Just enough solutions

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Main claim: A well known criticism of Optimality Theory (OT, Prince and Smolensky 1993, 2004) is known as the *too-many-solutions* or *too-many-repairs* (TMR) problem (e.g. Steriade 2001, Blumenfeld 2006). An instance of the TMR problem is final devoicing, or better, the alleged absence of other repairs for (syllable-)final voiced obstruents (Steriade 2001, Van Oostendorp 2007). I show with so-far overlooked data from Heligoland Frisian (Germanic, Borchert et al. 1987) and Southeastern Tepehuán (Uto-Aztecan, Willett 1991) that languages may indeed choose how to repair this marked structure and that the prediction of OT is thus borne out. **Data:** Heligoland Frisian does not allow voiced coda obstruents. However, underlying voiced coda obstruents are not necessarily devoiced, but undergo a range of different processes depending on their place and manner of articulation: the coronal and the velar stop, /d/ and /g/, are deleted at the end of a syllable, but they re-appear in front of the affixes like PL {-n̩~ən}, see (1) and (2).

(1) a. /slɛd/ → slɛ 'sled'
b. /slɛd-n/ → slɛdn̩ 'sleds'
(Borchert et al. 1987, p.156)

(2) a. /sɨrɪg/ → sɨrɪ 'sorrow'
b. /sɨrɪg-n/ → sɨrɪgən 'sorrows'
(Borchert et al. 1987, p.155)

The only voiced fricative of Heligoland Frisian, /v/, is not deleted but either fused with the preceding schwa vowel to form [ʊ] or sonorised to a glide [w] elsewhere (3).

(3) a. /liːv/ → liːw 'oystercatcher' (Borchert et al. 1987, p. 38)
b. /liːv-n/ → liːvən 'oystercatchers' (Borchert et al. 1987, p.38)

(4) a. /kʊb/ → kʊp 'seagull' (Borchert et al. 1987, p. 38)
b. /kʊb-n/ → kʊbm̩ 'seagulls' (Borchert et al. 1987, p.38)

However, the typologically common final devoicing is also found in the language: the voiced bilabial stop /b/ devoices to [p] syllable finally (4). Deletion and sonorisation target voiced obstruents only, they are thus not an instance of a general process of final lenition. Examples in (5) show that voiceless obstruents always surface faithfully in syllable final position.

(5) a. /fɨrɪt/ → fɨrɪt 'murre chick' (Borchert et al. 1987, p. 149)
b. /miːsk/ → miːsk 'kittiwake' (Borchert et al. 1987, p. 38)
a. /vɨf/ → vɨf 'woman' (Borchert et al. 1987, p. 10)

Southeastern Tepehuán employs yet another strategy to avoid syllable-final voiced obstruents: In coda position, voiced obstruent stops become pre-glottalised nasals, see (6) to (8).

(6) a. /kaib/ → kaiˀm 'it ripened' (Willett 1991, p. 17)
b. /kaib-aʔ/ → kaibaʔ 'it will ripen' (Willett 1991, p. 17)

(7) a. /duːd/ → duːˀn 'it rained' (Willett 1991, p. 17)
b. /duːd-uʔ/ → duːduʔ 'it will rain' (Willett 1991, p. 17)

(8) a. /baiɟ/ → baiˀɲ 's/he cooked' (Willett 1991, p. 17)
b. /baiɟ-aʔ/ → baiɟaʔ 's/he will cook' (Willett 1991, p. 17)

Like in Heligoland Frisian, /v/ is the only voiced fricative of Southeastern Tepehuán and shows a behaviour differing from the stops, as it devoices (9).

(9) a. /viv/ → vif 'tobacco' (Willett 1991, p. 14)

Analysis: The gist of the analysis is straightforward and follows from the core principles of OT. A triggering markedness constraint, in this case *D# against final voiced obstruents, is highly ranked. The repair the language chooses depends on the relative ranking of (mainly) faithfulness constraints. A language in which ID[voice] is lowly ranked will result in devoicing, while a language with low ranked MAX prefers deletion (Heligoland Frisian) and a language with low ranked ID[±nas] – nasalisation (Southeastern Tepehuán, ignoring the glottalisation). The case of Heligoland Frisian is actually more complicated, since it chooses among three repairs: deletion, sonorisation and devoicing. I argue that the preferred repair is to sonorise the obstruent, ID[±son] is thus the lowest ranked relevant constraint (10).

(10)

li:v		*D#	ID [±vc]	MAX	ID [±son]
a.	li:v	*!			
b.	li:			*!	
☞ c.	li:w				*
d.	li:f		*!		

(11)

slɛd		*D#	*r#	ID [±vc]	MAX	ID [±son]
a.	slɛd	*!				
☞ b.	slɛ				*	
c.	slɛr		*!			*
d.	slɛt			*!		

For underlying /d/ and /g/ , sonorisation is not an option. First, there is no velar sonorant in the language, a high ranked constraint against one is thus needed independently. The sonorant counterpart of the coronal is the trill /r/. However, the rhotic is – like in many Germanic languages – banned from coda position. Sonorisation of /d/ therefore does not improve the violation profile. Deletion is illustrated for /d/ in (11), the derivation for /g/ is parallel. In an analogous fashion, /v/→[f] in Southeastern Tepehuán can easily be accounted for as last resort devoicing due to a constraint against nasal continuants. A reasoning along these lines cannot be extended to the devoicing of /b/ in Heligoland Frisian, see derivation in (12), since [w] is a possible coda in the language. Nonetheless, we know from another process that the voiced labial stop is more resistant than the velar and coronal one: Optional intervocalic lenition targets /d/ and /g/ but not /b/ (12-e,f). A constraint like ID[±cnt]/LAB that penalises changes in the continuancy of labials is thus independently motivated. In order to rule out deletion, yet another faithfulness constraint relativised to labials is needed, MAX-LAB (Barlow 1997). With sonorisation and deletion being blocked by labial faithfulness, the candidate with devoicing results as optimal.

(12)

kʊb		*D#	MAX LAB	ID[±cnt] LAB	ID [±vc]	MAX	ID [±son]
a.	kʊb	*!					
b.	kʊ		*!			*	
c.	kʊw			*!			*
☞ d.	kʊp				*		

(13)

a.	bədəl ~ bərəl	‘bottle’
b.	hɔgələ ~ hɔɣələ	‘to angle’
c.	dɔbə *dɔvə	‘to snooze’

Summary: The claim that devoicing is the only possible repair for marked syllable final obstruents turns out to be due to the lack of data. In fact, various repairs for this marked structure are attested, even in a single language, see the scheme in (14). Classical OT predicts these repairs and can derive them without further assumptions. Restrictions on the phonological component that serve to exclude such repairs – like P-Map (Steriade 2001) or Van Oostendorp’s (2007) approach to assume representations with which deletion, lenition and nasalisation will always be harmonically bounded by devoicing – are therefore an unnecessary enrichment of the theory. However, it does not derive why one repair, devoicing, is typologically so much more frequent than the other strategies. A different question is whether this difference in frequency should be accounted for by phonology or rather by diachrony or learning (eg. Blevins 2004, Ohala 1993).

(14)

Repair		Language
Devoicing	/tab/→[tap]	Dutch, Polish, Turkish...
Deletion	/tab/→[ta]	Heligoland Frisian
Lenition	/tav/→[taw]	Heligoland Frisian
Nasalisation	/tab/→[tam]	Southeastern Tepehuán
Epenthesis	/tab/→[tabə]	Buggenhout Dutch (potentially, Van Oostendorp 2007)

Selected references: Barlow, Jessica A. 1997. *A constraint-based account of syllable onsets: evidence from developing systems*. Doctoral dissertation, Indiana University•Blevins, Juliette. 2004. *Evolutionary phonology: The emergence of sound patterns*: Cambridge University Press•Blumenfeld, Lev. 2006. *Constraints on phonological interactions*. Doctoral Dissertation, Stanford University.•Borchert, Mina, Ritva Århammar & Nils Århammar. 1987. *Wi Lear Halunder*:Förderverein Museum Helgoland•Ohala, John J. 1993. The phonetics of sound change. In *Historical linguistics: Problems and perspectives*:Longman•Steriade, Donca. 2001. The phonology of perceptibility effects: The p-map and its consequences for constraint organization. Ms., UCLA•Van Oostendorp, Marc. 2007. Restricting repairs.Ms., Meertens Institute •Willett, Thomas L. 1991. *A reference grammar of Southeastern Tepehuan*: SIL