KBM INDONESIA

MISNADIN

LARYNGEAL CONTRASTS IN MADURESE STOPS

LARYNGEAL CONTRASTS IN MADURESE STOPS

Author:
Misnadin

KBM INDONESIA

KBM INDONESIA PUBLISHERS

is a publisher with a mission to facilitate the book publishing process by authors in Indonesia. As well as being a medium for sharing the book publishing process.

LARYNGEAL CONTRASTS IN MADURESE STOPS

ISBN : 978-634-202-590-1
15,5 x 23 cm, iv + 172 Pages
First Printing, July 2025

Author : **Misnadin**
Cover Designer : **Aswan Kreatif**
Layouter : **AtikaNS**
Editor : **Dr. Muhamad Husein Maruapey, Drs., M.Sc.**
Background of the book is taken from **https://www.freepik.com/**

Publisher:
KARYA BAKTI MAKMUR (KBM) INDONESIA
Member of IKAPI (Ikatan Penerbit Indonesia)
NO. IKAPI 279/JTI/2021
Depok, Sleman-Jogjakarta (Office)
081357517526 (Phone/WhatsApp)

Website : https://penerbitkbm.com
www.penerbitbukumurah.com
Email : naskah@penerbitkbm.com
Distributor : https://penerbitkbm.com/toko-buku/
Youtube : Penerbit KBM Sastrabook
Instagram : @penerbit.kbmindonesia
@penerbitbukujogja

Sanctions for Violating Article 113

Law no. 28 of 2014 concerning Copyright

i. Any person who unlawfully commits a violation of economic rights as intended in Article 9 paragraph (1) letter i for Commercial Use shall be punished by a maximum imprisonment of 1 (one) year and/or a maximum fine of IDR 100,000,000 (one hundred million rupiah).

ii. Every person who, without the right and/or without the permission of the Creator or Copyright holder, violates the economic rights of the Creator as intended in Article 9 paragraph (1) letter c, letter d, letter f, and/or letter h for Commercial Use shall be punished with a maximum prison sentence of 3 (three) years and/or a maximum fine of Rp. 500,000,000.00 (five hundred million rupiah).

iii. Any person who, without the right and/or without the permission of the Creator or Copyright holder, violates the economic rights of the Creator as intended in Article 9 paragraph (1) letter a, letter b, letter e, and/or letter g for Commercial Use shall be punished with a maximum prison sentence of 4 (four) years and/or a maximum fine of Rp. 1,000,000,000.00 (one billion rupiah).

iv. Every person who fulfills the elements as intended in paragraph (3) and commits it in the form of piracy, shall be punished with a maximum imprisonment of 10 (ten) years and/or a maximum fine of IDR 4,000,000,000.00 (four billion rupiah).

PREFACE

This book presents and discusses acoustic properties of laryngeal contrasts in Madurese stop consonants by thoroughly looking at several acoustic measures that are commonly used to distinguish them in the world's languages. The book consists of four major parts.

The first part introduces the rationale of the book and sets the stage for the topics. The second part addresses and discusses theoretical frameworks for understanding voicing and laryngeal contrasts used in the world's languages. We describe how laryngeal contrasts are manifested through several acoustic properties. The third part presents and discusses acoustic correlates of laryngeal contrasts in Madurese stops, i.e., voice onset time (VOT), stop closure duration, fundamental frequency (F0), H1*-A1*, H1*-A2*, H1*-A3*, H1*-H2*, H2*-H4*, and ceptral peak prominence (CPP). The last part wraps up the whole discussion of the book.

We hope the book provides meaningful resources concerning specific acoustic aspects of the laryngeal contrast in Madurese. We also hope it gives insightful knowledge about general aspects of Madurese phonetics and phonology that can inspire and stimulate further interest in that field.

Bangkalan, 25 June 2025
Author,

Misnadin

TABLE OF CONTENTS

CHAPTER 4

REFERENCES

Abdelli-Beruh, N. B. (2004). The stop voicing contrast in French sentences: Contextual sensitivity of vowel duration, closure duration, voice onset time, stop release and closure duration. *Phonetica*, *61*, 201–219.

Abdelli-Beruh, N. B. (2009). Influence of place of articulation on some acoustic correlates of the stop voicing contrast in Parisian French. *Journal of Phonetics*, *37*, 66–78.

Abramson, A. S., & Lisker, L. (1971). Voice timing in Korean stops. Presented at *the Seventh International Congress of Phonetic Sciences*, Montreal.

Abramson, A. S., Nyea, P. W., & Luangthongkum, T. (2007). Voice register in Khmu' Experiments in production and perception. *Phonetica*, *64*, 80–104.

Alghamdi, M. (1990). *Analysis, synthesis and perception of voicing in Arabic* (Doctoral Dissertation). University of Reading.

Anderson, S. (1991). Vowel-consonant interaction in Madurese. In Ann, J. and Yoshimora, K. (eds.) *Coyote Papers, Arizona Phonology Conference* (vol. 4) (pp.1-15).

Anderson, S. R. (1981). Why phonology isn't "natural." *Linguistic Inquiry*, 493–539.

Andruski, J. E., & Ratliff, M. (2000). Phonation types in production of phonological tone: the case of Green Mong. *Journal of the International Phonetic Association*, *30*, 37–61.

Archangeli, D. B., & Pulleyblank, D. G. (1994). *Grounded phonology* (Vol. 25). MIT Press.

Avery, P., & Idsardi, W. J. (2001). Laryngeal dimensions, completion and enhancement. In Hall, T. A. (Ed.), *Distinctive feature theory* (Vol. 2) (pp. 41-70). Berlin: Mouton de Gruyter.

Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language*, *59*, 390–412.

Bates, D., Maechler, M., Bolker, B., Walker, S., Christensen, R. H. B., Singmann, H., & Dai, B. (2014). Package "lme4." *R Foundation for Statistical Computing*, Vienna.

Beckman, J., Helgason, P., McMurray, B., & Ringen, C. (2011). Rate effects on Swedish VOT: evidence for phonological oversimplification. *Journal of Phonetics*, *39*, 39–49.

Beckman, J., Jessen, M., & Ringen, C. (2013). Empirical evidence for laryngeal features: Aspirating vs. true voice languages. *Journal of Linguistics*, 1–26.

Benguerel, A.-P., & Bhatia, T. K. (1980). Hindi stop consonants: an acoustic and fiberscopic study. *Phonetica*, *37*(3), 134–148.

Blankenship, B. (1997). *The time course of breathiness and laryngealization in vowels* (PhD Dissertation). UCLA.

Blankenship, B. (2002). The timing of nonmodal phonation in vowels. *Journal of Phonetics*, *30*, 163–191.

Blevins, J. (2004). *Evolutionary phonology: the emergence of sound patterns*. Cambridge University Press.

Boersma, P. (1993). Accurate short-term analysis of the fundamental frequency and the harmonics-to-noise ratio of a sampled sound (Vol. 17, pp. 97–110). Presented at *the Proceedings of the Institute of Phonetic Sciences*, Amsterdam.

Boersma, P., & Weenink, D. (2014). {P}raat: doing phonetics by computer. Retrieved from www.praat.org

Bradley, D. (1982). Register in Burmese. *Pacific Linguistics. Series A. Occasional Papers*, (62), 117.

Brunelle, M. (2010). The role of larynx height in the Javanese tense~lax stop contrast. *Austronesian and Theoretical Linguistics, Amsterdam: John Benjamins*, 7–24.

Casali, R. F. (2008). ATR harmony in African languages. *Language and Linguistics Compass*, *2*(3), 496–549.

Catford, J. C. (1977). *Fundamental problems in phonetics*. Midland Books.

Chen, Y. (2011). How does phonology guide phonetics in segment–f0 interaction? *Journal of Phonetics*, *39*, 612–6125.

Chomsky, N., & Halle, M. (1968). *The Sound Pattern of English*. New York: Harper and Row.

Cho, T., & Ladefoged, P. (1999). Variation and universals in VOT: evidence from 18 languages. *Journal of Phonetics*, *27*, 207–229.

Cho, T., Ladefoged, P., & Jun, S.-A. (2002). Acoustic and aerodynamic correlates of Korean stops. *Journal of Phonetics*, *30*, 193–228.

Clements, G. N., & Hallé, P. (2010). Phonetic bases of distinctive features: introduction. *Journal of Phonetics*, *1*(38), 3–9.

Cohn, A. C. (1993b). Consonant-vowel interaction in Madurese: the feature lowered larynx. *Chicago Linguistics Society*, *29*, 105–119.

Cohn, A. C. (1993a). Voicing and vowel height in Madurese: a preliminary report. *Oceanic Linguistics Special Publication*, 107–121.

Cohn, A. C., & Ham, W. H. (1998). Temporal properties of Madurese consonants: a preliminary report. *Working Papers of the Cornell Phonetics Laboratory*, *12*, 27–51.

Cohn, A. C., & Lockwood, K. (1994). A phonetic description of Madurese and its phonological implications. *Working Papers of the Cornell Phonetics Laboratory*, *9*, 67–92.

Davies, W. D. (2010). *A grammar of Madurese* (Mouton grammar library, 50). Walter de Gruyter.

Dempwolff, O. (1938). *Vergleichende lautlehre des austronesischen Wortschatzes, Band 3: Austronesisches Worterverzeichnis (19. Beiheft zur Zeitschrift fur Eingeborenen-Sprachen)*. Berlin, Hamburgh: D. Reimer.

Denning, K. (1989). *The diachronic development of phonological voice quality, with special reference to Dinka and the other Nilotic languages* (PhD Dissertation). Stanford University, Ann Arbor, MI.

DiCanio, C. T. (2009). The phonetics of register in Takhian Thong Chong. *Journal of the International Phonetic Association*, *39*(2), 162–188.

Dmitrieva, O., Llanos, F., Shultz, A. A., & Francis, A. L. (2015). Phonological status, not voice onset time, determines the acoustic realization of onset f0 as a secondary voicing cue in Spanish and English. *Journal of Phonetics*, *49*, 77–95.

Dutta, I. (2007). Four-way stop contrasts in Hindi: an acoustic study of voicing, fundamental frequency and spectral tilt (PhD Dissertation). University of Illinois at Urbana-Champaign.

Dyen, I. (1965). *A lexicostatistical classification of the Austronesian languages* (Vol. Memoir 19). Baltimore: Waverly Press.

Edmondson, J. A., & Esling, J. H. (2006). The valves of the throat and their functioning in tone, vocal register and stress Laryngoscopic case studies, *23*(2), 157–191.

Esposito, C. M. (2004). Santa Ana del Valle Zapotec Phonation. *UCLA Working Papers in Phonetics*, *103*, 71–105.

Esposito, C. M. (2010a). The effects of linguistic experience on the perception of phonation. *Journal of Phonetics*, *38*, 306–316.

Esposito, C. M. (2010b). Variation in contrastive phonation in Santa Ana Del Valle Zapotec. *Journal of the International Phonetic Association*, *40*(2), 181–-198.

Esposito, C. M. (2012). An acoustic and electroglottographic study of White Hmong tone and phonation. *Journal of Phonetics*, *40*, 466–476.

Esposito, C. M., & Khan, S. ud D. (2012). Contrastive breathiness across consonants and vowels: a comparative study of Gujarati and White Hmong. *Journal of the International Phonetic Association*, *42*(2), 123–143.

Fischer-Jørgensen, E. (1967). Phonetic analysis of breathy (murmured) vowels in Gujarati. *Indian Linguistics*, *28*, 71–139.

Fischer-Jørgensen, E. (1968). Voicing, tenseness and aspiration in stop consonants, with special reference to French and Danish. *Annual Report of the Institute of Phonetics, University of Copenhagen*, *3*, 63–114.

Fulop, S. A., Karib, E., & Ladefoged, P. (1998). An acoustic study of the tongue root contrast in Degema vowels. *Phonetica*, *55*, 80–98.

Gao, J. (2015). *Interdependence between tones, segments and phonation types in Shanghai Chinese* (PhD Dissertation). Universite Sorbonne Nouvelle-Paris 3.

Garellek, M., & Keating, P. (2011). The acoustic consequences of phonation and tone interactions in Jalapa Mazatec. *Journal of the International Phonetic Association*, *41*(02), 185–205.

Goldstein, U. G. (1980). An articulatory model for the vocal tracts of growing children.

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

Gósy, M. (2001). The VOT of the Hungarian voiceless plosives in words and in spontaneous Speech. *International Journal of Speech Technology*, *4*(1), 75–85.

Gósy, M., & Ringen, C. (2009). Everything you always wanted to know about VOT in Hungarian. Presented at *the 19th International Conference on the Structure of Hungarian*, Debrecen, Hungary.

Guion, S. G., Post, M. W., & Payne, D. L. (2004). Phonetic correlates of tongue root vowel contrasts in Maa. *Journal of Phonetics*, *32*, 517–542.

Halle, M., & Stevens, K. (1969). On the feature "advanced tongue root." *Quarterly Progress Report of the MIT Research Laboratory in Electronics*, *94*, 209–215.

Halle, M., & Stevens, K. N. (1971). *A note on laryngeal features* (Quarterly Progress Report of the Research Laboratory of Electronics 101) (pp. 198–213).

Han, M. S., & Weitzman, R. S. (1970). Acoustic features of Korean /P, T, K/, /p, t, k/ and /p^h, t^h, k^h/, *Phonetica, 22(2)*, 112–128.

Hanson, H. M. (1997). Glottal characteristics of female speakers Acoustic correlates. *Journal of the Acoustical Society of America*, *101*(1), 466–481.

Hanson, H. M., & Chuang, E. S. (1999). Glottal characteristics of male speakers: acoustic correlates and comparison with female data. *Journal of the Acoustical Society of America*, *106*(2), 1064–1077.

Hanson, H. M., Stevens, K. N., Kuo, H.-K. J., Chen, M. Y., & Slifka, J. (2001). Towards models of phonation. *Journal of Phonetics*, *29*, 451–480.

Hayes, B., Kirchner, R., & Steriade, D. (2004). *Phonetically based phonology*. Pearson Education.

Hayes, B. P. (1999). Phonetically driven phonology. *Functionalism and Formalism in Linguistics*, *1*, 243–285.

Helgason, P., & Ringen, C. (2008). Voicing and aspiration in Swedish stops. *Journal of Phonetics*, *36*, 607–628.

Henderson, E. J. (1952). The main features of Cambodian pronunciation. *Bulletin of the School of Oriental and African Studies*, *14*(01), 149–174.

Hillenbrand, J., Cleveland, R. A., & Erickson, R. L. (1994). Acoustic correlates of breathy vocal quality. *Journal of Speech and Hearing Research*, *37*, 769–778.

Holmberg, E. B., Hillman, R. E., Perkell, J. S., Guiod, P. C., & Goldman, S. L. (1995). Comparisons among aerodynamic, electroglottographic, and acoustic spectral measures of female voice. *Journal of Speech, Language, and Hearing Research*, *38*(6), 1212–1223.

Hombert, J. M. (1975). *Towards a theory of tonogenesis: an empirical, physiologically and perceptually based account of the development of tonal contrasts in languages* (Doctoral Dissertation). University of California, Berkeley.

Hombert, J. -M. (1978). Consonant types, vowel quality, and tone. In Fromkin, V. A. (Ed.), *Tone: A Linguistic Survey* (pp. 77-112). New York: Academic Press.

Hombert, J. -M., & Ladefoged, P. (1976). Effect of aspiration on the fundamental frequency of the following vowel. *The Journal of the Acoustical Society of America*, *59*(S1), S72–S72.

Hombert, J. -M., Ohala, J. J., & Ewan, W. G. (1979). Phonetic explanations for the development of tones. *Language*, 37–58.

Honda, K. (1983). Relationship between pitch control and vowel articulation. *Haskins Laboratories Status Report on Speech Research, SR*, *73*, 269–82.

Honda, K., Hirai, H., Masaki, S., & Shimada, Y. (1999). Role of vertical larynx movement and cervical lordosis in F0 control. *Language and Speech*, *42*, 404–411.

Honeybone, P. (2005). Diachronic evidence in segmental phonology: the case of obstruent laryngeal specifications. In van Oostendorp, M., & van de Weijer, J. M. (Eds.), *The internal organization of phonological segments* (Vol. 77) (pp. 319-354). Berlin: Mouton de Gruyter.

House, A. S., & Fairbanks, G. (1953). The influence of consonant environment upon the secondary acoustical characteristics of vowels. *The Journal of the Acoustical Society of America*, *25*(1), 105–113.

House, A. S., & Stevens, K. N. (1958). Estimation of formant bandwidths from measurements of transient response of the vocal tract. *Journal of Speech, Language, and Hearing Research*, *1*(4), 309–315.

Huffman, M. K. (1987). Measures of phonation type in Hmong. *Journal of the Acoustical Society of America*, *81*(2), 495–504.

Hyman, L. M. (2001). The limits of phonetic determinism in phonology:* NC revisited. *The Role of Speech Perception in Phonology*, 141–185.

Iseli, M., & Alwan, A. (2004). An improved correction formula for the estimation of harmonic magnitudes and its application to open quotient estimation. In *Acoustics, Speech, and Signal Processing, 2004. Proceedings.(ICASSP'04). IEEE International Conference on* (Vol. 1, pp. I–669–72 vol. 1). IEEE.

Iseli, M., Shue, Y.-L., & Alwand, A. (2007). Age, sex, and vowel dependencies of acoustic measures related to the voice source. *Journal of the Acoustical Society of America*, *121*, 2283–2295.

Iverson, G. K., & Salmons, J. C. (1995). Aspiration and laryngeal representation in Germanic. *Phonology*, *12*(03), 369–396.

Laboratory, Department of Linguistics, UCLA.

Jacobson, L. C. (1980). Voice-quality harmony in Western Nilotic languages. *Issues in Vowel Harmony (studies in Language Companion Series, Vol. 6)*, 183–200.

Jessen, M. (1996). *Phonetics and phonology of the tense and lax obstruents in German* (PhD Dissertation). Cornell University.

Jessen, M. (2001). Phonetic implementation of the distinctive auditory features [voice] and [tense] in stop consonants. In Hall, T. A. (Ed.), *Distinctive feature theory* (Vol. 2) (pp. 237-292). Berlin: Mouton de Gruyter.

Jessen, M., & Ringen, C. (2002). Laryngeal features in German. *Phonology*, *19*, 189–218.

Kagaya, R., & Hirose, H. (1975). Fiberoptic electromyographic and acoustic analyses of Hindi stop consonants. *Annual Bulletin of the Research Institute of Logopedics and Phoniatrics*, *9*, 27–46.

Kang, Y. (2014). Voice Onset Time merger and development of tonal contrast in Seoul Korean stops: a corpus study. *Journal of Phonetics*, (45), 76–90.

Keating, P. A. (1984). Phonetic and phonological representation of stop consonant voicing. *Language*, *60*(2), 286–319.

Keating, P. A. (1988). Underspecification in phonetics. *Phonology*, *5*(2), 275–292.

Keating, P. A. (1990). Phonetic representations in a generative grammar. *Journal of Phonetics*, *18*(3), 321–334.

Keating, P. A., & Esposito, C. (2006). Linguistic voice quality. Presented at *the Proceedings of the Eleventh Australasian International Conference on Speech Science and Technology*.

Khan, S. ud D. (2012). The phonetics of contrastive phonation in Gujarati. *Journal of Phonetics*, *40*, 780–795.

Kiliaan, H. N. (1897). *Madoereesche Spraakkunst: I Inleiding en Klankleer and II Woordleer en Syntaxis*. Batavia: Landsdrukkerij.

Kim, M.-R., & Duanmu, S. (2004). "Tense" and "lax" stops in Korean. *Journal of East Asian Linguistics*, *13*(1), 59–104.

Kingston, J. (2007). The phonetics-phonology interface. *The Cambridge Handbook of Phonology*, 435–456.

Kingston, J., & Diehl, R. L. (1994). Phonetic Knowledge. *Language*, *70*(3), 419–454.

Kingston, J., Diehl, R. L., Kirk, C. J., & Castleman, W. A. (2008). On the internal perceptual structure of distinctive features: the [voice] contrast. *Journal of Phonetics*, *36*, 28–54.

Kingston, J., Macmillan, N. A., Dickey, L. W., Thorburn, R., & Bartels, C. (1997). Integrality in the perception of tongue

root position and voice quality in vowels. *Journal of the Acoustical Society of America*, *101*(3), 1696–1709.

Kirk, P. L., Ladefoged, P., & Ladefoged, J. (1984). Using a spectrograph for measures of phonation types in a natural language. *UCLA Working Papers in Phonetics*, *59*, 102–113.

Klatt, D. H., & Klatt, L. C. (1990). Analysis, synthesis, and perception of voice quality variations among female and male talkers. *Journal of the Acoustical Society of America*, *87*(2), 820–857.

Kluender, K. R. (1991). Effects of first formant onset properties on voicing judgments result from processes not specific to humans. *The Journal of the Acoustical Society of America*, *90*(1), 83–96.

Kohler, K. J. (1984). Phonetic explanation in phonology: the feature fortis/lenis. *Phonetica*, *41*, 150–174.

Kong, E. J., Beckman, M. E., & Edwards, J. (2012). Voice onset time is necessary but not always sufficient to describe acquisition of voiced stops: the cases of Greek and Japanese. *Journal of Phonetics*, *40*, 725–744.

Kreiman, J., Gerratt, B. R., & Khan, S. ud D. (2010). Effects of native language on perception of voice quality. *Journal of Phonetics*, *38*, 588–593.

Kulikov, V. (2012). *Voicing and voice assimilation in Russian stops* (PhD Dissertation). University of Iowa, Ann Arbor, MI.

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2016). lmerTest: Tests in Linear Mixed Effects Models. R package version 2.0-30. https://CRAN.R-project.org/package=lmerTest.

Ladefoged, P. (1971). *Preliminaries to linguistic phonetics*. University of Chicago Press.

Ladefoged, P. (1983). The linguistic use of different phonation types. *Vocal Fold Physiology: Contemporary Research and Clinical Issues*, 351–360.

Ladefoged, P., & Maddieson, I. (1996). *The sounds of the world's languages*. Oxford: Blackwell.

Laeufer, C. (1992). Patterns of voicing-conditioned vowel duration in French and English. *Journal of Phonetics*, *20*(4), 411–440.

Lai, Y., Huff, C., Sereno, J., & Jongman, A. (2009). The raising effect of aspirated prevocalic consonants on F0 in Taiwanese. In *Proceedings of the 2nd International Conference on East Asian Linguistics, Simon Fraser University Working Papers in Linguistics*

Laver, J. (1980). *The phonetic description of voice quality*. Cambridge: Cambridge University Press.

Lehiste, I. (1970). *Suprasegmentals (Cambridge, Mass.)*. Cambridge: MIT press.

Lenth, R. V. (2016). Least-Squares Means: the R Package lsmeans. Journal of Statistical Software, 69(1), 1-33.

Lindau, M. (1979). Feature expanded. *Journal of Phonetics*, *7*(2), 163–176.

Lindau, M., & Ladefoged, P. (1986). Variability of feature specifications. *Invariance and Variability in Speech Processes*. Hillsdale, NJ: Lawrence Erlbaum, 464–78.

Lisker, L., & Abramson, A. S. (1964). A cross language study of voicing in initial stops: acoustical measurements. *Word*, *20*, 384–422.

Lobel, J. W., & Riwarung, L. H. S. (2009). Maranao revisited: an overlooked

Löfqvist, A., Baer, T., McGarr, N. S., & Story, R. S. (1989). The cricothyroid muscle in voicing control. *The Journal of the Acoustical Society of America*, *85*(3), 1314–1321.

Lombardi, L. (1991). *Laryngeal features and laryngeal neutralization* (PhD Dissertation). University of Massachusetts at Amherst.

Lombardi, L. (1995). Laryngeal neutralization and syllable wellformedness. *Natural Language & Linguistic Theory*, *13*(1), 39–74.

Lynch, J., Ross, M., & Crowley, T. (2002). *The Oceanic Languages* (Vol. 1). Psychology Press.

Maddieson, I. (1984). *Patterns of sounds*. Cambridge University Press.

Mester, R. A., & Itô, J. (1989). Feature predictability and underspecification: palatal prosody in Japanese mimetics. *Language*, 258–293.

Mielke, J. (2008). *The emergence of distinctive features*. Oxford University Press.

Mills, T. (2010). spectralTiltMaster.praat version 0.0.5

Misnadin, M., Kirby, J., & Remijsen, B. (2015). Temporal and spectral properties of Madurese stops (Vol. 789). Presented at *the Proceedings of the 18th International Congress of Phonetic Sciences*, Glasgow, UK.

Mohr, B. (1971). Intrinsic variations in the speech signal. *Phonetica*, *23*(2), 65–93.

Nearey, T. M., & Rochet, B. L. (1994). Effects of place of articulation and vowel context on VOT production and perception for French and English stops. *Journal of the International Phonetic Association*, *24*(1), 1–18.

Ohala, J. J. (2005). Phonetic explanations for sound patterns. *A Figure of Speech: a Festschrift for John Laver*, 23–38.

Ohala, J. J., & Riordan, C. J. (1979). Passive vocal tract enlargement during voiced stops. *The Journal of the Acoustical Society of America*, *65*(S1), S23–S23.

Ohde, R. N. (1984). Fundamental frequency as an acoustic correlate of stop consonant voicing. *Journal of the Acoustical Society of America*, *75*(1), 224–230.

Paster, M. (2004). Vowel height harmony and blocking in Buchan Scots. *Phonology*, *21*, 359–407.

Perkell, J. S. (1969). Physiology of speech production: results and implications of a quantitative cineradiographic study. MIT research monograph, No 53.

Peterson, G. E., & Barney, H. L. (1952). Control methods used in a study of the vowels. *The Journal of the Acoustical Society of America*, *24*(2), 175–184.

Pierrehumbert, J. (1990). Phonological and phonetic representation. *Journal of Phonetics*, *18*(3), 375–394.

Pike, K. L. (1967). Tongue-root position in practical phonetics. *Phonetica*, *17*(3), 129–140.

Pind, J. (1999). The role of F1 in the perception of voice onset time and voice offset time. *The Journal of the Acoustical Society of America*, *106*(1), 434–437.

Port, R. F., & Rotunno, R. (1979). Relation between voice onset time and vowel duration. *Journal of the Acoustical Society of America*, *66*(3), 654–662.

Quené, H. (2014). Hqmisc: Miscellaneous convenience functions and dataset. R package version 0.1-1. https://CRAN.R-project.org/package=hqmisc

R Core Team. (2015). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Retrieved from https://www.R-project.org/.

Ren, N. (1992). *Phonation types and stop consonant distinctions: Shanghai Chinese* (PhD Dissertation). The University of Connecticut.

Ringen, C., & Kulikov, V. (2012). Voicing in Russian stops: cross-linguistic implications. *Journal of Slavic Linguistics*, *20*(2), 269–286.

Shimizu, K. (1996). *A cross-language study of voicing contrasts of stop consonants in Asian languages*. Seibido.

Silva, D. J. (2006). Acoustic evidence for the emergence of tonal contrast in contemporary Korean. *Phonology*, *23*(02), 287–308.

Silverman, D. (1997). Laryngeal complexity in Otomanguean vowels. *Phonology*, *14*(02), 235–261.

Soetoko, Soegianto, Soekarto, & Soetarto, A. (1986). *Pemetaan Bahasa Madura di Pulau Madura*. Jakarta: Pusat Pembinaan dan Pengembangan Bahasa, Departemen Pendidikan dan Kebudayaan.

Soetoko, Soegianto, Surani, Sariyono, & Suyanto. (1998). *Geografi Dialek Bahasa Madura*. Jakarta: Pusat Pembinaan dan Pengembangan Bahasa, Departemen Pendidkan dan Kebudayaan.

Stevens, A. M. (1965). Language levels in Madurese. *Language*, 294–302.

Stevens, A. M. (1966). The Madurese reflexes of Proto-Malayopolynesian. *Journal of the American Oriental Society*, *86*, 147–56.

Stevens, A. M. (1968). *Madurese Phonology and Morphology*. New Haven: American Oriental Society.

Stevens, A. M. (1980). Formative boundary in phonological rules. In *Junctures: a collection of original papers* (pp. 135–141). Saratoga, California: Amma Libri.

Stevens, A. M. (1991). Madurese reduplication revisited. *Royal Institute of Linguistics and Anthropology*.

Stevens, K. N. (1977). Physics of laryngeal behavior and larynx modes. *Phonetica*, *34*, 264–279.

Stevens, K. N. (1989). On the quantal nature of speech. *Journal of Phonetics*, *17*, 3–45.

Stevens, K. N., & Hanson, H. M. (1995). Classification of glottal vibration from acoustic measurements. *Vocal Fold Physiology: Voice Quality Control*, 147–170.

Stevens, K. N., & Klatt, D. H. (1974). Role of formant transitions in the voiced-voiceless distinction for stops. *The Journal of the Acoustical Society of America*, *55*(3), 653–659.

Summerfield, Q., & Haggard, M. (1977). On the dissociation of spectral and temporal cues to the voicing distinction in

initial stop consonants. *Journal of the Acoustical Society of America*, *62*(2).

Thurgood, E. (2004). Phonation types in Javanese. *Oceanic Linguistics*, *43*(2), 277–295.

Thurgood, G. (2007). Tonogenesis revisited: revising the model and the analysis. *Studies in Tai and Southeast Asian Linguistics*, 263–291.

Tiede, M. K. (1996). An MRI-based study of pharyngeal volume contrasts in Akan and English. *Journal of Phonetics*, *24*(4), 399–421.

Traunmüller, H., & Eriksson, A. (2000). Acoustic effects of variation in vocal effort by men, women, and children. *The Journal of the Acoustical Society of America*, *107*(6), 3438–3451.

Trigo, L. (1991). On pharynx-larynx interactions. *Phonology*, *8*(1), 113–136.

Tsuchida, A. (1997). *Phonetics and phonology of Japanese vowel devoicing* (PhD Dissertation). Cornell University.

Tucker, A. N., & Mpaayei, J. T. O. (1955). *A Maasai grammar, with vocabulary*. Longmans, Green.

Turk, A., Nakai, S., & Sugahara, M. (2006). Acoustic segment durations in prosodic research: a practical guide. *Methods in Empirical Prosody Research*, *3*, 1–28.

van Heuven, V. J., Roosman, L., & van Zanten, E. (2008). Betawi Malay word prosody. *Lingua*, *118*, 1271–1287.

Vaux, B. (1996). The status of ATR in feature geometry. *Linguistic Inquiry*, *27*(1), 175–182.

Wayland, R., & Jongman, A. (2003). Acoustic correlates of breathy and clear vowels: the case of Khmer. *Journal of Phonetics*, *31*, 181–201.

Westbury, J. R. (1983). Enlargement of the supraglottal cavity and its relation to stop consonant voicing. *Journal of the Acoustical Society of America*, *73*(4), 1332–1336.

Wickham, H. (2009). *ggplot2: elegant graphics for data analysis*. Springer Science & Business Media.

Xu, C. X., & Xu, Y. (2003). Effects of consonant aspiration on Mandarin tones. *Journal of the International Phonetic Association*, *33*(02), 165–181.

ABOUT THE AUTHOR

Misnadin was born in Pamekasan, Madura, East Java Province, Indonesia. He earned a Bachelor's degree in English Language and Literature from Airlangga University, Indonesia; a Master's degree in Advanced Linguistics from The University of Queensland, Australia in 2010, working with John Ingram; and a PhD from The University of Edinburgh, UK in 2016, where he worked with James Kirby and Bert Remijsen. He has joined Universitas Trunojoyo Madura as an English lecturer since 2003. He currently teaches Introduction to Linguistics, Phonetics, Phonology, Syntax, and Linguistics Research Methodology. He currently serves as Head of the Language Center of Universitas Trunojoyo Madura.

Misnadin has written scholarly articles published in reputable international journals, including: *Madurese* (published in the Journal of the International Phonetic Association, Q1); A*coustic*

correlates of plosive voicing in Madurese (published in the Journal of the Acoustical Society of America, Q1); *Phonetic realisations of Madurese vowels and their implications for the Madurese vowel system* (published in the Indonesian Journal of Applied Linguistics, Q2); *Voice onset time and vowel quality in Madurese: The role of gender and dialect* (published in the Journal of Asia-Pacific Language Variation, Q4), and *Acoustic cues to the perception of plosive voicing in Madurese* (published in Journal of the Acoustical Society of America, Q1). His main research interests include language variation, phonology, acoustic phonetics, socio-phonetic variation, and language documentation.