

The Impact of Foreign Language Accent on Expert Listeners' Auditory-Perceptual Evaluations of Dysphonia

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Introduction: Auditory-perceptual evaluations of dysphonia, though essential for comprehensive voice evaluation, are subject to listener bias. Knowledge of an underlying voice disorder can influence auditory-perceptual ratings. Accented speech results in increased listener effort and delays in word identification. Yet, little is known about the impact of foreign language accents on auditory-perceptual ratings for dysphonic speakers. The purpose of this work was to determine the impact of a foreign language accent on experts' auditory-perceptual ratings of dysphonic speakers.

Methods: Twelve voice-specializing SLPs who spoke with a General American English (GAE) accent rated vocal percepts of 28 speakers with a foreign language accent and 28 with a GAE accent, all of whom had been diagnosed with a voice disorder. Speaker groups were matched based on sex, age, and mean smoothed cepstral peak prominence. Four linear mixed-effects models assessed the impact of a foreign language accent on expert auditory-perceptual ratings of the overall severity of dysphonia, roughness, breathiness, and strain.

Results: The twelve raters demonstrated good inter- and intra-rater reliability ($ICC[3, k] = .89$; mean $ICC = .89$). The linear mixed-effects models revealed no significant impact of foreign language accent on ratings of overall severity of dysphonia, roughness, breathiness, or strain.

Conclusion: Despite the possibility of increased listener effort and bias, foreign language accent incongruence had no effect on expert listeners' auditory-perceptual evaluations for dysphonic speakers. Findings support the use of auditory-perceptual evaluations for voice disorders across sociolinguistically diverse populations.

Key Words: auditory-perception, evaluation, muscle tension dysphonia, accent.

Level of Evidence: 3

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INTRODUCTION

Auditory-perceptual assessments of dysphonia are an essential part of a comprehensive voice evaluation. Yet these assessments, like many clinical judgments, are susceptible to bias that may lead a clinician to minimize or over-pathologize a person's symptoms.¹ This bias may stem from contextual factors, like diagnostic information. For example, clinicians with knowledge of medical diagnosis may rate a speaker's dysphonia as more severe than they would without this knowledge.² Bias may also stem from factors related to a patient's identity. Though the effect of speaker identity has not specifically been measured in voice evaluations, race and gender biases are known to have widespread effects on clinical judgments, treatment recommendations, and patient experiences.³⁻⁵

The use of accented speech can also activate a listener's bias.⁶ Speech accented by a language other than English may be perceived by English speakers as less intelligible⁷ and thus the speaker less intelligent, professional, and patient.⁸ Furthermore, voice quality may differ by language,⁹⁻¹¹ and voice qualities considered typical in a speaker's first language may carry over into a second language, in which the same quality could be perceived as pathological.^{12,13} Accent differences thus have the potential to elicit well-documented biases, yet little is known about how foreign language accents may specifically affect auditory-perceptual ratings of dysphonia.

Research on the effect of foreign language accent on auditory-perceptual evaluations has focused on cross-language differences (e.g., an English speaker evaluating the voice of someone speaking Cantonese¹⁴) rather than cross-accent differences. These studies found cross-language differences in ratings of both global percepts of voice quality (e.g., overall severity of dysphonia) and individual percepts (e.g., strain).¹⁴⁻¹⁶ However, they do not address the question of whether accent differences within a language shared by speaker and listener would similarly affect auditory-perceptual outcomes.

Following the American Speech Language Hearing Association's Code of Ethics,¹⁷ speech-language pathologists (SLPs) must ensure that cultural variables, language exposure, and cultural-linguistic differences are considered during evaluation and treatment. As an initial step, Procter and Joshi¹⁸ investigated the effect of accentedness

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on auditory-perceptual assessment. They found no difference in ratings of speakers with French accents and speakers with General American English (GAE) accents despite differences in CPPS, suggesting a bias that raters potentially rate speakers with French accents less severe. However, their speaker sample included only speakers *without* a voice disorder. Furthermore, their listener sample included only two SLPs who were not blinded to the study purpose. Their finding thus cannot be generalized to a broader clinical context, leaving the question largely unanswered.

The purpose of this work was therefore to determine how expert listeners' auditory-perceptual ratings of dysphonia are affected by speakers' foreign language accents. Twelve voice-specializing SLPs who spoke with a GAE accent rated the overall severity of dysphonia and other vocal percepts of 28 speakers with a foreign language accent and 28 with a GAE accent, all of whom had been diagnosed with a voice disorder. The degree to which the phonological features of a first language are transferred to a second language varies by speaker and is perceived as differences in the "strength" of an accent.^{18,19} Thus, the degree of accentedness was documented by two SLPs. We predicted that experts' ratings for dysphonic speakers with foreign language accents would be higher (more severe) compared to those with GAE accents due to listener bias.

METHODS

Expert Listeners

Expert listeners included 12 voice-specialized SLPs from around the United States who spoke with a GAE accent and had at least 3 years of experience treating a caseload primarily consisting of patients with voice and upper airway disorders. All expert raters were originally from the US or Canada. One expert spoke French fluently in addition to English; the other 11 experts did not speak languages other than English. Listeners were consented per the Boston University Institutional Review Board (# 2625). Listeners reported no history of hearing loss. Data were collected virtually via Gorilla (gorilla.sc), a web-based platform that hosted our experiment.²⁰ A study staff member supervised each session via videoconference. Listeners were instructed to participate in a quiet environment and use wired headphones that connected to a personal computer. Each listener participated in a volume adjustment and headphone screening²¹ before auditory-perceptual ratings were collected. Each listener played recordings of each speaker and rated the overall severity of dysphonia, breathiness, roughness, and strain using a slider scale that was modeled after the Consensus Auditory Perceptual Evaluation of Voice (CAPE-V) using 100-unit visual analog scales (VASs). Listeners were permitted to listen to each recording twice. All four VASs were presented at once on a single screen. Each VAS was a continuous input scale with responses quantized to whole numbers from 0 to 100.

Anchors were placed at 10 for mild, 35 for moderate, and 72 for severe, consistent with the CAPE-V.²² Recordings were presented in a random order and 20% of the recordings were repeated for intra-rater reliability.

Speakers

Participants in this study included 56 speakers diagnosed with muscle tension dysphonia by a board-certified laryngologist, as approved by the Boston University Institutional Review Board (# 2625). Muscle tension dysphonia was defined as the presence of vocal hyperfunction in the absence of a known pathology or neurological condition.²³ Speakers belonged to two groups: The foreign language accent group consisted of 28 speakers who spoke English with an accent influenced by a first language other than GAE—8 Haitian Creole/French, 7 Caribbean English (e.g., Jamaican English, Trinidadian English), 5 Spanish, 3 Portuguese, 1 Cape Verdean, and four speakers from Puerto Rico or the Dominican Republic for whom the first language was not specified. The GAE accent group consisted of 28 speakers who spoke with a GAE accent, which matched the accent of the listeners.

Speakers were matched based on age (± 5 years), sex, and mean smoothed cepstral peak prominence (CPPS), which is an acoustic measure associated with voice quality.²⁴ The rationale for controlling for CPPS was to balance groups in terms of overall severity so that differences found would reflect a bias based on the presence of a foreign language accent. Table I describes the mean and standard deviation (SD) of age, sex distribution, and mean and SD CPPS for each group. Audio recordings were made for each participant as they read the second and third sentences of the Rainbow Passage²⁵ in a quiet clinical environment using a head-mounted microphone placed approximately 7 cm off-center from the lips. Files were digitized at 44.1 kHz. Two SLPs (the first and second authors) rated the degree of accentedness for all speakers, which was defined as how much the speech differed from GAE due to the influence of the speaker's first language.²⁶ The SLPs documented accentedness using a VAS with features consistent with the scale used for the auditory-perceptual ratings. The SLPs were permitted to listen to each recording twice. Twenty percent of the samples were repeated for intra-rater reliability.

Statistical Analysis

All statistical analyses were carried out in *R* statistical software,²⁷ with $\alpha = 0.05$. Intra- and inter-rater reliability (ICC, A, 1)²⁸ were calculated for the expert listeners ratings of overall severity, as well as for the two listeners' ratings of accentedness. For accentedness ratings, intra-rater reliability (ICC, A, 1) was 0.99 and 0.93 for the two raters, and interrater reliability (ICC, A, 1) was 0.86, demonstrating good reliability.

Four linear mixed-effects models²⁹ were used to assess the impact of accentedness on expert listeners' ratings of overall severity, roughness, breathiness, and strain, respectively. As ratings of accentedness are log-normally distributed, accentedness was defined as the log of accentedness ratings +1. For each model, expert listener ratings were regressed on accentedness, and speakers and listeners were included as random effects. The

TABLE I.
Speaker Characteristics by Group.

Group	Mean age	SD age	Sex distribution (M:F)	Mean CPPS	SD CPPS
Foreign Language accent	49.07	15.41	7; 21	10.63	4.73
General American English accent	49.86	14.92	7; 21	10.24	4.60

mixed-effects models were conducted using the lme function in the lme4³⁰ package in R.²⁷ Linear mixed effect models were fit by restricted maximum likelihood.²⁹ Cohen's partial f^2 effect size was calculated using package effect size.³¹

RESULTS

For expert listeners' ratings of overall severity, mean intra-rater reliability (ICC, A, 1) was 0.89, demonstrating good reliability within each listener. Intra-rater reliability (ICC, A, 1) ranged from 0.78 to 0.96. Inter-rater

reliability (ICC, A, 1) was 0.89, demonstrating good reliability among expert listeners.

Figure 1 displays mean ratings for each group with 95% confidence intervals (CIs) for overall severity, breathiness, roughness, and strain. Table II lists the mean ratings per group, as well as SDs and 95% CIs. Based on the results of the four mixed-effects models, no impact of foreign language accent (measured by accentedness) was found for any of the four auditory-perceptual parameters (overall severity, roughness, breathiness, and strain), with negligible effect sizes.

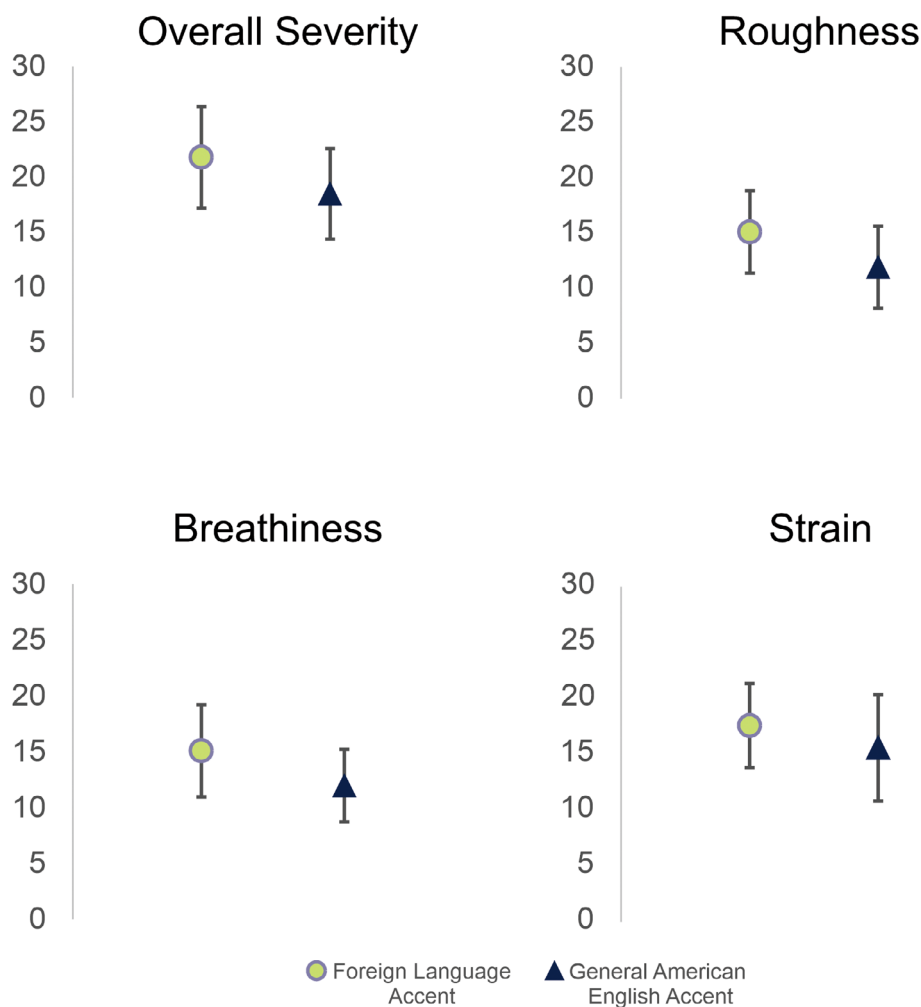


Fig. 1. Mean expert auditory-perceptual ratings and 95% confidence intervals by group. [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]

TABLE II.
Mean, Standard Deviation, and 95% Confidence Intervals for Severity Ratings Per Group.

Percept	Foreign language accent group				General American English accent group			
	OS	Breathiness	Roughness	Strain	OS	Breathiness	Roughness	Strain
Mean	21.73	15.06	15.57	17.56	18.45	11.95	12.48	15.58
SD	12.45	11.11	9.84	10.18	12.75	8.73	9.79	12.92
95% CI	(17.12, 26.34)	(10.94, 19.73)	(11.92, 19.21)	(13.79, 21.33)	(13.72, 23.17)	(8.72, 15.19)	(8.85, 16.10)	(10.79, 20.36)

DISCUSSION

Auditory-perceptual evaluations are an important piece of a comprehensive voice assessment. Per the American Speech Language Hearing Association's code of ethics,³² SLPs must consider cultural-linguistic differences when providing assessment and treatment to patients. According to the 2020 US Census results, approximately 22% of households in the United States speak a language other than English,³³ so it is important that clinical evaluations are robust to the sociolinguistic differences of the patient population. In this study, we investigated the impact of incongruent accents on expert listeners' auditory-perceptual judgments of dysphonia.

At least six language varieties other than GAE were represented within our speaker sample, including varieties from South America, the Caribbean, and West Africa. None of these are known to have phonemic phonation types other than modal phonation.¹¹ Nevertheless, voice quality can differ by language, and bilingual speakers may carry over the voice qualities of their first language to other languages.⁹⁻¹¹ Given the diversity of language varieties within our speaker sample and the lack of specific research on the voice qualities of these language varieties, we cannot determine whether the transference of first-language voice qualities may have played a role in our findings. But as we found no effect of foreign language accent on dysphonia ratings, we believe any role was likely minor. Despite the potential for increased listener effort and presence of bias, the presence of a foreign language accent that was incongruent with the raters' accent (GAE) did not influence expert listeners' auditory-perceptual ratings of dysphonia, even when controlling for CPPS and degree of accentedness. These findings are consistent with Procter and Joshi's findings¹⁸ that expert listeners' auditory-perceptual evaluations were not statistically different for speakers with French and Spanish accents compared to speakers of GAE. Our results extend their findings to speakers with dysphonia, filling a previous gap in the literature, and answering an important question as it relates to expert listeners' clinical assessment of speakers with accents incongruent with their own. Our findings suggest that SLPs can evaluate dysphonic speakers in a consistent manner, regardless of a speakers' accent or degree of accentedness. Nevertheless, it is critical that clinicians be mindful of potential biases related to auditory-perceptual evaluations and biases that may affect other aspects of patient experiences.³⁻⁵

This study was limited to 56 total speakers, which limits the generalizability of the findings. The foreign language accent group consisted of individuals originally from South America, the Caribbean, and West Africa, encompassing a range of accents and dialects. The study was also limited to expert raters who spoke with GAE accents, and most of the expert raters were monolingual. Further investigation of ratings of dysphonia from experts with accents other than GAE and/or bilingual experts would provide a richer context for this area of work.^{34,35} Additional work is needed to study the impact of specific accents, dialects, and

primary languages associated with other geographical regions on auditory-perceptual assessments of dysphonia. Further, studies are needed to investigate the potential interactions of foreign language accent and dysphonia on quantitative measures of a comprehensive voice evaluation.

CONCLUSION

Despite the possibility of increased listener effort and bias, foreign language accents of speakers with dysphonia had no effect on expert listeners' auditory-perceptual ratings. Findings support the use of auditory-perceptual evaluations for voice disorders across sociolinguistically diverse populations. Further work is warranted to investigate the effects of specific accents and dialects on auditory-perceptual assessments of dysphonia. Further, more studies are needed to investigate the potential interactions of accents and dysphonia on other parts of a comprehensive voice evaluation.

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CONFLICT OF INTEREST STATEMENT

Cara E. Stepp has received consulting fees from Altec, Inc./Delsys, Inc., companies focused on developing and commercializing technologies related to human movement. Stepp's interests were reviewed and managed by Boston University in accordance with their conflict-of-interest policies. The other authors have declared that no other competing interests existed at the time of publication. The other authors have declared that no competing financial or nonfinancial interests existed at the time of this study.

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