Why mid vowels are not always mid vowels

Marie-Luise Popp (marie_luise.popp@uni-leipzig.de)
Leipzig University

NELS 49 Cornell University

Puzzle

Chain Shifts are phonological processes where an input element /A/ surfaces as [B] while /B/ becomes [C] in the output. However, /A/ does not surface as [C]. These instances of Counter-Feeding have been argued to be theoretically problematic since it remains unclear why /A/ can map onto [B] while /B/ shifts to [C] (cf. Neasom 2016). Well-known examples of Chain Shifts are partial height harmonies, as exemplified by Nzebi in (1). In these systems, /a/ becomes [e] and /e/ becomes [i], but /a/ does not become [i].

(1) Nzɛbi (Bantu, Gabon) (Clements 1991, Parkinson 1996, Moreton 2010, Neasom 2016)

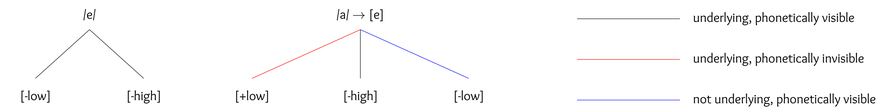
a → ɛ	salə	→ sɛli	'work'	e → i	betə	→ biti	'carry'
ɛ → e	sɛbə	→ sebi	'laugh'	o → u	βoomu	→ βuumi	'breathe'

I will show that the opacity problems posed by **Chain Shifts** can easily be analysed within Containment Theory (cf. Prince & Smolensky 1993, van Oostendorp 2003, 2006, Trommer 2011, Trommer & Zimmermann 2014). In Containment Theory, phonological features are never deleted but remain in the phonological structure. Specifically, I suggest that a shift from /a/ to [i] leads to illicit combinations of vowel features.

Proposal

In Containment (cf. Prince & Smolensky 1993, van Oostendorp 2003, 2006, Trommer 2011, Trommer & Zimmermann 2014), phonological processes never lead to the deletion of features. Rather, they make phonological elements invisible for phonetics but remain in the phonological structure. Thus, an underlying segment has a different featural specification than a derived segment.
I make use of the consequence that an underlying vowel /e/ has different features than a vowel [e] that is derived by vowel raising. While an underlying /e/ is specified as [-high, -low], a derived [e] is necessarily specified as [-high, -low, +low] since the [+low] feature of the underlying /a/ remains phonologically accessible.

Featural specifications of underlying vs. derived vowels



Furthermore, I adopt the *Cloning Hypothesis* (Trommer 2011) by assuming that there are two versions of constraints.

P-Constraints only refer to the phonological elements that are phonetically visible. marked with indexed $_P$
I-Constraints refer to all elements. marked with indexed $_I$

I suggest that the featural specification prevents derived /e/ vowels from changing into [i]. This can be obtained by a markedness constraint sensitive to all features in the candidate against the combinations of features [+low,+high] within a segment. Crucially, this constraint builds on a strong phonological basis - evidence comes from the typology of vowels inventories (Casali 2014), the patterns of phonological processes (Archangeli & Pulleyblank 1994) or the phonetic markedness of certain segments (Hall 2000).

References

Archangeli, D. B. and D. G. Pulleyblank. *Grounded phonology*. Vol. 25. MIT Press, 1994. **Casali**, R. F. 2014. *Assimilation, markedness and inventory structure in tongueroot harmony systems*. **Clements**, G.N. 1991. Vowel height assimilation in Bantu languages. In *Annual meeting of the Berkeley linguistics society*, Vol. 17, No. 2, pp. 25–64. **Clopper**, C. G. 2001. The Nzema Verbal Phrase: An Optimality Theoretic Account. *IULC Working Papers*, 1(1). **Hall**, T. A. *Phonologie*. De Gruyter, 2000. **Harris**, J. and G. Lindsey. 1995. The elements of phonological representation. *Frontiers of phonology: atoms, structures, derivations*, 34-79. **Kirchner**, R. 1996. Synchronic chain shifts in Optimality Theory. *Linguistic Inquiry*, 27(2), 341-350. **Moreton**, E. 2010. *A compendium of synchronic chain shifts*. Ms., Chapel Hill, NC: University of North Carolina Chapel Hill. **Neasom**, N. C. 2016. *Against synchronic chain shifting*. Doctoral dissertation, UCL. **Parkinson**, F. B. 1996. *The representation of vowel height in phonology*. Doctoral dissertation, The Ohio State University. **Prince**, A. & P. Smolensky. 1993. *Optimality Theory: Constraint Interaction in Generative Grammar*. Rutgers University Center for Cognitive Science Technical Report 2. **Trommer**, J. 2011. *Phonological aspects of Western Nilotic mutation morphology*. Habilitation dissertation, Leipzig University. **Trommer**, J., & E. Zimmermann. 2014. Generalised mora affixation and quantity-manipulating morphology. *Phonology*, 31(3), 463-510. **van Oostendorp**, M. (2003). Comparative markedness and containment. *Theoretical linguistics*, 29(1-2), 65-75. **van Oostendorp**, M. 2006. *A theory of morphosyntactic colours*. Ms., Meertens Institute, Amsterdam.

Derivations

The tableau in (2) shows how this can be modelled in OT. Raising is driven by two harmony constraints, necessarily ranked higher than the respective faithfulness constraints. However, the constraint *[+low,+high]$_I$ rules out [i] as it penalizes a combination of a +low and +high feature on a single vowel and exactly such a combination arises if an underlyingly low vowel is raised to a high vowel.

1. *[+LOW,+HIGH]$_I$ Avoid [+low,+high] vowels.
2. *[+LOW,+ATR]$_I$ Avoid [+low,+ATR] vowels.
3. *[+HIGH,-ATR]$_I$ Avoid [+high,-ATR] vowels.
4. [FAITH]$_F$ Do not make features of [±F] phonetically invisible.
5. [HARMONY]$_F$ Avoid contradictory features of [±F].

Independent evidence!

Crucially, candidate (e.) in (2) is optimal with respect to the harmony constraints but violates the high-ranked markedness constraints. The faithfulness constraints are never decisive.

(2) Nzɛbi, a → ɛ

/a/ - [+high, -low, +ATR]	*[+LOW,+HIGH]$_I$	*[+LOW,+ATR]$_I$	*[+HIGH,-ATR]$_I$	[HARMONY]$_{HIGH}$	[HARMONY]$_{LOW}$	[HARMONY]$_{ATR}$	[FAITH]$_I$
a. a[-high,+low,-ATR]				*	*	*	
b. ☞ ɛ[-high,+low,-ATR,-low]				*		*	*!
c. e[-high,+low,-ATR,-low,+ATR]		*!		*			**
d. ɪ[-high,+low,-ATR,+high,-low]	*!		*!			*	**
e. i[-high,+low,-ATR,+high,-low,+ATR]	*!	*!	*!				***

(3) Nzɛbi, ɛ → e

/ɛ/ - [+high, -low, +ATR]	*[+LOW,+HIGH]$_I$	*[+LOW,+ATR]$_I$	*[+HIGH,-ATR]$_I$	[HARMONY]$_{HIGH}$	[HARMONY]$_{LOW}$	[HARMONY]$_{ATR}$	[FAITH]$_I$
a. ɛ[-high,-low,-ATR]				*		*!	
b. ☞ e[-high,-low,-ATR,+ATR]				*			*
c. ɪ[-high,-low,-ATR,+high]			*!			*	*
d. i[-high,-ATR,-low,+high,+ATR]			*!				**

(4) Nzɛbi, e → i

/e/ - [+high, -low, +ATR]	*[+LOW,+HIGH]$_I$	*[+LOW,+ATR]$_I$	*[+HIGH,-ATR]$_I$	[HARMONY]$_{HIGH}$	[HARMONY]$_{LOW}$	[HARMONY]$_{ATR}$	[FAITH]$_I$
a. e[-high,-low,+ATR]				*!			
b. ɪ[-high,-low,+ATR,+high,-ATR]			*!			*	**
c. ☞ i[-high,-low,+ATR,+high]							*

Discussion

- Less powerful than approaches using Constraint Conjunction (Kirchner 1996)
- Can be applied to other Chain Shifts, e.g. partial sonorization in Nzema, see (5)
- Independent from the vowel feature system, can easily be applied to Element Theory (Harris & Lindsey 1995)

(5) Nzema (Niger-Congo, Ghana) (Clopper 2001, Moreton 2010, Neasom 2016)

t → d	tia	→ on-dia	'he does not walk'
d → n	di	→ on-ni	'he does not eat'

I have analysed the opacity problem posed by partial height harmonies within Containment Theory. Concretely, I have shown that phonetic markedness constraints that can make reference to both input and output prevent shifts from /a/ to [i].