Myopic spreading with weighted string constraints and gradient activity

This paper demonstrates that Harmonic Grammar can model unbounded spreading with constraints defined over strings like Agree(nasal) by modeling autosegmental spans as gradiently shared activity (Tebay, 2023). The proposal further avoids non-local blocking by string constraints, resolving a pathology with strictly ranked constraints.

Optimality Theory (OT; Prince and Smolensky, 1993/2004) assumes strictly ranked constraints. Under the ranking A ≫ B, *arbitrarily many violations* of B are preferred to one violation of A. This enables the framework to model unbounded processes such as nasal spreading using constraints defined over strings, i.e., contiguous spans of a fixed length.

/ma^n/	Agree(nasal)	Max(nasal)	Dep(nasal)
a. ma^n	W 1		L
b. ba^n		W 1	L
☞ c. mã^n			n

Harmonic Grammar (Legendre et al., 1990) instead assumes weighted constraints. One consequence is that it cannot model unbounded processes, which require *asymmetric tradeoffs* between constraints (Pater et al., 2007; Farris-Trimble, 2008a,b, 2010; Pater, 2009a,b, 2012, 2016; O'Hara, 2016). Given two constraints A and B, where $w(\text{A}) > w(\text{B})$, there is a *maximum number of violations* of B that is preferred to one violation of A.

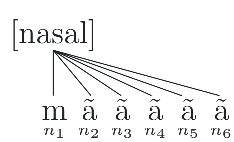
/ma^n/	Agree(nasal) x	Max(nasal) y	Dep(nasal) z	$\mathscr{H}$
(☞) a. ma^n	-1			$-x$
b. ba^n		-1		$-y$
(☞) c. mã^n			$-n$	$-nz$

In this example, candidate (a) is always preferred to candidate (b) if $y > x$. However, there is no weighting of x, y, z that *always* prefers candidate (c) to candidate (a). Eventually the accumulated violations of Dep(nasal) exceed the violation of Agree(nasal).

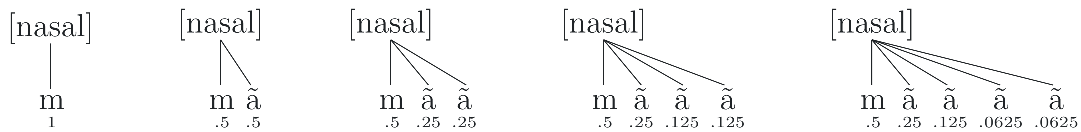
$$\text{ma}^n \mapsto \begin{cases} \text{ma}^n & \text{if } n > \lceil \frac{x}{z} \rceil \\ \text{mã}^n & \text{if } n < \lfloor \frac{x}{z} \rfloor \end{cases}$$

This paper demonstrates that gradient activity solves this problem while simultaneously avoiding the problem of non-local blocking or *sour grapes* (Wilson, 2003, 2006) and is consistent with parallel and serial frameworks.

Following the proposal by Tebay (2023), autosegmental spans are analyzed as a fixed amount of activity distributed among their constituents. Thus, for a [nasal] feature with activity n linked to six segments with activity $n_1, n_2, n_3, n_4, n_5, n_6$, $\sum_{i=1}^{6} n_i = n$.



I enrich this representation by encoding the *head* of the span (Iacoponi, 2018) as the segment(s) with the highest activity, with activity decreasing exponentially towards the frontier. The intuition behind this representation is that it models spreading by iteratively fissioning the activity of the left-/rightmost element. Under unidirectional spreading, the head is the left-/rightmost element; it may be span-internal under bidirectional spreading.



Under this representation, the accumulated violations of faithfulness are bounded because the sum of exponentially decreasing terms is convergent: $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\cdots=1$. If the weight of Agree(nasal) is greater than that of Dep(nasal), the grammar models unbounded spreading rather than imposing a maximum threshold, resolving the asymmetric trade-off.

/ma^n/	Agree(nasal) x	Max(nasal) y	Dep(nasal) z	$\mathscr{H}$
a. ma^n	-1			$-x$
b. ba^n		-1		$-y$
☞ c. mã^n			$\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\cdots+\frac{1}{2^n}$	$-z$

Further, it is impossible to model non-local blocking using string constraints; I leave to future research the question of attested apparently non-myopic processes (Jardine, 2016; McCollum et al., 2020). In OT, the violation of a string constraint can only be removed by total spreading. If total spreading is blocked, partial spreading is harmonically bounded.

/ma^{n}s/	*NS	Max(nasal)	Agree(nasal)	Dep(nasal)
☞ a. ma^{n}s			1	
b. ba^{n}s		W 1	L	L
c. mã^{n}s	W 1		1	W n

Following Tebay (2023), phonotactic violations scale according to locus activity. Thus, the violation of Agree(nasal) is proportional to the activity of the nasal segment. Because spreading reduces the activity of segments at the frontier, partial spreading is not harmonically bounded. In this example, nasality will spread up to the blocker, which is attested (Walker, 2011). If the weight of *NS is sufficiently high, it will instead spread up the segment preceding the fricative.

/ma^{n}s/	Agree(nasal) x	Max(nasal) y	Dep(nasal) z	$\mathscr{H}$
a. ma^{n}s	$\propto -1$			$\propto -x$
b. ba^{n}s		-1		$-y$
☞ c. mã^{n}s	$\propto -\frac{1}{2^n}$		$\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\cdots+\frac{1}{2^n}$	$\propto -\frac{x}{2^n}-z$