SCIENCE

Effects of Face Masks on the Acoustic Properties of Speech

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Social interactions have been affected by the COVID-19 pandemic for over a year. Face masks can affect speech signals, impacting speech perception (M. Magee et al., "Effects of face masks on acoustic analysis and speech perception: Implications for peri-pandemic protocols," *Journal of the Acoustical Society of America,* 2020, doi .org/10.1121/10.0002873; L. L. Mendel et al., "Speech understanding using surgical masks: A problem in health care?," *Journal of the American Academy of Audiology,* 2008, doi.org/10.3766/jaaa.19.9.4). While previous research has focused on subjective measures of face masks on speech perception, little research has assessed the degree to which wearing a mask distorts acoustic properties of physical speech itself.

Speech samples were recorded with and without a surgical mask. The 11 tokens were CVC (consonant vowel consonant) words, each with a different English vowel: scene, sin, sane, send, sand, suit, soot, soap, sought, sock, and sunk. An acoustic analysis of the recorded speech was performed using Praat (version 6.1.40), a dedicated program for speech analysis. The waveforms and spectrograms of speech with and without a mask were compared.

Formants between samples showed no significant difference with or without a mask, which was expected because masks do not affect the configuration of the oral tract. An increased duration was found in speech through masks especially for word-initial sibilants. Amplitude was consistently higher without a mask, despite compensatory volume with a mask. As seen in Figure 1, word-initial /s/ appeared to have a fragmented waveform shape (i.e., silent gap during production). Additional phonemes in this location (word-initial, stressed, prevocalic) need to be tested to further examine this phenomenon. Future studies should analyze a variety of speakers using identical speaking styles with and without a mask and a larger number of speech sounds.

Research advisors Chris Grindrod and Naomi Gurevich write: "Kailyn and Gabrielle used their training in communication sciences and disorders to address a current priority in global health care. Their analysis of the acoustic properties of English sounds confirms that masks distort speech. Their study has implications for speech perception in individuals with hearing loss or in acoustically challenging environments."

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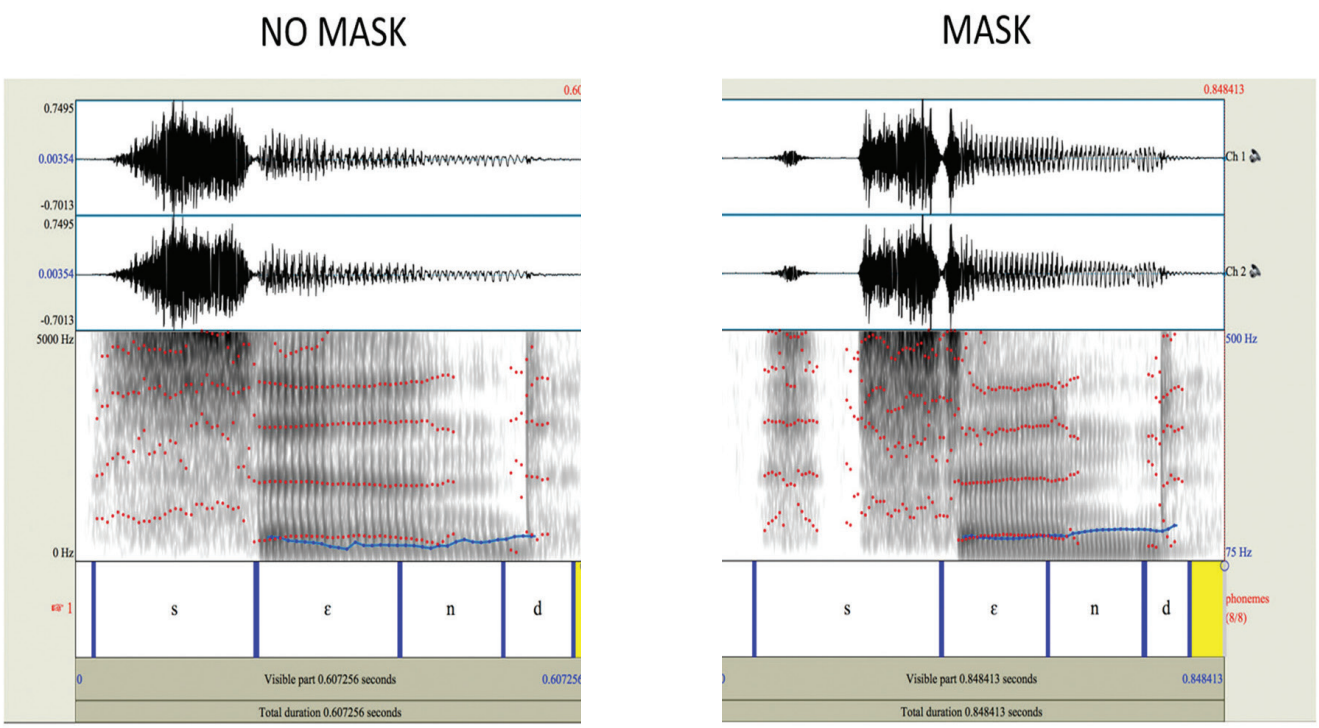

Waveform and spectrogram of "send." Speech with a ma on the left, and speech without a mask is shown on the right.