No categorical gang effects. The evidence for gang effects (i.e. multiple lower-weighted constraint violations outweighing one violation of a higher-weighted constraint, as predicted by Harmonic Grammar (Legendre et al. 1990a,b)) is robust for *variable* grammatical processes (Breiss 2023 and refs. therein). For *categorical* processes, evidence of gang effects has proven harder to find – a notable and oft-cited exception being a set of cumulative faithfulness effects discussed in Farris-Trimble 2008 (FT). I argue here that FT's examples are unconvincing, yielding the hypothesis that gang effects are always variable.

Kikuyu nasal prefixing. Kikuyu (Bantu) has a prefix which FT describes as a nasal segment, following Peng 2008. This segment fails to surface before a voiceless continuant (/N+θɛru/ → θɛru 'bright'). Voiced continuants undergo post-nasal stopping (/N+βuθu/ → mbuθu 'rotten') and voiceless stops undergo post-nasal voicing (/N+kɛnu/ → ŋgɛnu 'rotten'). The claim is that avoiding either process individually would not justify nasal deletion, but avoiding *both* cumulatively justifies deletion, explaining the voiceless continuant case. But Navarro (2015) argues convincingly based on acoustic and phonological evidence that the prefix is not a separate segment, but rather forms a prenasalized stop with the stem onset (ᵐbuθu, ᵑgɛnu). And the only onsets for which the prefix goes unrealized (/h/, /θ/) are all and only those for which the consonant inventory lacks a homorganic prenasalized stop (ibid.). The tradeoff is simple and non-cumulative: form a prenasalized stop, but not at the expense of place faithfulness.

Greek nasal deletion. In Greek (Hellenic, Newton 1972), post-nasal obstruents undergo voicing (/pénTe/ → pénde 'five') and adjacent obstuents agree in voicing (/rávtis/ → ráftis 'tailor'). A nasal preceding two voiceless obstruents deletes (/épeNpsa/ → épepsa 'I sent'), which FT takes to be cumulatively justified by the avoidance of two voice faithfulness violations (1. post-nasal voicing, 2. voice assimilation of the second obstruent). For dialects in which this process applies across word boundaries, deletion is variable in this context (Newton 1972), so not relevant to the present discussion. Word-internally, deletion is obligatory, but is unrelated to voicing: word-internal nasal-obstruent-obstruent sequences are simply unattested in Greek (Newton 1972; the corresponding orthographic sequences are also absent in Wiktionary (Agiannis 2019)), so forms like **épembza* are ruled out independently of voice faithfulness.

Luwanga /iN-/ prefixing. Green (2008) observes that Luwanga (Bantu) has an underlying voicing contrast for obstruents which is almost always neutralized. Voiced obstruents generally devoice (/axa+duuma/ → axatuuma 'small yam') except after the prefix /iN-/ (/iN+duuma/ → induuma 'yam'). When an underlyingly voiceless obstruent follows /iN-/, the nasal deletes (/iN+takata/ → itakata 'chest'). FT takes this pattern to be the result of cumulative constraint interaction: for [induuma], *<u>Voiced</u><u>Obs</u>truent is worth violating because the next best candidate, [ituuma], would violate both voice faithfulness and Max. ([intuuma] is unavailable due to a high-weighted *NC̥ constraint (Pater 1996).). Violating Max but not voice faithfulness ([itakata]) or vice versa ([axaduuma]) is not sufficient to justify violating *VoiObs. What this analysis misses is that this pattern does not apply after all nasals: it is specific to the prefix /iN-/. In general, the repair for *NC̥ violations is post-nasal voicing (/eN+paaka/ → embaaka (Eshitemi 2019)). Thus the pattern with /iN-/ is best analyzed as allomorphy (as in Eshitemi 2019). This removes the cumulative interaction of Max with voice faithfulness: Max is no longer involved. The listed allomorphs are 1. the preferred allomorph /iN-/ (this preference can be encoded using Priority (Mascaró 2007)) and 2. the less-preferred allomorph /i-/, which gets selected before voiceless obstruents because it saves a voice faithfulness violation ([i-takata] beats *[in-dakata]).

Fula /vw/ adaptation. Fula (Senegambian, Paradis 1995) lacks [v]; /v/ in loanwords generally surfaces as [w] (/sivil/ → siwil 'civil'). Onset clusters are repaired with epenthesis (/bwasɔ̃/ → buwasɔŋ 'drink'), except for /vw/, which surfaces as [w] (/vwaju/ → waju 'bum'). Following Paradis 1995, FT proposes that /v/ deletion is cumulatively justified by the avoidance of both /v/ → w and vowel epenthesis. I propose a coalescence analysis instead: /$v_1 w_2$/ → $w_{1,2}$. FT separately argues (based on nasal vowel patterns)

that Dep outranks Integrity; this predicts coalescence should indeed beat epenthesis. Epenthesis beats coalescence only when it allows faithful realization of both Cs – not possible for /vw/, since [v] is banned.
Fula /ɥ/ adaptation. Paradis (1995) also reports that /ɥ/ is adapted as [w] (/minɥi/ → minwi 'midnight') and onset clusters are repaired with epenthesis (see 'drink' above) – except /ɥ/ is deleted in onset clusters (/tɥijo/ → tijo 'pipe'). The claim is that avoiding both epenthesis and /ɥ/ → w cumulatively justifies deletion, which FT accepts. But Paradis only provides 7 examples. Outside sources challenge the generalization. In some loans, /ɥ/ in an onset cluster maps to [w] and a vowel breaks up the cluster (/ʒɥije/ → suwije 'July' (Bah 2014); /kɥijɛʁ/ → kuwijer 'spoon' (Osborn et al. 1993)). In other cases, /ɥ/ is deleted even though it would not form an onset cluster (/mənɥizje/ → minisiyee 'carpenter' (Bah 2014)).
Hawaiian /s/ adaptation. Adler (2006) reports data from a Hawaiian (Oceanic) speaker who realizes /s/ as [k] prevocalically in loans (pelekine 'blessing') but deletes /s/ otherwise (pikə 'speak'; kaliː 'crease'). Hawaiian lacks codas and clusters, so if /s/ were not deleted nonprevocalically, a vowel would need to be inserted. FT proposes that avoiding both epenthesis and /s/ → k justifies deletion. But similar effects exist even in languages with codas/clusters, motivating dedicated prevocalic faithfulness constraints (Rubach 2008; see also Beckman 1998). I propose *prevocalic Max >> place faithfulness >> general Max* here.
Fon rhotic adaptation. In Fon (Gbe, Kenstowicz 2003), /ʀ/ is deleted in coda position in loanwords (/saʀdin/ → sadini 'sardine'). Elsewhere it surfaces as [l] (/byʀo/ → bilo 'office'), except in word-initial position, where it surfaces as [ʁl] (/ʀido/ → ʁlido 'curtain'). Underlying /l/ in coda position is repaired with epenthesis (/kɔl/ → kɔlu 'neck'). FT proposes that /ʀ/ deletes in coda position to avoid the cumulative cost of both /ʀ/ → l and vowel epenthesis. This analysis does not attempt to account for word-initial [ʁl]. FT states in a footnote that [ʁl] appears in order to 'preserve both the uvular and liquid qualities of the source.' This statement suggests that position-relativized faithfulness constraints exist (like I assumed for Hawaiian above). But if we permit word-initial faithfulness constraints, surely syllable-onset faithfulness constraints (e.g. Beckman 1998) should be available too, explaining the onset vs. coda asymmetry.
Outlook. In light of the above, I hypothesize that categorical processes never exhibit gang effects. This challenges standard Harmonic Grammar (HG, Legendre et al. 1990a,b). One interpretation of this finding could be that the grammar does not allow cumulativity, and cumulativity in variation results from extragrammatical forces; I am skeptical of this line of analysis given that the extragrammatical forces would need to a) be sensitive to grammatical constraints and b) somehow be prevented from 'accidentally' producing categoricity. A more promising avenue, in my view, is to pursue a probabilistic formulation of HG that makes the right prediction: roughly stated, variation and cumulativity should arise under the same circumstances, viz. when the relevant constraints are close (on a relative linear scale) in weight.
MaxEnt HG (Goldwater and Johnson 2003) fails here, learning a categorical grammar from this table.

INPUT	OUTPUT	FREQ	C1	C2	C3
X	X_a	0%	-1	0	0
	X_b	100%	0	-1	0
Y	Y_a	0%	-1	0	0
	Y_b	100%	0	0	-1
Z	Z_a	100%	-1	0	0
	Z_b	0%	0	-1	-1

The problem is that MaxEnt compares harmony on a non-linear scale. If C1, C2, C3, had weights 3, 2, 2, then $P(Z_a)$ would be $e^{-3}/(e^{-3}+e^{-4}) = 73.1\%$; but 30, 20, 20 yields categoricity: $P(Z_a) = e^{-30}/(e^{-30}+e^{-40}) = 99.995\%$. A version of Noisy HG (NHG, Boersma and Pater 2008/2016), though, can work. NHG adds noise to weights; the method of setting the width of the noise distribution is left up to the analyst. NHG in OTSoft (Hayes et al. 2013) scales width to weight, but such that 3, 2, 2 (or equivalent, e.g. 30, 20, 20) yields categoricity. A simple increase in width relative to weight fixes this.
Select refs. Bah 2014, Dictionnaire Pular, SIL. Beckman 1998, UMass Amherst dissertation. FT, Indiana U dissertation. Eshitemi 2019, Pwani U dissertation. Navarro 2015, Phonology, In *A Basic Sketch Grammar of Gĩkũyũ*, Rice WPL. Newton 1972, The Generative Interpretation of Dialect: [...], CUP.