Cyclic domains and prosodic spans in the phonology of European Portuguese functional morphs

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INTRODUCTION

§1 Most current approaches to the morphosyntax-phonology interface are confronted with the key task of formulating empirical criteria to distinguish between two types of morphosyntactic conditioning in phonology:

- *representational* (e.g. through prosodification),

and

- *procedural* (e.g. through the cycle or through OO-correspondence).

§2 Cyclic theories like Stratal OT provide a strong criterion that is unavailable to theories based on OO-correspondence:

☞ each cyclic domain is exactly coextensive with a grammatical constituent.

And in Stratal OT, as a special case,

☞ each grammatical word (GWd) defines a word-level phonological domain.

§3 This paper demonstrates the correctness and usefulness of this criterion with a case study from European Portuguese (EP):

- Morphosyntactic evidence shows that
  an EP pronominal enclitic cluster belongs to the same GWd as its verbal host,
  but an EP pronominal proclitic cluster lies outside the GWd containing the verb.
- This entails a *stratal* difference:
  verb+enclitic combinations form word-level domains,
  whereas proclitic+verb combinations form phrase-level domains.
- But the phonological behaviour of pronominal enclitics differs markedly from that of other word-level suffixes.
- Therefore, if their difference is not stratal, it must be *prosodic*: i.e.
  word-level suffixes incorporate into the prosodic word (*ω*),
  whereas pronominal enclitics Chomsky-adjoin to *ω*.
- These predictions are corroborated by phonological parallels with morphs whose stratal and prosodic behaviour can be independently ascertained:
  pronominal enclitics behave like word-level prefixes (which adjoin to *ω*)
  and pronominal proclitics behave like prepositions (which are phrase-level).

THE DIVISION OF LABOUR BETWEEN PROSODY AND THE CYCLE

The problem

§4 *Two types of morphosyntactic conditioning in phonology* [1]

	Representational	Procedural
SPE	boundary symbols	the cycle
Lexical Phonology [2]	prosodic units (built by rules)	the cycle (with strata)
Stratal OT [3]	prosodic units (via ALIGN)	the cycle (with strata)
Classic OT [4]	prosodic units (via ALIGN)	OO-correspondence
Lateral Phonology [5]	empty CV units	the cycle (phases)

[1] Asumed in all generative approaches to phonology's upper interfaces since *SPE*: see Scheer (2008b: 172; 2008a: §72 and *passim*).

[2] E.g. Booij and Rubach (1984), Booij (1988, 1992).

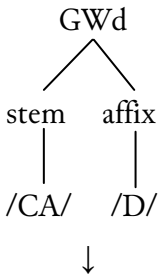
[3] E.g. Kiparsky (1998), Bermúdez-Otero (forthcoming).

[4] E.g. Benua (1997).

[5] E.g. Scheer (2008b, 2008a).

§5 *The danger of empirical underdetermination*

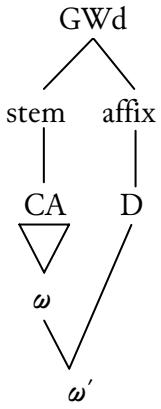
- Let there be a phonological process $\mathcal{P}$ whereby A → B / C__D
- Let $\mathcal{P}$ display morphologically triggered misapplication:



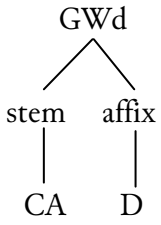
↓

SR [CAD] instead of expected *[CBD]

- Representational (prosodic) solution: $\mathcal{P}$ is bounded by ω.



- Procedural (stratal-cyclic) solution: $\mathcal{P}$ is stem-level.



Derivation:	⟦CA⟧ ⟦D⟧	stem-level cycle ($\mathcal{P}$ active)
	⟦CAD⟧	word-level cycle ($\mathcal{P}$ inactive)

For instances of this underdetermination problem, see e.g. Raffelsiefen (2005) on English, Yun (2008) on Korean.

§6 💣 Unless this underdetermination is resolved, the theory will haemorrhage empirical content.

☞ We need criteria for distinguishing between prosodic and cyclic effects.
Below is a nonexhaustive list; cf. Raffelsiefen (2005: §9.4) for a different set of criteria.

Criterion 1: phonetics

§7 The principle:

- Prosodic units are phonetically implementable phonological objects.
  - ⇒ Surface prosodic structure directly triggers phonetic effects:
    e.g. preboundary lengthening, F_0 effects, relative gestural timing.

  See e.g. Gussenhoven and Rietveld (1992), Wightman et al. (1992), Byrd (1996), Clements and Hertz (1996).

- In a modular feedforward architecture of grammar, phonetics cannot see morphosyntax.
  - ⇒ Phonetics cannot see cyclic domains.

  See e.g. Myers (2000: 263).

§8 An application:

	preboundary lengthening of [i:l] [1]	⇒	prosodification
*Mr **Beel**ik*	—		[$_{\omega}$ Beelik]
***beel**-ic*	no		[$_{\omega}$ beelic]
***beel**-ing*	no		[$_{\omega}$ beeling]
***beel**-equator*	yes		[$_{\omega'}$ [$_{\omega}$ beel] [$_{\omega}$ equator]]

[1] Data from Sproat and Fujimura (1993); see also Sproat (1993: 178).

Therefore:

- Prosodifications like [$_{\omega'}$ [$_{\omega}$ *beel*]*ing*] are incorrect (cf. e.g. Goad et al. 2003: 246).
- The phonological differences between English *-ic* ('class-one') and *-ing* ('class-two') are not prosodic, but stratal, as traditionally assumed.

Criterion 2: variation

§9 The principle:

Ceteris paribus, a variable phonological process will display identical application rates in expressions with identical cyclic/prosodic structures.

§10 An application:

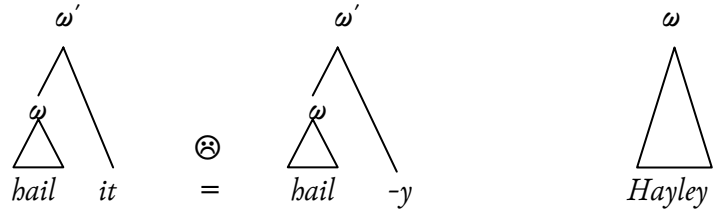
Relative rates of /l/-darkening in American English (Hayes 2000: 98):

← [ɬ] more frequent [l] more frequent →

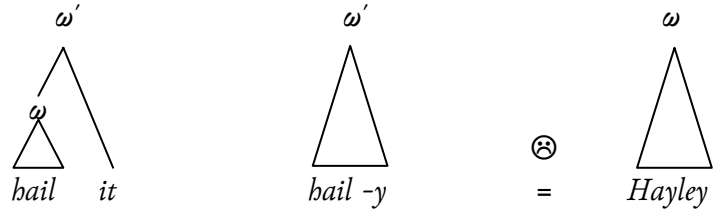
mail it > *mail-er, hail-y* > *Hayley, Norman Mailer*

This effect *cannot* be prosodic under either the following prosodifications:

(a)



(b)



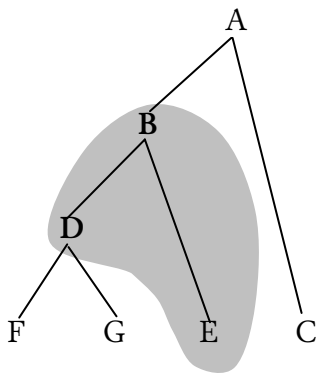
For a different interpretation of the evidence, see Raffelsiefen (2005: §9.5.2). For another example of a cyclic effect upon rates of variation, see Guy (1991a, 1991b).

Criterion 3: Bracket Erasure

§11 The principle (Orgun and Inkelas 2002: 116):

Phonology cannot access the internal morphosyntactic structure of cyclic subdomains.

I.e.



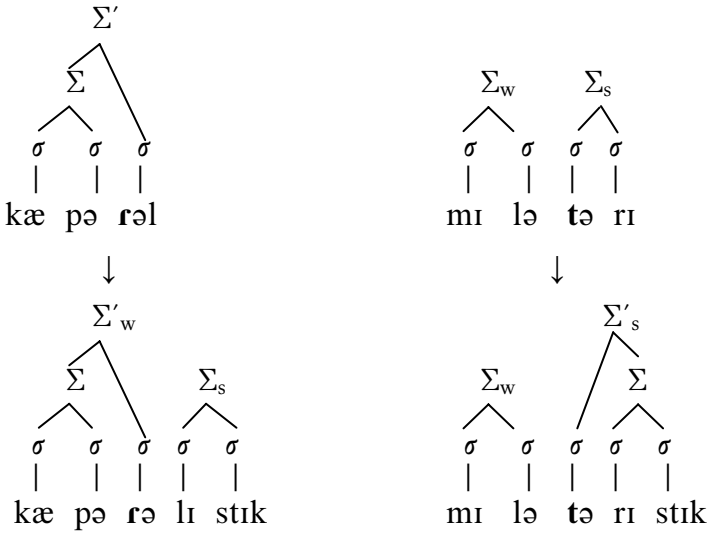
If nodes B and D define cyclic domains

Then phonological processes applying in the cycle triggered by B can be sensitive to D and E, but not to F and G

Bracket Erasure originates in *SPE*'s technical definition of the cycle. Kiparsky (1982a: 140, 1982b: 11) adopted a weaker version. In Bermúdez-Otero (forthcoming), the formulation above is deduced from independent postulates.

§12 An application: the Withgott Effect (Withgott 1982)

- American English /t/-flapping applies in phrase-level domains: e.g. *hi*[tˆ] vs *hi*[ɾ] *Ann*.
- Therefore, by Bracket Erasure, it cannot see the internal morphological structure of the words *càpi*[ɾ]*alístic* and *mìli*[t]*arístic*.
- Therefore, the different outcomes of phrase-level flapping in *càpi*[ɾ]*alístic* and *mìli*[t]*arístic* must reflect a prosodic difference arising at earlier levels and retained faithfully at the phrase level:



See Kiparsky (1998), Jensen (2000: 208-11), Davis (2005), Bermúdez-Otero and McMahon (2006: 403-04), Bermúdez-Otero (forthcoming); cf. Steriade (2000).

Criterion 4: coextensiveness of morphosyntactic categories and cyclic domains

§13 The principle (repeated from §2):

- Each cyclic domain is exactly coextensive with a grammatical constituent.

  For an opposing view, see Inkelas (1989) and McHugh (1990, 2006), where phonology cycles over prosodic categories; cf. Bermúdez-Otero (forthcoming) for a critique, and see Downing (2006) for a noncyclic version.

- And in Stratal OT, as a special case,
  each GWd defines a word-level phonological domain.

§14 An application: the EP case-study in this paper.

THE MORPHOSYNTACTIC AFFILIATION OF EP PRONOMINAL CLITICS

Tests (Luís forthcoming: §2)

§15 *Separability*

	Proclitics?	Enclitics?
Clitic can be separated from verb:	YES	NO

(1) *Acho que ela **lho** ainda não **disse**.*
I.think that she **3SG.DAT_3SG.MASC.ACC** yet not **told**
'I think that she hasn't told it to him/her/them yet.'

§16 *Coordination*

	Proclitics?	Enclitics?
Clitic takes wide scope over coordination:	YES	NO

(2) *Acho que **lhes** ⟦leram uma história e deram um livro⟧.*
I.think that **3PL.DAT** ⟦they.read a story and they.gave a book⟧
'I think that they read **them** a story and gave **them** a book.'

§17 *Allomorphy*

	Proclitics?	Enclitics?
Verb+clitic combination displays arbitrary allomorphy:	NO	YES

(3) *Procura**mo=lo** todo o dia.* (not expected **procura**mos=o***)
searched.1PL=3SG.MASC.ACC all the day
'We searched for him all day.'

Cf.

(4) *lápi**s** **a**zul* (not **lápi***[∅ l]***zul*)
pencil blue
'blue pencil'

This is just one example: for other types of allomorphy triggered by enclitics, see Luís (2004: §7.1).

Results (Luís forthcoming: 10, 12)

§18

	An EP pronominal enclitic cluster belongs to the same GWd as its verbal host,
but	an EP pronominal proclitic cluster lies outside the GWd containing the verb.

- Luís (2004, forthcoming) analyses EP enclitics as *lexical affixes*
  and EP proclitics as *phrasal affixes* (clitics à la Anderson 2005)
- Bermúdez-Otero and Payne (forthcoming) deny the existence of clitics as a category. In their framework, therefore, EP enclitic clusters are *affixes*
  whereas EP proclitic clusters are *words*.

- Vigário (1999a; 2003: ch. 4) argues that *all* EP pronominal clitics are *phrasal* elements. This fails to capture the contrasts in §15 and §16, and forces Vigário to analyse the allomorphy in §17 nonlocally using Hayes's (1990) precompilation theory (cf. Luís 2004: §7.2.1). For a local alternative to precompilation, see Bermúdez-Otero (forthcoming) .

§19 Not a particularly strange state of affairs: cf. negation in English negative interrogatives ...

- ... is realized as an affix when following the finite auxiliary:

  (5) ***Won't** the President reconsider his position?*

  For the affixal status of *-n't* in *won't*, see Zwicky and Pullum (1983).

- ... is realized as a free word when preceding a nonfinite verb:

  (6) *Will the President **not** reconsider his position?*

Phonological implications

§20 By the coextensiveness principle stated in §2 and §13, it must be the case that

verb+enclitic combinations form word-level domains,
whereas proclitic+verb combinations form phrase-level domains

I.e.

morphosyntax		cyclic domains
$[_{GWd}$ V + enclitic$]$	⇔	$[_{WL}$ V + enclitic$]$
proclitic + $[_{GWd}$ V$]$	⇔	$[_{PL}$ ... $[_{WL}$ ... proclitic$][_{WL}$ V$]]$

The following sections put these predictions to the test.

THE STRATAL AND PROSODIC PROPERTIES OF EP PRONOMINAL ENCLITICS

The phonological behaviour of pronominal enclitics differs from that of other suffixes!

§21 *Stress*

EP suffixes are generally stress-affecting: primary stress in stem+suffix combinations is confined to a final three-syllable window. In contrast, pronominal enclitics are stress-neutral.

E.g.	*lév-a*	*lev-á-va-mos*	but	*lev-á-va-mos=lhes*
	'he carries'	'we carried'		'we carried for them'

§22 *Nasal diphthongization*

Nasal diphthongs occur only in word-final syllables (Mateus and d'Andrade 2000: 47):

e.g. ***en**fiamos* [ẽˈfjɐmuʃ], not *[ɐ̃̃ˈfjɐmuʃ] 'we insert'

But nasal diphthongs are also found in the final syllable of verbs in verb+enclitic combinations:

e.g. *diz**em**=lhe* [ˈdiz**ɐ̃j**ʎɨ], not *[ˈdizẽʎɨ] ‘say.3PL.PRESIND=3SG.DAT’

§23 *Mid vowel centralization before palatals*

Within words, front mid vowels undergo centralization to [ɐ] before a palatal consonant or high front vowel in the next syllable (Vigário 2003: 78-82; cf. Mateus and d'Andrade 2000: 19):

e.g.	*te**l**ha*	[ˈtɐ.ʎɐ]	‘tile’	*se**n**ha*	[ˈsɐ.ɲɑ]	‘signal’
	*cere**j**a*	[sɨ.ˈɾɐ.ʒɐ]	‘cherry’	*fe**ch**o*	[ˈfɐ.ʃu]	‘bolt’
	*ve**í**culo*	[vɐ.ˈi.ku.lu]	‘vehicle’			

But centralization is blocked before enclitics:

e.g. *dê=lhe* [ˈdɐ.ʎɨ], not *[ˈdɐ.ʎɨ] ‘give to him/her’

§24 *Distribution of /ʎ/*

*[ω ...CʎV...] but *damos=**[ʎ]**e* ‘we give to him/her’

Not a stratal effect…

§25 Conceivable approach:
- the phonological processes listed in §21-§24 are stem-level;
- enclitics are word-level suffixes, whilst other suffixes are stem-level.

Counterargument:
- suffixes like diminutive *-inho* and *-ito* are demonstrably word-level;
- yet these word-level suffixes undergo the processes in §21-§24.

The counterargument assumes a strictly tristratal model (e.g. Kiparsky 2000, Bermúdez-Otero forthcoming).

§26 *Evidence for the word-level status of* -inho *and* -ito

- Morphosyntax:
  - (i) *-inho* and *-ito* attach to free stems, rather than bound roots;
  - (ii) *-inho* and *-ito* occur outside other derivational suffixes.

- Morphophonology:
  - (i) Stem-level suffixes beginning with /i/ trigger softening of final /t, k, g/ in a lexically specified subset of roots: e.g.

*profe**t**-a*	[pɾuˈfɛ**t**ɐ] ‘prophet’	~	*profe**c**-ia*	[pɾufɨˈsiɐ] ‘prophecy’
*católi**c**-o*	[kɐˈtɔli**k**u] ‘Catholic’	~	*catoli**c**-ismo*	[kɐtuliˈsiʒmu] ‘Catholicism’
*psicólo**g**-o*	[psiˈkɔlu**g**u] ‘psychologist’	~	*psicolo**g**-ia*	[psikuluˈʒiɐ] ‘psychology’

(examples from Mateus and d'Andrade 2000: 99)

In contrast, *-inho* and *-ito* never trigger softening: e.g.

*profe**t**-inha*	[pɾufɨ'**t**iɲɐ], not *[pɾufɨ'**s**iɲɐ]	'prophet-DIM'
*catoli**qu**-inho*	[kɐtuli'**k**iɲu], not *[kɐtuli'**s**iɲu]	'Catholic-DIM'
*psicolo**gu**-inho*	[psikulu'**g**iɲu], not *[psikulu'**ʒ**iɲu]	'psychologist-DIM'

These examples are naturally attested (e.g. *profetinha* in the website of *IOL Portugal Diário* 1 June 2007), though at extremely low frequencies, probably owing to competition from the diminutive allomorph *-zinho* (whose prosodic behaviour is different: see e.g. Vigário 2003: 48, 219ff.). However, forced elicitation demonstrates that the absence of softening is absolutely systematic.

.....

The ascription of *-inho* to the word level in EP may entail certain predictions about Brazilian Portuguese (BP). Namely,

- to the extent (and only to the extent) that the word-level status of *-inho* and *-ito* is primarily a product of their morphosyntactic properties,

and • to the extent (and only to the extent) that the relevant morphosyntactic properties of *-inho* and *-ito* are the same in BP as in EP,

then • we expect that, in BP too, *-inho* will not be in the scope of stem-level phonological processes.

This prediction is correct. In BP, stress shift triggered by stem-level suffixation feeds the raising of /ɛ, ɔ/ to [e, o] in unstressed syllables: e.g.

BP	*belo* ['bɛlu] 'beautiful'	~	*bel-eza* [bɛ'lezɐ] 'beauty'
BP	*pobre* ['pɔbɾi] 'poor'	~	*pobr-eza* [pɔ'bɾezɐ] 'poverty'

But stress shift triggered by the addition of *-inho, -ito* counterfeeds raising: e.g.

BP	*flecha* ['flɛʃɐ] 'arrow'	~	*flech-inha* [flɛ'ʃiɲɐ] 'arrow-DIM'
BP	*bola* ['bɔlɐ] 'ball'	~	*bol-inha* [bɔ'liɲɐ] 'ball-DIM'

See Lee (1995: §2.1.2), Ferreira (2005: §5.1), Bachrach and Wagner (2006).

.....

§27 To account for the properties of pronominal enclitics listed in §21-§24, it is not enough to assign pronominal enclitics to the word level, because there are word-level suffixes (e.g. *-inho, -ito*) that lack those properties:

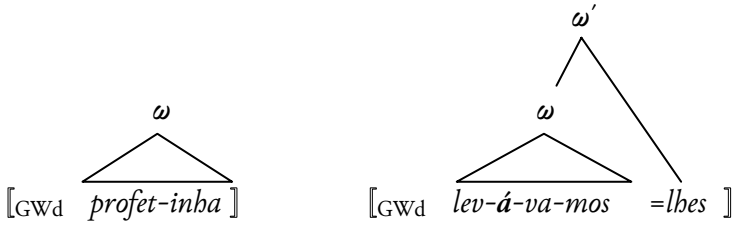
notably, *-inho* and *-ito* are stress-affecting (cf. §21).

…therefore a prosodic effect

§28 The solution (Luís 2006):

	ordinary word-level suffixes	incorporate into *ω*,
whereas	pronominal enclitics	Chomsky-adjoin to *ω*.

E.g.



Independent corroboration: *re-, des-*

§29 To test the prosodic solution proposed in §28, we need to examine the phonological behaviour of EP affixes that (i) are not pronominal enclitics,
(ii) are word-level,
and (iii) Chomsky-adjoin to *ω*.

We predict that such affixes, if they exist, will display the same phonological behaviour as pronominal enclitics.

§30 Portuguese has many types of prefixes (see e.g. Schwindt 2000, 2001). However, iterative *re-* and reversative *des-* provide a perfect term of comparison with pronominal enclitics:

- they are monosyllabic;
- they are stressless (showing vowel reduction) in transparent compositional use (see Vigário 2003: 171-72);
- they are word-level (no morphosyntactic or morphophonological evidence of stem-level status);
- they Chomsky-adjoin to *ω*, as shown by the diagnostics in §31 and §32 below.

§31 *Blocking of vowel reduction (Vigário 1999b: 272-73, 2003: 167)*

- Non-low vowels resist unstressed vowel reduction in word-initial position: e.g.
  ***o**cupar* [ɔkuˈpaɾ], not *[**u**kuˈpaɾ] ‘occupy’
- Reduction is also blocked in stem-initial vowels after *re-* and *des-*: e.g.
  *des-**o**cupar* [dɨz-ɔkuˈpaɾ], not *[dɨz-**u**kuˈpaɾ] ‘vacate’
- The generalization cannot be that reduction is blocked initially in stem-level domains, because EP vowel reduction applies at the word level, as shown by the fact that reduction is fed by the stress shift triggered by word-level suffixes like *-inho*: e.g.
  *s**e**lo* [ˈs**e**lu] ‘seal’ ~ *s**e**l-inho* [sɨˈliɲu] ‘seal-DIM’
- Therefore the correct generalization is that word-level unstressed vowel reduction fails to apply to non-low vowels in *ω*-initial position and that prefixes like *re-* and *des-* Chomsky adjoin to *ω*:
  [$_{ω}$ ɔkuˈpaɾ] [$_{ω'}$ dɨz[$_{ω}$ ɔkuˈpaɾ]]

§32 *Emphatic stress (Vigário 1999b: 274ff; 2003: 120-1, 201ff)*

- In words containing the prefixes *re-* and *des-*, emphatic initial stress (analogous to the French *accent d’insistence*) can be assigned either to the prefix or to the stem-initial syllable:
  e.g. *DES-ocupar ~ des-Ocupar*

- But emphatic initial stress is phrase-level, since it counterbleeds word-level vowel reduction in unstressed syllables (Vigário 2003: 121).
- If emphatic stress assignment is phrase-level, then by Bracket Erasure it cannot have access to the internal morphological structure of prefixed words: see §11.
- Hence, the correct analysis is that emphatic initial stress is assigned to *ω*-initial syllables at the phrase level, that prefixes like *re-* and *des-* Chomsky-adjoin to *ω* at the word level, and that this prosodic structure is faithfully transmitted to the phrase level (see §12):

  [$_{\omega'}$ *DES* [$_{\omega}$ *ocupar*]] ~ [$_{\omega'}$ *des* [$_{\omega}$ *Ocupar*]]

- Furthermore, this analysis correctly predicts that forward-leaning function words that Chomsky-adjoin to *ω*, like articles and prepositions (see §37), can also receive emphatic initial stress (Vigário 1999b, 2003: 198): e.g.

  (7) *a inteligência* [$_{\omega'}$ *da* [$_{\omega}$ *CAtalogadora*]] *foi determinante*
  a inteligência [$_{\omega'}$ *DA* [$_{\omega}$ *catalogadora*]] *foi determinante*
  'the intelligence of the archivist was crucial'

§33 So: do prefixes like *re-* and *des-* display the same behaviour as pronominal enclitics, as predicted in §29?

Yes!! Two sources of evidence: (i) mid-vowel prepalatal centralization
(ii) resolution of hiatus between [ɨ] and a following vowel.

§34 *Mid-vowel prepalatal centralization*

Mid-vowel prepalatal centralization (§23) fails

• across verb=enclitic boundaries	*dê=lhe*	*[ɐ]	'give to him/her'	
• across prefix+stem boundaries	*re-isolar*	*[ɐ]	'to isolate again'	
	cf. *veicular*	[ɐ]	'to diffuse'	(Vigário 2003: 167-8)

§35 *Resolution of hiatus between* [ɨ] *and a following vowel*

• verb=enclitic:	*bebe=a*	*[∅], [j]	gliding obligatory
	drink.3SG=3SG.ACC.FEM		
• prefix+stem:	*re-organizar*	*[∅], [j]	deletion blocked
	'reorganize'		

cf.

• proclitic=verb:	*te=ofereci*	[∅]~[j]	deletion
	2SG.DAT=offer.1SG.PAST		
• P NP:	*de assunto*	[∅]~[j]	optional
	'of matter'		

Analysis: obligatory word-level gliding bleeds optional phrase-level deletion

	⟦phrase ⟦word *reorganizar*⟧⟧	⟦phrase *de* ⟦word *assunto*⟧⟧
WL (gliding)	*r*[j]*organizar*	*assunto*
PL (deletion ~ gliding)	—	*d*[∅-j]*assunto*

THE STRATAL AND PROSODIC PROPERTIES OF EP PRONOMINAL PROCLITICS

Confirmation of the phrase-level status of proclitics

§36 Recall the contrast in hiatus resolution between (i) prefixes and (ii) prepositions and pronominal proclitics:

- prefix+stem: *re-organizar* *[∅], [j] 'reorganize'
- proclitic=verb: *te*=*ofereci* [∅]~[j] 'I offered to you'
  P NP: *de assunto* [∅]~[j] 'of matter'

§37 Can it be explained prosodically?

No: prepositions and proclitics Chomsky-adjoin to *ω*, just like prefixes.

- For prefixes, see §31 and §32 above.
- For prepositions, consider the evidence from variation (§9) in hiatus resolution (Vigário 1999b: 282):

> Complementizers like *que* undergo deletion at lower rates than prepositions like *de*.
>
> Since complementizers and prepositions are indisputably phrase-level, their difference must be prosodic: probably [$_{\omega'}$ *de* [$_{\omega}$ *assunto*]] but [$_{\varphi}$ *que* [$_{\omega}$ *acho*]].

§38 But if the explanation is not prosodic, it must be stratal, as per §35:

	⟦phrase ⟦word *reorganizar*⟧⟧	⟦phrase *te* ⟦word *ofereci*⟧⟧
WL (gliding)	*r*[j]*organizar*	*ofereci*
PL (deletion ~ gliding)	—	*t*[∅-j]*ofereci*

Q.E.D!

Conclusion

§39 Stratal OT makes very precise predictions about the stratal and prosodic properties of EP pronominal clitics:
- pronominal proclitics must be phrase-level,
- pronominal enclitics must be word-level,
- pronominal enclitics must Chomsky-adjoin to ω.

Each of these predictions is robustly confirmed by independent evidence.

This empirical success suggests that Stratal OT's approach to the division of labour between prosody and the cycle is on the right track.

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