WILEY

| TEACHING AND LEARNING GUIDE

Teaching and Learning Guide for: The Cross-Linguistic Patterns of Phonation Types

Christina M. Esposito[1] [ID] | Sameer ud Dowla Khan[2] [ID]

[1]Linguistics, Macalester College, St Paul, Minnesota, USA | [2]Linguistics, Reed College, Portland, Oregon, USA

Correspondence: Christina M. Esposito (esposito@macalester.edu)

1 | Author's Introduction

Phonation is the production of sound by the vocal folds. Voice quality, or the particular manner in which this phonation manifests, varies substantially within and across languages.

Cross-linguistically, modal, or 'plain', voice is the most common voiced phonation type. However, numerous languages make systematic use of other phonation types such as breathy or creaky voice (e.g., Chong [Dicanio 2019], Gujarati [Khan 2012], White Hmong [Esposito 2012], Santa Ana del Valle Zapotec [Esposito 2010]). Some languages make use of more varied phonation types such as pharyngealized voice in !Xóõ (Garellek 2019), falsetto in Pakphanang Thai (Rose 1997), harsh voice in Bai and Dinka (Edmondson & Esling 2006), and faucalized or hollow voice in Dinka (Denning 1989; Edmondson & Esling 2006).

The last two decades have seen a surge in high-quality research on phonation in part due to advances in measuring techniques, as well as improvements in synthesis techniques generating considerable growth in research on how phonation is perceived.

2 | Author Recommends

1. Laver, J. (1981). *Phonetic description of voice quality.* Cambridge: Cambridge University Press.

   This book provides a detailed explanation of the supra-laryngeal settings responsible for a variety of voice qualities. Detailed descriptions of various voice qualities are also provided.

2. Gordon, M., & Ladefoged, P. (2001). Phonation types: a cross-linguistic overview. *Journal of Phonetics* 29, 383–406.

   One of the first papers reviewing cross-linguistic patterns of phonation, this article defines and provides examples for three common varieties of phonation—breathy, modal, and creaky—as well as an overview of acoustic measures, timing of non-modal phonation and allophonic non-modal phonation.

3. Edmondson, Jerold A., & Esling, John H. (2006). The valves of the throat and their functioning in tone, vocal register, and stress: laryngoscopic case studies. *Phonology*, 23(2), 157–191.

   This article describes a model of articulation of phonation based on the manipulation of six 'valves'. Manipulation of one or more of these valves produces differences in phonation. Different manipulations are illustrated with laryngoscopic images.

4. Esposito, C. M. (2010). The effects of linguistic experience on the perception of phonation. *Journal of Phonetics* 38, 306–16.

   This is one of the first systematic investigations of the role of native language background on the perception of phonation, using listeners from three languages—English, Spanish, and Gujarati—representing three different linguistic uses of non-modal voice quality. Results showed that different listener populations all rely on H1–H2, but to differing degrees based on native language inventory.

5. Kreiman, J., & Sidtis, D. (2011). *Foundations of Voice Studies.* Oxford: Wiley-Blackwell.

This book provides a comprehensive description of voice quality from an interdisciplinary perspective. Topics include: voice production, physical characteristics associated with voice, perception of voice, perception of emotional state, voice in singing and advertising, forensic applications, etc. Supplemental material is available at www.wiley.com/go/voicestudies.

6. Garellek, M. (2019). The phonetics of voice. In Katz, W. F., & Assmann, P. F. (eds.) *The Routledge Handbook of Phonetics*: 75–106.

This chapter from the *Handbook of Phonetics* focuses on the phonetics of linguistically-relevant voice qualities, how these sounds are produced and manifested in a multidimensional acoustic space, and a psychoacoustic model of the voice.

7. Esling, J., Moisik, S., Benner, A., & Crevier-Buchman, L. (2019). *Voice Quality: The Laryngeal Articulator Model* (Cambridge Studies in Linguistics). Cambridge: Cambridge University Press.

This book provides a detailed description of voice quality, using a new framework: The Laryngeal Articulator Model. Evidence from instrumental examination of the laryngeal articulators is provided. Additional topics include: computational simulations of voice quality, models of the larynx (and laryngeal constrictions), phonological implications, infant acquisition, and clinical descriptions of voice quality.

8. Garellek, Marc. (2022). Theoretical achievements of phonetics in the 21st century: Phonetics of voice quality. Journal of Phonetics, Volume 94.

This article provides a review of voice quality research in linguistic phonetics since 2000, highlighting its crucial role in all aspects of speech. It emphasizes that voice quality is not limited to contrastive phonation types, but is also found at the prosodic level. Technological advancements in acoustic and articulatory analysis, along with refinements in linguistic models, are also discussed.

9. Keating, P., J. Kuang, M. Garellek, C. Esposito, & S. D. Khan. (2023). A cross-language acoustic space for vocalic phonation distinctions. *Language 99*: 351–389.

This study is one of the first to make a crosslinguistic comparison of phonation, finding that phonation categories are language-specific (e.g., Hmong breathiness is not the same as Gujarati breathiness). This paper provides evidence for the universality of H1–H2 as a measure of phonation in that only H1–H2 distinguished phonation types in all languages tested.

3 | Online Materials

1. http://www.phonetics.ucla.edu/voiceproject/voice.html.

This webpage is the homepage of the 'Production and Perception of Linguistic Voice Quality' project at UCLA, an NSF funded grant to Pat Keating, with Abeer Alwan, Jody Kreiman, and Christina Esposito. It provides audio files, wordlists, and spreadsheet files with measures gathered using VoiceSauce (Shue, Keating, Vicenik & Yu 2011) for acoustic measures and/or EGG measures for 10 different languages. Links to publications on voice quality in different languages and to measuring software are also provided.

2. https://www.cambridge.org/core/journals/journal-of-the-international-phonetic-association/illustrations-of-the-ipa-free-content.

This site provides free access to the 'Illustrations of the IPA', short, concise accounts of the phonetic structure of a language. Audio files are also available. Languages with phonation types include: Dinka, Hmu, Vietnamese, etc. (See Tables 3 and 4 in the article for possible languages to study.)

4 | Sample Syllabus

Students with a background in phonetics, even just an introductory course in articulatory phonetics, will benefit the most from this lesson plan. In particular, Weeks 1, 2, and 4 are appropriate for students with previous exposure to phonetics, though some of the readings on acoustic measures may be challenging without prior knowledge of measurement procedures. One idea would be to assign these readings, but to encourage students to focus on the big picture (e.g., in Week 2, when reading Esposito et al. 2019, students could answer the question 'What is the relationship between vowel quality and voice quality?' rather than exploring how this question is affected by different spectral measurements.) Another idea, that we have used in teaching undergraduates, is to annotate the .pdfs of the article with definitions and/or guidance on what parts students can skim through. The remaining weeks (Weeks 3 and 4) are best reserved for more advanced phonetic students, in particular ones that are familiar with the acoustic signal and measurement techniques.

Week 1. What is Voice Quality?

What is phonation, and how is it produced? Students will learn about common phonation types across languages, and how they are distributed within languages.

Readings

General

Kreiman, J. and Sidtis, D. (2011). Foundations of Voice Studies, Wiley-Blackwell, Oxford Chapter 2 Producing a Voice and Controlling Its Sound.

Gordon, M., & Ladefoged, P. (2001). Phonation types: a cross-linguistic overview. *Journal of Phonetics* 29, 383–406.

Garellek, M. (2019). The phonetics of voice. In Katz, W. F., & Assmann, P. F. (eds.) *The Routledge Handbook of Phonetics*: 75–106.

Laver, J. (1981). *Phonetic description of voice quality*. Cambridge: Cambridge University Press.

Language-specific

Berkson, K. H. (2019). Acoustic correlates of breathy sonorants in Marathi. *Journal of Phonetics* 73, 70–90.

Garellek, M. (2019). Acoustic discriminability of the complex phonation system in !Xóõ. *Phonetica*. doi: 10.1159/000494301.

Khan, S. D. (2012). The phonetics of contrastive phonation in Gujarati. *Journal of Phonetics* 40, 780–95.

Suggested Learning Exercise and Questions

Focus questions 1, 2a, 2b

Learning exercise activity 1

Week 2. Variation in Phonation

How can a single category of phonation vary by vowel type, sentence context, level of formality, and speaker identity?

Readings

Variation due to speaker identity

Becker, Kara, S. D. Khan, & L. Zimman. (2022). Beyond binary gender: creaky voice, gender, and the variationist enterprise. *Language Variation and Change* 34, 215–238.

Mendoza-Denton, N. (2011). The semiotic hitchhiker's guide to creaky voice: Circulation and gendered hardcore in a Chicano/a gang persona. *Journal of Linguistic Anthropology* 21, 261–80.

Podesva, R. J. (2007). Phonation type as a stylistic variable: the use of falsetto in constructing a persona. *Journal of Sociolinguistics* 11, 478–504.

Zimman, L. (2018). Transgender voices: Insights on identity, embodiment, and the gender of the voice. *Language and Linguistics Compass* 12 (8).

Variation due to linguistic features

Esposito, C. M. (2010). Variation in contrastive phonation in Santa Ana del Valle Zapotec. *Journal of the International Phonetic Association* 40, 181–98.

Esposito, C. M., Sleeper, M., & Schafer, K. (2019). Examining the relationship between vowel quality and voice quality. *Journal of the International Phonetic Association* 1–32.

Suggested Learning Exercise and Questions

Focus questions 3, 5

Learning exercise activity 2

Week 3. Acoustic Measurements

This week, introduce students to acoustic measuring techniques. Students should review the Gordon and Ladefoged (2001) reading from week 1, particularly Section 5.3, to understand the harmonic amplitudes associated with different phonation types.

Readings

Gordon, M., & Ladefoged, P. (2001). Phonation types: a cross-linguistic overview. *Journal of Phonetics* 29, 383–406.

Shue, Y.-L., Keating, P., Vicenik, C., & Yu, K. M. (2011). VoiceSauce: A program for voice analysis. *Proceedings of the 17th International Congress of Phonetic Sciences,* Hong Kong 1846–9.

Suggested Learning Exercise and Questions

Focus questions 4

Learning exercise activity 3

Week 4. Phonation and Tone

This week, students will explore the topic of tone, as it relates to phonation.

Readings

Brunelle, M. & Kirby, J. (2016). Tone and Phonation in Southeast Asian Languages. *Language and Linguistic Compass* 10, 191–207.

Esposito, C. M. (2012). An acoustic and electroglottographic study of White Hmong tone and phonation. *Journal of Phonetics* 40, 466–76.

Garellek, M., & Keating, P. (2011). The acoustic consequences of phonation and tone interactions in Jalapa Mazatec. *Journal of the International Phonetic Association* 41, 185–205.

Kuang, J. (2013). The tonal space of contrastive five level tones. *Phonetica (Special issue: Function and Form in Prosodic Analysis of Tonal and Non-Tonal Languages)* 70, 1–23.

Suggested Learning Exercise

Focus question 2c

Learning exercise activity 4

Week 5. Perception of Phonation

How are different phonations perceived? What are the effects of linguistic background on this perception? What role does tone and other features play in the perception of phonation?

Esposito, C. M. (2010). The effects of linguistic experience on the perception of phonation. *Journal of Phonetics* 38, 306–16.

Esposito, C. M., Khan, S. D., Berkson, K. H., & Nelson, M. (2019). Distinguishing breathy consonants and vowels in Gujarati. *Journal of South Asian Languages and Linguistics*.

Kreiman, J., Gerratt, B. R., & Khan, S. D. (2010). Effects of native language on perception of voice quality. *Journal of Phonetics* 38, 588–93.

DiCanio, C. T. (2014). Cue weight in the perception of Trique glottal consonants. *Journal of the Acoustical Society of America* 119, 3059–71.

Suggested Learning Exercise and Questions

Learning exercise activity 5

5 | Focus Questions

1. Define phonation. What are some common non-modal phonations that occur crosslinguistically? Describe at least one way in which different phonation types are produced.

2. Using a source such as the UCLA Archive, Wikipedia, or a collection of grammars, make a list of languages that possess non-modal phonation.
   Answer the following questions:
   a. Do these languages have any other features in common?
   b. Are they in the same language families? Locate the languages on a map and pose the question 'is phonation an areal feature?'
   c. Given what we know about tone and phonation, how do we expect the languages to pattern with respect to tone. Which languages include both tone and phonation, and which only contrast one of these features? Do any of the languages have an allophonic relationship between tone and phonation? Based on the readings, why does a relationship between tone and phonation exist?

3. Discuss (socio)linguistic phenomena that can interact with voice quality. Consider everything from phonological systems and phenomena that overlap with and/or interact with voice quality through morphosyntactic structure and sociolinguistic indices. How do these overlapping/intersecting phenomena complicate our understanding of what voice quality is (and isn't), and how do we properly measure it while keeping all these factors in mind?

4. Review some ways to measure phonation. Why is it important to measure phonation in a variety of ways? What do different measurements (or types of measurements) indicate about speech production?

5. The media has criticized young people for their use of creaky voice ('vocal fry'). How can the work on linguistic voice quality provide insight for pushing back against this type of linguistic discrimination? You can supplement this discussion by listening to Dr. Penelope Eckert's interview%20on%20NPR where she discusses vocal fry.

6 | Learning Exercise

Activity 1. Illustrating the multidimensional larynx

After reading about how phonation is produced, have students make a three-dimensional paper model available from Vocal%20Press.

Activity 2: Exploring phonation in your own speech

Have students record themselves reading (or retelling) a short passage. Impressionistically, do they appear to produce instances of non-modal phonation? If so, is there a discernible pattern to these productions? Students familiar with phonetic measurements could measure these productions and compare them to their modal voice. How do the results of the phonetic measurements compare to their auditory perception? Students may also want to record different sociolinguistic styles and see if the use of non-modal phonation changes with stylistic changes.

Activity 3. Using VoiceSauce

Using the sound files in the Gujarati folder, practice producing the phonation difference produced in the (near-)minimal pairs provided. Then, use VoiceSauce to measure each vowel and determine which acoustic features successfully distinguish voice qualities. How do these line up with the findings of Khan (2012), which uses a superset of these recordings?

Activity 4. Archive work

Using the UCLA Archive or the Production and Perception of Linguistic Voice Quality webpage, each student is assigned a different language with multiple voice quality categories, such as Hmong, Mazatec, or Zapotec. Students listen to words from their assigned language, choose which sounds in which words to compare, and use VoiceSauce to determine which acoustic features distinguish the chosen sounds in terms of voice quality. Students should be encouraged to use more than one spectral measure, such as H1–H2, H1–A1, H1–A3, etc. and F0. How do these voice qualities compare across languages? Are the same measures successful for a given phonation type across languages? Students should also measure F0 and explore the relationship between F0 and phonation: are the two linked, or does tone freely vary with regard to phonation?

Activity 5. Perception experiments

Discuss how native language affects the perception of phonation. If students are working on individual languages (from data that they collected or from grammars), have them think of a perception experiment that they could conduct (or questions that they could answer for a more introductory course). Students will either design a proposal or, if data is available,

implement their own small-scale perception experiment using Praat's Multiple Forced Choice function or equivalent. How do the readings on perception (Week 4) help us inform hypotheses and interpret the (real or hypothetical) results?

Supporting Information

Additional supporting information can be found online in the Supporting Information section.