

Conversational Entrainment of Vocal Fry in Young Adult Female American English Speakers

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Summary: Objective. Conversational entrainment, the natural tendency for people to modify their behaviors to more closely match their communication partner, is examined as one possible mechanism modulating the prevalence of vocal fry in the speech of young American women engaged in spoken dialogue.

Method. Twenty young adult female American English speakers engaged in two spoken dialogue tasks—one with a young adult female American English conversational partner who exhibited substantial vocal fry and one with a young adult female American English conversational partner who exhibited quantifiably less vocal fry. Dialogues were analyzed for proportion of vocal fry, by speaker, and two measures of communicative success (efficiency and enjoyment).

Results. Participants employed significantly more vocal fry when conversing with the partner who exhibited substantial vocal fry than when conversing with the partner who exhibited quantifiably less vocal fry. Further, greater similarity between communication partners in their use of vocal fry tracked with higher scores of communicative efficiency and communicative enjoyment.

Conclusions. Conversational entrainment offers a mechanistic framework that may be used to explain, to some degree, the frequency with which vocal fry is employed by young American women engaged in spoken dialogue. Further, young American women who modulated their vocal patterns during dialogue to match those of their conversational partner gained more efficiency and enjoyment from their interactions, demonstrating the cognitive and social benefits of entrainment.

Key Words: Vocal fry—Conversational entrainment—Spoken dialogue—American women—Communicative success.

INTRODUCTION

Described perceptually as a “rapid series of taps like a stick being run along a railing,”^{1(p98)} and originally considered a voicing characteristic associated with vocal pathology,² *vocal fry* has been touted as becoming increasingly prevalent in the conversational speech behaviors of young adult female American English speakers.³ Although such increasing prevalence has yet to be empirically corroborated, there is certainly evidence that this voicing feature is frequently used this day and age by this population.^{3–5} Sociocultural motives have been raised as a possible explanatory framework for the prevalence of vocal fry in the speech of young American women engaged in spoken dialogue³; however, the evidence regarding these motives is largely equivocal (eg, Refs. 3, 6). Here, we examine conversational entrainment, the natural tendency for people to modify their behaviors to more closely match their communication partner,⁷ as one possible mechanism modulating the prevalence of vocal fry in the speech of young American women engaged in spoken dialogue.

Vocal fry—also commonly known as glottal fry, pulse or glottal register, laryngealization, or creaky voice—is typically defined as a series of discrete laryngeal excitations, with almost complete damping of the vocal tract between excitations.² The distinct vibratory pattern is generated with the arytenoid cartilages closely approximated,⁸ and the resulting slow and aperiodic vibrations create a “creaking” or “popping” sound.^{3,9} Vocal fry is a perceptually salient phenomenon, meaning that listeners can detect

its presence with relative ease and with a high degree of accuracy. Michel and Hollien¹⁰ reported that listeners were 95% accurate in distinguishing vocal fry from “harsh” phonation. Similarly, Blomgren and colleagues¹¹ reported that listeners were at least 95% accurate in categorizing speech samples as either vocal fry or modal (typical) phonation. Acoustically, vocal fry has been identified as occurring at the lower end of the fundamental frequency (F0) range.² In contrast to modal voice that occurs in the ranges of 85–180 Hz for men and 165–265 Hz for women,¹² vocal fry transpires around 7–78 Hz, a vocal range virtually identical for both men and women.^{4,11,13} This gives rise to the notion that vocal fry has its own distinct vocal register—the glottal register.¹³ Vocal fry has also been associated with increased measures of frequency and amplitude perturbation, termed jitter and shimmer, respectively.^{4,14} In addition, x-ray data have revealed that during vocal fry, the vocal folds are very thick and relatively short,¹⁵ and that airflow and subglottic air pressure is reduced.^{11,16} Vocal fry can, therefore, be recognized perceptually, acoustically, and physiologically.

Recent studies have confirmed that the use of vocal fry is a woman-dominated trend in young American college students.^{3–5} In an investigation of the effects of gender and nationality on the frequency of vocal fry in college students (aged 18–25 years), Yuasa³ reported that the number of female American students who produced vocal fry (two thirds) during conversational speech with a same-sex interlocutor was significantly greater than that of both their male and their Japanese female counterparts. In the listener perception portion of the study, Yuasa identified that 78.9% of American college students (n = 175) reported they had heard creaky voice frequently used by women in the area where they resided—Northern California and Eastern Iowa. Similar to Yuasa, although using read passages as opposed to conversational speech, Wolk and colleagues⁴ observed vocal fry use in approximately two thirds (n = 34) of female American speakers (also aged 18–25 years) and, in a follow-up study, the same research group found

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that the rate of vocal fry use was approximately four times higher for female speakers than for male speakers.⁵

Sociocultural motives have been raised as a possible explanatory framework for the prevalence of vocal fry in conversational speech among young American women.³ That is, that American women employ the creaky vocal quality in an attempt to project or convey a particular image of themselves. Yuasa,³ in addition to reporting on the prevalence of vocal fry in relatively young, educated American women, collected listener perception data from 175 American college students regarding their subjective impressions of the use of vocal fry in this population. Using speech stimuli from a single speaker and a set of preselected rating characteristics, Yuasa reported that listeners identified speech produced with creaky voice as sounding fundamentally more educated, professional, genuine, and nonaggressive than speech produced with non-creaky modal voice. Dilley and colleagues¹⁷ observed that female newscasters employed vocal fry more frequently than their male counterparts did. Although the study involved a small sample size ($n = 5$), the findings implicate that female newscasters may employ a creaky vocal quality in an attempt to evoke the authoritative connotations of masculinity (see Ref. 3 for a more detailed review). Collectively, these studies suggest that American women may use vocal fry in an endeavor to construct an identity that projects an educated and contemporary professional, capable of successfully competing with their male counterparts.

Opposing views of the impression of vocal fry, however, have also been reported. In a large-scale, nationwide study involving 800 listeners (18–65 years) and multiple voice exemplars, Anderson and colleagues⁶ found that regardless of gender or age, vocal fry was interpreted negatively relative to a non-fry-speaking voice. American women exhibiting vocal fry were perceived as less competent, less educated, less trustworthy, less attractive, and less hireable. The authors concluded that the use of vocal fry may substantially damage a woman's job prospects. These findings are at odds with those of Yuasa³ and others. Although differences in methodologies may contribute to the discrepancies noted, the existing data suggest that there is something more than just the desire to convey a particular image modulating the prevalence of vocal fry in the speech of young American women engaged in spoken dialogue.

Conversational entrainment describes the propensity for people to align their behaviors to more closely match those of their conversational partner. It transpires with no overt awareness¹⁸ and has been evidenced in the alignment of both verbal (ie, acoustic-prosodic features, lexical choice, linguistic style) and nonverbal behaviors (eg, Refs. 19–22). For example, Levitan and Hirschberg²⁰ observed that communication partners entrained on a number of speech features including F0, intensity, jitter, shimmer, and speaking rate, whereas Louwerse and colleagues²¹ reported behavioral alignment of facial expressions, manual gestures, and noncommunicative postures.

Recently, Borrie and Liss²³ demonstrated just how pervasive the entrainment phenomenon was, observing that healthy subjects unconsciously modified acoustic speech features to more closely match spoken stimuli, even when the features were pathologic in nature, as is the case with neurologically degraded speech,

dysarthria. In Borrie and Liss's study, healthy subjects increased their rate of speech in response to productions from individuals with hypokinetic dysarthria (characterized by abnormally fast speech rate), decreased their rate of speech in response to productions from individuals with ataxic dysarthria (characterized by abnormally slow speech rate), and reduced their F0 (pitch) variation in response to productions from individuals with hypokinetic and ataxic dysarthria (both of which were characterized by abnormally reduced pitch variation). These findings suggest that the drive to entrain with one's communication partner is so ubiquitous, it transcends boundaries of typical norms—at least with regard to acoustic realizations of speech.

Indeed this pervasive pull to entrain during conversation is understandable when one considers the functional value of aligning behaviors with one's communicative partner. Perhaps most importantly, conversational entrainment has been shown to reduce the computational load of spoken processing and improve the effectiveness and efficiency with which information is exchanged.^{24,25} Borrie and colleagues⁷ observed that entrainment of acoustic-prosodic features of speech, including F0, intensity, and jitter, correlates with greater task success during a problem-solving task that required dialogue partners to work together, using verbal communication to solve; and Pickering and Garrod²⁶ suggest that coordinated language and behavior may facilitate mutual understanding and reflect a shared situational model between conversational dyads.

Entrainment has also been shown to regulate turn-taking dynamics²⁷ and is considered critical to the development of rapport, empathy, and intimacy between conversational partners (eg, Refs 18, 28). Lee and colleagues,²⁸ for example, observed that pitch entrainment predicts the likelihood of positive interactions in married couples discussing problems in their relationship, and Chartrand and Bargh¹⁸ reported greater liking for a person who spontaneously mimics them. Gill goes as far as to comment that our ability “to synchronize with each other may be essential for our survival as social beings.”^{25(p111)} Indeed, conversational entrainment appears to function as a “. . . powerful coordinating device. . . to optimize comprehension, establish social presence, and create positive and satisfying relationships.”^{23(p816)} Thus, lack of entrainment, or inherent entrainment deficits, may result in conversational breakdowns.⁷ Considering the negative ramifications of not entraining to one's communication partner, as well as that entrainment is realized even when the speech properties are disordered,²³ we postulate that all speech and voicing features are susceptible to this behavioral alignment phenomenon.

Here, we examine conversational entrainment as one possible mechanism modulating the prevalence of vocal fry in the speech of young American women engaged in spoken dialogue. To explore this proposed mechanism further, we also examine whether entrainment on this voicing characteristic affords functional communicative benefits in terms of more efficient^a (ie, goal attainment in an accurate and timely manner) and enjoyable (ie, social connection and interaction satisfaction) conversation. Specifically, the following two key research

^aWe operationalize communicative efficiency using Duffy's definition in which communicative efficiency refers to “increasing the rate of communication without sacrificing intelligibility or comprehensibility.”^{34(p386)}

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