Gradient Symbolic Computation (Smolensky and Goldrick, 2016) does derive A'ingae stress patterns

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The issue

- **Dąbkowski (2021) (henceforth D) argues that phenomena such as A'ingae verbal stress are only explainable by co-phonologies and not by GSC.**
- **I show that GSC derives ALL A'ingae stress patterns in D.**

Interaction of stems and suffixes in A'ingae (all examples from D)

Suffix type ↓ none	Stressless stem *a(tápa)* 'breed'	Stressed stem *(kó*^{n}*da)se* 'tell'
Recessive destressing *-hi* (PRCM)	penult *ata(pá-hi)*	initial *(kó*^{n}*da)se-hi*
Dominant destressing *-k*^{h}*o* (RECP)	penult *ata(pá-k*^{h}*o)*	penult *ko*^{n}*da(sé-k*^{h}*o)*
Recessive prestressing *-saʔne* (APPR)	pre-suffix *ata(pá-sa)ʔne*	initial *(kó*^{n}*da)se-saʔne*
Dominant prestressing *-hama* (PROH)	pre-suffix *ata(pá-ha)ma*	pre-suffix *ko*^{n}*da(sé-ha)ma*

D's take on a hypothetical GSC analysis

- D places dominant 'destressing' suffixes lowest on a 'preference hierarchy' of stress-affecting suffixes.
- He assumes a **serial** view, where dominant destressing suffixes FIRST delete stress and THEN stress is assigned in a later cycle.
- In **parallel** GSC, this suffix does not destress but activates stress through other means ↗.

How a GSC analysis can work

- **Foot edges** are the URs of **stress** and accent (Yates, 2017)
- **Stressed stems** have **left** Foot edges; **prestressing suffixes right** Foot edges in UR.
- **Dominant destressing suffixes** have **left AND right** Foot edges in UR.
- Max and Dep **Path** constraints on Foot edges **care about location**.
- Max and Dep **non-Path** constraints on Foot edges **don't care** about location, but ...
- CrispEdgeStem **prevents** Foot edge migration across stem-suffix boundary.
- Left & right input Foot edges on dominant destressing suffixes **catalyse** stress.

A crucial case that D considered problematic for GSC

- After a stressed stem, a dominant destressing suffix allows a recessive prestressing suffix to prestress where it wouldn't otherwise.
- For D, the destressing suffix **feeds** the recessive prestressing suffix.
- In parallel GSC, the destressing suffix **boosts** the prestressing effect of the recessive prestressing suffix (1st tableau below).

- **Learned input activations on Foot edges:** (none on **N** = recessive destressing suffix)

Left edge		Right edge	
$(_\phi$A (stressed stem)	0.8375	**R$)_\phi$** (recessive prestressing suffix)	0.3750
$(_\phi$S (dominant destressing suffix)	0.8750	**S$)_\phi$**	0.4375
		D$)_\phi$ (dominant prestressing suffix)	0.9375

Subscript labels on a Foot edge of a candidate indicate its input source. Arrows indicate that it migrated from a different position; underscore, that it has no input correspondent.

input:(AA(S)NR)	Max(	MaxPath(	Dep(	DepPath(	Max)	MaxPath)	Dep)	DepPath)	AlFtR	⚓)	H
Learned wts.	0.1	0.313	−0.5	−1.063	0.1	0.5	−0.5	−0.5	0.5	−1.35	
$({}_A\mathrm{AA\_})\mathrm{SNR}$	0.084	0.262	−0.08	−0.173			−0.50	−0.50			−0.91
$\mathrm{A}({}_{\to A}\mathrm{AS}_S)\mathrm{NR}$	0.084		−0.08	−1.063	0.044	0.219	−0.28	−0.28			−1.36
$\mathrm{AA}({}_S\mathrm{SN}_{\to S})\mathrm{R}$	0.087	0.273	−0.06	−0.133	0.044		−0.28	−0.50		0.59	−1.16
☞ $\mathrm{AAS}({}_{\to S}\mathrm{NR}_R)$	0.087		−0.06	−1.063	0.044	0.188	−0.28	−0.31	0.5		−0.90

As above, but without a destressing suffix present.											
input:(AANNR)	Max(	MaxPath(	Dep(	DepPath(	Max)	MaxPath)	Dep)	DepPath)	AlFtR	⚓)	H
Learned wts.	0.1	0.313	−0.5	−1.063	0.1	0.5	−0.5	−0.5	0.5	−1.35	
☞ $({}_A\mathrm{AA\_})\mathrm{NNR}$	0.084	0.262	−0.08	−0.173			−0.50	−0.50			−0.91
$\mathrm{A}({}_{\to A}\mathrm{AN}_{\leftarrow R})\mathrm{NR}$	0.084		−0.08	−1.063	0.038		−0.31	−0.50			−1.84
$\mathrm{AA}(\mathrm{\_NN}_{\leftarrow R})\mathrm{R}$			−0.50	−1.063	0.038		−0.31	−0.50			−2.38
$\mathrm{AAN}(\mathrm{\_NR}_R)$			−0.50	−1.063	0.038	0.188	−0.31	−0.31	0.5		−1.46

Learning algorithm
for weights and activations

- 25 examples from D cover all crucial combinations of stems and suffixes.
- 13 training; 12 testing.
- Learning uses the Error-Driven Gradient Activation Readjustment algorithm (Smolensky et al., 2019).
- 100% train and test accuracy.

Discussion

- The relative input activations of morphemes affect their ability to affect stress.
- For D, the A'ingae data pose a challenge for GSC because **dominant** destressing suffixes imply **high** activation and their **apparent deletion** of stress suggests **low** activation.
- **This illusory contradiction disappears** in parallel GSC, where these suffixes enable stress to occur through locus-agnostic Max and Dep constraints on Foot edges.
- **These results are important because they refute the claim that that GSC cannot handle these kinds of 'dominance' effects.**

References

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