

# The Influence of Native Language on Auditory-Perceptual Evaluation of Vocal Samples Completed by Brazilian and Canadian SLPs

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**Summary: Objective.** This study aimed to determine the influence of native language on the auditory-perceptual assessment of voice, as completed by Brazilian and Anglo-Canadian listeners using Brazilian vocal samples and the grade, roughness, breathiness, asthenia, strain (GRBAS) scale.

**Study design.** This is an analytical, observational, comparative, and transversal study conducted at the Speech Language Pathology Department of the Federal University of Minas Gerais in Brazil, and at the Communication Sciences and Disorders Department of the University of Alberta in Canada.

**Methods.** The GRBAS scale, connected speech, and a sustained vowel were used in this study. The vocal samples were drawn randomly from a database of recorded speech of Brazilian adults, some with healthy voices and some with voice disorders. The database is housed at the Federal University of Minas Gerais. Forty-six samples of connected speech (recitation of days of the week), produced by 35 women and 11 men, and 46 samples of the sustained vowel /a/, produced by 37 women and 9 men, were used in this study. The listeners were divided into two groups of three speech therapists, according to nationality: Brazilian or Anglo-Canadian. The groups were matched according to the years of professional experience of participants. The weighted kappa was used to calculate the intra- and inter-rater agreements, with 95% confidence intervals, respectively.

**Results.** An analysis of the intra-rater agreement showed that Brazilians and Canadians had similar results in auditory-perceptual evaluation of sustained vowel and connected speech. The results of the inter-rater agreement of connected speech and sustained vowel indicated that Brazilians and Canadians had, respectively, moderate agreement on the overall severity (0.57 and 0.50), breathiness (0.45 and 0.45), and asthenia (0.50 and 0.46); poor correlation on roughness (0.19 and 0.007); and weak correlation on strain to connected speech (0.22), and moderate correlation to sustained vowel (0.50).

**Conclusion.** In general, auditory-perceptual evaluation is not influenced by the native language on most dimensions of the perceptual parameters of the GRBAS scale.

**Key Words:** voice–auditory perception–dysphonia–speech-language pathology–voice disorders.

## INTRODUCTION

The auditory-perceptual evaluation of voice quality is a noninvasive assessment and has rapid execution. However, it is considered subjective, because the results may reflect differences in the perception of voice quality according to the listener's training.<sup>1–3</sup>

Research shows that agreement among raters may also be influenced by the methods used. The importance of standardization of protocols for auditory-perceptual evaluation of voice quality should be considered, taking into account the scales, the chosen tasks, and the type of vocal samples analyzed (natural or synthesized).<sup>4,5</sup>

Some examples of scales used in auditory-perceptual evaluation of voice quality are Buffalo Voice Profile; Vocal Profile Analysis Scheme; grade, roughness, breathiness, asthenia, strain

(GRBAS) scale; Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V); Stockholm Voice Evaluation Approach; and others.

The Buffalo Voice Profile consists of 12 parameters, and the severity of voice disorder might be registered in a five-point scale. The Vocal Profile Analysis Scheme consists of three sections (vocal quality features, prosodic features, and temporal organization), and the severity of voice disorder might be registered in a six-point scale.<sup>6</sup>

The main scales used in auditory-perceptual evaluation of voice quality described in the literature include GRBAS<sup>7</sup> and CAPE-V.<sup>8</sup> The GRBAS was developed by the Japan Society of Logopedics and Phoniatrics and consists of five perceptual parameters: grade (G), roughness (R), breathiness (B), asthenia (A), and strain (S).<sup>7</sup> Later, the parameter I was added representing the instability of vocal production. In this case, the scale is known as GRBASI.<sup>9</sup> In both situations, GRBAS or GRBASI, the grade of voice disorder may be classified in a four-point ordinal scale as normal (0), mild (1), moderate (2), and severe (3).<sup>7</sup>

The CAPE-V was developed by the American Speech-Language-Hearing Association<sup>8</sup> and is composed of six parameters: overall severity, roughness, breathiness, strain, pitch, and loudness. The perception of disorder should be marked in a visual analogical scale measuring 100 mm, where the grade of disorder corresponds to the values marked; the most severe the disorder, the higher is the value.<sup>10</sup> The literature<sup>11,12</sup> shows

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that GRBAS and CAPE-V scales have high correlation and agreement.

The Stockholm Voice Evaluation Approach is a scale based on the analysis of 28 variables, resulting in 13 parameters for the voice assessment, quantified into five levels, where 0 is normal and 4 is very severe.<sup>13</sup>

When considering the speech tasks for this study, we found that it was apparent that open vowels, short segments, reduced speech rate, and contextualized vocal samples, as in counting from 1 to 10, have been shown to enhance inter-judge agreement.<sup>14</sup>

The type of speech sample more commonly found in the literature is the one that has not received any kind of technology modification (natural sample voice), probably because it easily captures the dysphonic voices in a clinical environment. However, some authors<sup>15</sup> argue that because many different perceptual parameters can be difficult to differentiate, and this makes vocal assessment more complex. It may be suggested that more research using synthesized voices for listener training is required<sup>16</sup> where the different perceptual parameters can be isolated, which tends to improve the listener's judgment of vocal quality.

A further complicating factor in achieving reliable auditory-perceptual evaluation of voice quality is the finding of studies that show how vocal perception is also influenced by native language, highlighting its importance in the auditory judgment of vocal quality. The functioning of neural substrates responsible for auditory perception of voice during magnetic resonance imaging suggests that perceptual voice analysis is a cognitive process that can be affected by the cultural and linguistic experience of the listener.<sup>17</sup>

In another study, using GRB of the GRBAS scale, French and Italian professionals evaluated vocal samples of French and Italian individuals under the same conditions. According to kappa classification, listeners demonstrated substantial agreement for G and moderate agreement for B and R. However, roughness was assessed differently between the two groups, suggesting a dependency relationship between auditory-perceptual evaluation of voice quality and native language within that parameter.<sup>18</sup> The cultural aspect seems to have influenced the results, considering that for Italians, rough voices tend to be considered as normal voices.

A study carried out by American and Japanese judges concluded that the overall severity, roughness, and breathiness were not influenced by native language, but the results for asthenia and strain were not consistent. It is possible that there were differences of interpretation of A and S between the two groups of listeners, but it is not clear that linguistics differences have truly influenced the results for these parameters.<sup>19</sup> In assessing voice quality using GRBAS, the correlation between the overall severity and the other parameters of the scale is important to demonstrate consistent results in auditory-perceptual evaluation of voice quality. This correlation was found between G and A in the American group, but has not been found in the Japanese group. When parameter S was considered, it showed no correlation with G, demonstrating inconsistent results in both groups.

The literature contains these few studies about the influence of native language on the auditory-perceptual evaluation of voice quality, and their results are inconsistent. It is worth noting that

studies comparing the influence of Portuguese and other languages in the auditory-perceptual evaluation of voice quality were not found.

It is known that there are several factors that may affect auditory-perceptual evaluation of voice quality results, contributing to their subjectivity. Nevertheless, auditory-perceptual evaluation remains a high standard type of assessment in vocal analysis.<sup>1,20,21</sup>

As the GRBAS scale has been globally accepted by the scientific community in the voice field, it becomes increasingly necessary to compare the results of research of the GRBAS carried out in different centers with aggregate scientific evidence to guide clinical practice. It is important to verify if the agreement of assessment of voices is dependent on native language.

The objective of this study was to investigate the influence of native language on the auditory-perceptual evaluation of voice quality carried out by Brazilians and Anglo-Canadian listeners, using the GRBAS scale and vocal samples of Brazilian speakers.

## METHODS

This is an analytical, observational, comparative, and transversal study realized at the Speech Language Pathology Department of the Universidade Federal de Minas Gerais, Brazil, and at the Communication Sciences and Disorders Department of the University of Alberta in Canada.

The project was approved by the Brazilian Research Ethics Committee (No. 16633113.3.0000.5149) and the University of Alberta Research Ethics Committee (Pro 00046452).

The sample size determination took into account a sampling error of 10%, with 80% statistical power at a 5% level of significance.

The vocal samples were drawn randomly from a database of recorded speech of Brazilian adults. The database of recordings is housed at the Federal University of Minas Gerais. We used in this study 46 samples of connected speech (recitation of week days) produced by 35 women and 11 men, 8 with healthy voices and 38 with voice disorders such as nodules (10), polyps (7), glottic chink (7), Reinke edema (4), laryngeal paralysis (3), sulcus vocalis (3), chronic laryngitis (2), and spasmodic dysphonia (2). For the samples of the sustained vowel /a/, we used 46 voices produced by 37 women and 9 men, 10 without voice disorders and 36 with dysphonia: glottic chink (10), nodules (9), polyps (5), Reinke edema (5), spasmodic dysphonia (3), laryngeal paralysis (2), and sulcus vocalis (2). We included in both samples normal voices and different severities of voice disorders. Given that sampling was random, the speakers who recorded recitation of days of the week may or may not have been the same speakers who recorded /a/. Furthermore, speakers of days of the week may or may not have exhibited the same voice disorders as speakers who produced /a/. The only intentional matching across speech production categories was the relative number of female and male voices in each category.

For the analysis of intra-rater agreement, 20% of the samples in each speech category were duplicated (20% of 46 = 9; 46 + 9 = 55 samples). Thus, for calculations of intra-rater

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