Deriving Listener-Driven Sound Change in a Harmonic Grammar

Roslyn Burns, Independent Researcher

This paper presents a framework to derive different outcomes of listener-driven sound change (Ohala 1989) in a multi-generational Optimality Theory (OT) grammar. When a listener misinterprets a speech signal, they may fail to understand that the speaker applied a process resulting in the incorporation of contextual assimilatory effects into the UR (*hypocorrection*). Alternatively, the listener may erroneously assume that the speaker applied a process resulting in the incorporation of dissimilatory effects into the UR (*hypercorrection*). While these processes are generally accepted among historical linguists, current generative modeling lacks a mechanism to capture these insights (Boersma & Hayes 2001, Boersma 2011, Boersma & Hamann 2008).

Failure to account for listener correction modes is problematic because similar conditioning environments can trigger opposing innovations. For example, labials depress F2 thereby triggering co-articulated backing. In eastern Bulgarian (South Slavic), labial co-articulation is incorporated into the UR (hypocorrection) as in [č'**uv**ìjə] 'peg' < Turkish c**iv**i 'nail' and [p**up**èr] 'pepper' < Greek **πιπ**έρι (Alexander & Zhobov 2016), but in Polabian (West Slavic), labial co-articulation results in dissimilation to a fronter UR (hypercorrection) as in [gl**aip**ə] 'young' < *gl**ip**ə < *gl**up**ŭ and [lʲ**aib**y] 'kindly' < *lʲ**ub**o < *lʲ**ub**ŭ (Polański & Sehnert 1967, cf. gl**ai**no 'clay' < *gl**i**na).

I model the frontness innovations discussed above in a bi-directional multi-generational form of the Harmonic Grammar (HG) sub-framework of OT. Bi-directional grammars model the relationship between speaker production and listener perception (Boersma 2011) and can be iterated over multiple generations where the output of one generation becomes the input of the subsequent generation. HGs use numerically assigned weights instead of ranking and can have phonetically gradient inputs, candidates, and constraints (Flemming 2001). This allows us to model co-articulatory effects of consonant place in vowel frequency innovations (Burns 2021). In this paper, I base the gradient definitions in the HG on phonetic data from Russian (Purcell 1979).

In my model, I use constraint weights as the driver of listener correction. In hypocorrection, the speaker's co-articulation production constraint weight is greater than the listener's co-articulation decoding constraint weight. In hypercorrection, the inverse holds; the speaker's co-articulation production constraint weight is less than the listener's co-articulation decoding constraint weight. Table 1 shows labial co-articulation (Δ195.13 hz) on a central vowel of 1200 hz over 3 generations where the speaker (S) and listener's (L) weights (W) for co-articulation differ, but W for vowel identity constraints are the same (Ident-V, W=1).

	Hypocorrection: S W:2 > L W:1				Hypercorrection: S W:2 < L W:4			
	S /UR/	S [SR]	L [SR]	L /UR/	S /UR/	S [SR]	L [SR]	L /UR/
Gen 1	1200 hz	1069.9 hz	1069.9 hz	1167.5 hz	1200 hz	1069.9 hz	1069.9 hz	1226 hz
Gen 2	1167.5 hz	1037.4 hz	1037.4 hz	1135 hz	1226 hz	1095.9 hz	1095.9 hz	1252 hz
Gen 3	1135 hz	1004.9 hz	1004.9 hz	1102.4 hz	1252 hz	1122 hz	1122 hz	1278.1 hz

Table 1. Correction modes for labial contexts based on data from Purcell (1979)

As shown above, when the speaker's co-articulation is greater relative to the listener's decoding of co-articulation, we can derive the effects of hypocorrection where a vowel that was originally 1200 hz becomes 1004.9 hz, similar to the effects described for eastern Bulgarian. When the listener's co-articulation decoding is greater than the speaker's co-articulation production, we can derive the effects of hypercorrection where a vowel that was originally 1200 hz becomes 1278.1 hz, similar to the effects seen in Polabian. While this paper mainly focuses on how to derive the different listener correction modes, the solution that I put forward can enrich preexisting frameworks that focus on other properties of sound change such as inherent variation in the linguistic system (Boersma & Hayes 2001, Hayes 2017) and the gradual attrition of co-articulation effects over time (Harrington 2012).

Keywords: listener-driven sound change, bi-directional grammar, harmonic grammar

References

Alexander, Ronelle & Vladimir Zhobov. (2016). *Bulgarian Dialectology as Living Tradition*. <http://www.bulgariandialectology.org>

Boersma, Paul. (2011). A programme for bidirectional phonology and phonetics and their acquisition and evolution. In Anton Benz & Jason Mattausch (eds.), *Bidirectional Optimality Theory*, 35–72. Amsterdam: John Benjamins.

Boersma, Paul & Bruce Hayes. (2001). Empirical tests of the gradual learning algorithm. *Linguistic Inquiry* 32(1): 45–86.

Boersma, Paul & Silke Hamann. (2008). The evolution of auditory dispersion in bidirectional constraint grammars. *Phonology* 25(2): 217–270.

Burns, Roslyn. (2021). Modeling gradient processes in Polabian vowel chain shifting and blocking. *Journal of Historical Linguistics* 11(1): 102–142.

Flemming, Edward. (2001). Scalar and categorical phenomena in a unified model of phonetics and phonology. *Phonology* 18: 7–44.

Harrington, Jonathan. (2012). The coarticulatory basis of diachronic high back vowel fronting. In Maria-Josep Solé & Daniel Recasens (eds.), *The Initiation of Sound Change: Perception, Production, and Social Factors*, 103–122. Amsterdam: John Benjamins.

Hayes, Bruce. (2017). Varieties of noisy harmonic grammar. In Karen Jesney, Charlie O'Hara, Caitlin Smith, & Rachel Walker (eds.), *Proceedings of the 2016 Annual Meeting on Phonology*. Washington D.C.: Linguistics Society of America. <https://doi.org/10.3765/amp.v4i0.3997>.

Ohala, John J. (1989). Sound change is drawn from a pool of synchronic variation. In Leiv E. Breivik & Ernst H. Jahr (eds.), *Language Change: Contributions to the Study of Its Causes*, 173–198. Berlin: Mouton de Gruyter.

Polanski, Kazimierz & James Allen Sehnert. (1967). *Polabian-English Dictionary*. The Hauge: Mouton.

Purcell, Edward. (1979). Formant frequency in Russian VCV sequences. *Journal of the Acoustical Society of America* 66(6): 1691–1702.