

Exposure to Consistent Room Reverberation Facilitates Consonant Perception

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Background: An important aspect of real-world speech communication is the ability to adapt to reverberant listening environments that distort the speech signal. A few past studies show that consistent exposure to a particular room facilitates speech understanding, at least for a limited set of speech sounds [A. J. Watkins, 2005, *J. Acoust. Soc. Am.* 118:249–262.] and for sentences with rich lexical information [N. Srinivasan and P. Zahorik, 2013, *J. Acoust. Soc. Am.* 133: EL33-9]. Here, we present the results of two experiments investigating the effects of room consistency on phoneme perception using a wide range of consonants. Stimuli were nonsense syllables, allowing us to factor out lexical influences on perceptual compensation for reverberation.

Methods: Stimuli were VC syllables consisting of 16 consonants that were preceded by the vowel /a/ spoken by three different talkers, presented over headphones. Using room-related transfer functions, we simulated two different reverberant environments or anechoic space. On each trial, listeners heard an initial “carrier” phrase consisting of 0, 2 or 4 VC syllables, followed by a single target VC syllable. Listeners had to identify the consonant in the final target syllable. In some trials, the target and carrier had the same reverberation (matching), while in others the carrier syllables were simulated with either a different reverberant room (non-matching) or in anechoic space (anechoic). In Exp. 1 the carrier length was randomly varied from trial to trial; in Exp. 2 it was fixed within each block. We hypothesized that phoneme identification would be best in the matching condition, and that the benefit would increase with the length of the carrier phrase.

Results: Qualitatively, there was no difference between randomized and blocked trials. Reverberation hampered phoneme perception, with some consonants being particularly affected. Consistent with our hypotheses, exposure to consistent reverberation improved target consonant identification accuracy compared to when the carrier was anechoic. Relative to non-matching reverberation, the benefit of matching reverberation was less consistent: the benefit was significant for both 2- and 4-VC carrier phrases in Exp. 2 (blocked trials), but only reached significance for the 2-VC carrier phrase in Exp. 1 (randomized trials).

Conclusions: Short-term exposure to a consistent acoustic environment mitigates the detrimental effects of reverberation on phoneme perception, facilitating speech understanding in adverse conditions.

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