sg. dim) and [sarEnEk] (gen.pl. dim)

There is a crucial distinction between the statement that a morphological form is structured in a complex way and the fact that there may be constraint-rankings that are correlating with each node of such morphological complex structure. The model of Monotonic Cyclicity is capable of expressing the different phonological patterns (or cophonologies) that correlate with different nodes of the hierarchical structure. The special situation of Polish vowel-zero alternations illustrates the conflicting nature of constraint-rankings associated with stem and word level. I hope to show that any serial approach of relating such competing cophonologies must hopelessly fail; for this reason I assume a parallel application of Eval, checking all constraint-rankings at once.

First, I present the URYER analysis that assumes yers to be present (in some shape) in underlying representation. The analysis is largely based on Optimality Theory proposals of Zoll (1994, 1995) concerning latent segments and I refer to her work for more sophisticated details. After arguing for the precise formulation of the constraint-rankings, I propose three hypotheses that account for the observed phonological patterns. Second, the NOURYER analysis is presented, assuming that yers are absent from the phonological input, but may be provided under certain conditions. I show the conflicting constraint-rankings and again point to three hypotheses that take care of the fuzzy data. A consequence of my presentation of the analyses URYER and NOURYER is that both approaches seem to be compatible and therefore equally adequate. I take this as an indication that from an OT perspective it does not matter whether or not yers are present in underlying representation.

3.2.1. URYER in Optimality Theory

Yers are represented as root nodes, indicated as "®". The Faithfulness constraint PARSE-® states that every yer-root must be assigned to a syllable. I assume that PARSE-® conflicts with another constraint that restricts the number of syllables in the output, *STRUC-σ, or "Have no syllables"[35].

(29)

input: sar®n (gen.pl)	PARSE-®	*STRUC-σ
sar<®>n	*!	*
☞ sarEn		**

In the diminutive form [sarEnEk] (gen.pl) both underlying yer-nodes are realized, against the penalizing constraint *STRUC-σ.

(30)

input: sar®n -®k (gen.pl)	PARSE-®	*STRUC-σ
sar<®>n<®>k	**!	*
sarEn<®>k	*!	**
sar<®>nEk	*!	**
☞ sarEnEk		***

A different optimal output form must result in the cases of [sarna] and [sarEnka]. In the form [sarna] (nom.sg) the yer-node is unparsed, that is, some constraint (for instance *STRUC-σ)[36] dominates the faithfulness PARSE-®.

(31)

input: sar®n -a (nom.sg)	*STRUC-σ	PARSE-®
☞ sar<®>na	**	*!
sarEna	***!	

In [sarEnka] the conflict between PARSE-® and *STRUC-σ is more complicated. If *STRUC-σ dominates PARSE-® then *no* yer-root will surface, which is clearly false. However, if PARSE-® dominates *STRUC-σ *all* yer-roots

[35]Consider Zoll (1994, 1995) for further motivation of this special version of Prince & Smolensky's general constraint *Struc.
[36]Notice that the actual choice of the constraint *Struc-σ is irrelevant here, as long as two aspects are expressed in the analysis: (i) Parse-® is dominated in one context, but in another context appears to undominated; (ii) these contexts are therefore correlating with conflicting constraint-interactions.

will surface, which is also the wrong output. In addition, PARSE-® may be applicable only on the outmost yer-root, which is not to be predicted on the basis of the current constraint-ranking.

(32)

input: sar®n -®k -a (nom.sg)	*STRUC-σ	PARSE-®
sar<®>n<®>ka	**	**
☞ ? sarEn<®>ka	***	*
sar<®>nEka	***	*
sarEnEka	****!	

I propose three hypotheses that will guide us to a more complete understanding of Polish yers.

- **Hypothesis I**: The solution to the paradox mentioned above is related to stem and word level phonology, that is, different stem and word ranking of the same constraints. PARSE-® is ranked above *STRUC-σ at the stem level, but vice versa at the word level.

(33) Multiple constraint-rankings in Polish

a. Stem ranking: PARSE-® >> *STRUC-σ

b. Word ranking: *STRUC-σ >> PARSE-®

- **Hypothesis II**: The following conditions regulate *satisfaction* of constraint-rankings.
  a. Eval checks a ranking of constraints iff there is a node in the morphological hierarchical structure. I assume such nodes to arise by means of derivational and inflectional morphology, corresponding with a stem cophonology and a word cophonology, respectively[37]. I also assume that an initial stem cophonology may be projected as the consequence of an idiosyncratic property of a morpheme-set[38].
  b. Eval checks all available constraint-rankings, i.e. maximizes cophonology satisfaction.
  c. In complex forms that contain both stem and word morphology, the constraint-rankings conflict. Here word cophonology as a consequence of overt inflection takes priority upon stem cophonology, which means that the word constraint-ranking must be satisfied, at the cost of the stem constraint-ranking. I hypothesize that this conflict is strictly local due to the fact that Eval maximizes satisfaction of constraint-rankings.
  d. Both constraint-rankings compete and produce separate optimal candidates if there is no overt inflection and no derivational evidence available. This predicts variation or fluctuation on nonderived forms without overt inflection.

[37]In an informal manner, an active constraint-ranking should be understood as a node in the morphological structure that at least contains previous unprocessed material. Similar statements have been made in Inkelas (1989) with respect to affixation that actively constructs prosodic constituency structure, in Borowsky (1994) with respect to the postulation of prosodic and morphological structures in compounds, and in Inkelas & Orgun (1994) on Level Economy as a method to limit available cophonologies in Turkish.

[38]The influence of idiosyncratic morphemic information on the phonology is discussed in more detail in the next section.

- **Hypothesis III**: The paradox between stem and word cophonologies can be resolved only in nonderivational approach. Eval operates on stem and word constraint-rankings in parallel and simultaneously.

Below I present the relevant structure with conflicting constraint-rankings. The lefmost column contains the correct output, the middle column gives the conflicting constraint-rankings, where "✓" graphically signals satisfaction of ranking.

(34) Word ranking due to overt inflection: [sarna] 'roe-deer' (nom.sg)

[sarn-a]$_{WD}$	✓*STRUC-σ >> PARSE-®	* [sarEn-a]$_{WD}$
[sarn]$_{ST}$	PARSE-® >> *STRUC-σ	[sarEn]$_{ST}$
/sarEn/ /-a/		/sarEn/ /-a/

The above structure shows that the stem constraint-ranking is not operative due to the fact that there is no derivational suffix available. The word cophonology dictates the absence of yers.

(35) Stem ranking due to overt derivational suffix: [sarEnEk] (gen.pl. dim)

[sarEn-Ek]$_{WD}$	*STRUC-σ >> PARSE-®	* [sarn-k]$_{WD}$
[sarEn-Ek]$_{ST}$	✓PARSE-® >> *STRUC-σ	[sarn-k]$_{ST}$
[sarEn]$_{ST}$	✓PARSE-® >> *STRUC-σ	[sarn]$_{ST}$
/sarEn/ /-k/		/sarEn/ /-k/

In (35) above the diminutive suffix *-k* renders the stem constraint-ranking operative. The absence of any overt inflection results in the phonological pattern that contains yers. Notice that I assume the morpheme *sarn* to project an independent stem constituent.

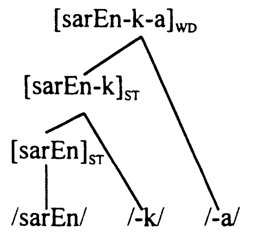
In the situation that no suffixation is available there appears to be a choice. Either the surface form exhibits the word level pattern (e.g. consonant clusters) or it may show the stem level phenomenon (e.g. yers). Consider the structures in (36) below, which are illustrative for the observed variation.

(36) Both word ranking and stem ranking are checked and provide optimal candidates, variation on nonderived stems without overt inflectional element: [sarEn] ≈ [sarn]

[sarn]$_{WD}$	✓ *STRUC-σ >> PARSE-®	[sarEn]$_{WD}$
[sarn]$_{ST}$	PARSE-® >> *STRUC-σ ✓	[sarEn]$_{ST}$
/sarEn/		/sarEn/

The fourth pattern is found in the cases in which both stem and word morphology is available. At first glance it seems as if the word constraint-ranking must obscure any effect of the embedded stem cophonology. But this is not the case, as can be seen in (37).

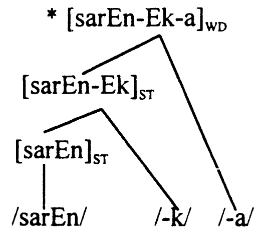
(37) Conflict between word and stem ranking, due to both word and stem elements.



✓ *STRUC-σ >> PARSE-®

PARSE-® >> *STRUC-σ

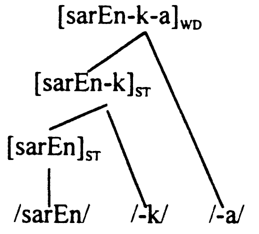
✓ PARSE-® >> *STRUC-σ



While the word and stem cophonologies exclude each other due to their very nature (with the word cophonology as the winner), notice that the conflict appears to strictly local. In other words, the word constraint-ranking as activated by the inflectional suffix *-a* excludes the favourable phonological make-up selected on the basis of the stem ranking, but because there are multiple nodes that are correlated with stem constituents only the topmost constituent is overruled.

There are two other possibilities that relate these competing constraint-rankings. First, we could assume that due to the fact that there is a diminutive suffix the stem level cophonology must be applicable, that is, we expect some sort of preservation of previous information (or cycles). However, as can be seen from the righthand structure of (37), this cyclic approach makes a wrong prediction. Second, we could assume that due to the fact that constraint-rankings conflict, the ultimate surface structure should always pattern with the ranking of the topmost constitutent and we may formulate this as a kind of dominance relationship between ranking. Hence the word cophonology must always obscure any evidence from stem level constraint-rankings. To see why this approach is also wrong, consider the righthand structure below.

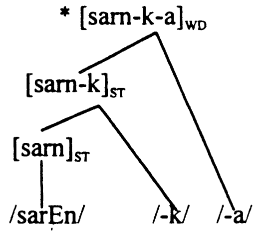
(37') Conflicting word and stem rankings



✓ *STRUC-σ >> PARSE-®

PARSE-® >> *STRUC-σ

✓ PARSE-® >> *STRUC-σ



I think there is a straightforward answer as to why both the Preservation-option and the Dominance-option predict incorrect output candidates. These alternative options of relating constraint-rankings are not capable of expressing the correct phonological patterns, precisely because they assume a derivational relationship in the hierarchical structure, and thus between the constraint-rankings. Only a nonderivational approach is suitable to account for the Polish vowel-zero alternations. In fact, the above hypothesis that Eval maximizes the satisfaction of constraint-rankings already includes the nonderivational aspect of my proposal.

The above URYER analysis accounts for the observed phonological patterns in a straightforward way. Let us now consider the results of a NOURYER approach.

3.2.2. NOURYER in Optimality Theory

This analysis is based on the assumption that yers are interpreted as not available in the phonological input, and need to be provided by epenthesis, or in Optimality terms as a FILL-μ violation. The syllabic well-formedness constraint *COMPLEXCODA[39] dominates faithfulness FILL-μ and is thus responsible for the occurrences of yers.

(38)

input: sarn (gen.pl)	*COMPLEXCODA	FILL-μ
sarn	*!	
☞ sarEn		*

Since yers are not underlyingly present, the position of epenthesis has to be specified. I assume that the constraint ALIGN(Stem,R,σ,R) states the position of epenthesis. ALIGN-R is not ordered with respect to *COMPLEXCODA and FILL-μ. The stem-edge is graphically indicated as '|'

(39)

input: sarn (gen.pl)	ALIGN-R	*COMPLEXCODA	FILL-μ
sarn | E	*!		*
☞ sarEn |			*

Basically, these three constraints govern the surfacing of yers in Polish in a NOURYER proposal. In [sarEnka] the relevance of the syllable structure constraint ONSET is visible, dominating ALIGN-R.

(40)

input: sarn -k -a (dim, nom.sg)	ONSET	ALIGN-R	*COMPLEXCODA	FILL-μ
sarn | k | a		*	**!	
☞ sarEn | k | a		*	*	*
sarn | Ek | a		**!	*	*
sarEn | Ek | a		**!		**
sarn | Ek | a	*!		*	*

The form [sarEnEk] is problematic for the analysis presented so far because the ill-formed structure [sarnEk] is predicted to be more harmonic.

[39]Probably the constraint *COMPLEXCODA is itself constructed as a large cluster of independent constraints, which regulate the possible well-formedness of codas in Polish. In my argument I abstract away from these details.

(41)

input: sarn -k (dim, ge.pl)	ONSET	ALIGN-R	*COMPLEXCODA	FILL-μ
sarn | k |			**!	
sarEn | k |			*!	*
☞ ? sarn | Ek |		*	*	*
☞ sarEn | Ek |		*		**

Tableaux (40) and (41) point out an additional problem with respect to interpreting the most harmonic candidate. In both cases there are two distinct stem-edges which may be adressed to by ALIGN-R. Notice, however, that in evaluating *COMPLEXCODA the distinct stem constituents are also taken into account. In (41) the candidate [sarn | k |] is violating *COMPLEXCODA twice, once as [sarn] and once as [sarnk].

As in the URYER analysis described above I presume that three hypotheses bring a solution to the above problems. Actually, the versions of the hypotheses are quite similar, indicated here by means of a prime ‘.

- **Hypothesis I'**: The constraint *COMPLEXCODA is active on the stem level, but is dominated on the word level. It has been extensively documented that Polish allows huge consonant clusters at word-final positions (for example in Rubach & Booij 1990a,b). This observation can be captured while using multiple conflicting constraint-rankings at stem and word level.

(42) Multiple constraint-rankings in Polish

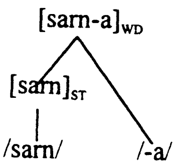
a.	Stem ranking:	*COMPLEXCODA	>>	FILL-μ
b.	Word ranking:	FILL-μ	>>	*COMPLEXCODA

- **Hypothesis II'**: The following conditions regulate *satisfaction* of constraint-rankings.
  a. Eval checks a ranking of constraints iff there is a node in the morphological hierarchical structure. I assume such nodes to arise by means of derivational and inflectional morphology, corresponding with a stem cophonology and a word cophonology, respectively. I also assume that an initial stem cophonology may be projected as the consequence of an idiosyncratic property of a morpheme-set.
  b. Eval checks all available constraint-rankings, i.e. maximizes cophonology satisfaction.
  c. In complex forms that contain both stem and word morphology, the constraint-rankings conflict. Here word cophonology as a consequence of overt inflection takes priority upon stem cophonology, which means that the word constraint-ranking must be satisfied, at the cost of the stem constraint-ranking. This conflict is strictly local due to the fact that Eval maximizes satisfaction of constraint-rankings.
  d. Both constraint-rankings compete and produce separate optimal condidates if there is no overt inflection and no derivational evidence available. This predicts variation or fluctuation on nonderived forms without overt inflection.

- **Hypothesis III'**: The paradox between stem and word cophonologies can be resolved only in nonderivational approach. Eval operates on stem and word constraint-rankings in parallel and simultaneously.

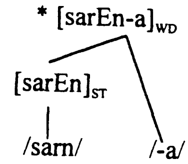
Below I give the relevant structures and indicate how the different constraint-rankings are interacting. It may become clear that, apart from the actual choice of constraints, the structures depicted in (43) to (46) bear a huge resemblance to the previous presented structures of the URYER analysis.

(43) Word ranking due to overt inflection: [sarna] 'roe-deer' (nom.sg)

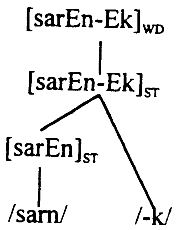


✓FILL-μ >> *COMPLEXCODA

*COMPLEXCODA >> FILL-μ



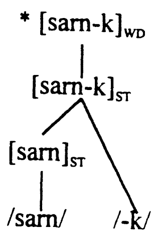
(44) Stem ranking due to overt derivational suffix: [sarEnEk] (gen.pl. dim)



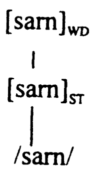
FILL-μ >> *COMPLEXCODA

✓ *COMPLEXCODA >> FILL-μ

✓ *COMPLEXCODA >> FILL-μ

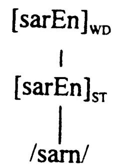


(45) Both word ranking and stem ranking are checked and provide optimal candidate, variation on nonderived stems without overt inflectional element: [sarEn] ≈ [sarn]

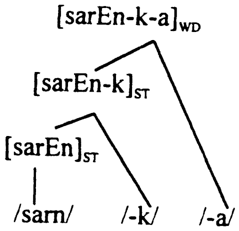


✓FILL-μ >> *COMPLEXCODA

✓ *COMPLEXCODA >> FILL-μ



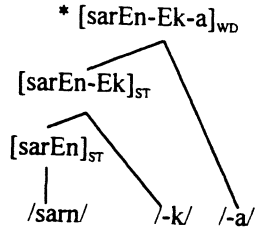
(46) Conflict between word and stem ranking, due to both word and stem "signaling elements".



✓FILL-μ >> *COMPLEXCODA

*COMPLEXCODA >> FILL-μ

✓ *COMPLEXCODA >> FILL-μ



All the arguments that I have given in the URYER analysis are applicable in the NONURYER account. For instance, notice the importance of a nonderivational approach to the phonological pattern in (46), which is stated in the hypothesis that Eval maximizes constraint-ranking satisfaction. It must be evident that the URYER and the NOURYER approaches lead to the same description of the vowel-zero alternations. Of course this result, surprising as it may be, must be traced back to the notion of what the approaches actually represent, namely different choices with respect to the theme of the tradeoff between phonological input and set of procedures or constraints. I conclude therefore that the question addressed to in these approaches, do we assume yers to be phonologically underlying present or not, is irrelevant from the point of view of Optimality Theory.

Notice that at this point of my argument the URYER approach appears to suffer from an internal inconsistency: it seems as if the information about yers is encoded twice in the phonology of Polish. On the one hand I have argued for the fact that vowel-zero alternations are related to a stem level versus word level constraint-ranking, but on the other hand the URYER option chooses yers to be part of the underlying representation in a distinct group of morphemes. As further research may conclude, such redundancy should be excluded a priori. Although I assume in the remaining of this paper a NOURYER approach towards Polish yers, I do not motivate this choice, precisely because from an OT perspective that question seems to be of little relevance.

4. Some other phenomena in Polish phonology

Within the framework of Monotonic Cyclicity a distinction may be made between noncyclic and cyclic constituency. Noncyclic forms are represented as n-ary branching or flat structures, whereas cyclicity arises in cases of binary branching structures. In the first part of this section I discuss word level phonology in Polish. I will give attention to a typical word-level suffix, namely Comparative Degree Formation; the interaction of the constraints PARSE-segment and FILL-μ at the word level will thus be demonstrated. Then I show how cyclicity is expressed at the Polish stem level cophonology, while using binary branching structure. The interaction between noncyclic and cyclic structures as it happens to be in Polish phonology is a crucial aspect of my proposal. It can be concluded that the distinction between morphemes that exhibit yers and those that do not relates to an unpredictable morphological property, which results in an initial stem constituent.

4.1. Comparative Degree Formation as word level suffix

Comparative Degree Formation or CDF comes in two phonological shapes: as *-szy* and as *-Eszy*. As Szpyra (1992) and Bethin (1991) point out, the choice of the allomorph *-Eszy* arises in cases of an unsyllabified consonant[40].

(47)

gLup-i	'silly'	gLup-sz-y
tward-y	'hard'	tward-sz-y
manrd-y	'wise'	manrd-Esz-y
zimn-y	'cold'	zimni-Esz-y

The extended allomorph is also selected in cases of a morpheme that exhibits a yer, such as [pewiEn] 'certain' - [pewn-y].

[40] All data are from Szpyra (1992) and Bethin (1992).

(48)

pewn-y	'certain'	pewni-Esz-y	*pewiEn-sz-y
godn-y	'worthy'	godni-Esz-y	*godEn-sz-y

Also in cases of a derived adjective that in turn contains a yer-morpheme, such as [hanb-a] 'shame' - [haniEb-n-y] 'shameful', the extended allomorph is selected.

(49)

haniEb-n-y	'shameful'	haniEb-n-Esz-y	*haniEbEn-sz-y, *hanbEn-Esz-y

The analysis of the above data may be developed along the following lines. Let us assume that the enlarged version of the CDF-suffix results from epenthesis exactly in the cases in which morphemic material tends to remain unsyllabified. In OT-terms this can be expressed as the requirement that every segment must be faithfully parsed, forcing a violation of FILL-μ. What is important to note is that the constraint-ranking at the word level does not allow dominance of FILL-μ by the constraint *COMPLEXCODA, as I have explained in the previous section.

Optimality Theory assumes constraints to be violable under certain conditions. This is precisely what we encounter in the situation of Comparative Degree Formation. In other words, although FILL-μ is highly ranked in the word cophonology, it is itself dominated by the constraint PARSE-segment. I propose the following morphological constituents to account for the CDF-examples.

(50)

[tward-sz-y]$_{WD}$ /tward/ /-sz/ /-y/

✓FILL-μ >> *COMPLEXCODA

* [manrd-sz-y]$_{WD}$ /manrd/ /-sz/ /-y/

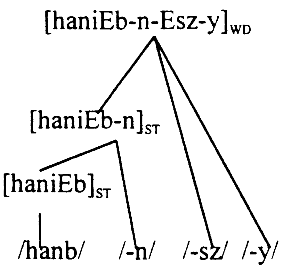
A closer look at the structure of [manrd-sz-y]$_{WD}$ shows that the final segment of the morpheme cannot be parsed into syllable position, therefore epenthesis occurs.

(51)

input: manrd -sz -y	PARSE-segment	FILL-μ
manr<d>szy	*!	
☞ manr.dE.szy		*

In the case of the derived base [hanb-n], an interesting conflict between stem and word constraint-rankings occurs. Notice that the constraint *COMPLEXCODA forces a FILL-μ violation on the stem [haniEb], but in the competing area of [haniEb-n-sz-y], the word level ranking does not allow epenthesis to occur twice, at the cost of leaving the nasal unparsed. The following morphological structure may express this observation.

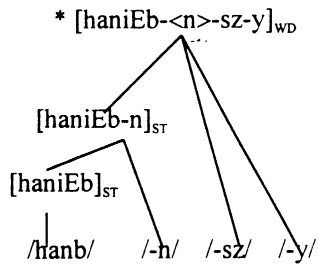
(52)



✓PARSE-SEGMENT >> FILL-μ (>> *COMPLEXCODA)

*COMPLEXCODA >> FILL-μ

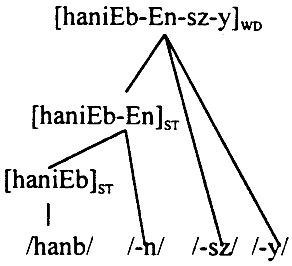
✓ *COMPLEXCODA >> FILL-μ



Why doesn't epenthesis occur in the position predicted by the stem level constraint-ranking? I propose that this possibility is excluded due to the fact that the stem cophonology of [hanb-n] is conflicting with the word level constraint-ranking activated by means of the inflectional marker *-y*, in the exact same way as constraint-rankings of stem and word level compete throughout the Polish phonology. In other words, the epenthetic site may not be positioned within the stem constituent, because the constraint *COMPLEXCODA is not outranking FILL-μ at the word level.

This interaction between constraints and their rankings can not be achieved in a derivational approach. For instance, as the lefthand example of (53) may illustrate, an account that allows information of embedded constituents to be preserved makes the wrong prediction that the allomorph *-szy* will be selected. In constrast, if the word cophonology is dominant on a global scale, then due to PARSE-segment an epenthetic segment will surface, but crucially in the wrong position. To see why this is the case, consider the rightmost structure of (53) below, motivated by the tableau in (54) (dots signal syllable boundaries).

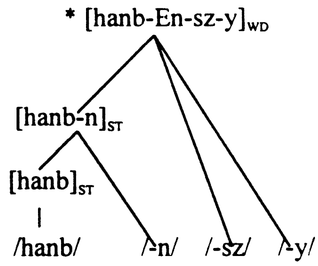
(53)



✓PARSE-SEGMENT >> FILL-μ (>> *COMPLEXCODA)

*COMPLEXCODA >> FILL-μ

✓ *COMPLEXCODA >> FILL-μ



(54)

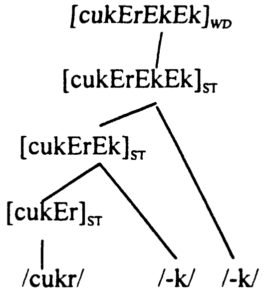
input: hanb, -n, -sz, -y	PARSE-segment	FILL-μ	*COMPLEXCODA
hanb.<n>szy	*!		*
han.<bn>szy	**!		
ha.niEb.<n>szy	*!	*	
? ☞ han.bEn.szy		*	
☞ ha.niEb.nE.szy		**	
? ☞ ha.niE.bEn.szy		**	

If the word constraint-ranking turns out to dominate all other cophonologies, the incorrect output candidate [hanbEnszy] will be selected as the most harmonic one, based on its number of FILL-violations. Notice that tableau (53) also allows an alternative candidate [haniEbEnszy] to compete with the actually optimal one. I think that the emergence of such different possible output candidates are consequences of the statement that there is a single dominant constraint-ranking. Unfortunately, this assumption turns out to be wrong; it seems to me that any correct analysis can only come forth in an approach using multiple constraint-rankings in a nonderivational way.

4.2. Stem cyclicity

Below I show that the stem level must be binary branching, which expresses cyclicity. Consider the example [cukErECEk] 'candy' (dim. nom.sg) and [cukErECka] (gen.sg), as given at the lefthand and righthand side, respectively.[41]

(54)

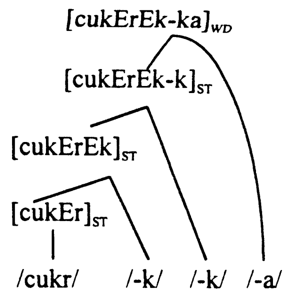


FILL-μ >> **COMPLEXCODA* (✓)

(✓) *COMPLEXCODA >> FILL-μ

✓ *COMPLEXCODA >> FILL-μ

✓ *COMPLEXCODA >> FILL-μ



A flat structure, representing noncyclicity, makes a complete false prediction here. Consider tableau (55) below that may illustrate this point. Tableau (55) results in the selection of incorrect output forms [cukErkEk] and [cukrEkEk], based on the number of Fill-violations. The actual output candidate can be achieved only on the condition that Eval checks the constraint-rankings on all depending stem constituents (dots represent σ-boundaries, " | " indicates morpheme boundary).

(55)

input: cukr -k (dim) -k (dim)	PARSE-segment	*COMPLEXCODA	FILL-μ
cuk<r> | <k> | <k>	***!		
cukr | <k> | <k>	**!	*	
cuk.r | Ek | <k>	*!		*
cukr | k | Ek |		*!	*
? ☞ cukEr | .k | Ek |			**
? ☞ cuk.r | E.k | Ek |			**
☞ cukE.r | E.k | Ek |			***

As can be seen in the topmost forms, any unparsed segment creates a final violation; observe that a violation of *COMPLEXCODA is also forbidden. Therefore, the number of FILL-μ violations must be decisive. A flat structure, processing the whole string in a single computation, cannot explain why epenthesis should occur three times, i.e. why does the correct output form contain three Fill-violations. Only the crucial assumption that the complex

[41] In the structures of (54) the palatalization of the velar is not taken into account.

word [cukErECEk] exhibits multiple stem constituents, each with their own stem level constraint-ranking and related by a nonderivational method, provides an adequate explanation for this unexpected redundant fact.

4.3. Stem constituents on morphemes

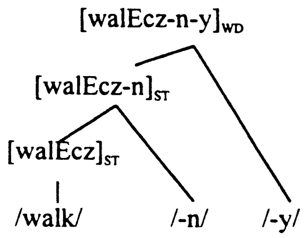
Polish phonology exhibits an unpredictable distinction between morphemes that show yer-phenomena and those that do not. In other words, there exists an separate morpheme-set which I will call yer-stems. A yer-stem constrasts with other morphemes because it projects an initial stem constituent that preceeds any morphology, i.e. it exhibits a distinct cophonology or constraint-ranking. This assumption is similar to the proposal of a stem 'cycle' as outlined in Inkelas (1989)[42]. This is expressed in the following hypothesis:

- **Hypothesis IV**: There is no distinction between an URYER and a NOURYER analysis. Yers are not specified phonologically, but follow from the constraint interaction on the stem level. Base morphemes that show yers are different, because they project an additional stem constituent, that correlates to an additional stem level constraint-ranking. Eval checks optimal candidates on all rankings, included this initial stem level.

I assume that the constraint-ranking of the yer-stem constituent is similar to the regular stem level ranking. This assumption allows for a consistent and elegant explanation of morpheme-sensitive phonology in Polish. Nonetheless, I do not exclude the possibility that further work on this language may reveal that such abstract similarities are not motivated; but these considerations are not explored in this paper[43].

The following structures illustrate the distinction in morpheme-set. On the lefthand side a yer-stem and its complex structure is given, whereas the righthand example contains a contrasting morpheme. It is important to see that the distinction is expressed in terms of absence versus presence of a stem constituent. Also notice that it is due to derivational morphology that a stem constituent arises. The tableau in (57) demonstrates that the initial stem level ranking precisely make up the difference in phonological patterning (only the stem constraint-rankings are given).

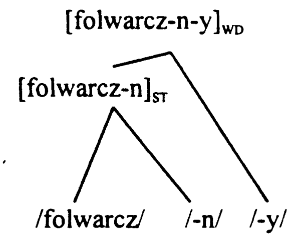
(56)



✓ FILL-μ >> *COMPLEXCODA

*COMPLEXCODA >> FILL-μ

✓ *COMPLEXCODA >> FILL-μ



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[42] I owe this suggestion to Sharon Inkelas and Orhan Orgun (personal communication);they refer to Perlmutter (1988) and to Henniss (1991).

[43] For instance, in a footnote above I have suggested that the constraint *COMPLEXCODA actually may be interpreted as a cluster of constraints. If this is the case, then we may expect this cluster to behave differently in different environments. The example cited in Prince & Smolensky (1993) of a constraint that actually consists of a large number of constraints is HNUC.

(57)

input: walcz, -n	*COMPLEXCODA	FILL-μ
walcz | n	**!	
walEcz | n	*!	*
☞ walEcz | En		**

input: folwarcz, -n	*COMPLEXCODA	FILL-μ
folwarczn	*!	
☞ folwarczEn		*
folwarEczEn		**!

In this section three aspects of my proposal concerning vowel-zero alternations in Polish have been considered. I have argued for a distinction between noncyclic and cyclic structures that are both operative in the grammar of Polish. Noncyclic word cophonology and cyclic stem constraint-rankings conflict. Arguments that are crucially in favor of a nonderivational approach to the interaction between cophonologies have been brought forward in the cases of Comparative Degree Formation and cyclic stem constituents in multiple diminutive forms. Finally, I have proposed to account for the behavior of bare morphemes with respect to vowel-zero patterns in terms of an initial stem constituent.

5. Consequences and further remarks

Many prominent questions remain untouched in this paper. In this concluding section I merely indicate various aspects that need to be explored in future research. From a phonological point of view one could ask whether or not there exists additional phonological evidence for the proposed division between stem and word cophonologies. For example, Gussmann (1992) discusses several voicing phenomena in Polish, that relate to syllable structure and word constituency. Consonant clusters in word-final position show neutralization effects to the extend that any [+voice] specification on obstruents is lost. Thus the word constraint-ranking captures the fact that huge consonant clusters are allowed, but at the same time disallows contrasting featural voice specifications on these clusters. One may wonder whether the stem cophonologies differ in this respect.

Another interesting topic not covered in this paper concerns the phonological patterns in morphological complex structures that contain prefixes. As among others Gussmann (1980) shows, prefixed forms behave differently in a number of phonological respects such as vowel-zero alternations and palatalization effects.

From a typological perspective a large number of important issues can be stated which concern both the conceptual aspects of the Monotonic Cyclicity model applied to the Optimality Theoretic framework as well as the nonderivational nature as outlined in this paper. For instance, if morpheme-specific phonology in Polish can be described in the way I have proposed here, does this also imply that Inkelas, Orgun, Zoll (1994)'s division of the Turkish phonological patterns may be accounted for in the same way? It also raises questions about the common differentiation between phonological information that is supposed to be listed in the lexicon and similar information that is generated via application of a set of procedures or constraints.

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