Evaluating Strict Domination: The Typological Consequences of Weighted Constraints

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The Strict Domination Hypothesis

- Harmonic Grammar (HG; Legendre, Miyata, and Smolensky 1990) and other "weighted" phonological models such as those in Goldsmith (1990; 1991; 1993) were being explored when Optimality Theory (OT; Prince and Smolensky 1993/2004) was formulated in the early 90's.
- One of the core innovations of OT was the assertion of *strict domination*. i.e. obedience to higher ranked constraints is strictly more important.

Reductio ad monstrum The adoption of strict domination was advocated on the grounds that weighted constraints can make weird predictions:

- Centering – if the constraints Align(**x**)-Left and Align(**x**)-Right have approximately equal weights then **x** will be centered in the form.
  (Prince 1993 observed this for the models of Goldsmith and Larson 1990)
- Gangs – in a one-versus-many battle between constrains, the many can overwhelm the one. E.g. In a language that has stem controlled nasal harmony, Ident(nas)$_{stem}$ can eventually be overwhelmed by Id(nas).
  (Legendre, Sorace, and Smolensky 2006 observed this for stress placement)

(1)

/bã+dida/	Agree(nas)	Ident(nas)$_{st}$	Ident(nas)
bã.nĩ.nã			***
ba.di.da		*	*
bã.di.da	*		

Monsters are dangerous It turned out that very close cousins of these monsters were lurking in the machinery of OT as well.

- *Quadratic* alignment constraints that do centering have computational problems (Eisner 1997), and even simple *gradient* alignment constraints are formally unusual (Potts and Pullum 2002) and make odd predictions that have led to their excommunication (McCarthy 2007).
- OT admits gang-like *majority rule* effects (Baković 2000). For example, if the Ident constraints are inverted in (1), the nasality of the surface form will depend on which feature value is more prevalent in the input.

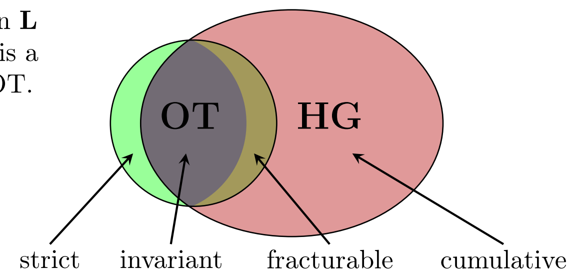
Monsters can be useful A growing body of research is emerging that supports the utility of gang effects for phenomena in several domains:

- Cumulative markedness effects in Japanese OCP phenomena (Itô and Mester 1998), English genitive variation (Jäger and Rosenbach 2006), the processing of identical place avoidance in Dutch (Kager and Shatzman 2007), acquisition (Jesney and Tessier 2008), and others.
- Cumulative faithfulness effects in Kikuyu nasal prefixation, Greek voicing assimilation, and others (Farris-Trimble 2008a, 2008b, in press).
- Ganging up and "anti-bottleneck" effects in gradient well-formedness judgment tasks (Albright 2007, 2008, Albright et al 2008).

Three questions:

i. Precisely what patterns arise without strict domination?
ii. Can we tell the difference between good gangs and bad ones?
iii. Are the good and bad gangs inextricably linked?

- Pater (2009) suggests that opportunities for constraints to 'trade-off' violations and generate gang-effects may in fact be rather rare.
- We created algorithms for generating and comparing the OT and HG typology generated by a specific constraint set **C** and lexicon **L**.
- For any given lexicon **L** the typology in HG is a superset of that in OT.



Four classes of languages:

i. *strict* languages are those that are generated in OT but not HG
ii. *magnitude invariant* languages are identical in both systems
iii. *fracturable* OT langs. fragment into HG langs. under weighting
iv. *cumulative* languages are generated by HG but not OT

- We ran two case studies, P&S (1993) syllable structure and quantity insensitive stress systems with Gordon's (2000) constraints.
- The metrical typology is infinite because it has alignment constraints that cause stress to run out of steam. Many many weird patterns emerge.

Syllable Typology[1]		Onset required: ONS, MAX ≫ DEPC	Onset required: ONS, DEPC ≫ MAX	Onset optional: MAX, DEPC ≫ ONS
Coda banned	NOC, MAX ≫ DEPV	**1.** CV (epe. / epe.)	**3.** CV (del. / epe.)	**5.** (C)V (epe.)
	NOC, DEPV ≫ MAX	**2.** CV (epe. / del.)	**4.** CV (del. / del.)	**6.** (C)V (del.)
Coda allowed	MAX ≫ DEPV ≫ NOC	**7.** CV(C) (epe. / *[ep]*)	**9.** CV(C) (del. / *[epe]*)	**11.** (C)V(C) (*[ep]*)
	DEPV ≫ MAX ≫ NOC	**8.** CV(C) (epe. / *[del]*)	**10.** CV(C) (del. / *[del]*)	**12.** (C)V(C) (*[del]*)

Figure 1: The twelve-language typology under strict domination

- Seven of the twelve languages fill the same fraction of the weighting and ranking space. These languages are *magnitude-invariant*; changing the magnitudes of the weighting differences does not affect the outcome.
- In magnitude-invariant languages it is never possible to trade a violation of one constraint for a set of violations of others. Lg.4 provides a nice example: 1×MAX vs. 1×DEP in /CVC/→[CV], but ...

(2)

/CVCC/	NOCODA	DEP-V	MAX
☞CV			**
CV.CVC	*	*	
CV.CV.CV		**	

- Four of the OT languages are *fracturable*. In these cases, changing the magnitude of the weighting differences gives rise to new patterns outside the OT typology. **Eleven** new HG languages come about by exchanging MAX violations for violations of other constraints.
- Each of the fracturable languages spawns several daughters in the HG typology one of Lg12's daughters is given in (3).

[1]The notations epe. and del. in the lower left and right corners of the cells refer to the mechanisms that repair ONSET and NOCODA violations respectively. Bracketed [*epe*] or [*del*] indicate the mechanism that repairs complex codas in languages that tolerate codas.

/CCVVC/	ONS	NOC	MAX	DEPV	DEPC
1. CV.CV.CV.CV				**	*
2. CV.CV			**		*
3. CV.CV.CV			*	**	
4. CV			***		
5. CV.CV.V.CV	*			**	
6. CV.V	*		**		
7. CV.CV.CVC		*		*	*
8. CV.CVC		*	*		*
9. CV.CVC		*	*	*	
10. CVC		*	**		
11. CV.CV.VC	*	*		*	
12. CV.VC	*	*	*		

Lg.	*r*-vol.	*w*-vol.
1.	0.133	0.133
2.	0.066	0.066
3.	0.066	0.066
4.	0.200	0.200
5.	0.133	0.133
6.	0.066	0.066
7.	0.075	0.075
8.	**0.058**	0.024
9.	**0.016**	0.008
10.	**0.050**	0.025
11.	0.075	0.075
12.	**0.058**	0.005

Figure 2: Identifying differences via ranking-volume and weighting-volume

(3)

/V/	ONSET	MAX	NOCODA
☞ *null*		*	
.V.	*		

/VC/	ONSET	MAX	NOCODA
null		**	
☞ .VC.	*		*

If $w(ons) + w(noc) < 2 \times w(max)$ then the licit syllables are {CV, CVC, VC} but not V. This language has a w-volume of 0.024

- This gang effect can cross with another gang effect between MAX and DEP-V that will repair simple codas by deletion but complex codas by epenthesis. This happens if $w(depV) < 2 \times w(max)$.
- This weighting scheme gives rise to a whole set of languages that prefer to repair marked structures with a single deletion but will elect to do epenthesis rather than two deletions.

Conclusions: The good the bad and the weird Infinite gangs are bad. Gangs involving MAX seem to arise rather easily. There is no easy way to block bad gangs and allow good ones (or to tell the difference in many cases). But, gangs in general (and especially the infinite ones) tend to be small.