Self-perceived and Acoustic Voice Characteristics of Russian-English Bilinguals

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Summary: Objective. The aim of this study was to investigate the vocal characteristics of bilingual individuals speaking in their native language as compared with the English language.

Methods. The participants consisted of 30 vocally healthy adults, 14 adult male and 16 adult female bilingual subjects, with ages ranging from 23 to 70 years old. The procedures included a demographic questionnaire, a self-perceptual questionnaire, and descriptions of two video clips. The self-assessment included 21 questions that investigated how participants perceived their communication characteristics in each language. For the description of the videos, participants randomly watched two video clips with no audio support. One of the videos was described in English and the other in their native language. Voice samples were recorded to allow for acoustic analysis of selected vocal parameters: pitch, intensity, intonation, and rate of speech.

Results. The results indicate that overall, there is no difference in how the individuals perceive their communication characteristics in both languages (all P values > 0.05). The only significant difference was found in speech rate and sentence duration. Individuals had faster speech rate and longer sentences when speaking in English than in Russian. The correlation analysis showed that the younger the participants were when they immigrated to the USA, the more interjections they reported having in their native language.

Conclusions. This study showed that language is a contributing factor to varying speech characteristics of Russian-English bilingual individuals. These findings have important implications for clinicians to be aware of cultural-linguistic influence in vocal and speech features.

Key Words: Bilinguals–Vocal characteristics– Acoustic analysis–Self-perception.

INTRODUCTION

According to the Center of Immigration Studies,[1] there were approximately 41.3 million immigrants living in the United States in 2013, accounting for 13% of the overall US population. This was a 1.4-million increase in immigrant population since 2010.[1] The immigrant population continues to increase each year. Immigration has a great impact on this country where several different cultures and languages mix together. Determining the differences in voice and speech characteristics among several cultural/linguistic groups is essential to identifying a normative database for this vast diversity of immigrants because analysis and perceptions of normal and deviated speech are based on such crucial information. At this juncture, there are no extensive normative data available for bilingual Russian-English speakers. Russians make up a substantial portion of the immigrant population in this country. Russian individuals who immigrate to the USA later in life often learn English as a second language (ESL). In many cases, this may lead not only to accent and pronunciation differences, but also different vocal characteristics between their native language, Russian, and their newly acquired language, English.

Evidence in the literature suggests that the production of voice quality is different across languages.[2] Communication involves several aspects such as prosody, verbal and nonverbal aspects, culture, and so on. It is known that cross-modality will impact the production and perception of another modality.[3] Many studies compared different ethnic groups,[4–7] which made it difficult to isolate the effect of language on the vocal characteristics. Research studies show that F0 (F0) can be affected when switching from one language to another.[8–14] Papangelou[9] examined the voices of Hispanic/Latino English Language Learners, kindergarten through third grade, in transitional bilingual classes and found that F0 declined in both genders, as age increased with the decrease most prominent in Spanish and the F0 was highest in girls. In addition to changes in F0, there were supplementary changes in vocal characteristics,[8,10,11,14] such as resonance, glottal attack, and voice onset time (VOT). Other parameters of changes in vocal quality between languages have yet to be analyzed.

F0 variability is also a vocal parameter that is affected by the language spoken.[2] A research study[13] examined F0 variability among adults who speak a tone language (Zapotec-Spanish bilinguals) and those who do not speak a tone language (Spanish speakers with substantial knowledge of English). The participants attempted to learn Russian words while hearing the words and viewing their corresponding pictures. F0 variability significantly improved vocabulary learning for speakers of the tone language (Zapotec) but not for the Spanish speakers.

Voice qualities produced by Catalan-Spanish bilinguals, as measured by long-term average spectrum, were significantly different in the two languages spoken by the same person. Mean spectral energy was higher and spectral tilt was lower when speaking in their native language.[8]

Even though the literature shows that language affects specific vocal parameters, such as the ones discussed previously,

TABLE 1.
Mean and Standard Deviation of Age, Age of Immigration, and Duration of English as a Second Learning Schooling

Characteristics	Total		Male		Female	
	Mean	SD	Mean	SD	Mean	SD
Age	42.76	15.1	40.85	14.90	44.31	15.56
Age of immigration	21.07	11.78	19.31	11.59	22.75	11.73
Duration of ESL schooling	35.09	19.33	1.38	0.77	1.85	0.99

Abbreviations: ESL, English as a Second Language; SD, standard deviation.

there are no studies that investigated the effect of language on speech parameters, such as duration and speech rate, of bilingual Russian-English speakers.

The focus of the present study is to investigate the vocal and speech characteristics of bilingual individuals in their native language, Russian, as compared with their second language, English. The vocal and speech characteristics selected for this study were analyzed by means of self-assessment and acoustic analysis. Literature shows that bilingual speakers differ in their patterns of language acquisition and language use, which also correspond to differences in their speech production.[15] Factors that have varied in previous studies of bilinguals (eg age of acquisition, language dominance, ratio of L1/L2 use, and accented input) may contribute to varying results. The hypothesis of this study is that vocal characteristics will change from the individuals' native language when compared with their second language.

METHOD

Participants
The participants included 30 Russian-English bilingual individuals. The average age of the participants was 42.8 years, with ages ranging from 23 to 70 years. The participants included 14 males (mean age: 40.8 years) and 16 females (mean age: 44.3 years). One female participant was excluded from the data analysis due to voice deviation, which would have altered results. All participants were emigrants to the USA (mean age of immigration: 21.1 years) and completed at least an elementary school equivalent in their native country. All the participants reported to be proficient in speaking, understanding, reading, and writing in their native language. The participants either took an ESL course or attended school in the USA that was taught in English. Individuals were excluded from the study if they had any previous history of voice disorders, voice therapy, or accent reduction. Transgender individuals and women who were pregnant during the time that data were collected were excluded as well to ensure that a change in hormone levels would not alter vocal characteristics. Individuals who were ill at the time with anything that may alter their voice such as an upper respiratory infection, common cold, sore throat, or cough did not participate.

Procedures
The participants completed a demographic questionnaire. This questionnaire contained questions pertaining to the participants' age, sex, bilingual status, age of immigration, type of schooling and duration of schooling in their native country and the United States. The participants also filled out a self-assessment questionnaire created for this research that investigated how they perceived their communication characteristics in each language. They rated their own voices according to loudness, pitch, resonance, rate, interjections, clarity, and accent through a variety of questions on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

To elicit spontaneous speech, the participants were shown two video clips from YouTube with no audio support. They were asked to describe them in English or in their native language in a few short sentences. The order of the languages in which participants were asked to describe the video clips in was randomly selected. The participants' voice samples were analyzed acoustically using *PRAAT* software (Phonetic Sciences, University of Amsterdam, The Netherlands). Two Russian-English bilingual researchers, both of whom are fluent in Russian, analyzed the samples. The following parameters were analyzed: mean, minimum and maximum F0, F0 variability (Hz and semitones), duration (seconds), and speech rate (words/minute).

Statistical analysis was performed by means of *StatDisk* (Triola Stats) and *SPSS* software (Armonk, NY, IBM Corp.). The Wilcoxon test was used to compare results of the self-assessment questionnaire and the *t* test to compare the acoustic results according to the language spoken. The Spearman correlation was used to check for correlation among the variables studied. The significance level adopted was 0.050(5%).

RESULTS
show the demographic characteristics of the participants.

TABLE 2.
Number and Percentage of Bilingual Status and Type of Schooling

Characteristics	Total		Male		Female	
	N	%	N	%	N	%
Bilingual status	30	100	14	46.67	16	53.33
Type of schooling						
Elementary	10	33.33	6	20.00	4	13.33
Middle	2	6.67	1	3.33	1	3.33
High	3	10.00	2	6.67	1	3.33
College	8	26.67	2	6.67	6	20.00
Graduate	7	23.33	2	6.67	5	16.67