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Analysing Iraqi Arabic Speakers' Voice Qualities: Gender as a Variable in Auditory-Perceptual VPA

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Abstract

This research delves into the examination of voice qualities among Iraqi Arabic speakers, encompassing both genders and age range from 20 to 45. The study employs a comprehensive auditory-perceptual analysis utilising the Vocal Profile Analysis (VPA) scheme developed by Laver, Wirz, Beck, and Hiller (1981), later refined by Beck (2018). Data collection involves two methods: narrative pictures and open-ended responses. The findings unveil shared characteristics among Iraqi Arabic speakers: pharyngeal constriction and pronounced high nasality, particularly noticeable in females; despite the consistent use of the advanced lingual tip/blade, the typically alveolar /l/ segment maintains a neutral position; the phonation voice is identified as a blend of whispery and creaky voices, with variations, including males displaying a higher prevalence of creaky voice quality and a lip-spreading feature; conversely, females tend to exhibit increased nasality and whispery voice settings, while males lean towards a creaky voice quality in addition to frequently exhibiting a lowered larynx.

Introduction

Voice quality, a phonetic phenomenon, has been comparatively neglected in contrast to the extensive focus on segmental aspects of speech, as highlighted by Hardcastle and Beck (2005: 286), despite its perceptual essence. Nevertheless, there is a burgeoning interest among phoneticians in investigating voice quality owing to its crucial implications across diverse fields like medicine, linguistics, and forensic sciences. Hence, there is a pressing need for heightened research attention in these areas.

Despite the rich historical and cultural influences of the first civilizations and the impact of historical occupations, voice quality of Iraqi people has not garnered the attention it deserves. Researchers, in general, have utilised various auditory-perceptual, acoustic, and articulatory methods to explore voice quality. In the realm of Iraqi Arabic research, to the best of current knowledge, only five studies have specifically addressed or investigated features related to the voice qualities of Iraqi Arabic speakers. These studies include an

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acoustic examination by Butcher and Ahmad (1987), an auditory-phonological study by Bellem (2007), an auditory-acoustic study by Alsiraih (2013) and Khattab et al. (2015), and a perceptual study by Naser and Hameed (2022).

Bellem (2007: 270), though not specifically focused on voice quality, characterised the Iraqi gelet dialects producing pharyngeal consonants as having more 'emphaticness' or a more 'guttural' quality due to a 'stronger' (creakier) voiced pharyngeal.

Alsiraih (2013) aimed to identify two auditory and acoustic signals associated with voice quality (VQ): nasalisation and creakiness. The study involved nine male speakers representing three different dialects (Basra, Baghdad, and Mosul), producing 150 Iraqi words varying pharyngeal and oral contexts. Dialect-specific voice quality characteristics were revealed; for example, the Baghdadi dialect exhibited higher levels of nasalisation, creakiness, and pharyngealisation compared to other dialects. This research highlights the connection between regional dialects and voice quality traits.

Khattab et al. (2015) explored distinct auditory and acoustic properties of pharyngeal consonants in Iraqi Arabic. The investigation explored the extent of nasalisation in oral, pharyngeal, and nasal contexts, revealing significant patterns. Pharyngeals paired with oral consonants displayed minimal nasalisation, but when paired with nasals, especially with the voiced pharyngeal, varying the degrees of nasalisation became evident. However, this did not inherently introduce breathiness but instead yielded a tense voice quality. The study suggests that nasality and breathiness can be intertwined or independent, varying by language and speaker.

Among auditory-perceptual tools, the VPA Scheme is widely used, and the sole study that applies this scheme to Iraqi Arabic is by Naser and Hameed (2021). Focusing on Iraqi Arabic speakers from Baghdad's Al-Dora region, the study involved 20 audio samples evenly split between males and females, aged between 23 to 35, representing various social classes. The analysis found no significant overall difference between male and female voices, except for increased nasality in females and pronounced creak in males. The data suggested a notable correlation between male and female voices, indicating habitual voice quality traits acquired during early language development. In males, creak could occasionally be accompanied by a whisper, resulting in a rougher phonation, while females exhibited a nasal, breathy creak.

The current research will utilise auditory-perceptual analysis with the VPA scheme to examine the voice quality of Iraqi Arabic speakers comprehensively in their speech. It will also consider gender as a social factor to assess its impact on the voice quality exhibited by the speakers mentioned.

2. Iraqi Arabic

Iraq, a country situated in the Middle East, shares borders with six neighbouring countries: Turkey to the north, Iran to the east, Syria and Jordan to the west, and Saudi Arabia and Kuwait to the south. The linguistic landscape of Iraq has been influenced by its diverse historical background. Ancient languages like Akkadian, Assyrian, and Sumerian have significantly shaped the region (Roux, 1992; Postgate, 2007). Presently, Arabic serves as one of the official languages and is the most

commonly spoken, featuring various Arabic dialects. Kurdish is also recognised as an official language, with small communities conversing in other languages such as Turkmen, Syriac, and Armenian (Jastrow, 2006; Visser, 2007). This linguistic diversity reflects Iraq's rich linguistic heritage, providing a compelling incentive for scholars to explore various linguistic phenomena within its borders.

The nation is split into 18 governorates for administrative reasons, divided between Iraqi Kurdistan in the north and other governorates in the centre and the south (figure 1).

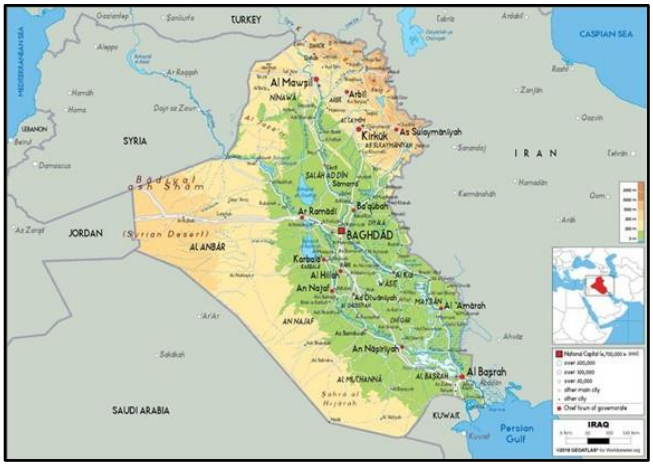

Figure 1: A map showing the location of Iraq and some of its geographical details (cited from: https://www.worldometers.info/img/maps/iraq_physical_map.gif)

In the intricate fabric of Iraqi Arabic, where geography merges with the cultural tapestry, the complex identity of its people is intricately shaped by diverse linguistic influences and regional subtleties. Beyond the earlier discussions on geographical distinctions and linguistic variations, it is crucial to acknowledge the indispensable role played by both men and women in moulding the sociolinguistic fabric of this dynamic nation. Understanding the variability in voice quality concerning gender is illuminated by two vital perspectives (Biemans, 2000):

The first perspective explores the interplay of anatomical and social influences on voice quality, emphasising how the physical structure of speakers significantly moulds their voice. Additionally, societal perceptions of gender impact speech patterns. The second perspective delves into variations within both men and women, acknowledging substantial diversity within each group. Individuals may exhibit a wide range of pitch levels and vocal attributes, including variations in voice pitch, roughness, smoothness, and speaking pace (Biemans, 2000).

These perspectives collectively contribute to four sources of voice quality variation related to gender: Firstly, anatomical differences between sexes suggest that, on average, women tend to have smaller larynxes and vocal tracts than men, resulting in higher pitch and vowel formant frequencies. Secondly, anatomical differences within women and men groups indicate that individuals with relatively large vocal cords, regardless of gender, typically exhibit lower pitch. The third source highlights social differences between sexes, where voices of boys and girls exhibit distinctions in pitch and formant frequencies before puberty-induced sex-specific developments. The final source is social differences within women and men groups, manifesting in culturally variable pitch and voice quality differences (Biemans, 2000).

In certain phonetic aspects like pitch, gender distinctions establish boundaries for potential variation within each group. The average pitch of female speakers usually falls within 170 to

210 Hz, while that of male speakers generally ranges from 90 to 140 Hz due to anatomical considerations. However, it is essential not to overstate the influence of socially constructed gender differences within a group of individuals. An individual's ability to sustain a lower pitch level, for instance, may be constrained by their anatomical structure.

Expanding upon the aforementioned observations that distinguish gender based on the male/female binary or within the same gender, this study incorporates the social factor within the diverse governorates of Arabic-speaking Iraqi society. The goal is to illustrate the characteristics of voice quality under the influence of this factor, encompassing both the indirect impact of the biological structure of Iraqi vocal organs in both genders and the cultural framework shaping each gender's vocal characteristics.

3. Voice Quality

Iraqi Arabic speakers are renowned for their distinctive voice quality, a quasi-permanent feature that consistently characterises their speech (Abercrombie, 1967: 91). This particular voice quality is often described by speakers of other Arabic dialects as involving an excessive use of the throat, leading to the perception that they 'speak in the throat' (Alsiraih, 2013). This trait is even exaggerated in portrayals by TV actors, who tend to overemphasise stereotypes with slight nasalisation or noticeable pharyngeal constriction in their general speech, findings supported by some studies such as Bellem's (2007) and Hetzron's (1969).

These observations fall within the realm of voice quality, a phenomenon distinct from both segmental features and voice dynamics (Abercrombie, 1967: 89). Voice quality, as Abercrombie defines it, encompasses characteristics that persist throughout a person's speech, constituting a quasi-permanent quality present in all emitted sounds (Abercrombie, 1967: 91). Expanding on this perspective, Laver (1980: 1) aligns with a broad interpretation of Voice Quality, describing it as "the distinctive auditory quality of an individual speaker's voice," rather than limiting it solely to laryngeal activity. Consequently, many researchers have adopted the term 'colouring of the voice' as a direct reference to the concept of Voice Quality (Laver, 1980; Alsiraih, 2013).

The term "Voice Quality" has undergone various conceptualisations over time, evolving through a chronological progression of different terminologies. It was thoroughly introduced and classified into various settings by Laver (1975), Abercrombie's student (see: Laver 1980; Beck 2018; Esling et al., 2019). Laver (1980: 13) defines 'a setting' as "the aspect of a segment's performance that it shares with other similar segments," derived from the articulation of segments, referring to the smallest speech units, including both consonants and vowels (Laver, 1980: 13). Another interpretation by Wirz and Beck (1995: 46), associates settings with "long-term-average configurations of the vocal apparatus," forming a foundation for the short-term movements needed to articulate phonetic segments. Beck (2018) further defines a setting as "a persistent inclination for a specific part of the vocal apparatus to adopt a particular configuration or pattern of behaviour." This study provides a concise overview of Laver’s

(1980) categorisation of voice quality settings and Beck's (2018) developments.

3.1 Settings of Voice Quality

Laver (1980: 4) posits that voice quality encompasses various settings, characterizing them as paralinguistic, prosodic, and extralinguistic features developed for cultural, communicational, and stylistic purposes. These settings depend on the "phonological repertoire" of the spoken language. Beck (2018) further defines these settings as enduring inclinations of specific vocal apparatus components to adopt specific patterns of conduct over time.

Laver (1980: 4), later updated by Beck (2018), classified voice quality into three primary categories. The first category comprises *configurational settings* that impact the longitudinal or cross-sectional configuration of the vocal tract, including lip protrusion or retraction, spread or rounded lips, jaw pause, the role of the tongue, and larynx position (raised or lowered). The second category consists of *articulatory settings*, defining the typical range of motion utilised by the lips, jaw, and tongue during speech. The third group encompasses *overall muscular tension features*, including larynx and pharynx tension, as well as phonation features identifying the sound source based on tension and vibration within the vocal tract. Beck (2018: 21) supplements this basic division with prosodic features and other diagnostic features, emphasising their significant role in identifying "sex, age, physique, and language background of the speaker."

The system avoids comparing voices to a 'normal' standard and instead utilises a clearly defined 'neutral' reference point. The perceptual quality of this neutral reference point is associated with a precisely defined configuration and activity range of each part of the vocal apparatus, along with anticipated acoustic attributes (Laver, 1980). This approach circumvents the challenges of defining 'normal' voice quality and eliminates the need to establish an 'ideal' standard for voice production (Hardcastle and Beck, 2005: 296, 297). Evidence indicates significant variations in voice quality among different languages and accent groups (e.g., Esling 1978; Stuart-Smith, 1999), implying diverse perceptions of what constitutes 'normal.' Using a neutral baseline ensures judgments are independent of preconceived notions of 'normality,' distinguishing this scheme from others, including the Buffalo III Voice Profile and the GRBAS. The potential drawback is that judges may require training to recognize the auditory characteristics of the neutral reference point (Hardcastle and Beck, 2005: 296, 297).

Consequently, this paper aims to document Iraqi voice features. It seeks to differentiate among these features, particularly focusing on gender distinctions, employing the VPAS as a model for analysis.

3.2 Approaches to Investigating Voice Quality

Laver (1980 and 1991) emphasises that a speaker's biology establishes the potential range of voice quality features, with larynx and vocal tract settings imposing constraints on this range. While speakers cannot modify their anatomy and physiology, habitual settings can be influenced by using these organs regularly, resulting in "phonetic adjustments" (Hardcastle and Beck, 2005: 288).

Approaches to voice quality vary based on the diverse scientific backgrounds and objectives of researchers. Researchers employ different methods, including auditory-perceptual, acoustic, articulatory (physiological), or combinations thereof (Alsiraih, 2013: 38). The choice of approach depends on the researcher's perspective and the availability of suitable tools. Technological advancements have played a role in shaping these approaches (Alsiraih, 2013: 38). Acoustic investigations are the most commonly used approach due to the accessibility and affordability of required tools, typically involving a computer and freely downloadable software. While acoustic approaches are considered reliable for research findings, they may lack the direct visualisation provided by articulatory instruments (Frohlich et al., 2000: 706). Nevertheless, some researchers recognise the inherent perceptual nature of voice quality and emphasize the importance of perceptual investigations (Kreiman et al., 2007). For these reasons, the current study adopts the auditory-perceptual approach.

The most popular auditory-perceptual approaches include the GRBAS scales (see: Bodt et al., 1997; Carding et al., 2000) and the VPA scheme (see: Laver, 1991; Stuart-Smith, 1999; Hardcastle and Beck, 2005; Beck, 2007, 2018; Khattab et al., 2015). This study adopts the VPA (Vocal Profile Analysis) scheme, notable for its novelty and standardised measurement approach. The VPA scheme is distinct because it relies on 'neutral settings' rather than the more ambiguous 'normal settings' used in other auditory-perceptual approaches, which can vary significantly among individuals (Hardcastle and Beck, 2005: 296; also see: Laver, 1980 and Hollien, 2000). Additional features are discussed in the following section.

4. The VPA (Vocal Profile Analysis) Scheme

This paper employs the VPA model, initially developed by John Laver, Sheila Wirz, Janet Mackenzie Beck, and Steve Hiller in the early 1980s. Subsequently, it was further refined and updated by Beck in 2018, and the (Vocal Profile Analysis Scheme: User's Manual) was exclusively published at Queen Margaret University. The manual was obtained via personal contact with Professor Beck, who granted permission for its use in this research (see: Appendix).

The distinguishing feature of the VPA scheme among perceptual auditory models lies in its analytical principles directly linked to the biological foundations of speech production and acoustic attributes (Hardcastle and Beck, 2005: 295). Apart from offering a systematic approach for assessing voice quality, the VPA provides a solid theoretical basis for addressing speech therapy and voice disorders, supported by clinical evidence (Hardcastle and Beck, 2005: 295). Consequently, Hardcastle and Beck (2005: 295) assert that the VPA is grounded in anatomical and physiological parameters, effectively bridging them with acoustic measurements, making it a robust framework for describing voice quality.

Hardcastle and Beck (2005: 297) highlight several fundamental aspects of the VPA scheme. Firstly, the VPA takes a comprehensive approach, considering the entire vocal apparatus, including habitual movements of the lips, jaw, tongue, and velopharyngeal systems. Secondly, the elements used to interpret speech within the

VPA are referred to as 'settings.' Thirdly, the VPA is fundamentally a perceptual approach capable of recognising distinct voice qualities and linking them to the perceptual characteristics of each setting. This association can be clinically applied for diagnosing specific voice-related pathologies or can be employed socially to delineate distinct language groups. Finally, the collection of 'neutral settings' mentioned earlier serves as the benchmark against which all voices are measured (also see: Naser and Hameed, 2021).

To use the VPA, training is required for perceptual-auditory analysis, ensuring reliability (Hardcastle, Beck, 2005: 301-302). Additionally, a high-quality recording of at least 40 seconds of connected speech is needed, with a preference for spontaneous speech (Hardcastle, Beck, 2005: 301). Beck's (2018) manual acts as a supplement to training courses on the VPAS and is utilised by the researchers in the current study.

4.1 The Structure of the VPA Scheme

The VPA scheme employs two perceptual strategies in the analysis of voice qualities: 'susceptibility' and 'key segments' (Laver, 1980: 20; Beck, 2018: 4-5). Laver (1980: 20) and Beck (2018: 4-5) define susceptibility as the repeated exposure of a segment to a specific situation. For example, only segments with phonologically voiced elements will be sensitive to phonation types like creakiness and breathiness, while voiceless sounds will remain unaffected. Similarly, lip spreading will impact segments with a phonological requirement for lip rounding, such as /u/, but have a lesser effect on /i/, as the /i/ segment phonologically demands spread lips. The susceptibility of individual segments to the biasing effects of a particular context varies a fundamental principle of the VPAS.

Laver (1980) and Beck (2018) define 'key segments' as norms that provide a cost-effective listening technique for listeners to test their initial perceptions of a voice when suspecting the existence of a certain setting. Beck (2018) offers an example to illustrate this technique, where a back vowel, /u/, can be realized as a fronted or less back segment due to an advanced tongue placement. Additionally, due to forward tongue positioning, alveolar sounds like /t, d, n, s, z, l/ can be realized as dental or interdental. Identifying the target deviated setting, known through susceptibility, requires consideration of the key segment when choosing the scalar degree. The VPAS (table 1) is provided below.

Table 1: Vocal Profile Analysis Scheme (original source by: John Laver & Janet Mackenzie Beck, Queen Margaret University, Edinburgh © 2012; developed later by: Beck, 2018)

VOCAL PROFILE ANALYSIS PROTOCOL

Speaker: …… Date of recording: …… Judge: …… Recording ID: ……

	FIRST PASS		SECOND PASS							
				moderate			extreme			
	Neutral	Non-neutral	SETTING	1	2	3	4	5	6	
A. VOCAL TRACT FEATURES										
1. Labial			Lip rounding/protrusion							
			Lip spreading							
			Labiodentalization							
			Extensive range							
			Minimised range							
2. Mandibular			Close jaw							
			Open jaw							
			Protruded jaw							
			Extensive range							
			Minimised range							
3. Lingual tip/blade			Advanced tip/blade							
			Retracted tip/blade							
4. Lingual body			Fronted tongue body							
			Backed tongue body							
			Raised tongue body							
			Lowered tongue body							
			Extensive range							
			Minimised range							

5. Pharyngeal			Pharyngeal constriction						
			Pharyngeal expansion						
6. Velopharyngeal			Audible nasal escape						
			Nasal						
			Denasal						
7. Larynx height			Raised larynx						
			Lowered larynx						
B. OVERALL MUSCULAR TENSION									
8. Vocal tract tension			Tense vocal tract						
			Lax vocal tract						
9. Laryngeal tension			Tense larynx						
			Lax larynx						
C. PHONATION FEATURES									
			Present		Scalar Degree				
			Neutral	Non-neutral	Moderate			Extreme	
	SETTING				1	2	3	4	5	6
10. Voicing type	Voice									
	Falsetto									
	Creak									
	Creaky									
11. Laryngeal frication	Whisper									
	Whispery									
	Breathy									
12. Laryngeal irregularity	Harsh									
	Tremor									
		Neutral	SETTING		moderate			extreme		
					1	2	3	4	5	6
D. PROSODIC FEATURES										
13. Pitch	Mean		High							
			Low							
	Range		Extensive range							
			Minimised range							
	Variability		High							
			Low							
14. Loudness	Mean		High							
			Low							
	Range		Extensive range							
			Minimised range							
	Variability		High							
			Low							
E. TEMPORAL ORGANIZATION										
15. Continuity			Interrupted							
16. Rate			Fast							
			Slow							

F. OTHER FEATURES		
17. Respiratory Support	Adequate	
	Inadequate	
18. Diplophonia	Absent	
	Present	

The structure comprises several columns, with the left one designated as the long-term settings, each group representing a part of the vocal apparatus. The first group focuses on *vocal tract features*, the second on *overall muscle tension*, and the third on *phonation settings* (Beck, 2018: 5). Despite the inclusion of some *prosodic elements*, Beck (2018: 3) dismisses them, stating that they "have a less secure theoretical foundation."

According to Beck (2018), the fundamental categories are further subdivided into more specific subcategories. For instance, supralaryngeal features, or characteristics of the vocal tract, are categorised into labial settings, mandibular settings, lingual settings, and so on. On the right, the columns are divided into 'the first pass' and 'the second pass', representing two levels of judgment. The first pass involves a straightforward evaluation of the neutrality of the voice setting, with neutrality distinct from normalcy. Interpretations of 'normal' can vary among individuals from different languages or speech backgrounds. The second pass requires a more detailed assessment of the feature's audibility, with the first degree indicating a barely perceptible feature, the second an audible one, and the third a noticeably perceptible one. These degrees represent the moderate presence of the trait that could distinguish an accent or a language (Beck, 2018: 3). While there are rare exceptions, extreme variations in accents or languages are not very common (Beck, 2018: 3). The three severe degrees are four, five, and six in the second pass, indicating a significant departure from neutrality. The sixth symbolises the most severe and common characteristic linked to pathological diseases, representing the most extreme and common feature that is audible. The fourth represents the fairly extremely audible feature, and the fifth is the second-degree extreme feature that nearly always exists (Beck, 2018: 3).

5. Methodology

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This section explains the details and procedures that the research is carried out to reach its analysis and thus its results.

5.1 Participants

This research enlisted a total of 36 individuals from Iraq, with an equal distribution between males and females. The participants, chosen from diverse occupational backgrounds, all have university education. They are native speakers of Iraqi Arabic (IA), raised in one of the 18 governorates of Iraq, specifically in urban areas, and have spent their entire lives in their respective hometowns. The age range of the participants is from 20 to 45 years. It is noteworthy that none of the participants reported any known voice disorders or issues with their vocal-nasal apparatus. Recordings were conducted in various locations, ensuring a quiet environment for the sessions.

5.2 Stimuli and Procedures

The study follows specific procedures to conduct the research. Speech from two speakers, one male and one female, has been recorded from each governorate. Two methods, narrative pictures and non-ended responses, are employed to suit the VPA scheme analysis, and the recordings have been 60 seconds long. The recordings are made using 'Wavepad' recording app for its professional audio quality (see: Munro, M. J., and Derwing, T. M., 2020; and Otachi, E., 2020), and a 'BOYA' brand microphone (BY-M1) with a frequency range of 65Hz-18Hz.

For the analysis and rating of the utterances, the first researcher underwent training by Professor Janet Mackenzie Beck in a two-day online workshop via 'Microsoft Teams' in April 2023 (see Appendix).

The auditory-perceptual analysis unfolded in two distinct phases. The initial phase aimed to discern if specific categories within a speaker's speech deviated from neutrality, focusing on factors such as labial, mandibular, and lingual aspects. The analysis follows the sequence within the scheme, outlining the biological sequence explaining changes in the vocal cavity (Beck, 2018). Prosodic features were deliberately excluded from consideration, as outlined in section 4.1.

The subsequent phase involved classifying non-neutral settings into specific levels using a graded scale ranging from 1 to 6. Degrees 1 through 3 were labelled as 'moderate,' while degrees 4 through 6 were categorised as 'extreme.' Degree 1 represented the smallest detectable departure from neutrality, discernible through auditory analysis. In contrast, degree 6 denoted the most significant conceivable deviation from neutrality achievable by a speaker with a standard vocal apparatus. The intermediary degrees were strategically chosen to represent equal perceptual intervals between these two extremes.

A scoring convention utilised the letter 'i' to indicate intermittent settings, reflecting the strength, not the frequency, of occasional setting adoption. This convention proved useful when a setting was present in less than 90% but more than 10% of susceptible segments. In cases requiring frequency representation, a percentage could be added alongside the strength judgment. This approach is particularly valuable in monitoring the progress of dysphonic patients, addressing intermittent harshness episodes associated with laryngeal tension peaks.

An intra-rater procedure involved the first researcher listening to and rating the recorded speech samples twice in two separate sessions, managing 22% of the dataset with a one-week gap for validation.

An inter-rater process enlisted a second judge, Prof. Janet M. Beck, the scheme's founder and developer. Prof. Beck, of British nationality, conducted inter-rater reliability assessments on 22% of the data, ensuring, through personal communication, that 20% of the data sufficed for VPA inter-rater reliability (see: Beck, 2023: 7, 20). This procedure served as a reliability test, comparing her ratings with those of the first researcher for additional validation.

Finally, the results underwent analysis, and figures were generated using Microsoft Excel (version 365) to measure the reliability of both intra-rater and inter-rater assessments, depicted through clustered column charts.

6. Analysis of Results and Discussion

6.1 Intra-Rater and Inter-Rater Reliability

In this reliability assessment, 8 audio recordings are selected to test the auditory analysis in the paper. The procedures are analysed using charts to depict correlations in non-neutral features among Iraqi subjects, particularly from the random sample. Prof. Janet Beck recommended a 20% reliability assessment, confirmed in a discussion on July 20, 2023. Accordingly, 8 samples were taken from the original 36 to validate consistency and ensure reliability. This evaluation, especially in intra-rater and inter-rater analyses, is visually represented in the figures and tables below.

In intra-rater analysis, the researcher performed two evaluations on Iraqi voice samples, identifying non-neutral characteristics. A strong correlation between the two evaluations was observed (figures 1 and 2). Disagreements on non-neutrality were primarily in the minimal first and moderate second degrees of the second evaluation, with intermittent instances of non-neutral settings (i).

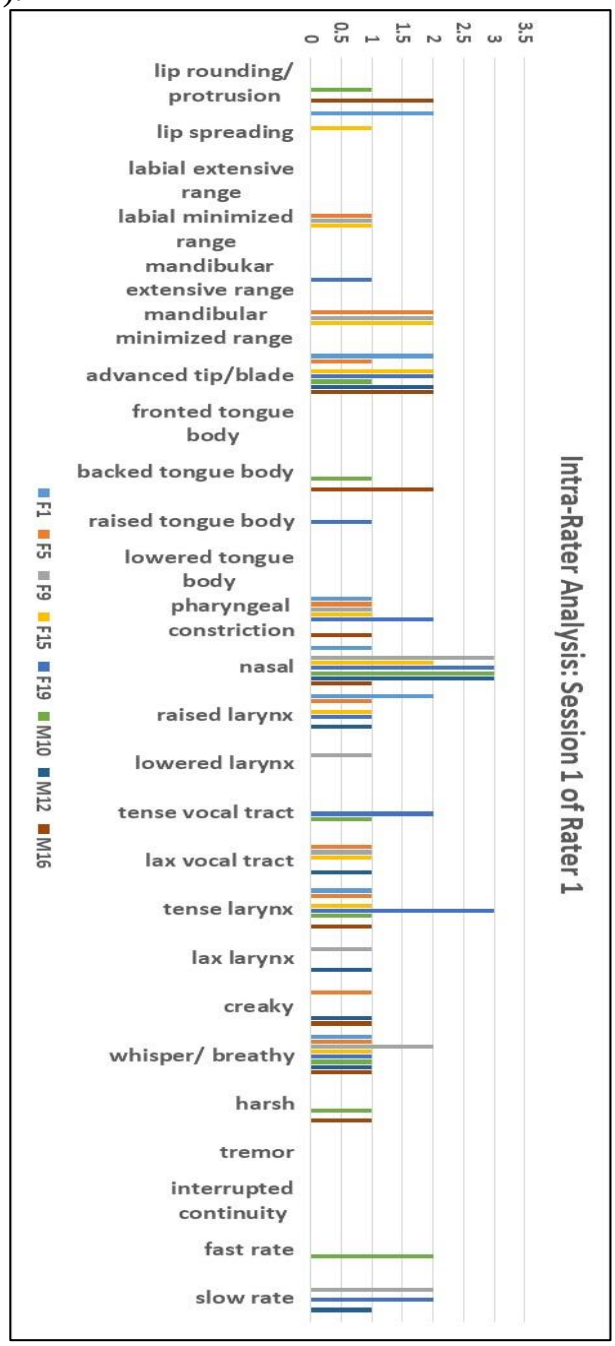

Figure 2: The non-neutral features detected in selected Iraqi voices throughout the first perceptual rating of the intra-rater analysis.

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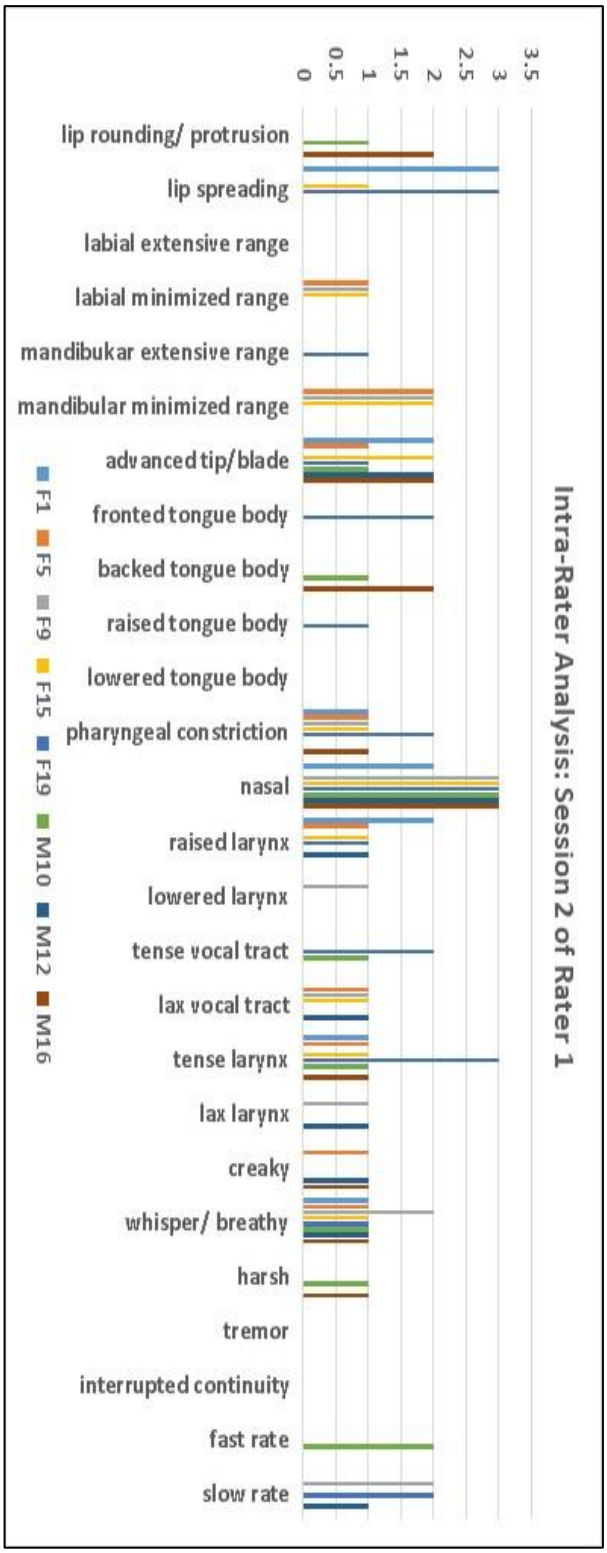

Figure 3: The non-neutral features detected in selected Iraqi voices throughout the second perceptual rating of the intra-rater analysis.

Two evaluations were conducted: the first by the researcher and the second by Prof. Janet Beck from Queen Margaret University in Britain on the voice samples. The inter-rater analyses of the two judges are illustrated in figures (4) and (5), indicating an 82% agreement in assessment, which is considered excellent (see: Cicchetti, 1994).

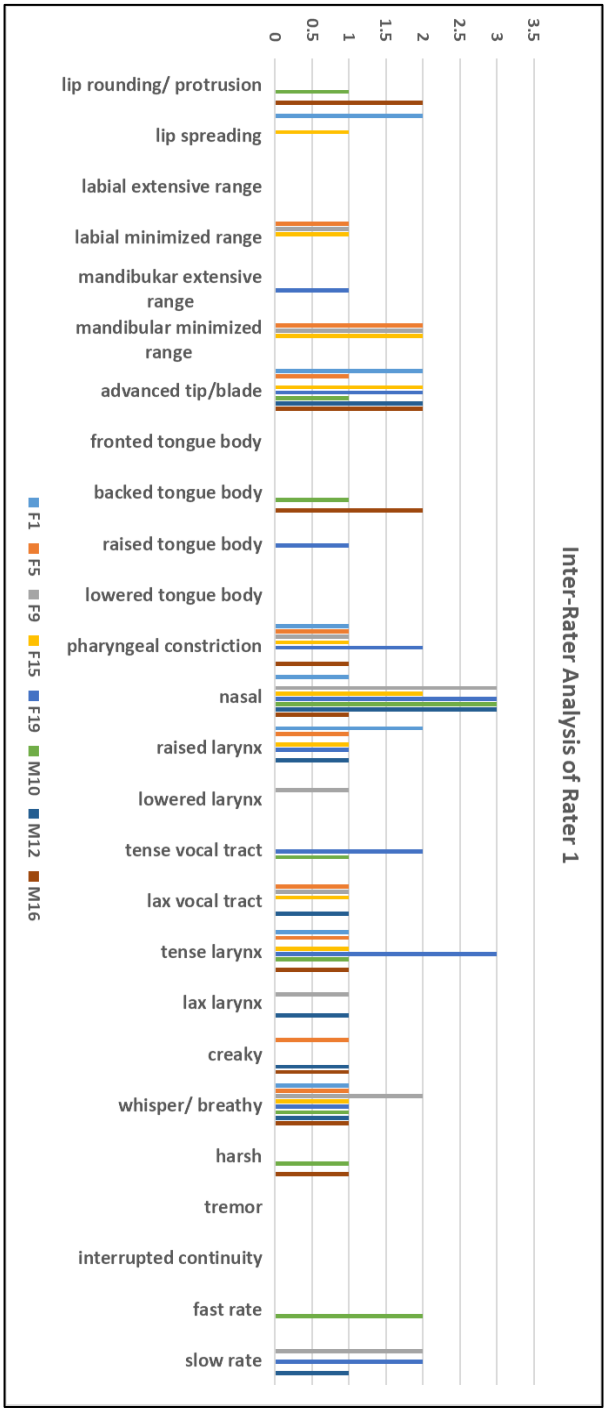

Figure 4: The non-neutral features detected in selected Iraqi voices by the 1st rater.

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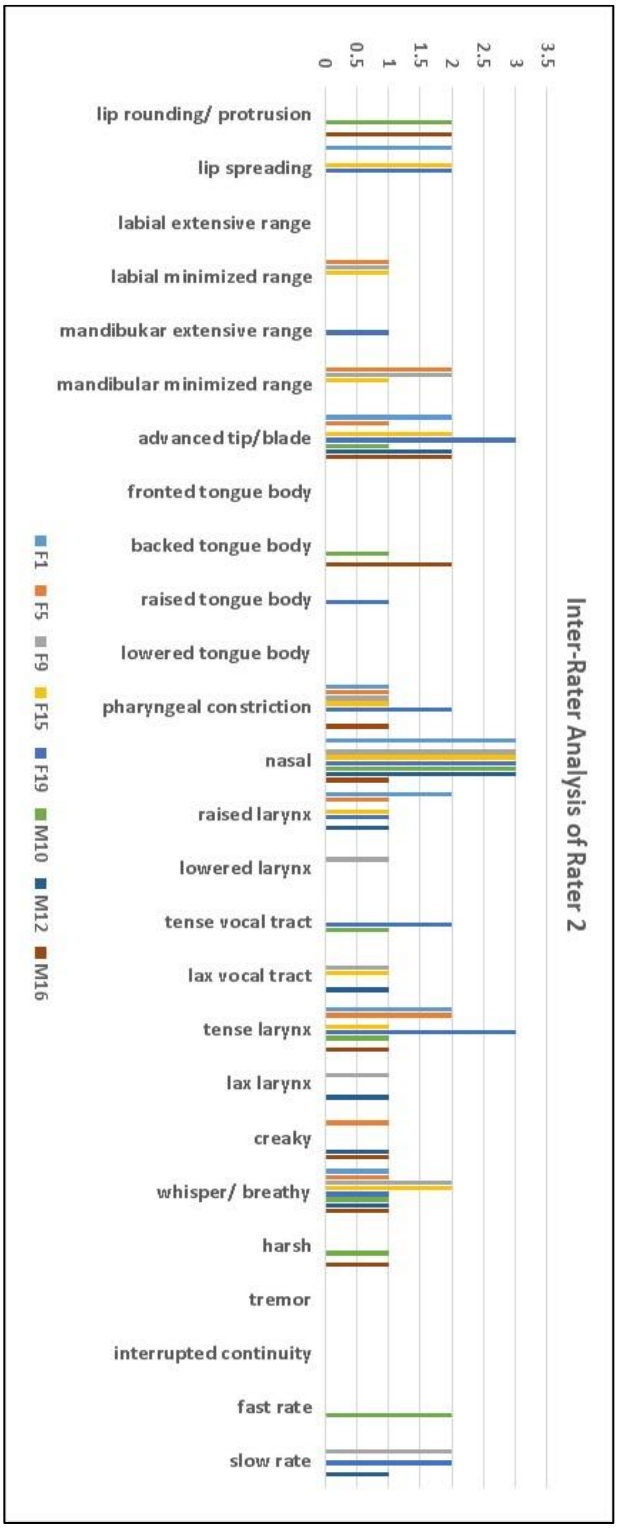

Figure 5: The non-neutral features detected in selected Iraqi voices by the 2nd rater.

6.2 Data Analysis

Within this section, gender serves as a variable, impacting the voice characteristics of Iraqi speakers across all Iraqi governorates. Prior research underscores the significant influence of a speaker's biological anatomy on voice quality, most notably evident in the inherent distinctions between males and females (Biemans, 2000). Factors such as the dimensions of speech organs, hormonal interactions, and the broader cultural and societal contexts in which individuals reside, further shape these vocal traits (Manning et al., 2003: 399-405). Detailed insights into these aspects are found in section 2.

6.2.1 Males

In this study, the speech of 18 male Iraqi speakers from the 18 Iraqi governerates underwent analysis. As detailed in the methodology section, this sample represents a meticulously chosen group from various Iraqi urban areas. The aim is to capture the comprehensive range of vocal characteristics inherent to Iraqi speakers, allowing listeners to discern their distinctiveness and authenticity in speech. Therefore, the current analysis would show the shared voice quality characteristics among male Iraqi speakers from different regions of Iraq.

Figure (6) demonstrates the analysis of male speakers' voice qualities.

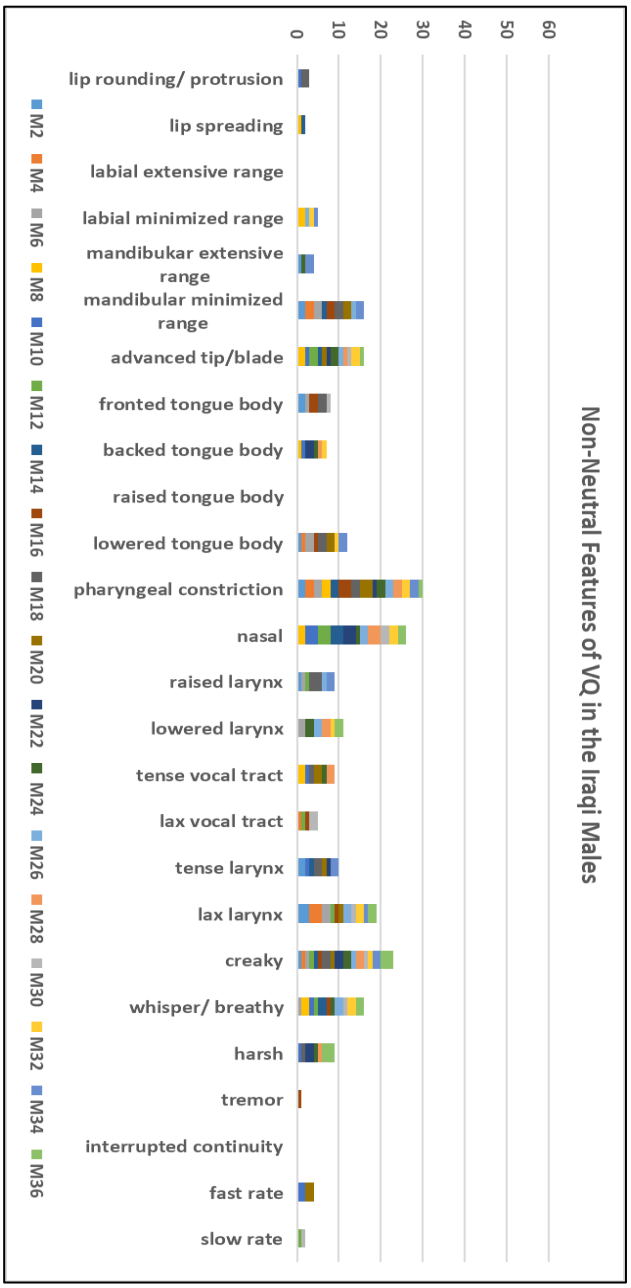

Figure 6: The non-neutral features of voice quality detected in Iraqi male speakers' voices.

The analysis results indicate that male speakers of Iraqi Arabic exhibit certain characteristics in voice quality. Notably, they display a higher degree of *lip protrusion / rounding* compared to lip spreading, and there is a tendency towards *a minimized range in both labial and mandibular* aspects. Despite some instances of mandibular extensive range, the overall trend favours mandibular minimization. Additionally, the study reveals that male Arabic speakers from Iraq, in general, tend to expose their tongues during speech, particularly evident in alveolar segments, showcasing *advanced tip/blade* articulation. The pronunciation of the /l/ is consistently neutral in tongue position.

Speakers of southern governorates exhibit a more advanced tongue position compared to speakers of other governorates. Pronunciation variations are observed in the /r/ sound, with central governorates as Baghdad, Karbala' and Babylon speakers producing a retroflex or close to neutral pronunciation, while northern areas individuals alternate between /ɣ/ and advanced /r/, especially speakers of Mousel.

Iraqi males are characterized by a *fronted or backed tongue body*, depending on the governorates. Southern governorates speakers typically demonstrate a backed tongue characteristic, while others tend to favour a fronted tongue body. However, a common feature among all is the *lowered tongue body*, potentially contributing to the tendency to enlarge the oral cavity for a louder voice, as observed during sample collection.

Two notable traits in male speakers are *pharyngeal constriction* and *nasalisation*, with pharyngeal constriction prevailing over nasality. This constriction results in an increased vocal tract length, while nasality affects the larynx, leading to a dominant *lowered* appearance in males. *Creakiness* is more prevalent than breathiness/whisperiness in males, contributing to a *harsh* quality, particularly in the southern and central Iraqi governorates. However, whisperiness still influences the *larynx*, maintaining an overall

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state of *laxity* in male voices. Despite a general inclination towards neutral speech, some cases exhibit a *slower* speed of speech, surpassing even slow rates.

Figure (7) illustrates the average presence of non-neutral voice quality characteristics identified in a set of Iraqi male voices.

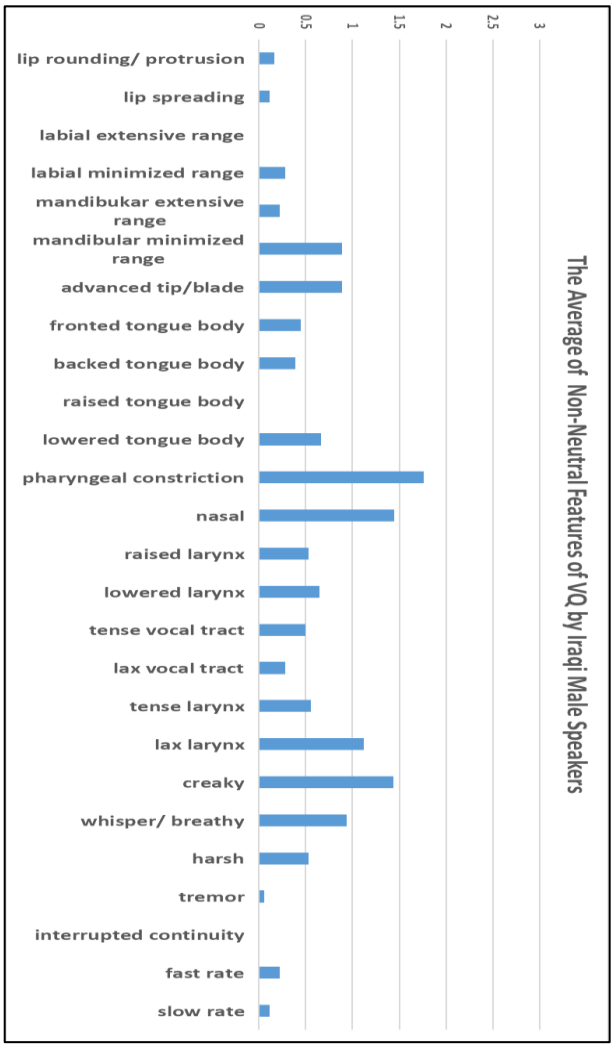

Figure 7: The average of non-neutral features detected in selected Iraqi male speakers' voices.

6.4.2 Females

Selected from various urban areas across Iraq, 18 female Iraqi speakers were examined in this study. The methodology section elaborates on the selection process. The goal is to highlight the distinct and authentic speech patterns unique to Iraqi women, aiming to identify the common voice quality settings prevalent among female speakers from different regions within Iraq.

Figure (10) demonstrates the analysis of female speakers' voice qualities.

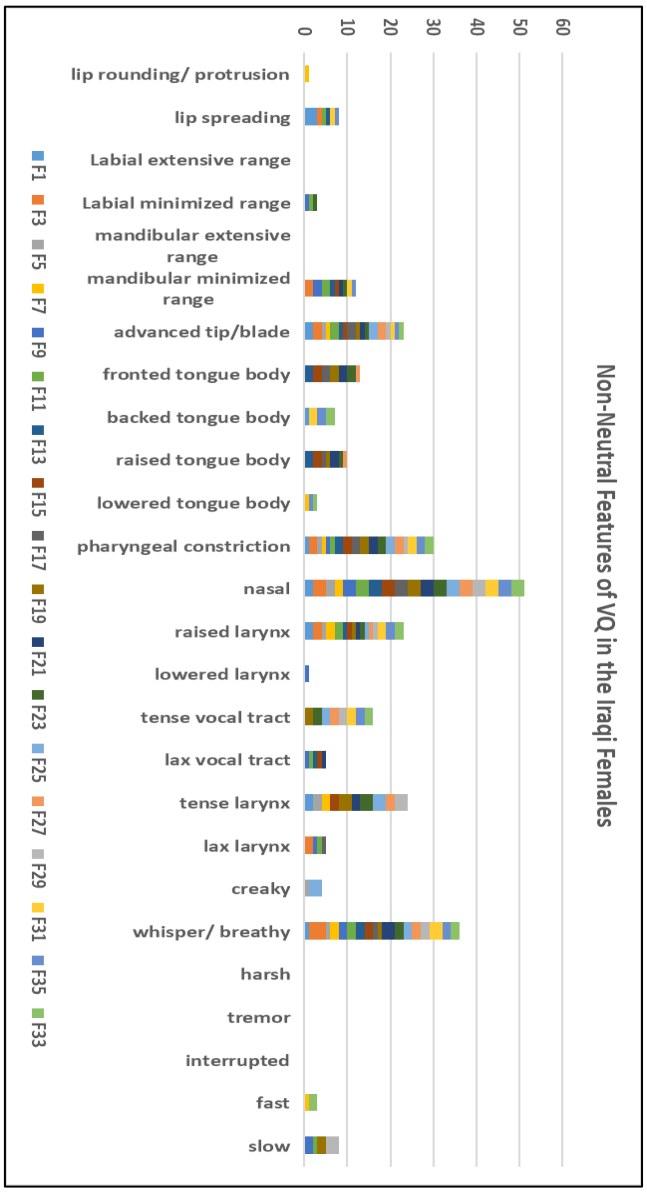

Figure 8: The non-neutral features of voice quality detected in Iraqi female speakers' voices.

The results of the analysis highlight distinctive voice quality characteristics among female speakers of Iraqi living in the 18 Iraqi governerates. In contrast to males, females display a preference for high *lip spreading*.

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Like their male counterparts, they also showcase a *labial minimized range* and a *mandibular minimized range*. Additionally, the analysis suggests that female Arabic speakers from Iraq, much like their male counterparts, tend to advance their tongues during speech, particularly evident in alveolar segments, showcasing *advanced tip/blade* articulation. Moreover, the pronunciation of the /l/ maintains a neutral tongue position, consistent with both genders.

Southern governorates female speakers tend to show more advancement than those from the other governorates. Pronunciation variations in the /r/ sound are observed, with central governorates speakers having a retroflex or close to neutral pronunciation, while northern governorates individuals, specially those of Ninewa (Mousel) alternate between /ɣ/ and advanced /r/.

Distinctive voice quality settings in Iraqi females include a predominantly *fronted tongue body*, surpassing the backed characteristic. This is influenced by the Iraqi speakers and the oral cavity space, as southern governorates speakers exhibit a backed tongue, while others tend to have a fronted tongue body. Females often demonstrate a *raised tongue body* more prominently than a lowered tongue body. Unlike males, females aim for a softer voice and, therefore, do not necessitate a large oral cavity, favoring the use of a fronted raised tongue.

The two notable characteristics in females are *pharyngeal constriction* and *nasalisation*, with nasalisation prevailing over pharyngeal constriction, contrasting with males. Pharyngeal constriction has a noticeable effect on the appearance of a *tense vocal tract* and a *raised larynx*, distinguishing it from males. In contrast to males, females exhibit *breathiness/whisperiness* more than creakiness, and the *tense larynx* characteristic is apparent.

Females generally tend to speak neutrally, although instances of *slow speech* at rates exceeding fast speed were observed in some cases.

Figure (9) provided below depicts the average occurrence of non-neutral voice quality characteristics identified in a collection of Iraqi female voices.

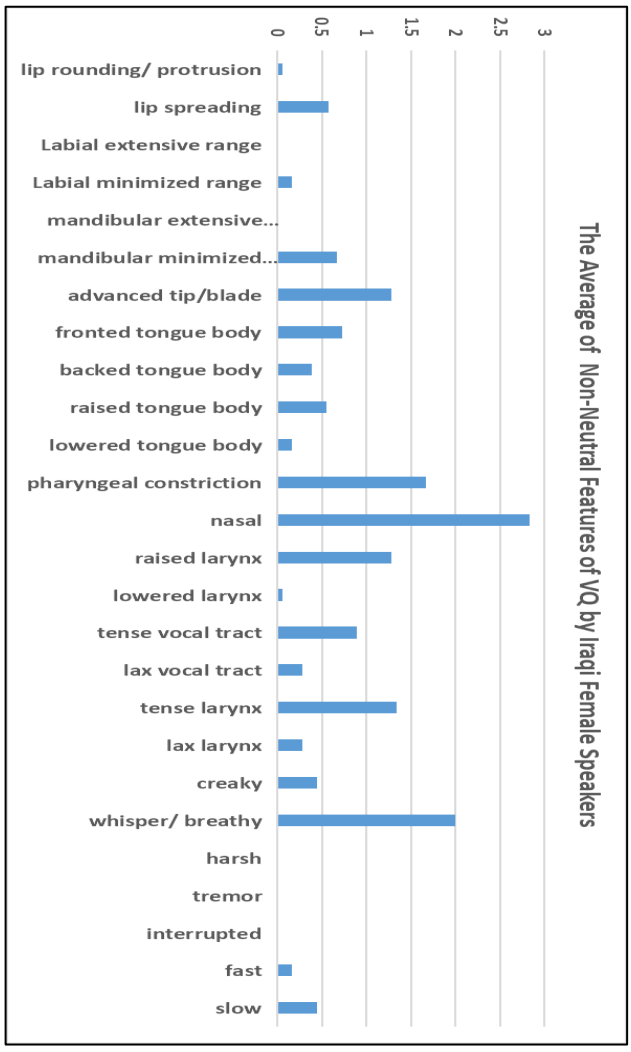

Figure 9: The average of non-neutral features detected in selected Iraqi female speakers' voices.

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7. Conclusions

The analysis of Iraqi Arabic voice characteristics reveals distinct features in both males and females. In males, a higher degree of lip protrusion/rounding is observed, with a tendency towards minimized ranges in labial and mandibular aspects. Advanced tip/blade articulation in alveolar segments and neutral pronunciation of the /l/ sound are common. Southern governorates males exhibit more advanced tongue positions, while variations in /r/ pronunciations are noted in different regions. Pharyngeal constriction prevails over nasalisation, and creakiness is more prevalent, contributing to a harsh quality. Some males exhibit slower speech rates. In females, there is a preference for high lip spreading, labial, and mandibular minimized ranges. Similar to males, females show advanced tongue positions and maintain a neutral /l/ sound pronunciation. Variations in /r/ pronunciations are observed, with nasalisation prevailing over pharyngeal constriction. Females demonstrate predominantly fronted tongue bodies, with raised tongue bodies more prominent than lowered ones. Breathiness/whisperiness is more common than creakiness, and females generally tend to speak neutrally, with occasional instances of slower speech. While both genders share some voice quality characteristics, variations exist in lip spreading, mandibular range, and the prevalence of creakiness vs. breathiness/whisperiness. These findings contribute to a comprehensive understanding of Iraqi Arabic voice patterns.

8. Further Research

Future research endeavours could greatly benefit from expanding the sample size to encompass a more diverse participant pool, thereby enhancing the generalisability of our findings regarding Iraqi Arabic (IA) voice qualities. Longitudinal studies tracking voice qualities over time would offer insights into their evolution and the influence of external factors. A finer-grained analysis of IA dialects would unveil unique voice characteristics, while cross-linguistic comparisons could illuminate shared features and dialect-specific traits. Investigating clinical applications within speech pathology and the development of structured voice training programs for actors and vocal performers could have significant therapeutic and artistic implications. Additionally, exploring the forensic applications of IA voice qualities in voice identification and speaker profiling within forensic linguistics could be a valuable direction. It is also worth investigating voice analysis tools and techniques for forensic casework. These multifaceted research paths hold the potential to deepen our understanding of voice production, linguistic identity, cultural context, and their forensic implications in IA speech. Furthermore, creating pedagogical materials tailored to the originality of IA voice qualities could enhance Arabic language teaching and learning. Delving into the influence of social and cultural factors, neurological correlates of voice qualities, and advancements in speech analysis technology further enrich the avenues for future research. These directions presage to deepen our understanding of voice production, linguistic identity, and cultural context in the realm of Iraqi Arabic speech.

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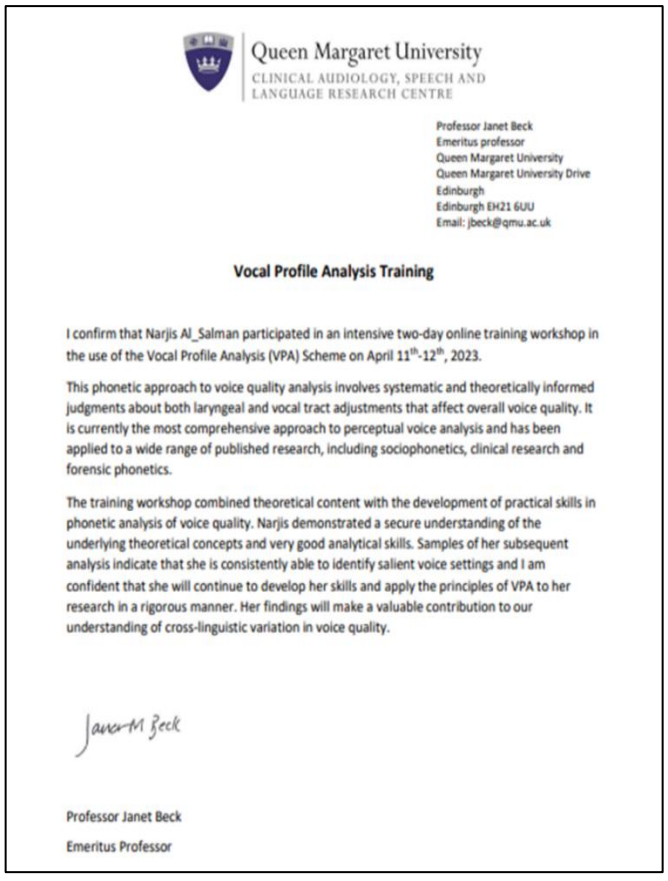
Appendix: A certification for the qualification of rating human voices using VPAS presented. by Janet M. Beck.



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Vocal Profile Analysis Training

I confirm that Narjis Al_Salman participated in an intensive two-day online training workshop in the use of the Vocal Profile Analysis (VPA) Scheme on April 11th-12th, 2023.

This phonetic approach to voice quality analysis involves systematic and theoretically informed judgments about both laryngeal and vocal tract adjustments that affect overall voice quality. It is currently the most comprehensive approach to perceptual voice analysis and has been applied to a wide range of published research, including sociophonetics, clinical research and forensic phonetics.

The training workshop combined theoretical content with the development of practical skills in phonetic analysis of voice quality. Narjis demonstrated a secure understanding of the underlying theoretical concepts and very good analytical skills. Samples of her subsequent analysis indicate that she is consistently able to identify salient voice settings and I am confident that she will continue to develop her skills and apply the principles of VPA to her research in a rigorous manner. Her findings will make a valuable contribution to our understanding of cross-linguistic variation in voice quality.

Janet M Beck

Professor Janet Beck
Emeritus Professor

تحليل الخصائص الصوتية لمتحدثي اللغة العربية العر اقية: الجنس كمتغير في توصيف (تحليل الملف الصوتي) السمعي الإدراكي

نرجس عبد المناف السلمان

وسن السريح

جامعة البصرة / كلية التربية للعلوم الإنسانية

الخلاصة

يتناول هذا البحث دراسة الصفات الصوتية لدى العراقيين الناطقين باللغة العربية، ويشمل كلا الجنسين، ذكوراً وإناثاً. تستخدم الدراسة تحليلاً سمعيًا إدراكيًا شاملاً باستخدام مخطط تحليل النمط الصوتي (VPA) الذي طوره كل من ليفر, وبرز, بيك وهيلر (1981)، والذي تم تنقيحه لاحقًا من قبل بيك (2018). جمعت البيانات من خلال طريقتين: الصور السردية والاجابات المفتوحة. كشفت النتائج عن خصائص مشتركة بين العراقيين المتحدثين باللغة العربية ، وكما يلي: انقباض البلعوم والخنة المرتفعة الواضحة، وخاصة عند الإناث؛ على الرغم من الاستخدام المستمر للطرف/الشفرة اللسانية المتقدمة، إلا أن الصوت السنخي النموذجي /l/ إحتفظ بوضع محايد؛ وقد تم تحديد صوت النطق على أنه مزيج من الأصوات الهامسة والصرير، مع وجود اختلافات، بما في ذلك عند الذكور الذين يظهرون انتشاراً أعلى لصوت الصرير وميزة نشر الشفاه؛ على العكس من ذلك، تميل الإناث إلى إظهار زيادة في الخنية والصوت الهامس، بينما يميل الذكور نحو صوت الصرير بالإضافة إلى استخدام الذكور للحنجرة المنخفضة في كثير من الأحيان.

الكلمات المفتاحية: خصائص الصوت، VPAS، متغير الجنس، التحليل السمعي الإدراكي.