

The Role of Lexical Stress on the Use of Vocal Fry in Young Adult Female Speakers

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Summary: Objectives. Vocal fry is a voice register often used by young adult women for sociolinguistic purposes. Some acoustic correlates of lexical stress, however, appear incompatible with the use of vocal fry. The objective of this study was to systematically examine the role of lexical stress in the use of vocal fry by young adult women.

Study Design. This is a semi-randomized controlled laboratory study.

Methods. Fifty female undergraduate students were recorded repeating one-, two-, three-, and four-syllable nonwords that conformed to English phonotactics. Nonwords were presented in order from shorter to longer lengths, with stimuli randomized within syllable length. Perceptual analyses of recordings were augmented by acoustic analyses to identify each syllable in which vocal fry occurred.

Results. Eighty-six percent of participants produced at least one episode of vocal fry. Vocal fry was more likely to occur in unstressed than stressed position, and the likelihood increased as distance from the stressed syllable increased. There was considerable variability in the use of vocal fry. Frequent and infrequent users varied on the degree to which they used vocal fry in single-syllable nonwords.

Conclusions. Vocal fry use persists among young adult women even in the absence of syntactic and pragmatic influences. Lexical stress appeared to dramatically reduce the use of vocal fry. Patterns of vocal fry use appeared to be different for frequent and infrequent users of this vocal register.

Key Words: Vocal fry–Lexical stress–Perceptual judgments–Register–Young adult women.

INTRODUCTION

Vocal fry, sometimes referred to as glottal fry or creaky voice, has been identified as a vocal register produced by speakers with non-pathological voices.¹ Although historically associated with male voice features,² vocal fry has received attention recently because of its widespread use by young female speakers of American English.^{3,4} During vocal fry, a thick vibrating mass is created as the vocal folds are strongly adducted while maintaining low longitudinal tension.⁵ The resultant voice register is characterized by diminished energy, a low fundamental frequency (F_0), and irregular vocal fold vibratory patterns. In fact, each vibratory cycle during vocal fry countenances two openings and closings of the vocal folds.^{6,7}

The acoustic features of vocal fry register create a distinct perceptual signature when compared with modal register. Vocal fry has been described as a “rapid series of taps, like a stick being run along a railing.”⁸ It is salient because it differs considerably from the regular periodicity and higher F_0 produced during modal register. Vocal fry serves both linguistic and sociolinguistic purposes. A significant body of research has demonstrated that vocal fry is most likely to appear at the end of sentences² and paragraphs.^{9,10} Researchers have interpreted this to mean vocal fry likely is a cue to syntactic boundaries.¹¹ Its role as a boundary marker, however, appears also to apply at the word level. For example, within phrases, vocal fry has been found most likely to occur at word boundaries. Within words, it is most likely to

occur at syllable boundaries.¹² The use of vocal fry as a boundary marker overlaps with the assertion that it serves as a pragmatic marker indicating the end of a turn in conversation.¹³

In addition to linguistic purposes, sociolinguistic purposes appear to play a role in vocal fry use. As reviewed by Sicoli,¹⁴ young women’s use of creaky voice has been associated not only with signaling insecurity¹⁵ and commiseration,¹⁶ but also toughness¹⁷. There also appears to be gender differences in its use. Wolk et al³ and Abdelli-Beruh et al¹⁸ investigated the use of vocal fry in women and men using a sentence reading task in an attempt to separate syntactic from pragmatic influences. Results demonstrated similar patterns for the two groups but with significantly more use of vocal fry by women than men. Henton and Bladon² and others¹⁹ have proposed that men use this register to signal masculinity.

Recent research has focused on the sociolinguistic motivations for young women’s use of the vocal fry register when speaking American English.⁴ Dilley et al²⁰ found that female radio newscasters had significantly higher usage of vocal fry than their male counterparts. Yuasa⁴ proposed that, like these female radio newscasters, young upwardly mobile women who spoke American English adopted vocal fry as a masculine register to appear more authoritative as a strategy to better compete with males in the marketplace (although subsequent research suggests that use of vocal fry may incur negative evaluations²¹).

Linguistic and sociolinguistic motivations, however, might compete with each other. For example, several acoustic features correlate robustly with lexical stress in English, including higher fundamental frequency (F_0), longer syllable duration, and greater intensity in stressed than unstressed syllables.^{22–24} Therefore, nuclei produced with vocal fry are significantly dissimilar to those produced with lexical stress (low F_0 vs high F_0 , low intensity vs high intensity, irregular vibratory patterns vs regular vibratory pattern, respectively). Circumstances in which a speaker

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wishes to signal a sociolinguistic cue might, therefore, compete with signals to the linguistic cue of lexical stress.

Lexical stress has been found to be a strong competitor against other linguistic cues. Some languages, such as Mandarin Chinese^{25,26} and Jalapa Mazatec,²⁷ use vocal fry to contrast sounds phonemically. Bird and colleagues^{28,29} analyzed productions of St'át'imcets, a Native American language in which vocal fry occurs phonemically in some sonorant consonants. Vocal fry decreased when these sonorants resided in stressed syllables. The authors concluded that cues to lexical stress were more important than phonemic cues in that language.

The purpose of the current study was to examine the role of lexical stress in the use of vocal fry by young American English-speaking women as a way to compare the competing concerns of linguistic and sociolinguistic cues. Analysis of vocal fry during the repetition of nonwords presumably minimized influences of syntactic, semantic, and pragmatic motivations to a greater degree than other methodologies like reading sentences.¹ This allowed for a comparison between linguistic (phonological) and sociolinguistic cues (habitual cues to masculinity).

METHODS

Participants

Participants included 50 female American undergraduate college students between the ages of 19 and 26 ($M = 20.40$, standard deviation [SD] = 1.01). All were monolingual speakers of American English with self-reported normal hearing and no audible signs of voice disorder. Extra credit in a communication sciences and disorders course was given for participation.

Materials

Participants repeated three lists of nonwords, two of which were used in the current study. The Nonword Repetition Task (NRT) and the Late-8 Nonword Repetition Task (L8NRT) were developed by Dollaghan and Campbell³⁰ and Moore et al.,³¹ respectively. These were created originally as measures of phonological short-term memory. Because NRT was developed for children, adults frequently yielded ceiling effects, so the more difficult L8NRT was developed for adults.³¹ Both nonword lists are described as nonword-like because the syllables occur infrequently in real English words (eg, /laʊʒ/). All nonwords followed English phonotactics. The primary difference between the NRT and L8NRT is that the L8NRT incorporates a greater number of late-developing phonemes. However, for the current study, there was no statistically significant difference between the amount of vocal fry produced on the two lists ($t[49] = .29$, $P = 0.78$). Therefore, the results from the lists were collapsed. Stimuli included 32 nonwords between one and four syllables in length. There were eight stimuli at each syllable length (ie, there were eight one-syllable nonwords, eight two-syllable nonwords, and so on). Primary stress was on the first syllable of one-, two-, and three-syllable nonwords, and on the second syllable of four-syllable nonwords. One exception occurred on one of the four-syllable nonwords in which the production of the stimulus resulted in two spondee-like primary stresses on the second and third syllables. Therefore, repetitions of this stimulus item were not

included in the current study. This resulted in 76 syllables to be examined for possible occurrence of vocal fry. On the few occasions in which participants presented with false starts, measurement began at the beginning of a completed nonword production, not at the beginning of the false start.

Procedure

Participants were tested under laboratory conditions seated facing a tester. The nonwords were presented via over-the-ear headphones. Following the procedures of Moore et al.,³¹ the material was presented in increasing length, from one-syllable to four-syllable nonwords. The order of presentation was randomized within each syllable length. Before beginning the repetition task, participants were asked to repeat three real English words to adjust the volume for each individual if necessary. Participants were told "You are going to hear some made-up words. After you hear a word, begin repeating it exactly as you heard it. You will hear each word only one time." No time limit was given to produce the repetitions, but all repetitions occurred immediately after stimulus presentation. The subsequent item was presented once the participant repeated the previous item. Participants' productions were recorded using a TASCAM DR-05 digital audio recorder (TEAC Corporation, Tokyo, Naka-cho, Japan).

Reliability

Two undergraduate speech language pathology students with previous phonetic transcription instruction were trained by the primary investigator (PI) to identify vocal fry perceptually. To train the perceptual judges, the PI randomly selected three recordings from the third nonword repetition list whose data were not used in the current study. Each recording contained 40 repeated nonwords, for a total of 120 nonwords used for training. The PI and the two students collectively listened to these productions and discussed them until arriving at a consensus with respect to the presence of vocal fry. Listeners employed an option to augment their perceptual judgments with analysis of acoustic waveform patterns (aperiodic patterns) and fundamental frequency (below 100 Hz) using the *TF32* software program.³² However, both listeners reported that this occurred only once for each of them. The recordings of six participants (12% of the sample) were randomly selected to test for reliability. Point-to-point inter-rater reliability was 99%. Between the two listeners, there was an average difference in the number of identified occurrences of vocal fry of 1.67 episodes.

RESULTS

Eighty-six percent of the sample (38 participants) had at least one occasion of vocal fry, but there was a broad range in the frequency of use, from 0 to 34 episodes across the 76 opportunities ($M = .10$, $SD = .13$) (see Table 1 for descriptives).

Vocal fry in stressed versus unstressed syllables

To compare stressed versus unstressed syllables, the averages of stressed syllables in multisyllabic nonwords (the first syllable of two-syllable nonwords, the first syllable of three-syllable nonwords, and the second syllable of four-syllable nonwords) were collapsed into a single variable. To create the

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