LINGUAL EGRESSIVE AIRSTREAM HARMONY IN BEATBOXING

Reed Blaylock, Nimisha Patil, Timothy Greer, Shrikanth Narayanan | University of Southern California

1 BEATBOXING AND LANGUAGE

Beatboxing shows us which types of sound patterns are domain-specific.

ABOUT BEATBOXING

Beatboxing is a form of vocal music, characterized by the use of sounds that emulate percussion and synthesized music.

As a tool for studying which capacities of phonology are specific to language and which are parts of a broader cognitive system, beatboxing is:

Convenient
It uses the vocal tract, which we understand fairly well.

Useful
Beatboxing sounds are organized and coordinated, but without meaning

Beatboxing history: TyTe & Defenicial 2005. **Domain specificity:** Pinker & Jackendoff 2005.

THE PATTERN

Attested: { b r b ^K b }
lingual egressive

Unattested: *{ B r B ^K b }
glottalic egressive
lingual egressive

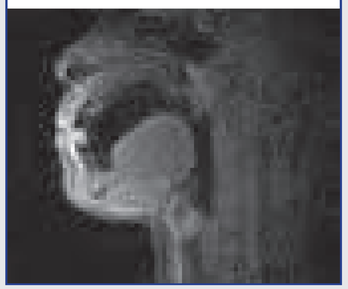
Lingual egressive airstream harmony in beatboxing resembles language harmony.

2 SOUNDS USED IN LINGUAL EGRESSIVE AIRSTREAM HARMONY

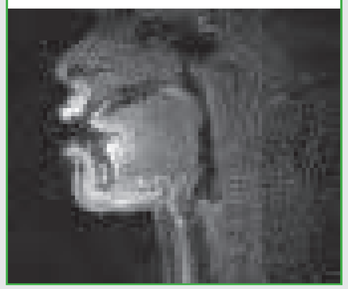
Beatboxers use ejective, lingual egressive, and pulmonic ingressive airstreams.

■ glottalic egressive
■ lingual egressive

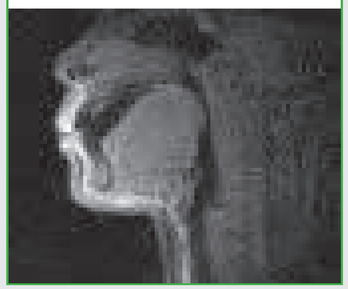
Kick drum {B}
Bilabial ejective
Important features: [+lab], [-dor], [-pulm]



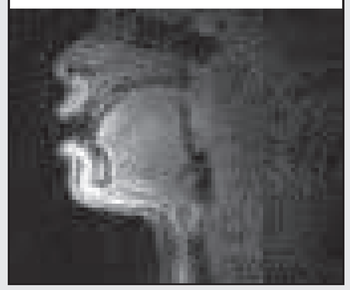
Clickroll {r}
Lingual egressive alveolar trill
Important features: [+cor], [+dor], [-pulm]



Lip pop* {b}
Lingual egressive labial stop
Important features: [+lab], [+dor], [-pulm]



Inward K {^K}
Pulmonic ingressive velar affricate
Important features: [+dor], [+pulm]



Beatboxing sounds: Proctor et. al. 2013; Blaylock et. al. 2017; Patil et. al. 2017; Underdown 2018. **Standard Beatbox Notation:** Splinter & TyTe 2002/2005. **Real-time MRI:** Narayanan et. al. 2004; Lingala et. al. 2016.

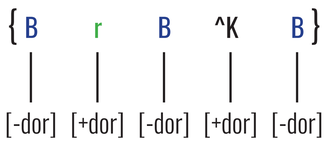
For airstream harmony, the different airstreams can be characterized by a combination of their [dorsal] and [pulmonic] features.

3 AIRSTREAM HARMONY ANALYSIS

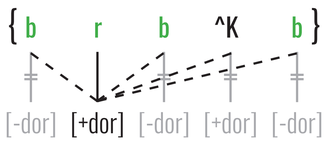
Beatboxing and language (e.g. Nandi-Kipsigis Kalenjin) both have unbounded bidirectional spreading.

AUTOSEGMENTAL SPREADING

Before harmony:



After harmony:



OPTIMALITY THEORY ALIGNMENT

MAX[+/-dor]
Assign a violation to a segment that is specified for [+/-dor] in the input but not in the output.

ALIGN[+dor]-L/R
Assign a violation when [+dor] in the output is not aligned to the Left/Right side of the output.

	{ B r B ^K B }	MAX[+dor]	ALIGN[+dor]-R	ALIGN[+dor]-L	MAX[-dor]
a.	{ B r B ^K B }		*(!)	*(!)	
b. ☞	{ b r b ^K b }				****
c.	{ B R B ^K B }	*!			

OT: Prince & Smolensky 1993/2004
Nandi OT analysis: Finley 2009

Unbounded bidirectional harmony is domain-general: it exists in both language and beatboxing.

4 ON DOMAIN SPECIFICITY

Beatboxing helps us distinguish domain-general phenomena from phenomena that are specific to language.

HARMONY MAY NOT BE RESTRICTED TO LANGUAGE

The lingual egressive-ness of beatboxing airstream harmony may not be found in language, but the capacity for harmony appears to be domain-general, rather than specific to language.

WHY IS BEATBOXING RELEVANT TO PHONOLOGISTS?

Like speech, beatboxing has an inventory of contrastive units and patterns of phenomena that indicate a broader organization (i.e. a grammar).

A program of empirical beatboxing research can test which sound patterns in beatboxing are productive and similar to the sound patterns of language. Identifying those patterns helps us identify which other language phenomena are unique to language.

REFERENCES

See handout for full references.

USC University of Southern California
SAIL
IIS 1514544
NIH RO1DC007124

REFERENCES

1. Blaylock, R., Patil, N., Greer, T., & Narayanan, S. (2017). Sounds of the human vocal tract. In Proceedings of the Annual Conference of the International Speech Communication Association, INTERSPEECH.
2. Fitch, T. W., Hauser, M. D., & Chomsky, N. (2005). The Evolution of the Language Faculty: Clarifications and Implications. Cognition, 97, 179–210.
3. Finley, S. (2009). Locality Restrictions on Exceptions to Vowel Harmony. University of Rochester Working Papers in the Language Sciences, 5, 17–48.
4. Hauser, M. D. (2001). What's So Special about Speech? In E. Dupoux (Ed.), Language, Brain, and Cognitive Development (pp. 417–433). The MIT Press.
5. Hauser, M. D., Chomsky, N., & Fitch, T. W. (2002). The Faculty of Language: What Is It, Who Has It, and How Did It Evolve? Science, 298(November), 1569–1579.
6. Hockett, C. D. (1960). The origin of speech. Scientific American, 203(3), 88–96.
7. Jackendoff, R., & Pinker, S. (2005). The nature of the language faculty and its implications for evolution of language (Reply to Fitch, Hauser, and Chomsky). Cognition, 97, 211–225.
8. Lederer. (2006). The phonetics of beatboxing [Online]. Available: https://www.humanbeatbox.com/articles/the-phonetics-ofbeatboxing-part-4/.
9. Lingala, S. G., Zhu, Y., Kim, Y. C., Toutios, A., Narayanan, S., & Nayak, K. S. (2017). A fast and flexible MRI system for the study of dynamic vocal tract shaping. Magnetic resonance in medicine, 77(1), 112-125.
10. Narayanan, S., Nayak, K., Lee, S., Sethy, A., & Byrd, D. (2004). An approach to real-time magnetic resonance imaging for speech production. Journal of the Acoustical Society of America, 115(4), 1771–1776.
11. Patil, N., Greer, T., Blaylock, R., & Narayanan, S. (2017). Comparison of basic beatboxing articulations between expert and novice artists using real-time magnetic resonance imaging. In Proceedings of the Annual Conference of the International Speech Communication Association, INTERSPEECH.
12. Pinker, S., & Jackendoff, R. (2005). The faculty of language: what's special about it? Cognition, 95, 201–236.
13. Prince, A. & Smolensky, P. (1993/2004). Optimality theory: Constraint interaction in generative grammar. Cambridge: Blackwell.
14. Proctor, M., Bresch, E., Byrd, D., Nayak, K., & Narayanan, S. (2013). Paralinguistic mechanisms of production in human "beatboxing": a real-time magnetic resonance imaging study. The Journal of the Acoustical Society of America, 133(2), 1043–54.
15. Splinter, M. & TyTe, G. (2002/2005). Standard Beatbox Notation (SBN) [Online]. Available: https://www.humanbeatbox.com/articles/standard-beatboxnotation-sbn/.
16. Stowell, D. (2008–2012). The beatbox alphabet. Available: http://www.mcld.co.uk/beatboxalphabet/
17. D. Stowell and M. Plumbley. (2008). Characteristics of the Beatboxing Vocal Style [Online]. Available: https://www.humanbeatbox.com/articles/characteristics-of-thebeatboxing-vocal-style/.
18. TyTe, G. and Defenicial. (2005). Part 1: The Pre-History of Beatboxing [Online]. Available: https://www.humanbeatbox.com/articles/history-of-beatboxingpart-1/.
19. Underdown, A. D. (2018). Physiologie des « kick drums effects » dans la production du Human BeatBox. Retrieved from https://www.researchgate.net/publication/326631858

reed.blaylock@gmail.com **http://sail.usc.edu/span/beatboxingproject** **http://reedblaylock.com**