

# Phonology

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**Editorial Address** Professor Colin J. Ewen, Vakgroep Engels, Rijksuniversiteit te Leiden, P.N. van Eyckhof 4, Postbus 9515, 2300 RA Leiden, The Netherlands. (EWEN@HLERUL5.BITNET).

Intending contributors from the United States should submit typescripts to: Professor Ellen M. Kaisse, Department of Linguistics GN-40, University of Washington, Seattle, WA 98195, USA. (KAISSE@U.WASHINGTON.EDU.).

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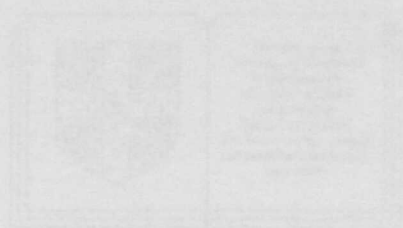
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(Continued on inside back cover)

Phonology

7

NUMBER 1  
1990



CAMBRIDGE UNIVERSITY PRESS

NEW YORK

325 WEST 87TH STREET, NEW YORK, NY 10024

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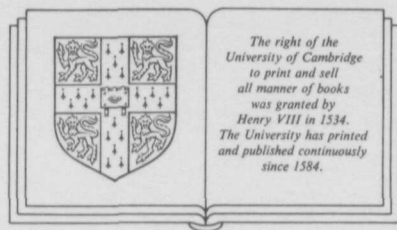
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Edited by  
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CAMBRIDGE UNIVERSITY PRESS

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NEW YORK PORT CHESTER MELBOURNE SYDNEY



Published by the Press Syndicate of the University of Cambridge  
The Pitt Building, Trumpington Street, Cambridge CB2 1RP  
40 West 20th Street, New York, NY 10011, USA  
10 Stamford Road, Oakleigh, Melbourne 3166, Australia

© Cambridge University Press 1990

First published 1990

Printed in Great Britain by the University Press, Cambridge

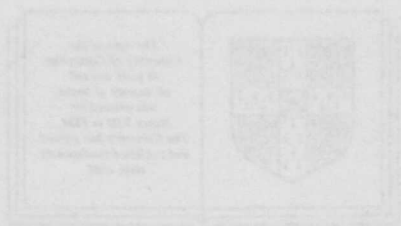
*British Library cataloguing in publication data*

Phonology. 7

1. Grammar, Comparative and general  
Phonology

414 P217

ISSN 0952-6757



CAMBRIDGE UNIVERSITY PRESS

CAMBRIDGE

NEW YORK PORT CHESTER MELBOURNE SYDNEY

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# *Syllable structure assignment in Polish\**

**Jerzy Rubach**

University of Warsaw

**Geert Booij**

Free University, Amsterdam

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## **0 Introduction**

This study deals with syllable structure in Polish. The central theme is the question of when and how syllabification rules apply in the lexical phonology of Polish. In §1 we lay the ground for our subsequent discussion by giving the basic syllable patterns of Polish. We also propose here a first version of the syllabification algorithm for Polish. In §2 we show that syllabification applies cyclically, because certain cyclic phonological rules make crucial use of information about the prosodic structure of their potential inputs. §3 then shows that the syllabification algorithm has to apply both before and after the application of cyclic phonological rules on one cycle, and that syllabification is therefore a continuous process. In §4 we argue that the syllabification algorithm proposed in §1 must be modified to enable us to predict whether a high [—consonantal] segment will surface as a vowel or as a glide. Since the distinction between vowels and glides is crucial for the application of certain cyclic phonological rules of Polish, this again shows that syllabification has to apply cyclically. §5 defends the hypothesis that resyllabification is restricted to Coda Erasure (and the subsequent syllabification of the desyllabified consonants). Again, the (un)predictability of the vowel/glide distinction plays a crucial role here. We summarise our conclusions in §6.

## **1 Syllabification**

Polish is well known for the fact it allows remarkable types of consonant clusters, and seems to indulge in violating the Sonority Sequencing Generalisation (Selkirk 1984), which we state as follows:

(1) *Sonority Sequencing Generalisation* (SSG)

The sonority of segments must decrease towards the edges of a syllable, where the sonority of segments is defined by the following scale of decreasing sonority:

vowels – liquids – nasals – fricatives – stops

Below we present a typology of these violations:

(2) a. *stop/affricate + stop/affricate*

*initial*: ptak 'bird', kpić 'joke', kto 'who', czkawka [čk-]<sup>1</sup> 'hiccup'

*final*: fakt 'fact', kopć 'smoke' (IMPER), liczb [-čp] 'number' (GEN PL)

b. *fricative + fricative*

*initial*: scheda [sx-] 'inheritance', szwindel [šf-] 'swindle', chwała [xf-] 'glory'

*final*: zmierzch [-šx] 'twilight', nazw [-sf] 'name' (GEN PL), orzeźw [-šf] 'refresh' (IMPER)

c. *initial fricative + stop*

szpieg [šp-] 'spy', wtorek [ft-] 'Tuesday', skok 'jump'

d. *final stop + fricative*

gips 'plaster', boks 'boxing', pieprz [-pš] 'pepper', patrz [-tš] 'look' (IMPER)

e. *nasal + nasal*

*initial*: mnożyć 'multiply', mnie [mń-] 'me'

*final*: hymn 'anthem', kolumn 'column' (GEN PL)

f. *initial liquid + nasal*

lnu 'linen' (GEN SG), lniany [lń-] 'linen' (ADJ)

g. *final nasal + liquid*

skoml 'whine' (IMPER), Kreml 'Kremlin'

h. *initial sonorant + obstruent*

rtęć 'mercury', lwy 'lions', lkać 'sob'

i. *final obstruent + sonorant*

myśl 'idea', umysł 'mind', teatr 'theatre', pieśń 'song', blizn 'scar' (GEN PL), rytm 'rhythm', wiedźm [-ćm] 'witch' (GEN PL)

Thus many unusual combinations of consonants are possible word-initially and word-finally. Yet, as we shall explain below, word-internal syllabification is considerably restricted. Thus, the fact that word-initially we have [rt] and [lk] does not warrant the syllabification of *karty* 'cards' and *pałka* 'stick' as *ka-rty* and *pa-lka*. These syllabifications do not occur, even though the division of VCCV into V-CCV is the preferred pattern in Polish (see below). The attested division is *kar-ty* and *pał-ka*. Thus, there are some generalisations, but for the moment it is not clear what they are.

Let us look at clusters that contain more than two members and constitute violations of the SSG:

- (3) a. *initial sonorant + obstruent + consonant*  
 lśnić 'shine', lgnąć 'to stick', mdlić 'feel sea-sick', mścić się  
 [mścić-] 'avenge'
- b. *final consonant + obstruent + sonorant*  
 siostr 'sister' (GEN PL), filtr 'filter', astm 'asthma' (GEN PL)
- c. *obstruent + sonorant + consonant*  
*initial*: krtani 'larynx', brnąć 'plough through' (very few examples exist)  
*final*: no such clusters exist
- d. *three or more obstruents*  
*initial*: wściekły [fść-] 'furious', bzdura 'nonsense', pszczoła  
 [pšč-] 'bee', wspaniały [fsp-] 'great', wstyd [fst-]  
 'shame', grzbiet [gžb-] 'back'  
*final*: babsk 'witch' (GEN PL), wydawnictw [-ctf] 'publisher',  
 tekst 'text', głupstw [-pstf] 'nonsense' (GEN PL),  
 marnotrawstw [-fstf] 'waste' (GEN PL), przestępstw  
 [-mpstf] 'crime' (GEN PL)

These data show much more restrictiveness in the combinatorial possibilities of consonants than the data in (2). There are no violations of sonority in the classes of liquids and nasals, neither within each class nor in combinations of these two classes. That is, there are no clusters of three liquids or nasals or clusters of liquid-nasal-liquid or nasal-liquid-nasal. The sonorants that violate the SSG appear invariably in a cluster with obstruents and, with the exception of a handful of words in (3c), they are restricted to word edges: initially they are the first and finally the last member of a cluster. This is a significant observation. Let us assume the following working hypothesis:

- (4) The consonant at an edge of a word, that is, word-initial or word-final, does not count from the point of view of the SSG

This hypothesis was suggested by Fudge (1969) and by Halle & Vergnaud (1980). It was confirmed as a valid observation by a number of researchers, notably Steriade (1982). Polish follows the path of many other languages in that word-initial and word-final clusters correspond partly, but not entirely, to the phonotactic patterns in syllable-initial and syllable-final clusters.<sup>2</sup>

With the hypothesis in (4), the words in (2) above do not constitute violations of the SSG and the violations exhibited in (3) can now be seen as severely limited. On a massive scale these violations are found only in the class of obstruents. We conclude that, for the purposes of sonority sequencing, Polish does not distinguish between fricatives and stops, i.e. it does not require a sonority distance for clusters if they are obstruents.

A certain refinement of this conclusion is necessary. While fricatives and stops can occur in clusters in either order, it remains a fact that universally geminate sequences are split between two syllables (Kur-

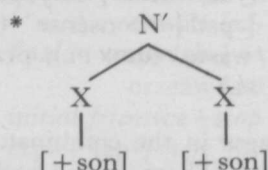
yłowicz 1947: 87). Thus, *netto* 'net' and *passa* 'spell' are syllabified exclusively as *net-to* and *pas-sa*. In sum, the SSG in (1) must be complemented by the following language-specific principle:

(5) *Obstruent Sequencing Constraint*

With non-identical obstruents there is no requirement of sonority distance

A language-specific restriction on syllable structure in Polish is the constraint on codas. As pointed out by Alicja Gorecka (personal communication), Polish does not admit codas of two sonorants, regardless of whether they constitute a violation of the SSG. We state this generalisation in (6), where N' is the coda node, as suggested by Levin (1985):

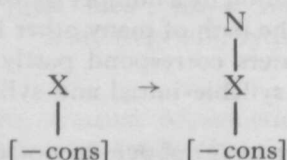
(6) *Coda Constraint*



In phonetic terms the Coda Constraint is seen to operate in words such as *karmnik* 'feeder', where the syllabifications *kar-mnik* and *karm-nik* are equally arbitrary. The former is not permitted by the sonority hierarchy, while the latter is disallowed by the Coda Constraint.<sup>3</sup>

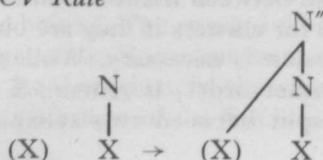
We are now in a position to propose syllable parsing rules for Polish. We follow Levin (1985) in assuming that the syllable is characterised as an X-bar projection of the primitive category N (nucleus). The terms 'onset' and 'coda' are retained only for descriptive convenience. We assume that in addition to the universal CV Rule, there is a language-specific onset formation rule, and two language-specific rules for coda formation:

(7) *N-placement*



(7) evidently overgenerates, since it does not distinguish between vowels and glides. We postpone the discussion of this issue until §4.

(8) *CV Rule*

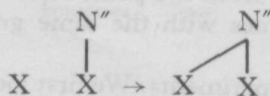




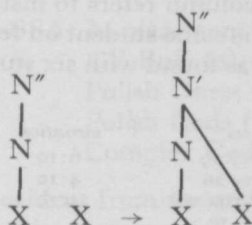
The CV Rule applies regardless of whether or not there is material to be included in the onset, since  $N''$  corresponds to the node  $\sigma$  (the syllable) and must be projected even if the  $X$  is not available, hence the parentheses.

Clusters of consonants are derived by the following rules:

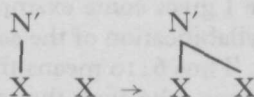
(9) *Polish Onset*



(10) *Polish Coda*



(11) *Complex Coda*



The CV Rule and the Polish Onset Rule have a different status: the former is obligatory while the latter is optional. This means that the sequence VCV can only be parsed as V-CV, for example, *do-my* 'houses', while the sequence VCCV could be syllabified as either V-CCV or VC-CV. When the first C in a sequence VCCV has not been syllabified by the Polish Onset Rule, it will be prosodically linked by the Coda Rule or the Complex Coda Rule, which we assume to be ordered after the onset creating rules, and which apply obligatorily, because all consonants that are 'left over' by the onset rules must be linked prosodically, if possible.

We have now come to an important point in the description of Polish syllabification. There is a considerable variation in parsing strings into syllables. This may explain why the facts of syllabification have never been studied in any detail by descriptive grammarians.

We wish to put forward the following claim. While variation unquestionably exists, it is governed by principles that place a limit on its scope. Some parsings are more likely than others and, more importantly, there are also parsings that are impossible or virtually impossible. The latter qualification is to be understood as a cautious way of admitting that, say, in a syllabification test done by a group of one hundred people, one may find one or two instances that diverge from what seems to be the norm. We have given an example of an impossible syllabification: VCV  $\rightarrow$  VC-V. More examples of this nature and examples of a different type will be discussed later. We now address the problem of the probability ratio of various syllabification patterns.

To establish how syllabification works, native speaker intuitions of one of the authors of this article, Rubach, have been complemented by the findings of a test that was carried out with a group of students at the



University of Warsaw. The students were dictated a list of words and were asked to divide these words exhaustively into syllables while writing them down. The list was dictated quickly, and no time for consideration was allowed. If the results were not clear, which happened in the case of some words, the test were repeated one or more times with a different group of students. In instances of particular interest from the point of view of the data, the same test was repeated three times with the same groups of students at intervals of at least one week.

Below we present the findings of these experiments. We first look at the case where variation was observed. The typology is as follows:

(i) *Pattern VCCV*: preferred parsing V-CCV, less likely parsing VC-CV. Table I gives some examples. The last column refers to instances of variable syllabification of the same word by the same student on repetition of the test. Thus 6:10 means that variation was found with six students in a group of ten who took the test.

		<i>number of instances</i>	<i>variation</i>
dobry	'good'	do-bry 29, dob-ry 19	6:10
Tatry	'Tatra'	Ta-try 39, Tat-ry 26	4:10
patrzeć	'look' [patšec]	pa-trzec 36, pat-rzec 20	3:10

[Table I]

(ii) *Pattern VCCCV*: the hierarchy of preference is well illustrated by the parsing of the word *listwa* [l'istfa] 'board': VC-CCV [l'is-tfa] 40; VCC-CV [l'ist-fa] 11; V-CCCV [l'i-stfa] 8.

(iii) *Pattern VCCCCV*: example *abstrakt* [apstrakt] 'abstract': VC-CCCV [ap-strakt] 20; VCC-CCV [aps-trakt] 14; V-CCCCV [a-pstrakt] 6.

(iv) *Pattern VCCCCCV*: example *skąpstwo* [skompstfo] 'meanness': VCC-CCCV [skomp-stfo] 28; VC-CCCCV [skom-pstfo] 19; VCCCC-CV [skomps-tfo] 2.

We conclude that Polish shows a clear preference for an onset that is heavier than the coda.

These patterns are surface representations. How exactly they are arrived at is an empirical question: are they derived cyclically or do they arise by postcyclic adjunction, or perhaps by some combination of these two modes of applying the parsing rules? These problems will be investigated in the following sections. Now let us return to the results of the syllabification test.

While variation gives rise to interesting observations, it is far more intriguing to discover that there are instances in which only one, or virtually only one, parsing is possible. The examples in point are given in Table II. For clarity we omit the syllabification of the irrelevant parts of the words.

Note that, unlike Table I, there is no rubric 'variation in the same word' since such variation was not found. These results are striking. They show that in spite of what seems to be rather unsystematic phonotactics (see (2) above) Polish obeys the SSG (1). The difference between Polish and some other languages is that this hierarchy only plays a role word-internally.

			number of instances		
kontakt	'contact'	kon-takt	45,	ko-ntakt	o
kormoran	'cormorant'	kor-mo-	46,	ko-rmo-	i
korniszon	'gherkin'	kor-ni-	46,	ko-rni-	o
par[t'j]a	'party'	par-tia	45,	pa-rtia	o
komputer	'computer'	kom-pu-	46,	ko-mpu-	o
regionalny	'regional'	-al-ny	46,	-a-lny	o
pokorny	'humble'	-kor-ny	34,	-ko-rny	i
konserwa	'can'	kon-ser-wa	45,	ko-nser-wa	o
				kon-se-rwa	o

[Table II]

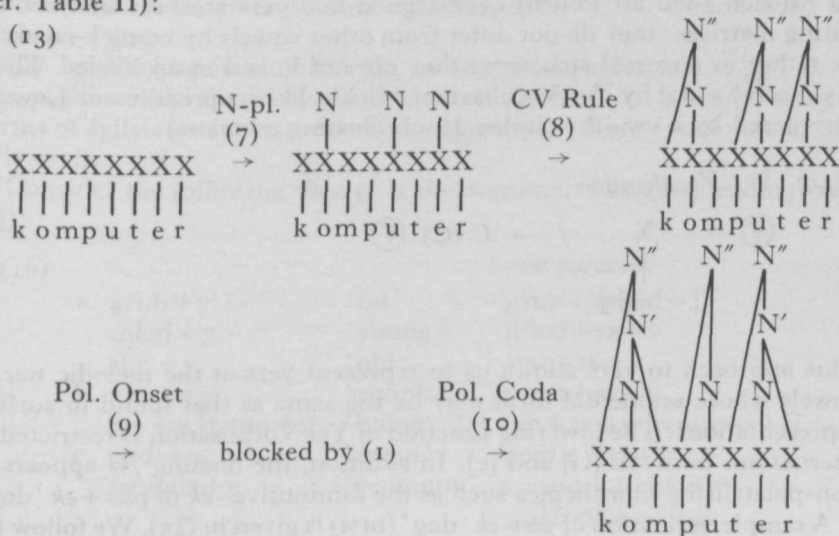
Summarising the results obtained so far, we assume that the following rules constitute the Syllable Structure Algorithm of Polish (henceforth SSA):

- (12) SSA: N-placement (7)  
 CV Rule (8)  
 Polish Onset (9)  
 Polish Coda (10)  
 Complex Coda (11)

As is evident from the statement of the rules, the function of the SSA is to organise a string of Xs represented at the skeleton into well-formed syllables. Well-formedness is determined not only by the structural descriptions of the rules, but also by the principles of syllabification. We have identified three such principles: the SSG (1), the Obstruent Sequencing Constraint (5) and the Coda Constraint (6). Compliance with these principles is checked by looking at the melodic tier, since there the feature composition of segments is stated.

In sum, the SSA operates on Xs but it has access to the melody in order to determine whether the application of its syllabification rules is permitted. As an illustration, consider the derivation of *komputer* 'computer' (cf. Table II):

(13)



While in the vast majority of cases the relation between the melody and the skeleton is one-to-one (that is, each melodic segment corresponds to one X-slot), it has been shown that there are also other types of relation. For example, long vowels are characterised as single melodic units that are linked to two skeletal slots, while affricates are two melodic units (stop and fricative) that are linked to a single slot. Analyses have been proposed to demonstrate that we can also have slots that are not associated with any melody (for example, Anderson's 1982 study of the French schwa). The reverse is also possible: there are melodic units that do not correspond to any X-slot. These are the so-called 'floating matrices'. Polish yers provide an instance of precisely this situation. We will discuss them here because they occur in our analysis below, and because, depending on their interpretation, they might involve restructuring of syllables.

The term 'yer' is used to describe a pair of vowels that alternate with zero in Slavic languages. In Polish, the alternation is that between *e* and zero, and this mobile *e* may also alternate with [i] and [ɨ], which themselves alternate with zero.

Since Lightner (1965) Polish yers have been assumed to be lax high vowels: //ĩ// and //i// (cf. Rubach 1984a). The rule known as Lower turns //ĩ i// into [e] in the context 'C<sub>0</sub> yer'. Another rule, known as Derived Imperfective Tensing, turns them into [i i] before the suffix *-aj*. Both rules are cyclic. The yers which have not undergone one of these rules delete by the context-free postcyclic rule of Yer Deletion.

This system of rules predicts that in a sequence of several yers all surface except the last one, which deletes by Yer Deletion. For instance, the nominative singular form of *pies*, //pĩs+ĩ// 'dog', is realised as /pes/ (we ignore the problem of palatalisation here), whereas the genitive singular form //pĩs+a// surfaces as [ps+a].

Recent studies of the Slavic yers (Kenstowicz & Rubach 1987 for Slovak and Rubach 1986 for Polish) have argued that yers are best analysed as floating matrices: they do not differ from other vowels by being [-tense], but rather in terms of structure: they are not linked to an X-slot. They may receive a slot by Yer Vocalisation, which, like its predecessor Lower, is triggered by a yer (the circles denote floating matrices):

(14) *Yer Vocalisation*

$$\begin{array}{c} \textcircled{\text{V}} \rightarrow \quad \text{X} \quad / \text{---} \text{C (C)} \textcircled{\text{V}} \\ \quad \quad | \\ \quad \quad [-\text{high}] \end{array}$$

This approach to yers allows us to represent yers at the melodic tier as vowels whose segmental form may be the same as that found in surface representations. The lowering function of Yer Vocalisation is restricted to alternations between [i i] and [e]. In addition, the floating /i/ appears in non-palatalising morphemes such as the diminutive *-ek* of *pies+ek* 'dog'.

A sample derivation of *pies-ek* 'dog' (DIM) is given in (15). We follow the

traditional assumption that the nominative singular ending is a yer. The full morphemic structure of the word is: root + DIM + NOM SG ending:

(15) Cycle 2:	X X X	Yer Voc.	XXX X
		(14)	
	p e s + i k	→	p e s + i k
Cycle 3:	XXX X	Yer Voc.	XXX XX
		(14)	
	p e s + i k + i	→	p e s + e k + i

The final yer cannot vocalise since it is not followed by a yer. It deletes postcyclically, probably by a general convention of Stray Erasure (Steriade 1982).<sup>4</sup>

The consequence of this analysis of yers is that they play no role with respect to syllabification, since syllable structure is erected on the X-tier.

With the understanding that yers are floating matrices, we now return to the operation of the SSA.

## 2 In which component does the SSA start to apply?

In the framework of Lexical Phonology it is necessary to determine at which point the SSA starts to apply. In particular, the question is whether the SSA applies cyclically, postcyclically (that is, at the word level, see Booij & Rubach 1987) or postlexically. In this section we show that the SSA must apply in the cyclic component. We adduce two types of evidence for this claim:

(i) Comparative Allomorphy, a cyclic rule, is sensitive to syllable structure (this fact was pointed out independently by Bethin 1987 and Rubach 1986).

(ii) Iotation, again a cyclic rule, makes crucial reference to /j/. Given the position that the distinction between /j/ and /i/ is made solely in terms of syllable structure, the SSA must apply before Iotation, and thus it is cyclic.

Consider the following data (y is the nominative singular ending; sz is [š]):

(16)		comparative
a. grub + y	'fat'	grub + sz + y
młod + y	'young'	młod + sz + y
star + y	'old'	star + sz + y
b. prost + y	'simple'	prost + sz + y
tęp + y [temp + i]	'blunt'	tęp + sz + y [temp + š + i]
c. podł + y	'mean'	podł + ejsz + y
szczodr + y	'generous'	szczodrz + ejsz + y
		[ščodž + ejš + i]

The underlying representation of the comparative morpheme *-sz* is //š//.<sup>5</sup> As is evident from the comparison of (16a, b) and (16c), the comparative suffix is augmented by the addition of *-ej* if the stem ends in a cluster in which the final consonant is a sonorant:

(17) *Comparative Allomorphy*

$$\emptyset \rightarrow ej / C \underset{\substack{| \\ [+son]}}{C} - \check{s}$$

However, rule (17) misses a generalisation. Why should it be necessary for the second consonant in a cluster to be a sonorant? Clearly the problem is that at the intermediate stage /podl-š/ in the derivation of *podl+ejsz+y* 'meaner' the /l/ is extrasyllabic because it violates the SSG. A more insightful statement of (17) is therefore the following (the asterisk indicates extrasyllabicity):

(18) *Comparative Allomorphy*

$$\emptyset \rightarrow \underset{\substack{| \\ e}}{XX} \underset{\substack{| \\ i}}{X^*} / \quad \underset{\substack{| \\ \check{s}}}{X}$$

The fact that Comparative Allomorphy is better stated as a syllable-oriented rather than a purely segmental rule is confirmed by two other pieces of evidence: the Coda Constraint and the invisibility of yers.

Notice that *-ej* is also inserted if the coda contains two sonorants and is therefore unsyllabifiable by the Coda Constraint (6):

(19)	czarn + y	'black'	czarn + iejsz + y	[čarní + ejš + i]
	ogól + n + y	'general'	ogól + n + iejsz + y	[ogul + n̄ + ejš + i]
	skromn + y	'modest'	skromn + iejsz + y	[skromn̄ + ejš + i]
	fajn + y	'nice'	fajn + iejsz + y	[fajn̄ + ejš + i]

These data, and those in (16c), indicate that the SSA must apply prior to Comparative Allomorphy. If we now show that Comparative Allomorphy is cyclic, the SSA must also be cyclic.

The crucial evidence comes from the interaction between Comparative Allomorphy and Coronal Palatalisation. First, let us briefly introduce the rule of Coronal Palatalisation (for details, see Rubach 1984a). The generalisation is that coronal consonants are palatalised before front vowels and glides:

(20) *Coronal Palatalisation*

$$\left\{ \begin{array}{l} t d s z \\ r n l \end{array} \right\} \rightarrow [-back] / \quad - \left[ \begin{array}{l} -cons \\ -back \end{array} \right]$$



### Palatalisation:

- zez 'squint' – zez + ie (LOC SG):

The operation of Comparative Allomorphy also provides evidence for the treatment of the vers as floating matrices:

- światł+o 'light' (there is a *y*er between *t* and *ł*; cf. the genitive plural *światel*) – światł+y 'enlightened' – światł+ejsz+y 'more enlightened'

We summarise this discussion of Comparative Allomorphy by looking at the partial derivation of *podl + ejesz + y* [l + ejš + i] 'meaner' (a non-*yer* stem) and *kwaś + n + ejesz + y* [-ś + n + ejš + i] 'more sour' (a *yer* stem). The relevant stage is the derivation of the comparative degree cycle, the asterisk denotes extrasyllabicity, and *E* is a floating matrix:

- (23) podl + š      kvaś + En + š

1\*

 $n^*$ 

SSA

podl + ejš

kvaś + En + ejš

Comparative Allomorphy (18)

podl + ejš

kvaš + En + ejš

### Coronal Palatalisation (20)

The conclusion from this analysis of Comparative Allomorphy that the SSA applies in the cyclic component is corroborated by the operation of Iotation. For the purposes of this rule a distinction must be made between /i/ and /j/, and since this distinction is made solely in terms of syllable structure we shall conclude that the SSA must precede Iotation. The latter is cyclic, and hence the former must be cyclic as well.

Students of Slavic are familiar with the fact that in the class of obstruents Coronal Palatalisation competes with Iotation, a rule that applies before /j/. While the end result of Coronal Palatalisation is a class of prepalatal consonants [č ʒ š ž], the end result of Iotation is a series of postalveolar hard obstruents:<sup>7</sup>

(24) *Iotation*

{t' d' s' z'} → {č ʒ š ž}/—j

Iotation operates on the output of Coronal Palatalisation. Needless to say, the oppositions [š]–[ʒ], [č]–[ʒ], etc. are phonemic. The different effects of the two rules are seen in the verbal system.<sup>8</sup> Compare:

- (25) a. wóz 'cart' – woz + i + č [vož + i + č] 'to carry' – woż + ąc [vož + onc] 'carrying'  
 do + nos 'report' – do + nos + i + č [do + noš + i + č] 'to report'  
 – do + nosz + ąc [do + noš + onc] 'reporting'  
 gniazd + o 'nest' – gnieźdz + i + č [gnežž + i – č] 'to nest' – gnieźdz + ąc [gnežž + onc] 'nesting'  
 czyst + y 'clean' – czyśc + i + č [čišć + i + č] 'to clean' – czyśc + ąc [čišć + onc] 'cleaning'
- b. za + pis 'inscription' – pis + a + č 'to write' – pisz + ąc [p'iš + onc] 'writing'  
 wy + kop 'ditch' – kop + a + č 'to dig' – kop + iąc [kop' + jonc] 'digging'

It may be surprising that, except for the last example, the /j/ is not to be seen in the gerundive forms that have been derived by Iotation. To understand what is going on, we must look at some deeper layers of Polish morphology and phonology.

First, observe that there are two verbalising suffixes in (25): *-i* in (25a) and *-a* in (25b). Second, the infinitive morpheme is *-ć*. Third, the gerundive morpheme *-ąc* is //onc// at both the underlying level and the phonetic level. Fourth, the gerundive is obviously a deverbal construction, hence its structure is lexical root + verbalising suffix + gerundive suffix. The underlying representations of *woż + ąc* 'carrying', *pisz + ąc* 'writing' and *kop + iąc* 'digging' (see (25)) are therefore as follows:

- (26) voz + i + onc    pis + a + onc    kop + a + onc

They diverge considerably from the phonetic forms. Notably, there are no vowel clusters on the surface. This is due to the well-known rule of Slavic that deletes vowels in verbs (Jakobson 1948):



(27) *Vowel Deletion* $V \rightarrow \emptyset / \text{---} V ]_{\text{Verb}}$ 

Now the question is how we obtain the /j/ in the gerundive form. Clearly it is not present at the underlying level since no palatalisation effect is observed if the verb stem ends in a consonant, for instance, *paś* + *ć* 'to graze' – *paś* + *ąc* 'grazing'. Yet the gerundive forms in (25) must have a /j/. This is shown by the following two facts: (i) the gerundive forms exhibit reflexes of Iotation, which applies only before /j/, and (ii) in the last example of (25b) the /j/ actually surfaces phonetically: /kop + jonc/. We follow the traditional generative account of these facts and assume that Polish has a rule of *j*-insertion which applies before a certain configuration of vowels in a verb:<sup>9</sup>

(28) *j-insertion*

$$\emptyset \rightarrow \left[ \begin{array}{c} + \text{high} \\ \text{---} \text{back} \end{array} \right] / \text{---} [ \text{---} \text{cons} ] \left[ \begin{array}{c} \text{---} \text{cons} \\ \text{---} \text{high} \end{array} \right] ]_{\text{Verb}}$$

Rule (28) inserts a front high segment which is syllabified as the glide /j/ by the SSA (see § 5.3.1). The fact that phonetically /j/ is found in *kop* + *ąc* 'digging' but not in the other examples of (25) becomes clear when we realise that Polish has a rule of *j*-deletion that deletes /j/ after coronal consonants:

(29) *j-deletion* $j \rightarrow \emptyset / [ + \text{cor} ] \text{---}$ 

This is a very general rule, whose operation extends far beyond the verbal system. In other words, it is motivated entirely independently of *j*-insertion (28).<sup>10</sup>

A sample derivation sums up the discussion. For clarity we keep the morpheme boundaries until the last cycle. Our examples come from (25): *woż* + *ąc* 'carrying', *pisz* - *ąc* 'writing' and *kop* + *ąc* 'digging':

(30)	voz	pis	kop	
Cycle 2	voz + i voz' + i	pis + a —	kop + a —	WFR: Verb. Cor. Pal. (20)
	no other rules apply			
Cycle 3	voz' + i + onc	pis + a + onc	kop + a + onc	WFR:
	voz' + ji + onc	pis + ja + onc	kop + ja + onc	Gerundive
	—	pis' + ja + onc	—	<i>j</i> -insertion (28)
	vož + ji + onc	piš + ja + onc	—	Cor. Pal. (20)
	vož + jonc	piš + jonc	kop + j + onc	Iotation (24)
				V Deletion
				(27)
	vož + onc	piš + onc	—	<i>j</i> -deletion (29)

Iotation operates on the output of Coronal Palatalisation. Like the latter, it must be a cyclic rule. One clear reason for this is that Iotation feeds *j*-deletion, which is cyclic as it does not apply morpheme-internally (cf. Rubach 1984a).<sup>11</sup> We return to Iotation in §5.3.1.

To summarise, the cyclic rules of Comparative Allomorphy and Iotation require that syllable structure be available in the cyclic component. Consequently, the SSA must be cyclic.

### 3 Reapplication of the SSA

In this section we investigate further the application of the SSA in the cyclic component. Like Itô (1986), we put forward the claim that syllabification is continuous. This claim is based on the operation of Imperative Allomorphy, which is sensitive to changes in syllable structure that are effected by rules applying in the course of cyclic derivation.

The conclusion from the preceding section that the SSA is cyclic leaves open the question of how the SSA applies. Specifically, does the SSA apply only once on every cycle, and hence behave like a phonological rule, or does it reapply continuously, and hence is an 'anywhere rule'? Furthermore, this second hypothesis entails the following two possibilities:

(i) The SSA reapplies whenever a change at the skeletal tier has been introduced. This means that in addition to applying at the beginning of a cycle when new material has been introduced by a word formation rule, the SSA reapplies in the middle of a cycle after rules of deletion or insertion. The logic of such a procedure is clear: the SSA deals with Xs, hence it is natural that the manipulation of Xs should trigger the SSA.

(ii) The alternative is to assume that the SSA applies at the beginning of each cycle, and reapplies automatically after every rule, regardless of what type of operation such a rule performs.

We will defend the hypothesis of continuous syllabification by means of an analysis of the phonological behaviour of the imperative mood, in particular the interaction of the rule of Imperative Allomorphy with other cyclic rules.

#### 3.1 Imperative Allomorphy

For our purposes it is important to note that the imperative is manifested on the surface in three different ways:

- (31) a. Coronal Palatalisation:  $s \rightarrow \acute{s}$   
        $\text{kos} + \text{i} + \acute{c} // \text{kos} + \text{i} + \acute{c} //$  'to mow' –  $\text{ko}\acute{s}$   
        $\text{wis} + \text{ie} + \acute{c} // \text{vis} + \text{e} + \acute{c} //$  'to hang' –  $\text{wi}\acute{s}$   
   b. Iotation:  $s \rightarrow \acute{s}$   
        $\text{pis} + \text{a} + \acute{c}$  'to write' –  $\text{pi}\acute{s}\text{z}$  [ $\text{p}'\text{i}\acute{s}$ ]  
   c. the ending *-ij* (plus palatalisation)  
        $\text{kln} + \acute{a}\acute{c}$  'swearing' –  $\text{kln} + \text{ij}$  [ $\text{kl}\acute{n} + \text{ij}$ ]  
        $\text{dm} + \acute{a}\acute{c}$  'blowing' –  $\text{dm} + \text{ij}$  [ $\text{dm}' + \text{ij}$ ]

The fact that in (31a, b) the imperative is manifested on the surface solely by palatalisation with no overt vocalic ending suggests that the imperative morpheme is a yer. It triggers palatalisation but does not surface phonetically, since the environment of Yer Vocalisation is not met. The question now is which yer it is. Following a suggestion of Morris Halle (personal communication), we propose that the imperative morpheme has the same phonetic make-up as the stem extension vowel, but differs from it by not having an X-slot. That is, the imperative is the yer //I// in the classes of verbs exhibited in (31a) and //E// in the remaining classes of verbs.<sup>12</sup> The palatalisation effects, Coronal Palatalisation *vs.* Iotation, are now correctly derived: Iotation is only applicable in the case of *pisz* 'write' (IMP), since only this verb has the vowel configuration that triggers *j*-insertion and hence Iotation: //pis + a + E//.

With this background we return to the relation between the imperative and syllable structure. The relevant data are given in (31c), the imperatives *dm + ij* 'blow' and *kln + ij* 'swear'. The imperative is manifested here on the surface as the suffix *-ij*. Given our claim that yers have no X-slots, it is evident that *-ij* appears with those stems whose final consonant cannot be syllabified. As pointed out by Bethin (1987), this extrasyllabic consonant triggers Imperative Allomorphy.<sup>13</sup> We state the rule as follows (the circled vowel indicates a yer):

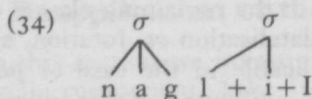
(32) *Imperative Allomorphy*

$$\emptyset \rightarrow ij / \quad - \textcircled{V}]_{\text{IMP}}$$

Rule (32) turns  $//dm + E//$  into  $/dm + ijE/$ . Now the SSA applies and assigns syllable structure. Thus these data show that the SSA has to apply before Imperative Allomorphy in order to determine the prosodic status of the stem-final consonant, and after Imperative Allomorphy, in order to integrate  $-ij$  into the prosodic structure of the imperative forms. However, these data do not show that the SSA has to apply twice on the same cycle, since the extrasyllabic status of the stem-final consonants can already be derived by the application of the SSA on the previous stem cycle. We therefore have to look for other crucial evidence. Consider the following data:

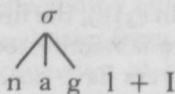
(33)	<i>infinitive</i>	<i>imperative</i>
a.	nagl+i+ć 'to hurry'	nagl+i+j
	tęskn+i+ć 'to long'	tęskn+i+j
	ścieśn+i+ć 'to narrow down'	ścieśn+i+j
	usztywn+i+ć 'to make stiff'	usztywn+i+j
	spulchn+i+ć 'to make soft'	spulchn+i+j
	zaprzyjaźn+i+ć 'to make friends'	zaprzyjaźn+i+j
	uprzytomn+i+ć 'to realise'	uprzytomn+i+j
b.	zwołn+i+ć 'to fire'	zwołn+i+j
	utajn+i+ć 'to cover up'	utajn+i+j

There is no doubt that the appearance of *-ij* in these words must again be linked to the fact that the roots end in consonants which cannot be syllabified. The extrasyllabic consonants trigger Imperative Allomorphy.<sup>14</sup> We take *nagl+ij*, the imperative of *nagl+i+ć* 'to hurry' as an example, and begin with cycle 3. We simplify the representation of syllable structure by omitting the X-tier. The morphological structure is: root+verbalising morpheme+IMP (here //I//, as *nagl+i+ć* is an *i*-stem):



-

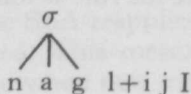
SSA (not applicable)



Vowel Deletion (27)

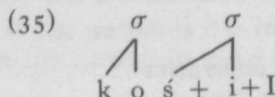
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SSA (not applicable)



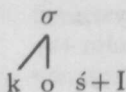
Imperative Allomorphy (32)

In this case the stem-final consonant is not extrasyllabic on the second cycle, and hence has to become extrasyllabic on the third cycle. An objection to this argument might be that the stem-final consonants are simply made extrasyllabic by the rule of Vowel Deletion, which removes the nucleus of the second syllable, and thus makes the *l* extrasyllabic. Hence, the SSA could also be ordered after the rule of Imperative Allomorphy, thus applying only once on the third cycle. This counter-analysis does not go through, however, because it can be shown that the SSA has to apply between Vowel Deletion and Imperative Allomorphy in other cases. This is demonstrated by the derivation of *kos*, the imperative of *kos+i+ć* 'to mow':



-

SSA



Vowel Deletion (27)

The next derivational step is to apply Imperative Allomorphy, but this is incorrect: the phonetic form is *kos*, and not *\*kos+ij*. Evidently, the SSA

must be allowed to apply after Vowel Deletion and before Imperative Allomorphy. The *ś* is then included in the coda, and Imperative Allomorphy is blocked. In derivation (34) the *l* remains extrasyllabic after application of the SSA due to the SSG, and consequently Imperative Allomorphy takes effect.<sup>15</sup>

We conclude that the SSA must be allowed to apply twice on the same cycle, before Imperative Allomorphy in order to derive the correct set of extrasyllabic consonants, and after Imperative Allomorphy for the syllabification of the inserted sequence *-ij*. Thus the hypothesis of continuous syllabification is supported.

A further question is: what kinds of rules trigger the reapplication of the SSA? Notice that the types of rules that we have discussed so far have an important feature in common: they manipulate the Xs since they are insertion and deletion rules (WFRs, Vowel Deletion). The SSA operates on the Xs, hence it is natural that it reapplies. This question will be dealt with in the next section.

### 3.2. Reapplication after every rule

Above we saw that manipulation of the Xs triggers the SSA. One wonders whether the generalisation is not more extensive: the SSA applies after every rule. To resolve this problem we look at some details of the imperative.

First of all, notice that our description of the imperative neatly complements the descriptive evidence given in §1 that, with regard to sonority, Polish makes no distinctions in the class of obstruents. Thus, codas containing stops and fricatives or stops and affricates do not trigger Imperative Allomorphy; hence they must be syllabifiable from the point of view of the SSA:

(36) <i>infinitive</i>	<i>imperative</i>
kopc + i + ć 'smoke'	kopć [-pć]
zmiękc + y + ć 'soften' <sup>16</sup>	zmiękc [-kć]
ulpesz + y + ć 'improve'	ulpesz [-pś]
powiększ + y + ć 'enlarge'	powiększ [-kś]

After Vowel Deletion the floating consonants /ć ǯ ʃ/ must be syllabified into the coda and hence *-ij* is not inserted.

We have now prepared the ground for presenting the data that have a bearing on the subject of this section: should the SSA apply after every rule?

Consider the following denominal and deadjectival verbs:

(37)	srebr + o 'silver' - po + srebrz + y + ć [-bż + i + ć]
	ostr + y 'sharp' - ostrz + y + ć [-tś + i + ć]
	chytr + y 'crafty' - prze + chytrz + y + ć [-tś + i + ć]

The verbalising suffix spelled *-y* comes from underlying //i// and the surface [i] is derived by a postcyclic rule of Retraction (see note 16). All



the roots in (37) end in /r/, as found in the nouns and adjectives on the left. The /r/ is palatalised to /r'/ in the verb and subsequently spelled out as [ž] by *r*-spell-out (Rubach 1984a: 200):

(38) *r*-spell-out

$$r' \rightarrow \begin{cases} r / - C \\ \check{z} \end{cases}$$

The reason for this roundabout way of deriving [ž] is not only that the change  $r \rightarrow \check{z}$  could not be effected in one step by Coronal Palatalisation (20). The more important observation is that /r'/, but not for example /s'/, depalatalises before consonants. Thus, we have *po+srebrz+y+ć* 'cover with silver' but *srebr+n+y* 'silver' (ADJ), where the *r* must have been palatalised to /r'/ at an earlier stage (compare *kwas* 'acid' with *kwas'+n+y* 'sour': the adjectivising -*n* is //En//). A partial derivation of *po+srebrz+y+ć*, *srebr+n+y* and *kwas'+n+y* is as follows:

(39) *po+srebrz+y+ć*    *srebr+n+y*    *kwas'+n+y*

Cycle 2	$-r+i$ $r'+i$	$-r+En$ $r'+En$	$-s+En$ $s'+En$	Cor. Pal. (20)
Cycle 3	$r'+i+ć$	$r'+En+i$ no rule applies	$s'+En+i$	
Postcyclic	$-$ $\check{z}+i+ć$	$r'+n+i$ $r+n+i$	$s'+n+i$ $-$	Yer Deletion <i>r</i> -spell out (38)

Now let us ask the crucial question: what is the imperative form of the verbs in (37)? The regularity is clear: the verbs all fail to take the -*ij* allomorph: *posrebrz* 'cover with silver', *ostrz* 'sharpen', *przechytrz* 'outwit'. This is unexpected. If the derivation is along the lines of that in (34), then Imperative Allomorphy (32) should apply since /r'/ remains extrasyllabic. In cycle 3 we have:

$$(40) \text{ ostrz 'sharpen' } (os)_\sigma (tr'+i)_\sigma + I$$

$$\begin{array}{lll} (os)_\sigma & tr'+I & \text{Vowel Deletion (27)} \\ (ost)_\sigma & r'+I & \text{SSA} \end{array}$$

Upon reapplication the SSA can syllabify the stranded *t* but not the stranded /r'/, since then the SSG would be violated. The explanation must clearly be sought in the fact that *r*-spell-out (38) changes /r'/ into [ž] prior to the application of Imperative Allomorphy. The /ž/ is syllabified into the coda and hence Imperative Allomorphy is blocked.

For this explanation to be valid, two assumptions have to be made: (i) *r*-spell-out is cyclic, and (ii) SSA applies after *r*-spell-out. Given the framework of three-dimensional phonology and our interpretation of the

yers as floating matrices, the first assumption can hardly be controversial. Notice that /r'/ is a derived segment, hence the Strict Cyclicity Constraint cannot block *r*-spell-out. The reason why *r*-spell-out is interpreted as postcyclic in (39) is that it applies after Yer Deletion. While this was a convincing argument in the linear framework of Rubach (1984a), it cannot be maintained in three-dimensional phonology. As mentioned in §2, Yer Deletion is probably not a rule at all. Rather, the yers are stray erased at a late stage of phonological derivation.

The way to establish the adjacency of /r'/ and the consonant across a yer is to refer to the X-skeleton where yers are not represented (see §2 and Rubach 1986). Thus, *r*-spell-out (38) is replaced by (41):

(41) *r*-spell-out

$$\begin{array}{c} \text{X} \\ | \\ \text{r}' \end{array} \rightarrow \left\{ \begin{array}{l} \text{r} / \\ \text{ž} \end{array} \right. - [+ \text{cons}] \begin{array}{c} \text{X} \\ | \end{array}$$

The change of /r'/ into [ž] is effected at the melodic tier. Yet it triggers the SSA. We conclude that all rules, not only those that manipulate Xs, induce reapplication of the SSA. The reason why this observation is not easy to make is that in most cases where rules effect changes at the melodic tier only, the reapplication of the SSA is vacuous.

The analysis given here also shows that the SSA cannot be considered as a phonological rule ordered between other phonological rules. Given the following ordering of phonological rules established in Rubach (1984a) and above: 1. Comparative Allomorphy (18), 2. Coronal Palatalisation (20), 3. *r*-spell-out (41), 4. Imperative Allomorphy (32), ordering the SSA among these rules is impossible, because it has to apply before Comparative Allomorphy (§2), after *r*-spell-out (this section), and after Imperative Allomorphy (§3.1). Hence, the only general hypothesis compatible with these findings is the hypothesis of continuous syllabification.

#### 4 Vowels and glides

As shown above, the opposition between vowels and glides is crucial for a correct application of cyclic phonological rules like Coronal Palatalisation and Iotation. In this section, it will be shown that the difference between vowels and glides in Polish is basically predictable by the SSA. Thus, the analysis of the vowel–glide opposition lends support to the claim that prosodic structure must be available at the beginning of the cycle. We show that /j/ comes from three different sources: Progressive Gliding, Regressive Gliding (both of which are discussed in this section) and *j*-insertion, the rule which we introduced in §2 and which we further discuss in §5.3.1.



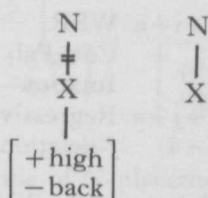


4.2.1 *One rule or two?* At first glance it seems that gliding is a mirror image rule that turns high vowels into [j w] in the context of vowels. A careful inspection of the data in (44) reveals a systematic gap in the combinations of glide + vowel. The only glide found in this context is /j/ (cf. (44b)). The glide [w] does not occur. The examples in (46) make this clear. In all instances the melody *u* is realised as the vowel [u]:

- (46) sytuacja 'situation', ewentualny 'probable', Papuas 'Papuan',  
Suez 'Suez'

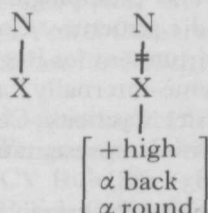
We conclude that Polish has two gliding rules, regressive and progressive. Regressive Gliding applies only to /i/, and turns it into [j] before a vowel:

- (47) *Regressive Gliding*



On the other hand, Progressive Gliding applies to both /i/ and /u/:

- (48) *Progressive Gliding*



There are further differences between Regressive Gliding and Progressive Gliding, which will come to light in subsequent discussion.

4.2.2 *Algorithm rules or phonological rules?* It remains to be determined where in the grammar the gliding rules belong. In principle, they can either belong to the SSA or be phonological rules. The matter is important, since depending on their status they have different properties. One evident difference is that the SSA is a set of anywhere rules, whereas phonological rules are ordered, and apply only once in a given cycle. Our claim is that Progressive Gliding belongs to the SSA, whereas Regressive Gliding is a cyclic phonological rule. The effects of the latter rule can be seen on the surface in the class of words that end in a labial or in borrowings, names such as *Visconti*, which resist *j*-deletion (29). In all other instances, the /j/ from //i// is deleted by rule (29). Regressive Gliding is ordered after Iotation (24). This ordering guarantees that the

reflexes of Coronal Palatalisation, such as surface [š], are kept distinct from the reflexes of Iotation, such as [š̌]. Below we derive *Visconti+ego* 'Visconti' (GEN SG) and two denominal adjectives, *žab+i+a* [žab+j+a] 'frog' (adj, FEM) and *lis+i+a* [liš+a] 'fox' (adj, FEM), where *i* is the adjectivising suffix and *a* is the nominative singular ending.<sup>20</sup>

(49) Cycle 2	<i>viskonti+ego</i>	<i>žab+i</i>	<i>lis+i</i>	WFR
	—	—	<i>lis'+i</i>	Cor. Pal. (20)
	—	—	—	Iotation (24)
	<i>viskontj+ego</i>	—	—	Regressive Gliding
				(47)
	[exception]	—	—	<i>j</i> -deletion (29)
<hr/>				
Cycle 3		<i>žab+i+a</i>	<i>lis'+i+a</i>	WFR
		—	—	Cor. Pal.
		—	—	Iotation
		<i>žab+j+a</i>	<i>lis'+j+a</i>	Regressive Gliding
		—	<i>lis'+a</i>	<i>j</i> -deletion

It is now clear that Regressive Gliding cannot be part of the SSA. Had this been permitted, the SSA, which applies throughout the derivation, would have produced /j/ on cycle 3 prior to Iotation. We would then derive the incorrect surface form \*[liš+a] for [liš+a].

In sum, Regressive Gliding is a cyclic phonological rule. Notice, however, that it refers crucially to prosodic structure. Consequently, the rule of N-placement creates a derived environment for Regressive Gliding. The rule may therefore apply morpheme-internally, as predicted by Clements & Keyser's version of the Strict Cyclicity Constraint, which says that 'syllable structure creates a derived representation with respect to all rules that refer crucially to it' (1983: 168).

On the other hand, there is no evidence that Progressive Gliding should be ordered among the cyclic phonological rules. Consequently, it is part of the SSA. It applies after N-placement and feeds syllabification (the Coda Rule).

With Progressive Gliding in the SSA, we predict correctly that the words in (50) below end in a glide rather than a vowel. The SSA applies throughout the derivation, hence prior to Regressive Gliding:<sup>21</sup>

- (50) *kij* 'stick', *wuj* 'uncle', *pij* 'drink', *tyj* 'get fat', *pluj* 'spit'<sup>22</sup>

### 4.3 High Vowel Constraint

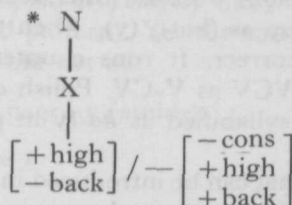
Our account of the vowel/glides distribution is incomplete in one important way. We are not able to derive [ju] in words such as the following, because Progressive Gliding would predict [iw] as the phonetic form of *i+u* sequences:

- (51) jutro 'tomorrow', biuro [bj-] 'office', tiul [tj-] 'tulle', debiut [bj-] 'debut'

A further stipulation is clearly necessary since we have minimal pairs like *juk* 'saddle-bag' vs. *kuj* 'hammer' (IMP; see note 22).

To remedy this situation we suggest that a constraint on N-placement should be postulated. We note that Polish does not permit the sequence [iw], which we express formally as (52):

(52) *High Vowel Constraint*



Now the rule of N-placement will assign an N to the second segment in the sequence *iu* only. Syllabification rules will put *i* into the onset and the correct forms are derived.

In the dialects of Polish that vocalise the dark *l* (*l* → *w*; cf. Rubach 1984a: 73), the High Vowel Constraint is contradicted on the surface: there is [iw] in *pil* 'he drank', *pila* 'saw', etc. We return to this problem in §5.2.

With the High Vowel Constraint we have arrived at a complete Syllable Structure Algorithm for Polish:<sup>23</sup>

- (53) SSA: N-placement (7) restricted by High Vowel Constraint (52)  
 Progressive Gliding (48)  
 CV Rule (8)  
 Polish Onset (9)  
 Polish Coda (10)  
 Complex Coda (11)

## 5 Restructuring

In this section we investigate the consequences of applying the SSA in a cyclic fashion. We observe that it is necessary to partly erase syllable structure before the SSA reapplies. The central questions are: how much of syllabic structure needs to be erased and how is this effected? We conclude that codas are erased and, as we will show, nuclei and onsets may stay intact.

## 5.1 Coda Erasure

We organise our discussion around the following simple examples:

- (54) a. kot 'cat' – kot + y (NOM PL)  
 b. most 'bridge' – most + y (NOM PL) *vs.* Boston  
 c. nagł + y 'sudden' (NOM SG) *vs.* mog + ł + y 'they could'

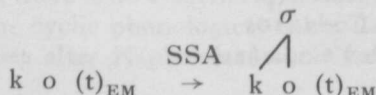
We showed in §§2–3 that the SSA applies cyclically. This mode of application has empirical consequences. Given the syllable structure apparatus that we have developed so far, the prediction is that syllabification is structure-preserving. Thus *kot* + y 'cats', which receives the structure  $(kot)_\sigma$  on cycle 1, should end up as  $(kot)_\sigma (y)_\sigma$  when the SSA reapplies on cycle 2. This result is incorrect. It runs counter to the universally valid pattern of syllabifying VCV as V-CV. Polish complies with this universal pattern and *koty* is syllabified as *ko-ty* in phonetic representation.

There are three different mechanisms that can be introduced in order to remedy this situation: (i) the CV Rule is structure-changing, (ii) final clusters are extrametrical or (iii) there is a rule of coda erasure. We will investigate them in this order.

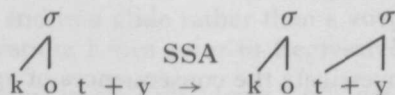
Levin (1985) suggests that the CV Rule is structure-changing; that is, it has the power to detach the last consonant of the preceding syllable and syllabify it as an onset of the following syllable. From the point of view of our examples, this mechanism is equivalent to Borowsky's (1986) proposal that the last consonant is universally extrametrical. Given the two options, we prefer to go along with Borowsky since we can then uphold our claim that syllabification rules act on unsyllabified Xs only. That is, they are not resyllabification rules.

With the universal extrametricality rule, *kot* + y 'cats' is derived correctly. To save space we limit ourselves to denoting the domain of syllables:

(55) Cycle 1:



Cycle 2:



In accordance with the universal convention, extrametricality is erased automatically when the segment stops being constituent-final, i.e. after -y has been added in our case.

The examples in (54b) present a problem that cannot be solved along the lines of (55). The difficulty is that *most* + y 'bridges' and *Boston* have exactly the same syllabification options: *mo-sty/mos-ty* and *Bo-ston/Bos-ton*, where the first option is the preferred pattern in both instances. The SSA would permit variation in *Boston*, but not in *mosty*. In fact, the false



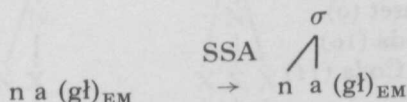
prediction is made that the only permissible syllabification is *mos-ty*. This prediction follows from the claim that only the last consonant is extrametrical and hence only this consonant can resyllabify in cycle 2 when the suffix *-y* is added.

An obvious correction to make is to assume that the whole final cluster is extrametrical, a move envisaged by Borowsky (1986) as a language-specific stipulation. Now both *s* and *t* in *mosty* are free to undergo the SSA. The parallelism of *mosty* and *Boston* is captured.

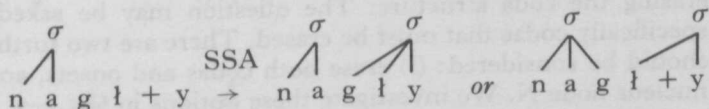
The data in (54c) are a reason for concern. The syllabification options are the same, regardless of the morphological structure: *na-gły/nag-ły* 'sudden', *mo-gły/mog-ły* 'they could' (in both cases the first option is the preferred pattern). Yet the extrametricality approach would predict that they should not be:

(56) a. *nagł+y* 'sudden'

Cycle 1: .



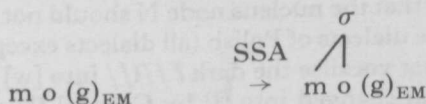
Cycle 2:



where the option of applying Polish Onset has not been taken

b. *mogł+y* 'they could'

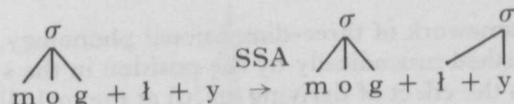
Cycle 1:



Cycle 2:



Cycle 3:



The variant *mo-gły*, which is actually the preferred syllabification, cannot be generated.

The desirable effect in (56) can be achieved if we assume that the restructuring mechanism is that of coda erasure. Now, on cycle 3, both *g* and *ł* are delinked and the operation of the SSA in *mogły* is the same as in *nagły*.

In sum, we propose that Polish has a rule of Coda Erasure. Given Levin's (1985) formalism, the coda is gathered under  $N'$  (see (10) above). The rule is therefore as follows:

- (57) *Coda Erasure*  
 $N' \rightarrow \emptyset$

The advantage of postulating Coda Erasure is that we can now dispense altogether with final extrametricality for Polish. Coda Erasure prepares the ground for syllabification. It is therefore the first rule of the SSA, whose final version we now state in (58):

- (58) SSA: Coda Erasure (57)  
 N-placement (7) restricted by High Vowel Constraint (52)  
 Progressive Gliding (48)  
 CV Rule (8)  
 Polish Onset (9)  
 Polish Coda (10)  
 Complex Coda (11)

We have demonstrated that the (re)application of the SSA begins with erasing the coda structure. The question may be asked whether it is specifically codas that must be erased. There are two further options that should be considered: (i) erase both codas and onsets, and (ii) erase the nucleus node  $N$ . We investigate these options in §§ 5.2–3. We begin with option (ii).

## 5.2 Nucleus preservation

In this section we argue that the nucleus node  $N$  should not be erased. The evidence comes from the dialects of Polish (all dialects except those spoken in the east of Poland) that vocalise the dark  $\ell$  / $\ell$ / into [w] in all positions except where it has been changed into [l] by Coronal Palatalisation (20). The vocalisation is effected by a context-free postcyclic (or probably even postlexical) rule (see Rubach 1984a: 73):

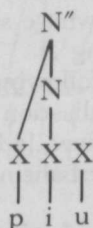
- (59) *Lateral Vocalisation*

$$\begin{bmatrix} +\text{lat} \\ +\text{back} \end{bmatrix} \rightarrow [-\text{cons}]$$

Within the framework of three-dimensional phonology, where [u] and [w] are distinguished prosodically by the position in the syllable, Lateral Vocalisation has the effect of deriving an [u] at the melodic tier. The  $u$  is then subject to the SSA which, as we have shown, reapplies after every phonological rule. The derivation of *pil* +  $a$  'saw' (n.) and its genitive plural form *pil* proceeds as follows.<sup>24</sup> We begin with the postcyclic level, since Lateral Vocalisation is postcyclic:



(60)

Lateral Vocalisation  
(59)SSA: Coda Erasure (57)  
N-placement (7)Progressive Gliding  
(48)

Polish Coda (10)

The argument for not erasing the node N comes from the observation that the High Vowel Constraint (52) should not take effect. Recall that this constraint does not permit the derivation of [iw], by blocking the application of N-placement to *i*. In (60) the High Vowel Constraint is inapplicable since *i* already has a nucleus. Had the nucleus on *i* been erased by the SSA, the High Vowel Constraint would have taken effect and we would have obtained the incorrect \*[pju] for [piw] in (60).

Slovak provides independent evidence for nucleus preservation. As shown by Kenstowicz & Rubach (1987), the node N is distinctive in Slovak. Had it been possible to erase it in derivation, the contrast between diphthongs and glide + vowel sequences would have been lost, which is incorrect.

### 5.3 Onset integrity

We have excluded the possibility that the SSA could be allowed to undo the effects of N-placement. What remains as an open question is whether onsets should be erased and redetermined in a fashion that mirrors the derivation of codas. We submit two types of argument to substantiate the claim that the integrity of onsets has to be respected. The first argument comes from derivation, and the second from rule application.

**5.3.1 Argument from derivation.** Let us return to the derivation of the gerundive form that we introduced in a simplified fashion in (30). We use the same examples: *pisz+ac* [piš+onc] 'writing' and *kop+iac* [kop+jonc] 'digging'. Recall that the roots *pis* and *kop* take *-a* as the verbalising suffix. The *-a* appears on the surface in the infinitives: *pis+a+ć*, *kop+a+ć*, where *-ć* is the infinitive desinence. The gerundive suffix is [onc], as demonstrated most clearly by so-called C-verbs, i.e. the words that are inherent verbs and whose stems end in a consonant, for example, *pas+ac* [pas+onc] 'grazing'.

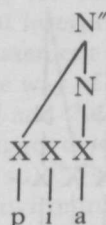
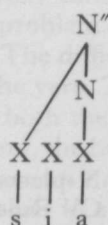
Recall further that Polish has the following rules: *j*-insertion (28) before a sequence of vowels; Coronal Palatalisation (20), which makes consonants [–back]; Iotation (24), which derives [š ž ċ ȝ] in the context of *j*; V-deletion (27), which truncates the verbalising morpheme. The ordering of the rules is as given.

We begin with the derivation of *pisz+ac* 'writing' and *kop+iac* 'digging' with cycle 3 where the gerundive suffix //onc// is added:





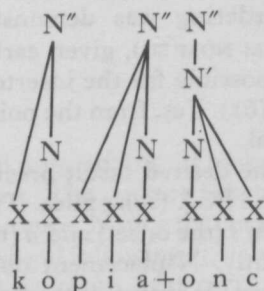
SSA (all rules)



*j*-insertion

BLOCKED (by well-formedness  
constraint on trees)

SSA: N-placement  
(7)



CV Rule (8)

s'

-

Cor. Pal. (20)

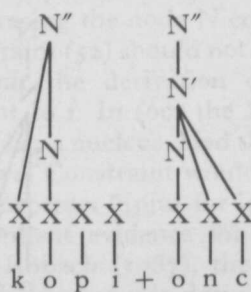
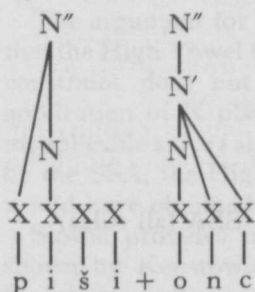
SSA (no effect)

§

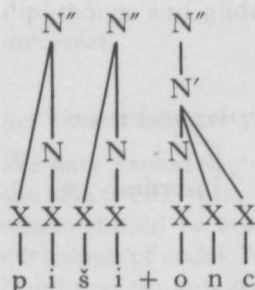
-

Iotation (24)

SSA (no effect)



### Vowel Deletion (27)



SSA: N-placement (7)  
CV Rule (8)

At this stage the phonological rule of Regressive Gliding applies, and turns *i* into *j*. Further, the *j* is deleted in /pišj+onc/, but not in /kopj+onc/, as *j*-deletion (29) applies only after coronal consonants.<sup>25</sup> Recall that Regressive Gliding (47) is ordered after Iotation (24). The importance of this ordering was demonstrated in the derivation of *lis+i+a* 'fox' (adj, FEM NOM SG), given earlier in (49). Consequently, it would not have been possible for the inserted *i* to be interpreted as *j* via Regressive Gliding in (61). Yet, from the point of view of Iotation such an interpretation is crucial.

We have achieved the desired result precisely by assuming that onsets are not erased when the SSA (re)applies. Thus, *j*-insertion has the effect of inserting /i/ between *s* (the onset) and *a* (the nucleus) – see step 3 in the derivation. Consequently, N-placement on *i* is blocked, and *i* must be integrated into the onset. It is thus interpreted as /j/ for the purposes of Iotation. If we permitted erasure of onsets when the SSA reapplies, then the *s* in the word on the left would be prosodically unlinked, and N-placement on the *i* could not be blocked. Consequently, Iotation would not be able to take effect, which is incorrect.

5.3.2 *Argument from rule application.* Words such as *telewizja* 'television', *komisja* 'committee', *sesja* 'session' and *wakacje* 'vacations' share a common feature: in the underlying representation they all have an intervening high vowel //i// between the consonant and the glide. The //i// is deleted when //j// is followed by a vowel ending. Otherwise it is retained, as shown by the corresponding adjectives in (62):

- (62) telewizyj + n + y, komisyj + n + y, sesyj + n + y, wakacyj + n + y

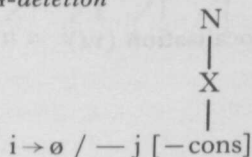
Upon closer examination it turns out that the sequence [ij] appears in phonetic representation if the suffix contains a yer. In (62) it is the yer of the adjectivising morpheme //En//. The word *melodi+a* 'melody' demonstrates that any suffix that begins with a yer indeed permits the //ij// to surface phonetically. The additional evidence comes from the diminutive suffix //Ek//:

- (63) *melod[j]+a* 'melody' – *melodyj+n+y* 'melodious' – *melodyj+k+a* 'melody' (DIM) – *melodyj+ek* (DIM, GEN PL)

We observe in (63) that //i// is deleted if a vowel is added after //j//. This vowel cannot be a yer. The formulation of *i*-deletion presents a serious problem for the traditional interpretation of the yers as high lax vowels. The difficulty lies in the statement of the environment: all vowels except the yers. There is no simple way of expressing this generalisation, because both the mid vowels [e o] and the low vowel [a] are lax. On the other hand, the high vowels that trigger deletion are tense, for example the //i// in *melodi+i* [*melodj+i*] (GEN SG).<sup>26</sup> To formulate the rule, one would have to refer to a rather baroque environment, 'before high tense vowels or before non-high vowels'.

All these difficulties disappear with the interpretation of the yers as floating matrices. The environment of *i*-deletion is that of a 'true' vowel, that is, a vowel which carries a nucleus:

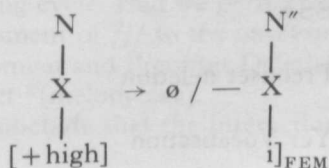
- (64) *i*-deletion



The formulation of (64) is still unsatisfying. It looks as if we have to 'jump over' *j* to see the environment. The correct generalisation is discovered when we consider syllable structure. Notice that in all instances where (64) applies, /j/ is an onset. If the vowel following /j/ is a yer, the syllabification of /j/ is not affected since, as we claim, yers carry no Xs and hence cannot be seen by the SSA. The relevant examples are *melodyj+n+y* //melodij+En+i// 'melodious' and *melodyj+k+a* 'melody' (DIM), where the /j/ is invariably in the coda.

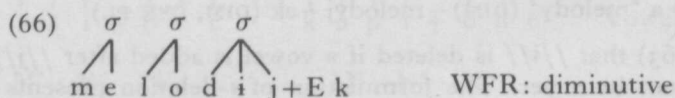
In sum, (64) is reformulated as a rule deleting /i/ if /j/ is in the onset. The rule applies to feminine nouns:<sup>27</sup>

- (65) *Preonset Deletion*





In (66) we look at the derivation of *melodyj+ecz+k+a* 'sweet little melody', a double diminutive from *melodi+a*. The underlying representation contains a sequence of yers since the diminutive morpheme is //Ek//. To save space, we ignore the skeletal tier and simplify the transcription of syllables. Unvocalised yers are capitalised and the melody segment *i* is transcribed as /j/ whenever it is in the syllable margin. The transcription /i/ denotes a vowel. We start with cycle 2:

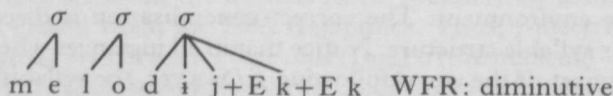


— 1st Velar Pal.  $k \rightarrow \check{c} / \text{---} \left[ \begin{smallmatrix} \text{V} \\ \text{---back} \end{smallmatrix} \right]$

— Preonset Deletion (65)

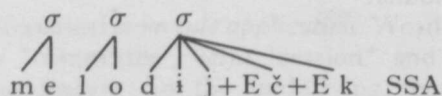
— Yer Vocalisation (14)

Cycle 3:



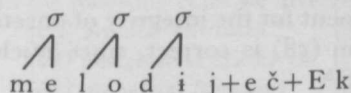
SSA: no effect

$\check{c}$  1st Velar Pal.



— Preonset deletion

e Yer Vocalisation



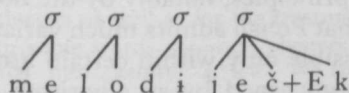
SSA: Coda Erasure



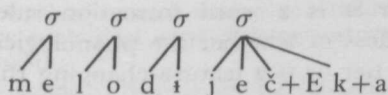
N-placement

j

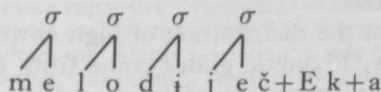
Progressive Gliding

Syllabification rules  
(8), (9), (10)

Cycle 4:



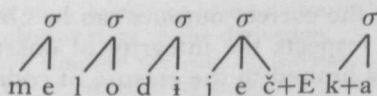
WFR: nom. sg.



Coda Erasure



N-placement



CV Rule, Coda Rule

1st Velar Pal.

Preonset Deletion

BLOCKED

As is clear from the derivation, Preonset Deletion must be ordered before Yer Vocalisation.<sup>28</sup> The Strict Cyclicity Constraint blocks the application of Preonset Deletion on cycle 4 since /j/ was syllabified as an onset on the preceding cycle. Had we permitted that onsets be erased by the SSA, the reassignment of /j/ to the onset on cycle 4 would have created a derived environment and Preonset Deletion would have taken effect, deriving the incorrect \*[melodječka].

We conclude that the interaction of Preonset Deletion with the Strict

Cyclicity Constraint provides an argument for the integrity of onsets. The Syllable Structure Algorithm stated in (58) is correct, since nuclei and onsets are not erased as part of the SSA.

## 6 Conclusion

Detailed examination reveals that Polish syllable structure is, to a large extent, rule-governed. Counter to appearances, the structure of onsets and codas is constrained by syllabification principles, notably by the Sonority Sequencing Generalisation. It is true that Polish admits much variation in syllabification but this variation is possible only within certain limits.

Assignment of syllable structure is governed by an algorithm whose most essential properties are the following:

- it begins to apply in the cyclic component;
- it is persistent in the sense that it reapplies exhaustively;
- the application of the Syllable Structure Algorithm is triggered by every rule, regardless of whether it is a word formation rule or a phonological rule, and also regardless of whether the phonological rule manipulates the Xs at the skeletal tier or is a feature-changing rule that affects the melodic tier only. Our analysis thus corroborates Itô's (1986) claim that syllabification is continuous.

It has also been demonstrated that the distribution of high vowels and glides is almost entirely predictable. Phonetic glides come from several sources. Notably, they are derived by Progressive Gliding, which is part of the SSA. In the prevocalic position they are generated by Regressive Gliding, which is a cyclic phonological rule. In yet another class of cases, they come from insertion into the syllable onset where the well-formedness constraint on tree structure guarantees that the inserted segment is not turned into a vowel.

A further important result is that the correct outputs can be obtained only if we recognise that the SSA respects the integrity of onsets and nuclei. Syllabic restructuring is thus limited to the erasure of codas.

Finally, our analysis lends strong support to the claim that yers are floating matrices. This conclusion is confirmed by a number of facts: the allomorphy of the comparative degree of adjectives, the allomorphy of the imperative, Preonset Deletion and *r*-spell-out.

## NOTES

- \* This article was written as part of research programme LETT 88/9, Vrije Universiteit, Amsterdam. Jerzy Rubach would like to thank the Netherlands Organisation for Scientific Research (NWO) for a research grant that enabled him to spend a period of four months in the Department of General Linguistics, Vrije Universiteit, Amsterdam, where the research for the article was conducted. We are also grateful to Christina Bethin, Morris Halle, Michael Kenstowicz, Norval Smith and the anonymous referees of this journal. Needless to say, the responsibility for the content of this article is solely ours.

- [1] In the following cases we diverge from the standard transcription symbols:

[c ʒ] alveolar affricates	[č ž] postalveolar affricates
[š ž] postalveolar fricatives	[ć ź] prepalatal affricates
[ś ź] prepalatal fricatives	[ń] prepalatal nasal

Note also that we use double slashes to denote underlying representations, single slashes for intermediate stages and traditional square brackets for phonetic representations. In transcriptions, an apostrophe denotes palatalisation. Finally, attention should be drawn to some peculiarities of Polish orthography: *ł* denotes a dark *l*, which in some dialects is realised as [w]; *sz* stands for [š], *rz* and *ż* are two different ways of writing [ž]; *i* before a vowel is [j] or is merely an orthographic symbol denoting palatalisation.

- [2] See Rubach & Booij (1990) for the analysis of word-initial and word-final clusters as well as for the treatment of syllabification at prefix junctures.
- [3] In some words sonorant clusters are found at constituent edges, for example *film* 'film', *szturm* 'attack'. We suggest that in these words as well as in all the other instances of violations of the SSG in (2) above unsyllabified consonants are linked to the phonological word node. See Rubach & Booij (1990) for a discussion of this problem.
- [4] Given the framework of three-dimensional phonology Yer Deletion can presumably be dispensed with as a rule. The evidence accumulated in Rubach (1984a) in favour of Yer Deletion such as the operation of Non-continuant Depalatalisation is now made invalid by the fact that adjacency of segments can be established across floating matrices by referring to the X-tier (see Rubach 1986).
- [5] Marginally, there is also a palatalising allomorph of the comparative degree. It triggers changes such as *g* → *ż* in *drog* + *a* 'expensive' (FEM NOM SG) – *droż* + *sz* + *a* 'more expensive'. Rubach (1986) assumed that this allomorph occurred also in words such as those in (16c): the yer, which is the palatalising segment in this allomorph, blocks *j*-deletion, a rule that operates on the melody and deletes /j/ before consonants. Another alternative is to assume that the words in (16c) have the principal allomorph //š/, but that the rule of *j*-deletion is ordered after Comparative Allomorphy, which adds *-ej* (see below).
- [6] The argument stands even if we assume that the comparative allomorph in words such as those in (16c) is //Iš/ (see note 5; we adopt the convention of denoting yers by capital letters). The relevant ordering relationship is then different. Comparative Allomorphy must apply before Yer Vocalisation (14). This is necessary to block the surfacing of the yer in the adjectivising morpheme *-n*, as then *kwaś* + *n* + *iejsz* + *y* 'sourer' has the structure /kvaś' + En + Iš/ at the relevant stage in the derivation.
- [7] We simplify the rule by leaving out the further condition that /t d/ become [č ž] if preceded by a strident obstruent, and otherwise alveolar affricates [c ʒ]. See Rubach (1984a: 75ff) for discussion.
- [8] In (25) we look at the infinitive and the gerundive forms of the verb. However, note that the same pattern of alternations generalises to a number of other instances. For discussion, see Rubach (1984a).
- [9] The reader interested in Polish phonology should observe that this rule is different from the one given in Rubach (1984a). The environment has been made sensitive to the feature [–high] rather than the feature [–tense] of the second vowel. This change is necessary since *j*-insertion also applies if the second vowel is the imperative yer, which we now represent as //E/. See §3 below.
- [10] See the discussion of *lis* + *i* + *a* 'fox' (adj, FEM) in §4.2. Full motivation is added in Rubach (1984a).
- [11] *j*-deletion is sensitive to the melodic tier only; hence manipulation of prosodic structure does not create derived environments for *j*-deletion.
- [12] Given this interpretation of the imperative, the rule of Front Vowel Truncation postulated in Rubach (1984a) becomes superfluous, as words such as *koś*

//kos+i+I// 'mow' and *wis* //vis+e+I// 'hang' are not subject to *j*-insertion and hence to Iotation. The stem extension vowel is found on the surface in, for example, the 2nd person singular: *wis*+*i*+*sz* //vis+e+i+š// 'you hang', *pis*-*z*+*e*+*sz* //pis+a+e+š// 'you write' (the verbalising morphemes *e*, *a* are deleted by (27)).

- [13] Earlier studies linked Imperative Allomorphy to the occurrence of the yer in a verb (see Rubach 1984a). However, Bethin (1987) has shown that this was a false step. (Consequently, we ignore the yers in the representation of verb stems.) She has found that the *-ij* allomorph also occurs with stems that do not contain a yer. We quote some of Bethin's examples in (33a).
- [14] Even though we can accommodate the facts adduced by Bethin (1987) and improve her analysis, some exceptions remain. In three words we would expect *-ij* as the imperative but we do not find it: *oczerni* 'defame', *oświeci* 'light up', *pomyśl* 'think'. As pointed out by Bethin, in some words there is variation, for example, *trzeźwii* - *trzeźw* 'sober up'. The forms that seem to win out are those that we would predict to be regular. In a few instances we do not agree with the data. For example, for one of the authors, Rubach, *iskrz* is the only possible imperative of *iskrzyć* 'sparkle'; *iskrzyj* does not exist. Standard sources such as Szober (1971) quote *iskrz* and *iskrzyj* as instances of variation.
- [15] The operation of Imperative Allomorphy provides an argument for interpreting yers as floating matrices. This is shown not only by simple examples such as *dm+i* //dm+E// 'blow' but also by more complex verb stems such as //sEn+i// 'dream' and //na+głos+En+i// 'install loudspeakers'. The former is a verbalisation of the yer stem noun *sen* 'dream' (compare the genitive singular *sn+u*, hence a yer) and the latter a verbalisation of the yer stem adjective derived from the noun *głos* 'voice' by adding the morpheme //En//. The imperatives are *śn+i* //sEn+i+I// and *na+głos+n+i* //na+głos+En+i+I//. After Vowel Deletion we obtain /sEn+I/ and /na+głos+En+I/. Crucially, the yers of //sEn// and //-głos+En// cannot project a syllable since then Imperative Allomorphy would be blocked.
- [16] Here and below, the verbalising vowel -y derives from underlying //i//. This is required by a number of facts, among others by velar palatalisation; compare *miękk*+*o* 'softly' - *zmiękc*+*y*+*ć* 'soften' (*k* → *č*). The surface y [i] is derived by postcyclic Retraction (see Rubach 1984a).
- [17] Some forms look like exceptions but in fact are not, for example *tramwa+i* and *złodzie+i*, pronounced [tramvaj+i], [zwoʒej+i], the genitive plurals of *tramwaj* 'tram' and *złodziej* 'thief'. First, the glide in the genitive plural comes from the underlying representation, as shown by the base forms *tramwaj* and *złodziej*. Second, the ending is the back vowel //i//, which is turned into [i] in the course of phonological derivation by the rule known as Fronting (Rubach 1984a). The evidence for it being //i// rather than //i// comes from the consideration of words such as *piec* 'oven' - *piec*+*y* (GEN PL), among others: no palatalisation *c* → *č*.
- [18] This and the previous word will be eliminated from the list of exceptions once they have nativised with the vowel [i] for *i*, as predicted by Retraction (see note 16 and Rubach 1984a: 203). This nativisation is under way and it has already taken place in words such as *patriota* [-rio-] 'patriot'. Note that in all these words the phonetic representation has the glide [j] between the vowels. This is purely a surface phenomenon. The hiatus breaking [j] and [w] are inserted by a mirror image rule that operates in the context /i i u/—V; see Rubach (1982). We disregard these details here.
- [19] The phonetic [v] in Polish words such as *dwa* 'two' comes from underlying //v//. This is the difference between Polish and the other Slavic languages, where [v] derives from //w//. That is, in Polish the historical rule of Slavic *w* → *v* survives at best as an allomorphy statement for some verbal forms. Elsewhere, the historical *w* behaves like an obstruent, e.g. it appears as [f] due to Progressive Devoicing, compare the Polish *twój* [tf] 'your' with the Russian *твой* [tv], where *v* behaves like a sonorant.



- [20] These words are not inputs to *j*-insertion (28) or Vowel Deletion (27) since both rules are restricted to verbs. Note also that the adjectivising suffix could not be yer. This is shown by the fact that, for example, in *ps+i+a* 'dog' (adj, FEM) the root yer does not surface by Yer Vocalisation (see the derivation in (15)).
- [21] We note two cases of alleged exceptions:
- (i) There is no gliding with prefixes, for example, *za+instalować* 'install' and *po+informować* 'inform'. See Rubach & Booij (1990) for an analysis of the phonological status of prefixes from which this follows.
- (ii) In the verbal system a problem seems to arise for the present tense extension *i*. As is well known (see Rubach 1984a), forms such as *lec+i+sz* 'you fly' have the structure root+verbalising suffix *e*+extension morpheme *i*+inflectional ending *sz*. The extension suffix *i* need not necessarily be an exception to Progressive Gliding. It may be interpreted as an underlying */i/* and the phonetic [i] is then derived by Fronting: *i*→*i* after soft consonants. In this way the incorrect gliding of the putative */let+e+i/* is avoided. Note that the extension *i*, now interpreted as underlying */i/*, occurs only with the palatalising *i* and *e* stems; hence the environment of Fronting is always met: the intermediate form after V-deletion on cycle 3 is */let'+i/*.
- [22] The last three words as well as *kuj* 'hammer' in §4.3 below are in the imperative form. They belong to the so-called C-stem verbs (inherent verbs); see Rubach (1984a: 35).
- [23] We note two exceptions to N-placement. They are (i) the nominalising suffix */j/*, which forms the so-called 'soft stems' (cf. Rubach 1984b) and (ii) the */j/-*allomorph of the adjectivising suffix *-i*. The soft stem */j/* occurs in a handful of words: *widz+a* 'viewer', *wiedz+a* 'knowledge', *niż* 'low pressure', *władz+a* 'authority', *plac+a* 'pay' and perhaps a few others. The suffix here must necessarily be */j/* since we have reflexes of Iotation (24) rather than Coronal Palatalisation (20). Soft stems that derive from roots ending in velars, labials or sonorants need not take */j/* since the palatalisation effects are the same, regardless of whether the palatalising segment is a vowel or a glide. The second exception, the adjectivising allomorph */j/*, appears with a few lexical items only. It is assumed to occur with adjectives such as *kobiec+a* */-t+j+a/* 'woman' (adj, FEM), where we get [c] by Iotation *vs.* [ć] in *koc+i+a* */kot+i+a/* 'cat' (adj, FEM).
- [24] In words which violate the SSG such as *lkać* 'sob' and *umysł* 'mind', the *l* is linked to the phonological word node by the rules of adjunction; see Rubach & Booij (1990). It is thus not subject to Coda Erasure, and the correct phonetic segment [w] is derived by Lateral Vocalisation.
- [25] After the application of Regressive Gliding, the SSA will reapply. At this stage, the SSA should put the *i* into the onset. However, when the SSA reapplies, it could turn the initial segment back into a vowel. The CV Rule is then blocked, and we end up with the incorrect disyllabic *io* for e.g. *jo*. This is a technical problem in the application of the algorithm. Clearly, it cannot be the case that a gliding rule removes the N-node, and N-placement puts it back again. We therefore assume that algorithms are governed by the following universal convention: 'Syllable structure algorithms cannot undo the effect of gliding rules'.
- [26] Surface [i] comes from Fronting (see Rubach 1984a).
- [27] The rule must also delete */i/*, which is found in words such as *bibli+a* 'Bible' (compare *biblij+n+y* 'biblical'). The formulation of (65) might perhaps be tightened to exclude */u/*. As stated, (65) has about eight exceptions: *szyj+a* 'neck', *żmij+a* 'viper', *chryj+a* 'brawl', *bryj+a* 'pulp', *szuj+a* 'villain', *tuj+a* 'thuja' and perhaps a few others. A certain subregularity can be noticed: all these stems are monosyllabic. It is not clear whether this observation merits formal expression since the class of exceptions is very small.
- [28] This ordering, along with the principles of Strict Cyclicity and Onset Integrity, can account for the 'minimal pair' *melodi+e* [melodj+e] 'melody' (NOM PL) *vs.* *melodyj+ek* (DIM, GEN PL). The latter derives from */melodij+Ek+ɪ/*. The

glide is integrated into the onset by the SSA which reapplies after Yer Vocalisation. At this stage Preonset Deletion is not applicable any longer. On the other hand, in *melodi+e* we have a 'true' vowel *e* and not a yer. The SSA places /j/ in the onset at the beginning of the cycle, which feeds Preonset Deletion.

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