

## Word-level affixes trigger stem-level cycles: evidence from German dorsal fricatives

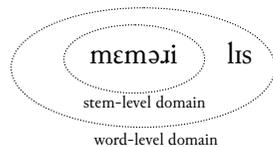
Helen Buckler & Ricardo Bermúdez-Otero  
*helen.buckler@mpi.nl*      *r.bermudez-otero@manchester.ac.uk*

### The question

In stratal-cyclic approaches to the morphology-phonology interface, there are two competing approaches to the behaviour of word-level ('class-two') suffixes:

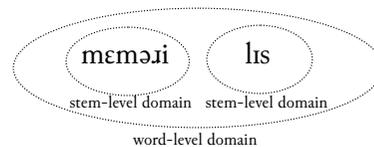
e.g. English *mémory-less*

**Option 1.** Word-level affixes do not define cyclic domains by themselves.



(Mainstream Lexical Phonology:  
e.g. Kiparsky 1982)

**Option 2.** Word-level affixes define stem-level domains by themselves.



(Mohan 1986: 17ff, Baker 2005, Buckler 2009,  
Bermúdez-Otero in prep.)

Predictions about the **phonological shape of stems and of word-level suffixes**:

**Option 1.** Relative different shapes:  
stems abide by stem-level phonotactics,  
but word-level affixes do not.

**Option 2.** Relatively similar shapes:  
stems abide by stem-level phonotactics,  
and word-level affixes do too.

☞ We argue that opacity effects involving German dorsal obstruents support **Option 2**:

German word-level suffixes like diminutive *-chen* and adjectival *-ig* behave like 'mini-stems'.

## Test case: German dorsal obstruents

**Puzzle 1:** *-chen* and the exceptions to the *ich-Laut/ach-Laut* rule

The *ich-Laut* [ç] and *ach-Laut* [x] are in near complementary distribution:

[x]	following a back vowel	[bu:x]	<i>Buch</i>	'book'
[ç]	elsewhere, i.e. following a front vowel	[ky:çə]	<i>Küche</i>	'kitchen'
	following a consonant	[mɪlç]	<i>Milch</i>	'milk'
	domain-initially	[çi:na]	<i>China</i>	'China'

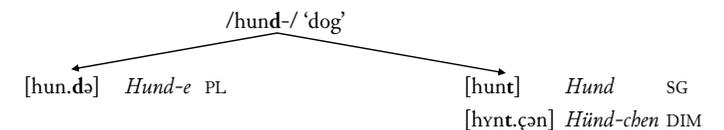
But the word-level diminutive suffix *-chen* creates exceptions in which [ç] appears after a back vowel:

<i>Kuchen</i>	'cake'	<i>Kub-chen</i>	'cow-DIM'	
[ku:xŋ]		[ku:-çən]		underapplication of dorsal fricative assimilation!

N.B. Nonetheless, the constraint banning [x] after front vowels, \*V<sub>[-back]</sub>X, remains unviolated in word-level constructions: e.g. *bru*[x] 'break(N)' - *brü*[ç]-*ig* 'breakable' (Goldrick 2000: 11-12).

**Puzzle 2:** *-ig* and the interaction of spirantization and devoicing

German voiced obstruents devoice in the coda at the word level:



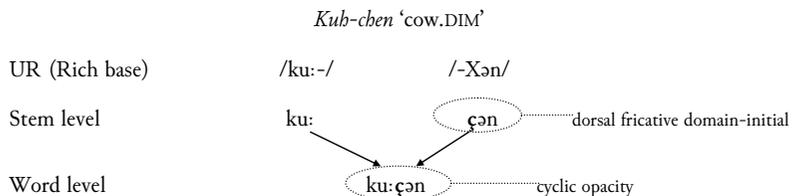
But, following the vowel /ɪ/, voiced [g] in the onset alternates with voiceless [ç] in the coda rather than with [k]:

ɪ <sub>σ</sub> g		ɪç <sub>σ</sub>			
[kø:.nɪ.ɡɪn]	<i>König-in</i>	'queen'	[kø:.nɪç]	<i>König</i>	'king'
[rau.xɪ.ɡəs]	<i>rauch-ig-es</i>	'smoky.GEN'	[rau.xɪç]	<i>rauch-ig</i>	'smoky'

N.B. • The explanation must lie in the representation of the alternating consonant in the input to the word level, since the rhyme ɪk<sub>σ</sub> is perfectly well-formed: e.g. [blɪk] *Blick* 'glimpse'.  
 • The alternation works in exactly the same way whether the relevant string belongs to a stem (e.g. *König*) or to a word-level suffix (e.g. *rauch-ig*).

**Our solution**

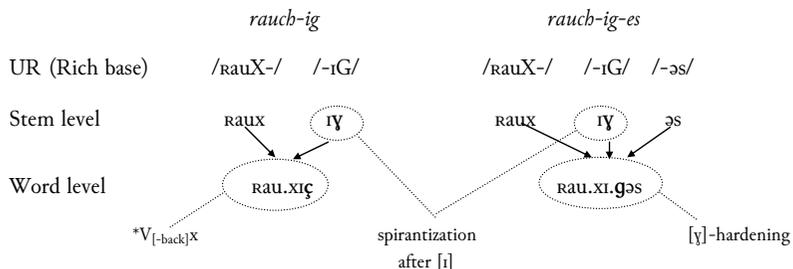
- (1) • The [ç] and [x] allophones are in perfect complementary distribution in stem-level domains.
- The word-level suffix *-chen* is always realized with [ç] because *-chen* goes through a cycle of the stem-level phonology by itself and, in this cycle, the dorsal fricative is domain-initial.



- (2) • In German, the continuancy of voiced dorsal obstruents is determined by a stem-level process:



- The stem-level representation of the final obstruent is [ɣ] both in the stem *König* and in the word-level suffix *-ig*, because both go through cycles of the stem-level phonology.
- At the word level, onset /ɣ/ hardens to [g] coda /ɣ/ devoices and fronts to [ç] after [i] because \*V<sub>[-back]X</sub> remains top-ranked.



**Stratal OT implementation (I): *-chen***

**The stem level**

- [ç] and [x] are in perfect complementary distribution within stem-level domains.
- We assume a context-free markedness constraint against [ç]: \*ç
- positional markedness constraints against [x]: \*V<sub>[-back]X</sub> (after front Vs)
- \*CX (after Cs)
- \*[x] (domain-initially)

Recall that \*V<sub>[-back]X</sub> is needed to capture the i<sub>[σg ~ içσ]</sub> alternation at the word level.

- Richness of the Base: input specifications for [back] don't matter because IDENT[back] is ranked low.

Stem Level	<i>Kuchen</i> 'cake'	*V <sub>[-back]X</sub>	*CX	*[x]	*ç	IDENT[back]
/ku:xn/	ku:çn				!	*
	ku:xn					*
/ku:çn/	ku:çn				!	*
	ku:xn					*

- The word-level suffix *-chen* goes through a stem-level cycle on its own, where the initial fricative becomes [ç] because it is domain-initial:

Stem Level	<i>-chen</i> 'DIM'	*V <sub>[-back]X</sub>	*CX	*[x]	*ç	IDENT[back]
/xən/	çən				*	*
	xən			!		*
/çən/	çən				*	*
	xən			!		*

**The word level**

At the word level, the input is no longer rich: it obeys the generalizations enforced by the stem-level phonology. Accordingly,

- IDENT[back] can be promoted above \*ç to protect the stem-level *ich-Laut* in *-chen*;
- but • IDENT[back] remains ranked below \*V<sub>[-back]X</sub>, and so stem-level i<sub>[çσ]</sub> becomes i<sub>[çσ]</sub>.

Word Level	<i>Kub-chen</i> 'cow.DIM'	*V <sub>[-back]X</sub>	IDENT[back]	*ç
ku:-çən	ku:çən			*
	ku:xən		!	*

Word Level	<i>rauch-ig</i> 'smoky'	*V <sub>[-back]X</sub>	IDENT[back]	*ç
raux-iy	rauxix	*!		
	rauxič ʔ		*	*

## Stratal OT implementation (II): *-ig*

### The stem level

- As we saw above, the stem-level hierarchy enforces the following generalization:

$$/G/ \rightarrow \begin{cases} [\gamma] & / [i] \_ \\ [g] & \text{elsewhere} \end{cases}$$

- In line with Richness of the Base, the underlying [continuant] specification of the voiced dorsal obstruent is not crucial, as IDENT[cont] is ranked low.

Stem Level	<i>-ig</i> 'y(ADJ)'	*I <sub>G</sub>	*γ	IDENT[cont]
/ig/	ig	*!		
	iy ʔ		*	*
/iγ/	ig	*!		*
	iy ʔ		*	

Stem Level	<i>Zug</i> 'train'	*I <sub>G</sub>	*γ	IDENT[cont]
/tsu:g/	tsu:g ʔ			
	tsu:γ		*!	*
/tsu:γ/	tsu:g ʔ			*
	tsu:γ		*!	

### The word level

- The devoiced realization of input [iy] becomes [ič] because \*V<sub>[-back]X</sub> ≫ IDENT[back]: see above. Hardening to [ik] is blocked because IDENT[cont] ≫ \*ç.

Word Level	<i>rauch-ig</i> 'smoky'	IDENT[cont]	*V <sub>[-back]X</sub>	IDENT[back]	*ç
raux-iy	rauxik	*!			
	rauxix		*!		
	rauxič ʔ			*	*

- However, the voiced realization does harden because \*I<sub>G</sub> is now demoted and \*γ becomes top-ranked:

Word Level	<i>rauch-ig-es</i> 'smoky-GEN'	*γ	IDENT[cont]	*I <sub>G</sub>
raux-iy-əs	rauxiyəs	*!		
	rauxigəs ʔ		*	*

## Summary and implications

### The evidence of German

Understanding the phonological behaviour of German dorsal obstruents requires that we treat the word-level suffixes of this language as '**mini-stems**', which go through a cycle of the stem-level phonology on their own:

- The initial dorsal fricative of the diminutive suffix *-chen* is realized as [ç] because it is **domain-initial at the stem level**, just like the initial fricative of the stem *China*.
- The adjectival suffix *-ig* participates in the [i<sub>σ</sub>g ~ i<sub>ç</sub>σ] alternation because its voiced dorsal obstruent is **contextually spirantized as the stem level**, just like the one in the noun stem *König*.

### Further implications

- The proposal that word-level suffixes go through separate stem-level cycles naturally accounts for languages where every suffix constitutes a **separate footing domain**:  
e.g. Ngalakgan (Baker 2005), Diyari (cf. Kager 1997, Poser 1989).
- The proposal that word-level suffixes pass through the stem level automatically correctly predicts that the **phonemic inventory of word-level suffixes** will not be a superset of the phonemic inventory of stems, *pace* McCarthy (2007: 133-34).

See Bermúdez-Otero (2007) for the role of the stem level in defining phonemic inventories.

## References

- Baker, Brett. 2005. The domain of phonological processes. In Ilana Mushin (ed.), *Proceedings of the 2004 Conference of the Australian Linguistics Society*. Published online at <http://hdl.handle.net/2123/112>.
- Bermúdez-Otero, Ricardo. 2007. Marked phonemes vs marked allophones: segment evaluation in Stratal OT. Paper presented at the workshop 'Segment inventories', 30<sup>th</sup> GLOW Colloquium, Tromsø. Available at [www.bermudez-otero.com/GLOW2007.pdf](http://www.bermudez-otero.com/GLOW2007.pdf).
- Bermúdez-Otero, Ricardo. in prep. *Stratal Optimality Theory*. Oxford: Oxford University Press.
- Buckler, Helen. 2009. *The phonology of word-level suffixes in German and Dutch*. Manchester: MA dissertation, University of Manchester.
- Goldrick, Matthew. 2000. Turbid output representations and the unity of opacity. In Masako Hirotani (ed.), *Proceedings of the 30<sup>th</sup> Annual Meeting of the North East Linguistic Society*, 231-46. Amherst, MA: GLSA, University of Massachusetts.
- Kager, René. 1997. Generalized alignment and morphological parsing. *Rivista di Linguistica* 9, 245-82.
- Kiparsky, Paul. 1982. Lexical Morphology and Phonology. In In-Seok Yang for the Linguistic Society of Korea (ed.), *Linguistics in the morning calm: selected papers from SICOL-1981*, vol. 1, 3-91. Seoul: Hanshin Publishing Company.
- McCarthy, John J. 2007. *Hidden generalizations: phonological opacity in Optimality Theory*. London: Equinox Publishing.
- Mohanan, K. P. 1986. *The theory of Lexical Phonology*. Dordrecht: Reidel.
- Poser, William. 1989. The metrical foot in Diyari. *Phonology* 6, 117-48.