Why and how not to counterbleed

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Summary. Counterbleeding orders between vowel epenthesis and voicing assimilation are unattested. We show that this typological fact follows from a combination of independent hypotheses within Optimality Theory (Prince & Smolensky 1993/2004), concerning (i) the perceptual basis of faithfulness constraints (Steriade 1997), (ii) the solution to the 'too-many-solutions' problem (de Lacy 2006), and (iii) the account of opacity (McCarthy 2007).

Background. Kenstowicz & Kisseberth (1971) identify a class of diachronically stable bleeding orders. A prominent member of this class is the bleeding interaction between vowel epenthesis and voicing assimilation in languages like English, Lithuanian, and Polish (see also Baković 2005, 2007; Pająk 2007, 2008): epenthesis applies between near-identical consonants (1), and assimilation applies otherwise (2). A counterbleeding order between vowel epenthesis and voicing assimilation is not attested in any language. Kiparsky's (1971, 1973) opacity hypothesis claims that at most such unattested cases are hard to learn; there is no formal distinction made between these and other, relatively common cases of counterbleeding.

(1) *Epenthesis bleeds assimilation: (a) English, (b) Lithuanian, (c) Polish*

UR	a.	/siːt+d/	b.	/at+duotʲi/	c.	/z+skɑwɔ̃/	
EPEN.		siːt+əd		atʲi+duotʲi		zɛ+skɑwɔ̃	
ASSIM.		*—bled—*		*—bled—*		*—bled—*	
SR		[siːt+əd] 'seated'		[atʲi+duotʲi] 'give back'		[zɛ+skɑwɔ̃] 'w/ a rock'	

(2) *Assimilation applies when epenthesis does not*

UR	a.	/siːs+d/	b.	/at+gautʲi/	c.	/z+kfɑsɛm/	
EPEN.		*—n/a—*		*—n/a—*		*—n/a—*	
ASSIM.		siːs+t		ad+gautʲi		s+kfɑsɛm	
SR		[siːs+t] 'ceased'		[ad+gautʲi] 'get back'		[s+kfɑsɛm] 'w/ acid'	

Assumptions. We argue that the typological absence of counterbleeding orders between epenthesis and assimilation follows from a combination of hypotheses from three independent strands of research in Optimality Theory, as outlined below.

i. *Perceptibility.* Steriade (1997) notes that voicing disagreement is only ever resolved by assimilation, never by epenthesis or deletion (see also Lombardi 2001). Steriade's explanation is that less perceptible repairs of marked sequences are preferred: a voicing contrast is difficult to perceive in e.g. the positions that undergo assimilation in (2) (VC$\underline{\text{C}}$#, V$\underline{\text{C}}$CV, #$\underline{\text{C}}$CCV), making assimilation the least perceptible possible change to avoid voicing disagreement.

ii. *'Too many solutions.'* If DEP ('no epenthesis'), MAX ('no deletion'), and IDENT(voi) ('no voicing changes') are independent and independently rankable constraints in OT, then the lowest-ranked of the three will determine the preferred resolution of voicing disagreement. Two ways to guarantee the preference for assimilation are (a) to rank these faithfulness constraints universally (i.e., {DEP, MAX} $\gg$ IDENT(voi)), much as Steriade (1997) proposes, or (b) to state these constraints such that they are in a stringency relation, as in de Lacy (2006), with violations of IDENT(voi) entailing violations of DEP/MAX but not vice-versa.

iii. *Opacity.* McCarthy's (2007) "candidate chain" (OT-CC) approach to the analysis of opacity in OT involves three crucial assumptions: (a) that candidates are chains composed of

links from input to output, with each link being at most one harmonically-improving change from the previous one; (b) that there is a special class of opacity-facilitating PREC(A, B) constraints, violated by candidate chains in which violations of a faithfulness constraint B are either followed by or not preceded by violations of another faithfulness constraint A; and (c) the universal ranking B ≫ PREC(A, B) for all faithfulness constraints B.

Proposal. We follow Baković's (2005) analysis of the interaction between epenthesis and assimilation; AGREE(voi) penalizes the faithful, unassimilated candidate and NOGEM penalizes the geminate outcome of assimilation between near-identical consonants. The tableau in (3) shows how counterbleeding between epenthesis and assimilation is possible in OT-CC under the assumption that DEP and IDENT(voi) are independent constraints.

(3) *Possibility of counterbleeding between epenthesis and assimilation*

Input: /z+s/	NOGEM	AGR(voi)	DEP	PREC(I(v), DEP)	ID(voi)	*comment*
a. z+s		* !				*faithful*
b. s+s	* !				*	*assimilation*
c. zɛ+s			*	* !		*epenthesis*
d. ☹ sɛ+s			*		*	*assim>epen*

The tableau in (4), on the other hand, demonstrates the impossibility of counterbleeding when the faithfulness constraints are instead perceptually defined and in a stringency relation. IDENT(voi) is replaced by 1-FAITH, which is violated equally by any change: assimilation, epenthesis, or both. DEP is replaced by 2-FAITH, which is violated gradiently depending on the extent of the perceptibility of the change: once for assimilation, twice for epenthesis, and thrice for both. Counterbleeding is in this case impossible because 2-FAITH universally dominates PREC(1-FAITH, 2-FAITH), the would-be facilitator of opacity.

(4) *Impossibility of counterbleeding between epenthesis and assimilation*

Input: /z+s/	NOGEM	AGR(voi)	2-FTH	PREC(1-F, 2-F)	1-FTH	*comment*
a. z+s		* !				*faithful*
b. s+s	* !		*		*	*assimilation*
c. ☞ zɛ+s			**	*	*	*epenthesis*
d. sɛ+s			*** !		*	*assim>epen*

Our prediction is thus that a counterbleeding candidate can only be optimal when the two changes involved are together somehow equally or less perceptible than the single change in the corresponding bleeding candidate. This indeed appears to be the case in a substantial class of commonly attested cases of counterbleeding. For example, assimilation + deletion (as in nasal substitution /ŋp/ → *mp* → [*m*]) is arguably a less perceptible change than deletion alone (/ŋp/ → [ŋ]), because assimilation makes the deleted element recoverable.