How powerful is too powerful?
Constraint conjunction in weighted constraint grammar and its typological consequences

Harmonic Grammar (HG; Legendre, Miyata, and Smolensky 1990) has been argued to accommodate ganging-up cumulativity (Jäger and Rosenbach 2006; Albright 2012) with no appeal to locally conjoined constraints (LCC; Smolensky 1993, 2006) (cf. Pater 2009b, 2016; Farris-Trimble 2008; Potts et al. 2010). HG's ability to model gang effects without LCC has been seen as a crucial argument in favor of HG over strict-ranking Optimality Theory (OT; Prince and Smolensky 1993/2004), given LCC's propensity to overgeneration (Kirchner 1996; Padgett 2002; McCarthy 2003; Pater 2009a, a.o.). However, without nondefault mechanisms, HG generates only a subset of cumulativity effects. Recent work (Green and Davis 2014; Shih 2017) suggests that both OT and HG necessitate LCC to model superadditive constraint ganging, whereby the joint weight of the ganging constraints exceeds the linear sum of their independent contributions.

This paper supports the necessity of LCC both in OT and in HG through the examination of a complex prosodic minimality effect in Bosnian/Croatian/Montenegrin/Serbian (BCMS). BCMS tolerates both degenerate (i.e. monomoraic) feet (1a) and feet headed by a toneless mora (cf. 1b; 2b; 3), but categorically prohibits the combination of these two marked structures—monomoraic feet with a toneless head mora. Effectively, bimoraic feet are well-formed regardless of the tonal profile of their head moras, while the only mora of a monomoraic foot must be High-toned. Across BCMS dialects, there is a conspiracy against degenerate feet with a toneless head mora. Two strategies are employed to eliminate this illicit structure. First, BCMS displays a vowel lengthening process that targets toneless (1c), but not High-toned stressed lights (1a) (Zec 1999). Second, in some of the Old Štokavian (OS) dialects of BCMS (Ivić 1958), there is a process of tonal flop, which shifts High tones from unstressed syllables to underlyingly toneless stressed lights (2a), but not to stressed toneless heavies (2b). Further evidence for the conspiracy against toneless degenerate feet is provided by the fact that the OS dialects that do not display tonal flop regularly exhibit vowel lengthening in stressed toneless lights (3). Thus, tonal flop (2a) and vowel lengthening (3) are competing strategies employed to eliminate toneless degenerate feet in OS. The present analysis unifies several prosodic processes in BCMS, which have not yet been considered related.

(1) a. *Monomoraic feet*

/brát/	→	[ˈ(brát)]	'brother.NOM.SG'	not *[ˈ(bráat)]
/líx/	→	[ˈ(líx)]	'pour.AOR.1SG'	not *[ˈ(líix)]

b. *Feet headed by an underlyingly toneless mora*

/graad/	→	[ˈ(graad)]	'city.NOM.SG'	not *[ˈ(gráad)]
/ʋuuk/	→	[ˈ(ʋuuk)]	'wolf.NOM.SG'	not *[ˈ(ʋúuk)]

c. *Monosyllabic Lengthening: no monomoraic feet with a toneless head*

/lɛd/	→	[ˈ(lɛɛd)]	'ice.NOM.SG'	cf. [(ˈlɛ.da)]	'ice.GEN.SG'
/bɔs/	→	[ˈ(bɔɔs)]	'barefoot.NOM.SG.M'	cf. [(ˈbɔ.si)]	'barefoot.NOM.PL.M'

(2) a. /ʋɔd-á/ → [(ˈʋɔ́.da)] 'water-NOM.SG' cf. [ʋɔ.(ˈdá=jɛ)] 'water is' (original tone)

b. /ruuk-á/ → [ˈ(ruu).ká] 'arm-NOM.SG' not *[ˈ(rúu).ka]

(3) /ʋɔd-á/ → [ˈ(ʋɔɔ).dá] 'water-NOM.SG'

The illicitness of doubly-marked toneless degenerate feet instantiates a gang effect. Two markedness constraints that individually yield to faithfulness, namely HEAD-H, which requires that foot-heading moras be High-toned, and FTBIN, which penalizes monomoraic feet, jointly

prevail against a higher-weighted faithfulness constraint. This interaction cannot be adequately modeled in an HG framework without nondefault mechanisms, as evident from the grammar in (4), which erroneously favors faithful realization over lengthening for toneless monomoraic inputs in BCMS, irrespective of the weight assigned to HEAD-H. This is due to the shared violation of HEAD-H, indicating that there is a symmetric, i.e. one-to-one trade-off (Pater 2009b, 2016; J. Smith 2022) between higher-weighted DEP-μ and *a single* lower-weighted penalty (FTBIN) in HEAD-H-violating contexts. (That DEP-μ outweighs FTBIN follows from the absence of lengthening in (1a).) Thus, the cumulative contribution of HEAD-H and FTBIN is superadditive, as the two constraints add up to more than the sum of their independent contributions. Following Green and Davis (2014) and Shih (2017), I introduce the local conjunction of the ganging constraints to capture the exacerbated severity of their coincident violation (5).

(4)

lɛd		$\mathscr{H}$	DEP-μ 2	HD-H n	FTB 1
a. 💣	ˈ(lɛd)	$-1+n$		-1	-1
b. ☹	ˈ(lɛɛd)	$-2+n$	-1	-1	

(5)

lɛd		$\mathscr{H}$	DEP-μ 2	HD-H&FTB 1.5	HD-H n	FTB 1
a.	ˈ(lɛd)	$-2.5+n$		-1	-1	-1
b. ☞	ˈ(lɛɛd)	$-2+n$	-1		-1	

The added predictive power that comes with LCC raises the question of whether the resulting constraint models are overly powerful. Despite overgeneration concerns, there has been little to no discussion of typology in the existing HG work that utilizes weighted LCC to model superadditivity. To address this gap in the literature, this paper provides a systematic exploration of the typological consequences of the LCC proposed herein in both OT and HG. Using the OT-Help software (Staubs et al. 2010) and the R statistical programming environment (R Core Team 2021), factorial typologies were calculated of the proposed LCC model, and of two alternative models with non-conjoined constraints only: the baseline model, and the model proposed by Zec (1999). The results indicate that the LCC model has superior typological coverage to both alternative models, since it is more powerful than the baseline model and more restrictive than Zec (1999)'s model. The baseline model fails to derive the BCMS lengthening pattern in (5) under any ranking/weighting conditions. Both the LCC model and Zec (1999)'s model capture this complex lengthening pattern. However, Zec (1999)'s model does so at the expense of overgeneration, as it produces pathological mappings. The LCC model is more restrictive, given that it captures the challenging minimality effect in BCMS without generating additional pathological grammars. Importantly, the LCC model produces identical factorial typologies in OT and HG. Therefore, while this study argues for the necessity of LCC in both OT and HG, it does not settle the debate between the two frameworks by arguing in favor of either OT with LCC or HG with LCC.

The findings of the typological survey lend further support to the use of LCC in both OT and HG as a means of modeling superadditive ganging-up cumulativity (Green and Davis 2014; Shih 2017). Another contribution of this study is that it identifies a superadditive gang effect in a categorical prosodic pattern, thereby expanding the empirical range of attested superadditivity effects, since virtually all superadditivity effects have been documented in variable phonological patterns (Shih 2017; B. Smith and Pater 2020; Breiss and Albright 2022; Kim 2022).

Selected references. Ivić, P. (1958). *Die serbokroatischen Dialekte*. Mouton. ■ Pater, J. (2009b). Weighted constraints in generative linguistics. *Cognitive science*. ■ Pater, J. (2016). Universal grammar with weighted constraints. In: Pater, J. and J. McCarthy (eds). *Harmonic Grammar and Harmonic Serialism*. Equinox. ■ Shih, S. (2017). Constraint conjunction in weighted probabilistic grammar. *Phonology*.■ Zec, D. (1999). Footed tones and tonal feet: Rhythmic constituency in a pitch-accent language. *Phonology*.