Asymmetries between assimilation and epenthesis

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Introduction

1. In Optimality Theory, all processes are motivated by a single set of markedness constraints so the typologies of different types of processes should converge in identifying the same configurations as marked.

2. The typologies of place and voice assimilation appear to be inconsistent with the typology of vowel epenthesis:
   - Consonant clusters that are prone to elimination by assimilation are not specifically targeted by epenthesis although epenthesis could also eliminate these clusters.
     - E.g. nasals are particularly prone to assimilation to major place of following stops, but vowel epenthesis never specifically targets nasal-stop clusters.
   - Epenthesis targets obstruent-sonorant clusters, which appear unmarked based on assimilation, sonority sequencing, etc.

3. Analysis:
   - In each case the clusters are marked because they are insufficiently perceptually distinct.
   - The different repairs – assimilation vs. epenthesis – result from a preference to repair indistinct contrasts by neutralizing the contrast.

Apparent mismatches between assimilation and epenthesis

<u>Major place assimilation</u>

4. Major place assimilation.
   - In VC_1C_2V, C_1 may assimilate in place to C_2 (neutralizing place contrasts in C_1 position).
   - Implicational universal: if stops in C_1 are targets of assimilation, then so are nasals (Jun 1995, Mohanon 1993).

5. Examples:
   - Malayalam (Mohanon and Mohanon 1984)
     - Nasals undergo assimilation:

/peɳ-kuʈʈi/	peŋkuʈʈi	'girl (female child)'	cf. peɳɳə	'female'
/miin-tʃan̪t̪a/	miin̠tʃan̪t̪a	'fish market'	cf. miin	'fish'

     - Stops do not undergo assimilation:

ut̪karʂam	'progress'
sapt̪am	'eight'

   - Korean (Jun 1995) – stops and nasals undergo assimilation:

/mit-ko/	[mikko]	'believe and'
/ip-ko/	[ikko]	'wear and'
/cinan-pam/	[cinampam]	'last night'
/nam-kɨk/	[naŋkɨk]	'the South Pole'

   - No language in which stops assimilate but nasals do not.

6. This implicational universal shows that heterorganic nasal-C clusters are more marked than heterorganic stop-C clusters.
   - Analysis in terms of constraints on sequences: A fixed ranking:
     AGREEPLACE(NC) >> AGREEPLACE(TC)

7. AGREEPLACE could also be satisfied by vowel epenthesis.
   - Assuming ranking in (7) (or similar), we should find parallel typology of epenthesis environments: epenthesis into stop-C clusters should imply epenthesis into nasal-C clusters.
   - E.g. epenthesis breaks up heterorganic nasal-stop clusters, but not heterorganic stop-stop clusters.
     - AGREEPLACE(NC), IDENT(place) >> DEPV >> AGREEPLACE(TC)
       /anba/ → [anəba] but: /atpa/ → [atpa]
   - This pattern is unattested.

8. Other implicational universals of place assimilation described by Jun and Mohanon lack parallel patterns of epenthesis.
   - E.g. If non-coronal stops are targets of place assimilation then so are coronals.
   - No corresponding pattern of vowel epenthesis: epenthesis into C_1C_2 clusters where C_1 is coronal, but no epenthesis into clusters where C_1 is non-coronal.
     /at-ka/ → [atəka] but: /ap-ka/ → [apka]

<u>Obstruent voicing assimilation</u>

9. Obstruent voicing assimilation:
   - In VC_1C_2V, where C_1, C_2 are obstruents, C_1 commonly assimilates in voicing to C_2.
     - Implies that mixed voicing clusters are more marked than clusters with uniform voicing.
     - Sequence markedness analysis: AGREE(voice) constraint.

- Mixed voicing obstruent clusters could be repaired by epenthesis, but this pattern is not attested (Myers 2002, Steriade 2001).
  - /ab-ka/→ [abəka]   but: /ap-ka/ → [apka]

10. Summary: Vowel epenthesis is not employed as a repair for clusters that are identified as marked based on the typology of assimilation processes.

Epenthesis into obstruent-sonorant clusters

11. Dorsey's Law, e.g. Winnebago (Miner 1978. 1990, 1993)
    - Copy vowel is inserted into obstruent-sonorant sequences:

/pras/	parás	'flat'
/knak/	kãnã́k	'put something not having length'
/hakwe/	hakewé	'six'
/hipres/	hiperés	'know'
/sni/	sĩnĩ́	'cold'
/ʃ+ruxruk/	ʃuruxúruk	'you earn'

- No epenthesis in obstruent-obstruent clusters

psĩ́ipsĩ́tʃ	'awkward'	kdʒée	'revenge'
ratʃgã́	'to drink'	skáa	'white'
xdʒaːnã́ne	'yesterday'	xgããsák	'energetic'
ksáatʃ	'stiff'	pʃoopʃótʃ	'fine'

  - Clusters transcribed as voiceless-voiced are probably voiceless-voiceless unaspirated.
- Similar pattern in Late Latin: Epenthesis into obstruent+liquid clusters (Steriade 1990).

12. Obstruent-Sonorant clusters are generally regarded as relatively unmarked clusters:
    - Obstruent-liquid clusters are less prone to place assimilation.
    - Obs+son clusters are less marked from a sonority sequencing perspective.
      - Syllable contact cannot explain epenthesis into initial clusters.
    - Obstruent+liquid clusters are among the most common initial clusters cross-linguistically, obstruent-obstruent clusters (other than s-stop) are rare (Greenberg 1978).

Analysis

13. In all of these processes the affected clusters are involved in marked contrasts – i.e. contrasts that are insufficiently perceptually distinct.
    - Nasal place contrasts are relatively indistinct in –NT- clusters.
    - Obstruent voicing contrasts are relatively indistinct preceding obstruents.
    - Vowel-∅ contrasts are less distinct in Obs_Son than in Obs_Obs.
  - In each, case the indistinct contrast is repaired by neutralization.
    - Results in assimilation in –NT- clusters, but vowel epenthesis where a V-∅ contrast is neutralized in favor of the vowel.
    - Follows from a preference for repairs to involve perceptually minimal changes (P-map hypothesis, Steriade 2001) – neutralization of an indistinct contrast is necessarily a minimal change.

Distinctiveness of V-∅ contrasts: C_1C_2 vs. C_1VC_2

14. Similarity between V and ∅ depends on context.
    - E.g. the acceptability of epenthesis as a repair for illicit onset clusters in loanword adaptation depends on the perceptual similarity of the source cluster, C_1C_2, to the output of epenthesis, C_1VC_2 (Fleischhacker 2005).
    - Hierarchy of susceptibility of initial clusters to epenthesis in loanword adaptation (Fleischhacker 2005)

      TL > SL > SN > ST

      (L = liquid, N = nasal, S = sibilant, T = stop)
      - TL - TVL are more similar than ST – SVT.
    - Generalization that covers these data (and more): a cluster is more susceptible to vowel epenthesis if it contains a larger sonority rise (Steriade 2006)
    - Steriade's analysis: vowel epenthesis introduces a sonority rise following C_1. This is a smaller change if there is a similar sonority rise following C_1 in C_1C_2.
      - kl → kil: Large sonority rise (kl) replaced by slightly larger (ki) (small change).
      - st → sit: Sonority fall (st) replaced by large sonority rise (si) (v. large change).

15. This has implications for the distinctiveness of V-∅ contrasts: if C_1C_2 and C_1VC_2 are more similar, then the V-∅ contrast is less distinct in that $C_1\_C_2$ context.
    - So V-∅ contrasts are less distinct in Obs_Son than in Obs_Obs
    - Neutralization of V-∅ contrast in Obs_Son results in V epenthesis in this context.

Implementation

16. Preference for perceptually distinct contrasts is implemented in terms of a ranked set of constraints requiring a specified minimum perceptual distance between contrasting sounds (Flemming 2002, 2004).

    MINDIST = F2:1 >> MINDIST = F2:2 >>... >> MINDIST = F2:4

    - Distances are specified along perceptual dimensions such as formant frequencies, VOT, etc.

17. C_1C_2 - C_1VC_2 contrasts must satisfy MINDIST constraints on difference in sonority rise.

▪ Assume the following sonority scale:

5	Vowel
4	Liquid
3	Nasal
2	Fricative
1	Stop

▪ The Sonority Rise of a segment is the difference in sonority between that segment and the following segment.

	C_1C_2	Rise	C_1V	Rise	Distance
	pra	3	**pa**ra	4	1
epenthesis	**sr**a	2	**sa**ra	3	1
	sni	1	**si**ni	3	2
no	**ps**i	1	**pi**si	4	3
epenthesis	**ktʃ**e	0	**ke**tʃe	4	4

18. MINDIST constraints evaluate difference in Sonority Rise between C_1C_2 and C_1V

▪ MINDIST = SonRise:2 >> MINDIST = SonRise:3 >> MINDIST = SonRise:4 …

▪ In Winnebago, a minimum difference in SonRise of 3 between C_1C_2 and C_1V is required for an acceptable V-∅ contrast.

19. Potential distinctiveness violations can be avoided by neutralizing the contrast.

▪ Neutralization incurs violation of Correspondence constraints.

▪ Magnitude of violation depends on the perceptual magnitude of the difference between input and output, measured in the same terms as perceptual distinctiveness (P-map).

▪ IDENT(SonRise)<*n*: The differences in Sonority Rise between corresponding Input and Output consonants is less than *n*.

20. Neutralization of V-∅ contrast in Obs_Son (Winnebago):

▪ MINDIST = SonRise:3 >> IDENT(SonRise)<2

i.

	pra, para	IDENT(Son Rise)<3	MINDIST = SonRise:3	IDENT(Son Rise)<2	MINDIST = SonRise:4
a.	pra, para		*!		*
b.	(☞) pra				
c.	☞ para				

ii.

	sni, sini	IDENT(Son Rise)<3	MINDIST = SonRise:3	IDENT(Son Rise)<2	MINDIST = SonRise:4
a.	sni, sini		*!		*
b.	(☞) sni			*(3→1)	
c.	☞ sini			*(3→1)	

iii.

	psi, pisi	IDENT(Son Rise)<3	MINDIST = SonRise:3	IDENT(Son Rise)<2	MINDIST = SonRise:4
a.	☞ psi, pisi				*
b.	psi	*! (4→1)		* (4→1)	
c.	pisi	*!(1→4)		*(1→4)	

21. The preference for epenthesis over deletion as the outcome of neutralization derives from other constraints. Distinctiveness of C_1 place contrasts is greater since the following vowel allows for the realization of release formant transition cues (required by MINDIST = {rel trans}).

	pra_1, $para_2$, kra_3, $kara_4$	MINDIST = SonRise:3	IDENT(Son Rise)<2	MINDIST = SonRise:4	MINDIST = {rel trans}
a.	pra, para, kra, kara	*!		*	*
b.	$pra_{1,2}$, $kra_{3,4}$				*!
c.	☞ $para_{1,2}$, $kara_{3,4}$				

▪ There is a dispreference for contrast between Obs-Son and Obs-V-Son, not simply a constraint against Obs-Son clusters - in other cases neutralization yields a cluster:

▪ English schwa deletion applies primarily in Obs_Son contexts (Bybee 1978)

▪ Dutch schwa deletion applies most frequently in Obs_Liquid contexts (Booij 1995).

<u>Voicing assimilation</u>

22. Place and voicing assimilation also fundamentally involve neutralization of insufficiently distinct contrasts (Jun 2004, Steriade 1997).

23. A key cue to obstruent voicing is Voice Onset Time.

▪ VOT cues are not available in pre-obstruent position, so this is a common context of neutralization (Steriade 1997).

▪ Neutralization of obstruent voicing results in assimilation to the following obstruent because this is the least effort realization of the neutralized consonant.

▪ *[+voice, -son] – for aerodynamic reasons, voicing is difficult to sustain during an obstruent (e.g. Ohala & Riordan 1979).

- *TD: *[-voice][+voice, -son] - due to hysteresis effects it is easier to maintain voicing from a sonorant into a following obstruent than it is to initiate voicing during an obstruent following a voiceless sound (Westbury and Keating 1986).
- Fixed ranking: *TD >> *[+voice,-son]

	dV	tV	d̚	t̚
VOT:	0	1	n/a	n/a
closure voice:	1	0	1	0

i.

	apka, abka	MINDIST = VOT:1	IDENT (clo voice)	*TD	*[+voice, -son]
a.	ap̚ka, ab̚ka	*			
b.	☞ ap̚ka		*		
c.	ab̚ka		*		*!

ii.

	apga, abga	MINDIST = VOT:1	IDENT (clo voice)	*TD	*[+voice, -son]
a.	ap̚ga, ab̚ga	*!			
b.	ap̚ga		*	*!	
c.	☞ ab̚ga		*		

24. An analysis of voice assimilation based on distinctiveness constraints captures the fact that neutralization of obstruent voicing contrasts in final position implies neutralization before obstruents, but not vice versa (Lombardi 1991, Steriade 1997).
    - Voice contrasts are more distinct in final position than before obstruents because cues from release burst are available in final position.
    - AGREE(voice) cannot motivate final voicing neutralization.

25. Vowel epenthesis (/ab-ka/→ [abəka]) would also satisfy MINDIST = VOT:1 since the epenthesized vowel would allow for the realization of VOT cues.
    - This repair is not attested.
    - The attested repair involves neutralizing the insufficiently distinct contrast, as in Winnebago.
    - Steriade's (2001) P-map analysis: the perceptually minimal repair for the indistinct contrast is preferred, i.e. violation of the lowest ranked Correspondence constraint.
        - perceptual difference between voiced and voiceless obstruents is small before obstruents – hence the MINDIST violation – whereas vowel epenthesis between obstruents is perceptually salient
        - IDENT(SonRise)<3 >> IDENT(clo voice)

	apga, abga	IDENT(Son Rise)<3	MINDIST = VOT:1	IDENT (clo voice)	*TD
a.	ap̚ga, ab̚ga		*!		
b.	apəga, abga	*!			
c.	☞ ab̚ga			*	

<u>Major place assimilation</u>

26. Assimilation is a side-effect of neutralization of place contrasts where they are insufficiently distinct – the least effort realization of the neutralized consonant takes the place of articulation of a following consonant (Jun 2004).

27. Oral stop assimilation implies nasal stop assimilation in clusters because nasal place contrasts are less distinct in this context (Jun 2004).
    - The main cues to place in pre-C context lie in the closure formant transitions.
    - Anticipatory nasalization affects the distinctiveness of formant transitions before nasals (cf. Wright 1980 on effects of nasalization on vowel quality contrasts).
    - Nasal murmur can also provide cues to place, but these cues are easily masked in normal speaking conditions (Malécot 1956, Johnson 2003:160).
    - Distinctiveness: oral closure transitions > nasalized closure transitions

    MINDIST = {nas closure transitions} >> MINDIST = {oral closure transitions}
    IDENT{oral closure transitions} >> IDENT{nas closure transitions}

    - Nasals assimilate (i), stops do not (ii):

i.

	anba, amba	MINDIST = {nas clos. transitions}	IDENT {oral clos transitions}	MINDIST = {oral clos transitions}	IDENT {nas clos transitions}	*GESTURE
a.	anba, amba			*!		***
b.	anba				*	**!
c.	☞ amba				*	*

ii.

	adba, abba	MINDIST = {nas clos transitions}	IDENT {oral clos transitions}	MINDIST = {oral clos transitions}	IDENT {nas clos transitions}	*GESTURE
a.	☞adba, abba			*		***
b.	adba		*!		*	**
c.	abba		*!		*	*

28. Analysis based on distinctiveness constraints can capture the fact that nasal place neutralization in final position implies neutralization before obstruents, but not vice versa (De Lacey 2001).

- Closure transitions of final post-vocalic consonants are more distinct than closure transitions in pre-C position because they are unaffected by overlap with the following consonants (Byrd 1992, Surprenant & Goldstein 1998, Dilley & Pitt 2007, Gow 2003).

29. Vowel epenthesis would also satisfy MINDIST={oral clos. trans} since it would allow for the realization of release formant transitions which are more distinctive than closure transitions (Fujimura et al 1978, Redford and Diehl 1999), but epenthesis in nasal-stop clusters only is unattested.
    - Again the attested repair is neutralization of the insufficiently distinct contrast.
    - Epenthesis of a vowel into an NT cluster would be a substantial faithfulness violation since sonority is falling in a NT cluster.
        - *SONORITYREVERSAL: An sonority fall must not correspond to a sonority rise (after Steriade 2006).
        - *SONORITYREVERSAL >> IDENT{overlapped nas clo trans}

Summary

30. The problem:
    - In principle vowel epenthesis should be able to serve as an alternative repair for marked clusters that are regularly repaired by assimilation.
    - But we do not find the parallel typologies of epenthesis and assimilation that are expected if epenthesis and assimilation were alternative repairs.
        - Clusters that are prone to assimilation are not prone to vowel epenthesis.
        - Epenthesis does target obstruent-sonorant clusters, which appear relatively unmarked.

    The solution:
    - All of these processes involve elimination of perceptually indistinct contrasts.
        - Nasal place contrasts are relatively indistinct in –NT- clusters.
        - Obstruent voicing contrasts are relatively indistinct preceding obstruents.
        - Vowel-∅ contrasts are less distinct in Obs_Son than in Obs_Obs.
    - In each case the indistinct contrast is repaired by neutralization.
        - Results in assimilation in –NT- clusters, but vowel epenthesis where a V-∅ contrast is neutralized in favor of the vowel.
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