

On the nature of the cycle

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INTRODUCTION

Postulates

- §1 This paper assumes two classic postulates concerning phonology's upper interfaces:
- *Cyclicity*
Certain constituents in the morphosyntactic structure of a linguistic expression define phonological domains; in the resulting nested domain hierarchy, phonology applies iteratively from smaller to larger domains.
E.g. Chomsky et al. (1956: 75), Chomsky and Halle (1968: 20), etc.
 - *Stratification*
Phonological domains associated with morphosyntactic constituents of different kinds (stems, words, phrases) may be subject to different phonological generalizations.
E.g. VV.AA. (1931: 321), Jakobson (1931: 165) (see Booij 1997: 264); Kiparsky (1982a, 1982b); etc.
- §2 I present two arguments against alternatives to the cycle based on transderivational correspondence:
- *Masked bases*
Transderivational correspondence fails to predict instances of morphosyntactically triggered misapplication in which the conditions for the application or nonapplication of the relevant phonological process hold within a morphosyntactic subconstituent of the expression but fail to surface transparently in any appropriately related expression.
Example based on Bermúdez-Otero (2007b: §34).
 - *Absent bases in noncanonical paradigms*
Transderivational correspondence incorrectly predicts that two words *a* and *b* with identical syntagmatic structure may be subject to different phonological misapplication effects if their paradigms are different (owing to defectiveness, deponency, suppletion, heteroclisis, etc.)
Example from Trommer (2006).

Questions and proposals

- §3 Why is phonology cyclic?
- *Innatist approach*
Cyclicity is hardwired in Universal Grammar.
► Philogenetic (evolutionary) explanation: adaptation, exaptation, 'laws of form'.
As per Fodor (1983) and Chomsky (1986). In this broad tradition, some emphasize adaptation (e.g. Pinker and Bloom 1990); others emphasize 'laws of form' (e.g. Jenkins 2000: ch. 5).

- *Neoconstructivist approach*

Cyclicality emerges in the course of acquisition from largely independent facts.

► **Ontogenetic (developmental) explanation.**

As per Karmiloff-Smith (1992, 1994, 1998), Quartz (1999). Specifically on phonology, see e.g. Hayes (1999), Bermúdez-Otero and Börjars (2006: 744-50), or the call for papers for the NELS38 phonology workshop 'Abstractness without innateness': <http://aix1.uottawa.ca/~nels38/index.htm>

This paper explores the neoconstructivist approach.

§4 Proposal defende here:

Stratum-internal cyclic effects arise at the stem level ('level one') if all of the following three conditions obtain:

- (i) nonanalytic listing (stem-level output representations are lexically stored)
 - (ii) morphological blocking
- and (iii) crucially active faithfulness to input.

See Bermúdez-Otero and McMahon (2006: §3.4), Bermúdez-Otero (forthcoming), Collie (in progress).

§5 Suggestion left for another occasion:

The stratification of phonology (and, with it, interstratal cyclicality) emerges from:

- (i) standard constraint-discovery and constraint-ranking algorithms, lightly modified,
- and (ii) the developmental time-line of morphosyntactic structure.

See Bermúdez-Otero (2003, forthcoming).

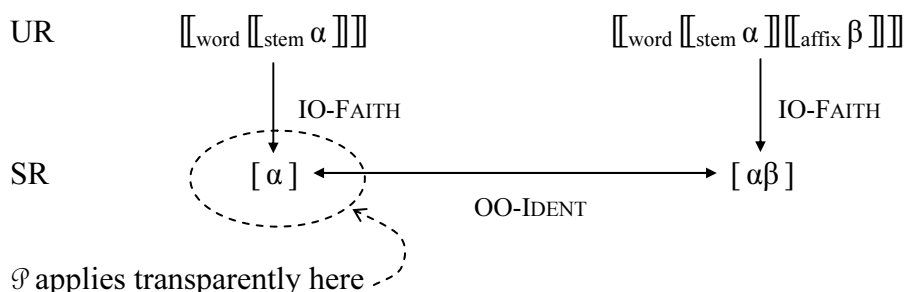
TWO ARGUMENTS (AMONG MANY) FOR THE CYCLE

Two approaches to morphologically induced misapplication

Problem: a phonological process \mathcal{P} misapplies in the presence of affix /-β/.

Focus on morphological structure causing misapplication directly, rather than indirectly via prosody (Booij and Rubach 1984; Booij 1988, 1992; Raffelsiefen 2005); in Scheer's (2007) terms, focus on 'procedural' rather than 'representational' intervention.

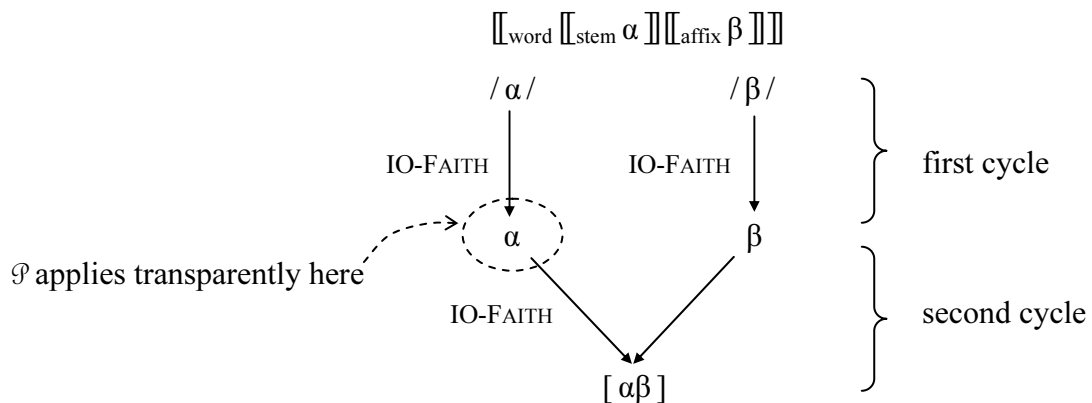
§6 The transderivational approach:



⇒ \mathcal{P} must apply transparently in some appropriately related expression.

E.g. Benua (1995, 1997), Kenstowicz (1996), Kager (1999), McCarthy (2005), etc; though no URs in Burzio (1996, 1998, 2002, etc.)

§7 The cyclic approach:



⇒ ∅ must apply transparently in some morphosyntactic subconstituent.

Masked bases

§8 /s/ in Highland Ecuadorian Spanish (Robinson 1979, Lipski 1989):

- [s] in the onset

<i>gasa</i>	/gasa/	[¹ ga.sa]	‘gauze’
<i>ganso</i>	/gaNso/	[¹ gan.so]	‘gander’
<i>da sueño</i>	/da sueño/	[₁ ða. ¹ swe.ño]	‘makes one sleepy’
<i>el sueño</i>	/el sueño/	[el. ¹ swe.ño]	‘the dream’

- [s] in the coda before voiceless segments or utterance-finally

<i>rasco</i>	/rasko/	[¹ ras.ko]	‘I scratch’
<i>gas</i>	/gas/	[gas]	‘gas’
<i>gas caro</i>	/gas karo/	[₁ gas. ¹ ka.ro]	‘expensive gas’

- [z] in the coda before voiced segments

<i>rasgo</i>	/rasgo/	[¹ raz.uɔ]	‘feature’
<i>plasma</i>	/plasma/	[¹ plaz.ma]	‘plasma’
<i>gas blanco</i>	/gas blaNko/	[₁ gaz. ¹ βlaŋ.ko]	‘white gas’
<i>gas noble</i>	/gas noble/	[₁ gaz. ¹ no.βle]	‘noble gas’

but, crucially, voicing assimilation overapplies to word-final prevocalic consonants

<i>gas acre</i>	/gas akre/	[₁ ga. ¹ za.kre]	‘acid gas’
cf. <i>gasa</i>	/gasa/	[¹ ga.sa]	‘gauze’
<i>has ido</i>	/as ido/	[a. ¹ zi.ðo]	‘thou hast gone’
cf. <i>ha sido</i>	/a sido/	[a. ¹ si.ðo]	‘he/she/it has been’

§9 Stratal-cyclic analysis:

- /s/ becomes susceptible to assimilatory voicing when it occurs in the coda at the word level, i.e. in the coda prior to phrase-level resyllabification;
- but • assimilatory voicing itself applies at the phrase level, since it crosses word boundaries.

The solution:¹

- at the word level, coda /s/ loses its LARYNGEAL node;
- at the phrase level, an input [S] without laryngeal specifications assimilates to the following segment; laryngeally-specified input [s] remains unchanged.

E.g.	<i>gasa</i>	<i>gas</i>	<i>gas acre</i>
	[[_{PL} [[_{WL} gasa]]]]	[[_{PL} [[_{WL} gas]]]]	[[_{PL} [[_{WL} gas]] [[_{WL} akre]]]]
WL	ga.sa	gaS	gaS
PL	ga.sa	gas	ga.za.kre

§10 [Phonetic note]

Is the voicing of word-final prevocalic /s/

- a categorical phrase-level phenomenon
- or • a gradient phonetic effect (passive voicing; cf. Bradley and Delforge 2006: 44)?

Evidence of categoriality:²

(i) Native speakers are able to use the difference between [s] and [z] to discriminate between the members of minimal pairs:

e.g. *ha*[z] *ido* vs *ha* [s]*ido* (Robinson 1979: 136, 140-1; Lipski 1989: 55).

(ii) /s/-voicing is used before hesitation pauses as a turn-holding device:

e.g. *es, digamo*[z]:: ...
'it's, let's say:: ...' (Lipski 1989: 54)

Robinson (1979: 141) describes the voicing in such instances as 'strong'.

§11 [Diachronic note]

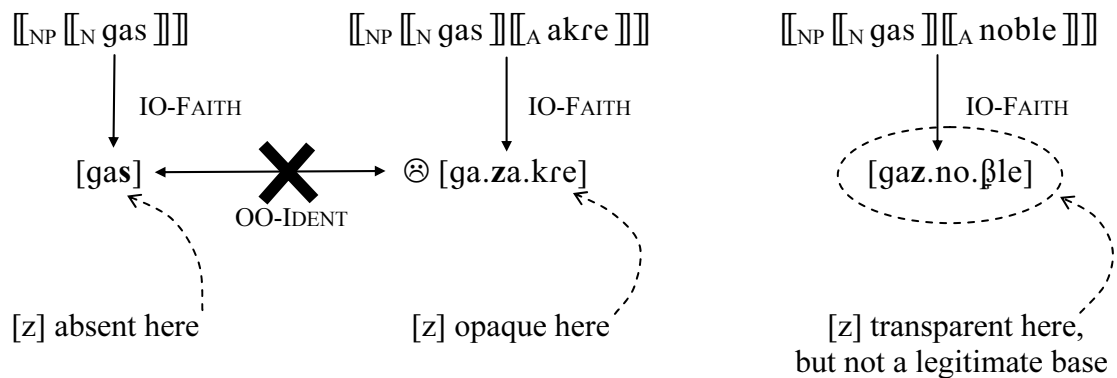
A possible diachronic scenario (cf. Robinson 1979, Bradley and Delforge 2006):

- 1 *Phonologization* Low perceptibility of laryngeal features in codas reinterpreted as phrase-level coda delaryngealization.
- 2 *Analogy* Coda delaryngealization percolates up to the word level.
- 3 *Phonologization* Passive voicing of delaryngealized sibilants reinterpreted as phrase-level spreading

See Bermúdez-Otero (2006a: 504; 2007a: 503-8) and references therein on the life-cycle of phonological processes.

¹ The alternative stratal analysis advanced by Colina (2006) fails to respect Richness of the Base. The account proposed here is based on my description of an analogous phenomenon in Catalan: cf. Catalan /gos/ [gos] 'dog', /gos-ə/ [go.sə] 'bitch', /gos əlat/ [go.zə.lat] 'winged dog' (Bermúdez-Otero's 2006b: §9, §17-§18; 2007b: §31-34). This cyclic derivation could be seen as an instance of Mascaró's (1987) reduction-and-spreading approach to laryngeal phenomena (see also Steriade 1999 on laryngeal neutralization as delaryngealization); however, I am not asserting that the reduction-and-spreading approach generalizes to all cases of laryngeal neutralization crosslinguistically. Jiménez (1999: 172-85) and Wheeler (2005: 162-64) propose novel constraints to deal with the Catalan facts.

² In Catalan (see footnote 1), one should note instances where the voicing of a word-final prevocalic sibilant spreads over a long sequence of obstruents: e.g. *disks antics* [dizg.zan.'tiks] 'old records' (Wheeler 1979: 313).

§12 The failure of transderivational correspondence:³

☞ OO-IDENT fails because it relies on the transderivational transmission of surface properties; word-final prevocalic /s/ in Highland Ecuadorian Spanish displays the cyclic transmission of a nonsurfacing property, viz. being a target for spreading.

Absent bases in noncanonical paradigms

§13 Stress assignment in Albanian polysyllables (Trommer 2004):

- if the ultima is $\left\{ \begin{array}{l} \text{either full-vowelled and closed} \\ \text{or headed by a non-mid vowel,} \end{array} \right\}$ then stress the ultima;
- otherwise, stress the penultimate.

§14 Misapplication in verbs (Trommer 2006):

‘to form’

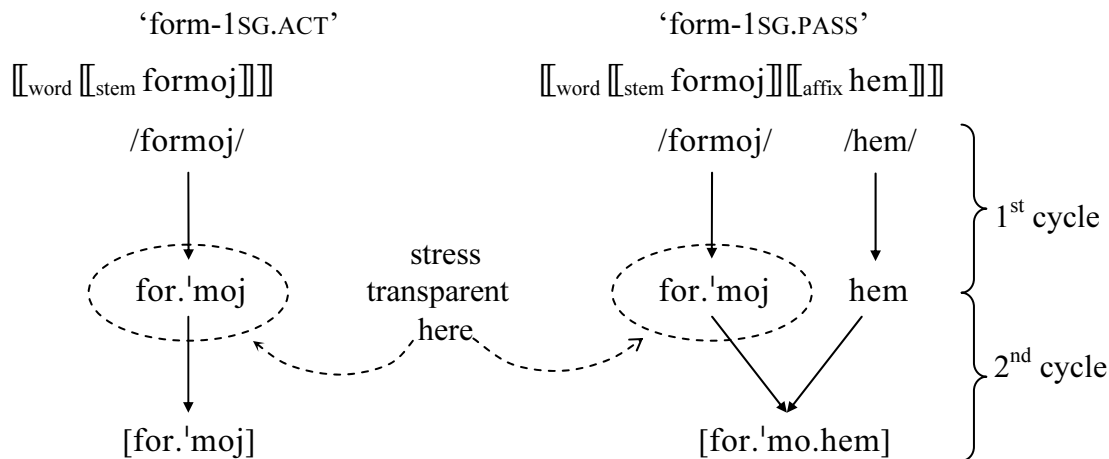
1SG.ACT	[[word [[stem formoj]]]]	[for.'moj]	stress assignment
2SG.ACT	[[word [[stem formon]]]]	[for.'mon]	misapplies
3SG.ACT	[[word [[stem formon]]]]	[for.'mon]	here
1PL.ACT	[[word [[stem formoj]] [[affix mə]]]]	[for.'moj.mə]	
2PL.ACT	[[word [[stem formon]] [[affix ni]]]]	[for.'mo.ni]	
3PL.ACT	[[word [[stem formoj]] [[affix nə]]]]	[for.'moj.nə]	
1SG.PASS	[[word [[stem formoj]] [[affix hem]]]]	[for.'mo.hem]	
2SG.PASS	[[word [[stem formoj]] [[affix heʃ]]]]	[for.'mo.heʃ]	
3SG.PASS	[[word [[stem formoj]] [[affix het]]]]	[for.'mo.het]	
1PL.PASS	[[word [[stem formoj]] [[affix hemi]]]]	[for.'mo.he.mi]	
2PL.PASS	[[word [[stem formoj]] [[affix heni]]]]	[for.'mo.he.ni]	
3PL.PASS	[[word [[stem formoj]] [[affix hen]]]]	[for.'mo.hen]	

For convenience I substitute ‘passive’ for ‘non-active’ and ignore the internal structure of the passive endings.

³ This may not be the only problem that the behaviour of /s/ in Highland Ecuadorian Spanish raises for classic (nonstratal) OT. A delicate question of ranking arises over the fact that the voicing of /s/ is non-structure-preserving: the markedness constraint penalizing [z] must be ranked high enough to exclude this consonant from non-word-final onsets, but low enough to allow it to arise by assimilation in codas and in word-final prevocalic onsets. Bermúdez-Otero (2007b) demonstrates a stratal-cyclic solution to a similar problem in Catalan; cf. Krämer (2006) for an alternative approach to this type of phenomenon.

§15 Stratal-cyclic analysis (Trommer 2006):

- Stress assignment operates transparently in the stem cycle.
- $n.n \rightarrow n$
- $j \rightarrow \emptyset / _h$ } by regular phonological processes in the word cycle.

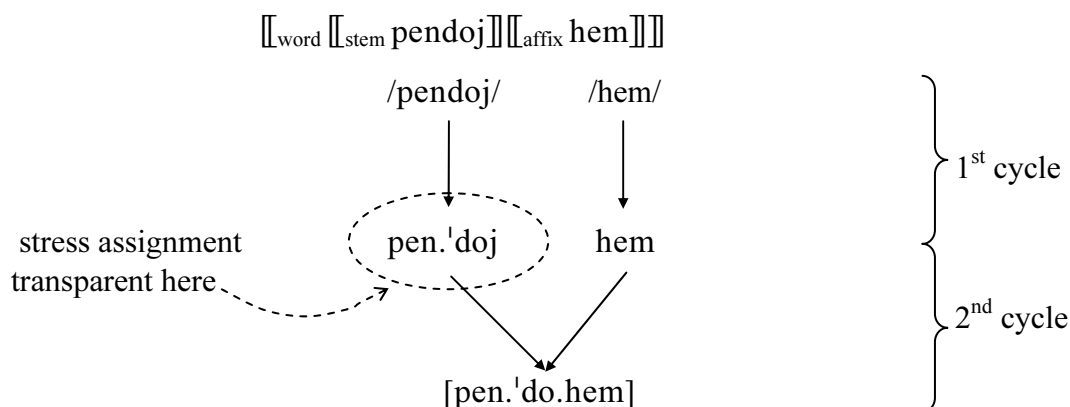


§16 A verb with a noncanonical paradigm: deponent ‘to regret’

	ACT	PASS	
1SG	×	[[[[pendoj]] [[hem]]]] → [pen.'do.hem]	} misapplication everywhere
2SG	×	[[[[pendoj]] [[hef]]]] → [pen.'do.hef]	
3SG	×	[[[[pendoj]] [[het]]]] → [pen.'do.het]	
1PL	×	[[[[pendoj]] [[hemi]]]] → [pen.'do.he.mi]	
2PL	×	[[[[pendoj]] [[heni]]]] → [pen.'do.he.ni]	
3PL	×	[[[[pendoj]] [[hen]]]] → [pen.'do.hen]	

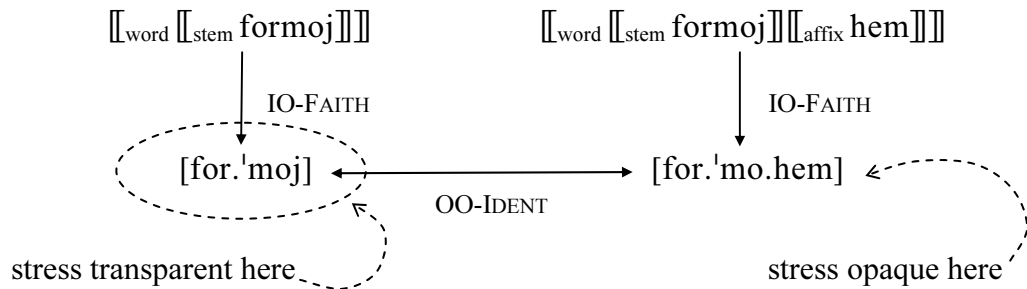
On deponency, see Baerman et al. (2007).

§17 The stratal-cyclic analysis generalizes to deponent verbs without stipulation:

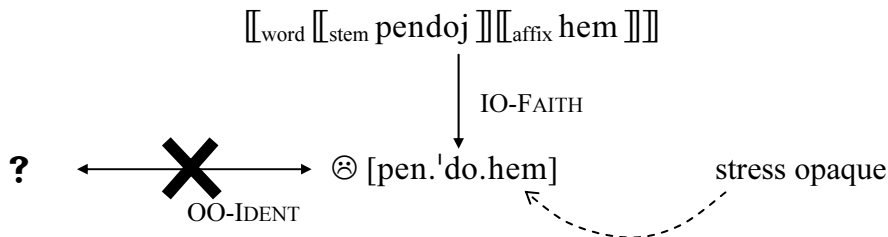


§18 The failure of transderivational correspondence:

- canonical paradigm



- deponent paradigm:



A conceivable way out is to posit not merely transderivational correspondence, but also transparadigmatic relationships (Blevins 2006). However, these are likely to incur the same problems of arbitrariness as transderivational correspondence: see §22 and §23 below.

§19 Comparing predictions:

- | | | | |
|-------------|---|---|--------|
| • the cycle | { | same syntagmatic structure
↓
same cyclic effects | RIGHT! |
| • OO-IDENT | { | different paradigms
↓
different transderivational effects | WRONG! |

For similar arguments, see e.g. Bailyn and Nevins (forthcoming), Bobaljik (1997, 2004), and Kiparsky (1998), among others.

Implications

§20 The status of paradigms

Q. Does this mean that paradigms are unimportant?

A. No, “the child needs them” (Wunderlich 2003: 28ff., quoting Lauri Karttunen).

During language acquisition, learners reinterpret phonological patterns across paradigms as effects of the syntagmatic structure of individual paradigm members.

§21 The relationship between morphology and phonology as disciplines

I propose the following methodological principle:

Taking Morphology Seriously (the Phonologist's Version)

When analysing morphology-phonology interactions, make maximum use of independently motivated morphological structure.

Very loosely based on a version of Taking Morphology Seriously for lexical semanticists (Koontz-Garboden 2007: 12, where it is attributed it to Paul Kiparsky).

In §22 and §23 I show that the cycle offers the best way of honouring this principle (for similar arguments, see e.g. Kiparsky 1998 or Piggott 2006, among others).

§22 What is a base in phonology?

- Under cyclicity, unequivocal answer:

base = immediate cyclic subdomain

I.e. $\llbracket_{\beta} \llbracket_{\alpha} \rrbracket \rrbracket$

α is a base for β iff β is a cyclic domain, α is a cyclic domain contained within β , and there is no cyclic domain that both contains α and is contained within β .

Ultimately, the independently verifiable syntagmatic structure of a linguistic expression determines what can or cannot be a base.

- Under transderivational correspondence, anyone's guess!

Any linguistic expression enters into an unbounded set of paradigmatic relationships, but which should be chosen to trigger identity relationships in phonology?

No settled answer: see the ongoing controversy in Albright (2002), Benua (1997), Kager (1999), Kenstowicz (1996), McCarthy (2005), Raffelsiefen (2004), etc.

Similar problems beset the definition of 'paradigm' in morphology: Should paradigms include periphrases? If so, which (e.g. Ackerman and Stump 2004, Börjars et al. 1997, Spencer 2001, Vincent and Börjars 2006, etc.)? Is derivation paradigmatic (e.g. Blevins 2001: 209, Spencer 2005)?

§23 Are base-derivative relationships symmetrical or asymmetrical?

- Under cyclicity, necessarily asymmetrical:

part-whole relationships in morphosyntactic structure give rise to input-output relationships between cyclic domains.

- Under transderivational correspondence, take your choice!

In the absence of stipulation, incorrectly predicted to be symmetrical.

See e.g. Bermúdez-Otero (1999: 113-25), Orgun (1996a: §5.1). *Pace* McCarthy and Prince (1995), base-reduplicant identity is not symmetrical either: see Inkelas and Zoll (2005), Kiparsky (2007a).

In practice, greater or lesser degree of asymmetry injected by stipulation:

Benua (1997)	all relationships asymmetrical
McCarthy (2005)	asymmetry in derivation, symmetry in inflection
Kenstowicz (1996)	symmetry and asymmetry mixed <i>ad libitum</i>

THE EMERGENCE OF STRATUM-INTERNAL CYCLICITY AT THE STEM LEVEL

A puzzle

§24 Stratum-internal cyclicality in classic rule-based Lexical Phonology:

- Stem level ('level one'): internally cyclic
every stem-level category defines a cyclic domain
e.g. $[[_{SL} [[_{SL} [[_{SL} \textit{origin}]] \textit{al}]] \textit{ity}]]$
- Word level ('level two'): internally noncyclic
only the outermost category defines a cyclic domain
e.g. $[[_{WL} [[_{SL} \textit{memory}]] \textit{less-ness}]]$

E.g. the cyclic and postcyclic levels in Booij and Rubach (1984, 1987), Kiparsky (1985), etc.

This is empirically correct (Bermúdez-Otero forthcoming: ch. 2, *pace* Orgun 1996b) but conceptually arbitrary.

§25 My proposal:

- All levels are internally noncyclic.
- Effects equivalent to internal cyclicality at the stem level are reflections of special properties of stem-level morphology.
- These effects arise whenever three ingredients are simultaneously present:
 - (i) *Nonanalytic listing of stem-level outputs*
Phonological output representations generated by the stem-level phonology are stored in the permanent lexicon.
 - (ii) *Morphological blocking*
A lexically listed item blocks the online grammatical derivation of a competitor.
 - (iii) *High-ranking faithfulness*
High-ranking faithfulness preserves some phonological property of inputs.

First proposed by Bermúdez-Otero and McMahon (2006: §3.4). Developed in Bermúdez-Otero (forthcoming: ch. 2) and Collie (in progress).

Nonanalytic listing

§26 Lexical listing does not have phonological consequences if the internal domain structure of the listeme remains visible to the phonology:

- Syntactic idioms must be listed in the permanent lexicon because their meaning is not fully compositional
e.g. *pull* [_{POSSP} x] *leg* 'tease [x]'
- But syntactic idioms have internal structure in the morphosyntax and, *a fortiori*, in the phonology
e.g. wh-movement *Whose leg_i are you trying to pull t_i?*

- A less trivial example:

*scholarship*₁ [[SCHOLAR]PROPERTY]

e.g. *His scholarship₁ deserted him and he was unable to answer like a scholar.*

*scholarship*₂ [EDUCATIONAL GRANT]

e.g. *His scholarship₂ was withdrawn but he remained a hard-working scholar.*

Although *scholarship*₂ must be listed in the permanent lexicon, to my knowledge this has no phonological consequences. The phonology sees the same domain structure as in *scholarship*₁: a word-level (i.e. 'level-two') category based on a stem, rather than a stem-level (i.e. 'level-one') category based on a root.

[[SCHOLAR]PROPERTY]	[EDUCATIONAL GRANT]	—
[[_{stem} [[_{stem} <i>scholar</i>]] <i>ship</i>]]	[[_{stem} [[_{stem} <i>scholar</i>]] <i>ship</i>]]	*[[_{stem} [[_v <i>scholar</i>]] <i>ship</i>]]
[[_{WL} [[_{SL} <i>scholar</i>]] <i>ship</i>]]	[[_{WL} [[_{SL} <i>scholar</i>]] <i>ship</i>]]	*[[_{SL} <i>scholarship</i>]]
<i>scholarship</i>	<i>scholarship</i>	* <i>scholarship</i>

In this instance, as in the case of *pull* [_{POSSP} x] *leg*, semantic noncompositionality does not reflect root-based derivation: cf. Marvin (2002), Arad (2003).

Lexical listing has phonological consequences when it is 'nonanalytic' (Kaye 1995), i.e. when the lexical entry contains a phonological representation with no internal domain structure.

§27 Postulate: ☞ stem-level constructions are listed nonanalytically.

At present I do not have an exhaustive account of why this postulate should hold true, but I note the following points:

- The postulate leads to the right predictions (§29ff.).
- Ascription to the stem level is highly correlated with listedness according to criteria other than semantic noncompositionality (cf. §26): notably, constructions that are 'nondefault' and therefore listed by the criteria of Pinker and Prince (1994) and Pinker (1999) typically invoke the stem-level phonology.

E.g. a diachronic instance in Modern Hebrew (Meir 2006):⁴

nondefault morphology	>	stem-level phonology
default morphology	>	word-level phonology

§28 N.B. listed nonanalytically ≠ synchronically inert

If stem-level outputs are listed nonanalytically, then stem-level morphological and phonological processes work as 'lexical redundancy rules' in the sense of Jackendoff (1975):

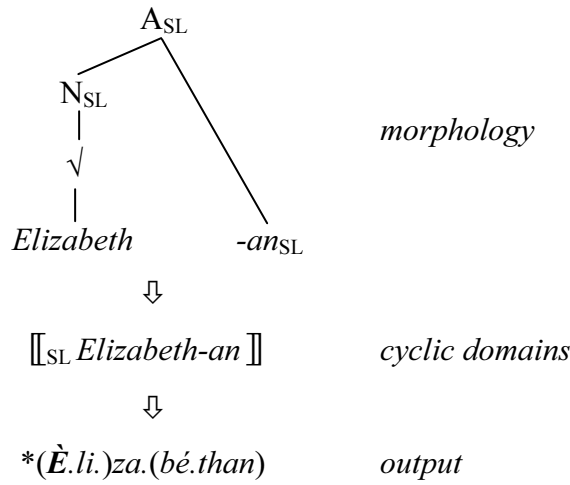
- they redundantly capture relationships between stored items;
- they apply online to generate novel items.

⁴ A similar development appears to have given rise to the stratification of the early Middle English dialect of the *Ormulum* as described in Bermúdez-Otero (1999: 213-214).

From nonanalytic listing to stem-level cyclicity via blocking

§29 Assume that the stem-level is internally noncyclic.

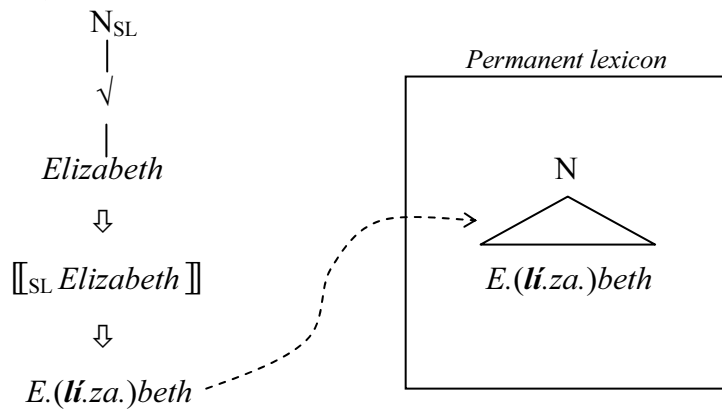
Then,



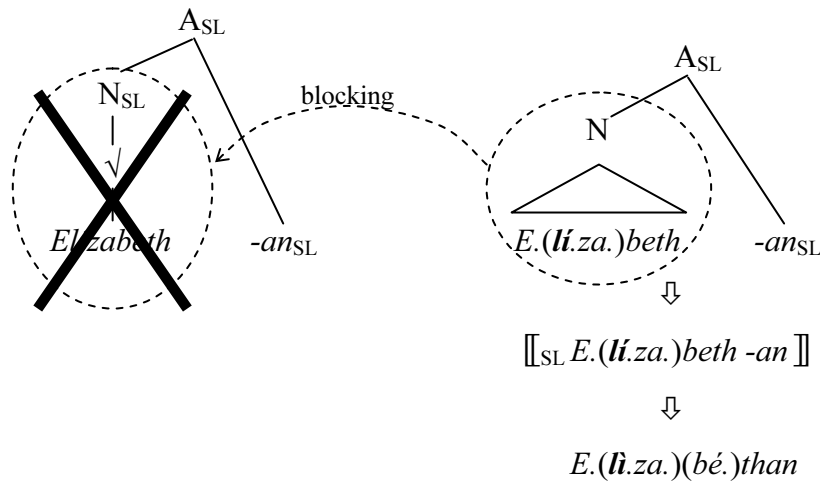
By the Abracadabra Rule: cf. *àbracadábra*, *dèlicatèssen*, etc.

§30 Now assume nonanalytic listing.

Then,



§31 Now, by morphological blocking,



§32 Predictions

- Blocking is sensitive to token frequency

This is presumably because token frequency affects resting activation, which in turn affects speed of retrieval, which in turn affects the outcome of the race between lexicon and grammar.

(Aronoff and Anshen 1998: 240 and references therein; see also Hay 2003)

- Therefore, if internal cyclicity at the stem level emerges from blocking, then it too should vary according to token frequency.

This is correct (Hammond 2003, Kraska-Szlenk 2007: §8.1.2, Collie in progress)

e.g.	noncyclic stress	<i>information</i> (38327)	<i>inform</i> (286)
		<i>conversation</i> (5169)	<i>converse</i> (13)
	cyclic stress	<i>àvantágeous</i> (372)	<i>advántage</i> (7220)
		<i>àuthénticity</i> (362)	<i>àuthéntic</i> (824)

(Kraska-Szlenk 2007: §8.1.2; figures from the British National Corpus online)

- This approach can cope with countercyclic effects, which are intractable in classic Lexical Phonology:

e.g. in idiolects with $c[ai]cle \sim c[ɪ]clīc \sim c[ai]clīcity$
stored $c[ɪ]clīc$ fails to block $c[ai]cl-ic-ity$

(I have observed this paradigm in the speech of my former colleague Dr John Hutton.)

Cyclic approaches to misapplication can incorporate insights from usage-based models of grammar (e.g. the rôle of frequency).

- §33 N.B. Here I have assumed the psycholinguistic conception of blocking embedded in race models of morphological processing.

This is different from —but not necessarily incompatible with— other conceptions of blocking: e.g.

- as a grammatical principle or constraint of greater or lesser scope (cf. Bresnan 2001, Kiparsky 2005, Embick and Marantz 2007, etc.)
- as a heuristic in language acquisition (e.g. Fuß 2006).


The adequacy of —and relationship between— all these conceptions of blocking is a vast problem that remains to be settled.

The rôle of faithfulness

- §34 In an OT-based cyclic model, a property of a listed input will be preserved in the output only if the relevant faithfulness constraint is ranked high at the stem level:

/E(líza)beth-an/ (see §31)	IDENT-FootHead	ALIGN($\omega, L; \Sigma, L$)
(Èli)za(bé)than	*!	
E(líza)(bé)than \rightarrow		*

- §35 However, by Richness of the Base, this entails that prespecified foot-heads in the UR of monomorphemic items can also block the Abracadabra Rule:

/apótheosis/	IDENT-FootHead	ALIGN($\omega, L; \Sigma, L$)
(àpo)the(ó)sis	*!	
a(pòthe)(ó)sis 		*

Prediction independently derived in Bermúdez-Otero and McMahon (2006: 400) and in Kiparsky (2007b).

- §36 Thus, Chung's Generalization is derived as a theorem:

 *Chung's Generalization*

If a stem-level phonological generalization displays cyclic misapplication, then it also has lexical exceptions.

I propose the label 'Chung's Generalization' in recognition of the pioneering insight of Chung (1983: 63). In Stratal OT, this theorem supersedes Structure Preservation, which is demonstrably wrong: see Bermúdez-Otero (forthcoming) for details.

Conclusion

- §37 Stratum-internal cyclicity at the stem level need not be stipulated, but can be derived from plausible independent assumptions (with a concomitant increase in empirical adequacy, as shown in §32).

In this respect, therefore, a cyclic approach to the morphology-phonology interface is compatible with an abstractness-without-innateness programme for linguistic theory.

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