

THE CREAKY VOICE PHONATION AS AN INDICATOR OF THE PROSODIC STRUCTURE IN STANDARD CHINESE TV NEWSCASTS

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ABSTRACT

The term voice quality or phonation types often comes from studies of pathological speech. In normal speech, speakers use different phonation types in some languages for linguistic distinction, prosodically as a boundary signal and in attitudes and emotions.

Our paper aims to describe the different phonation types that occur in Standard Chinese TV newscasts and the relationship between creaky voice phonation and the prosodic structure of a such corpus.

1 INTRODUCTION

Anatomical differences and a person's phonetic habits constitute the cues about the speakers' identity. Many languages of the world use differences in voice quality or phonation type to contain linguistic functions. For example in some African languages creaky voice phonation is used for phonological contrast to distinguish types of consonants and vowels from sounds with normally voiced phonation (Laver 1994). Thus in certain languages or dialects, lexical items are differentiated solely on the basis of differences in voice quality.

1.1 What we mean by creaky voice phonation

Creaky voice phonation contrasts with modal voice in many languages but not in Chinese.

What we call phonation types is the different state of the glottis during phonation. It can be distinguished four type of phonation : modal voice, breathy voice, creaky voice, and whisper. Creaky voice phonation (or vocal fry) is typically associated with vocal folds that are tightly adducted but open along a portion of their length. The acoustic result is a series of irregularly spaced vocal pulses that give the impression of "a rapid series of taps, like a stick being run along a railing" (Catford, 1964). Relative to modal phonation creaky phonation is characterized by irregularly spaced pitch period and decreased acoustic intensity as well as a lowered fundamental frequency

Creaky phonation is characteristically associated with aperiodic glottal pulses. The degree of aperiodicity in the glottal source can be quantified by measuring the "jitter", the variation in the duration of successive fundamental cycles. Jitter values are higher during creaky phonation than other phonation types as it been found for Burmese (Maddieson, 1985) or Jalapa Mazatec (Kirl et al. 1993).

Another major acoustic parameters that reliably differentiates phonation types is spectral tilt. Spectral tilt can be quantified by comparing the amplitude of fundamental to that of higher frequency harmonics, e.g. the second harmonic or the harmonic closest to the first formant. Spectral tilt is characteristically more steeply positive for creaky voice vowel. In creaky voice vowel the amplitude of the second harmonic is greater than that of the fundamental.

1.2 Previous studies

In previous studies we have shown that creaky voice phonation in Chinese isolated syllables occurs more often for low vowels and that creaky voice is highly correlated with tone 3 and tone 4. This appears also for male and female speakers.

For other languages than Chinese it was found (Henton & Bladon, 1987) that creak was more likely in syllables at the end of utterances than elsewhere. Redit and Shattuck-Hufnagel (2001) also shown for American English utterances that normal speakers exhibit glottalised voiced quality in association with the boundaries of intonation phrases. Creak is used to mark the end of both paragraphs and sentences within paragraphs (Kreiman 1982, Lehiste, 1975). Creak can also occur at the end of a single sentence in isolation.

Voice quality changes have also been observed at the edges of smaller prosodic units. In spontaneous speech creaky phonation is often associated with hesitations.

2 THE AIM OF OUR STUDY

The aim of the present study is to determine in Standard

Chinese connected speech is like in other languages special phonation type in relation to sentence intonation occurs. Furthermore we have examined what kind of word is pronounced with a different phonation type than modal voice, we also have examined on which position in the sentence the creaky voice word or syllable occur and the differences in stress and unstressed syllables. Because this is an ongoing study, we present here the first results only for one corpus produced by a female speaker.

3 METHODS

The corpus served for this experiment consists of a set of TV newscasts pronounced by a female speaker.

After recording, the speech materials were digitalized at a 22 KHz sampling rate and then were analyzed, segmented and hand-labeled, using Praat 4.1. The corpus is composed of three paragraphs with a total of 12 sentences and many enumerations.

3.1 Determination of the phonation type :

Creaky voice phonation and modal voice phonation are readily differentiated from each other by looking at basic displays such as waveforms and spectrograms. At the first

step we had analyzed the waveforms and spectrograms. In fact, the oscillographic analysis is a good way to determine whether or not a syllable is pronounced with or without creaky voice. Spectrographic analysis is also a good way because the formants are particularly clear during creaky voice vowels, and fairly evident during the modal voice. The higher frequency tend to be more clearly visible during creaky vowels (Ladefoged & al., 1988). As the second step we have quantified the phonation types. To do so, the best way quantifying the creaky voice phonation is to measure the spectral tilt : the amplitude differences between H2 (second harmonic) and H1 (the first harmonic or fundamental frequency) or between fundamental frequency and the harmonic the more intense in the first formant. Spectral tilt is characteristically most steeply positive for creaky vowels than for modal ones. In order to determine these differences we have measured this difference at the beginning of the vowel, at the middle and at the end of it.

Then we examine the relationship between creaky voice phonation and the vowel. We also examine the relationship between creaky voice phonation and the tone.

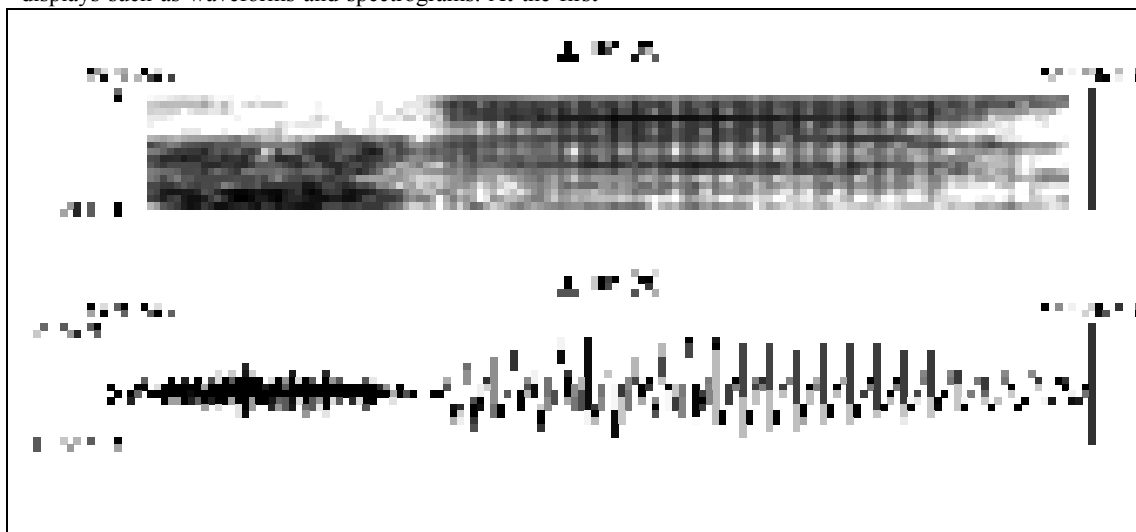


figure 1 : syllable *shao 3* pronounced with modal phonation

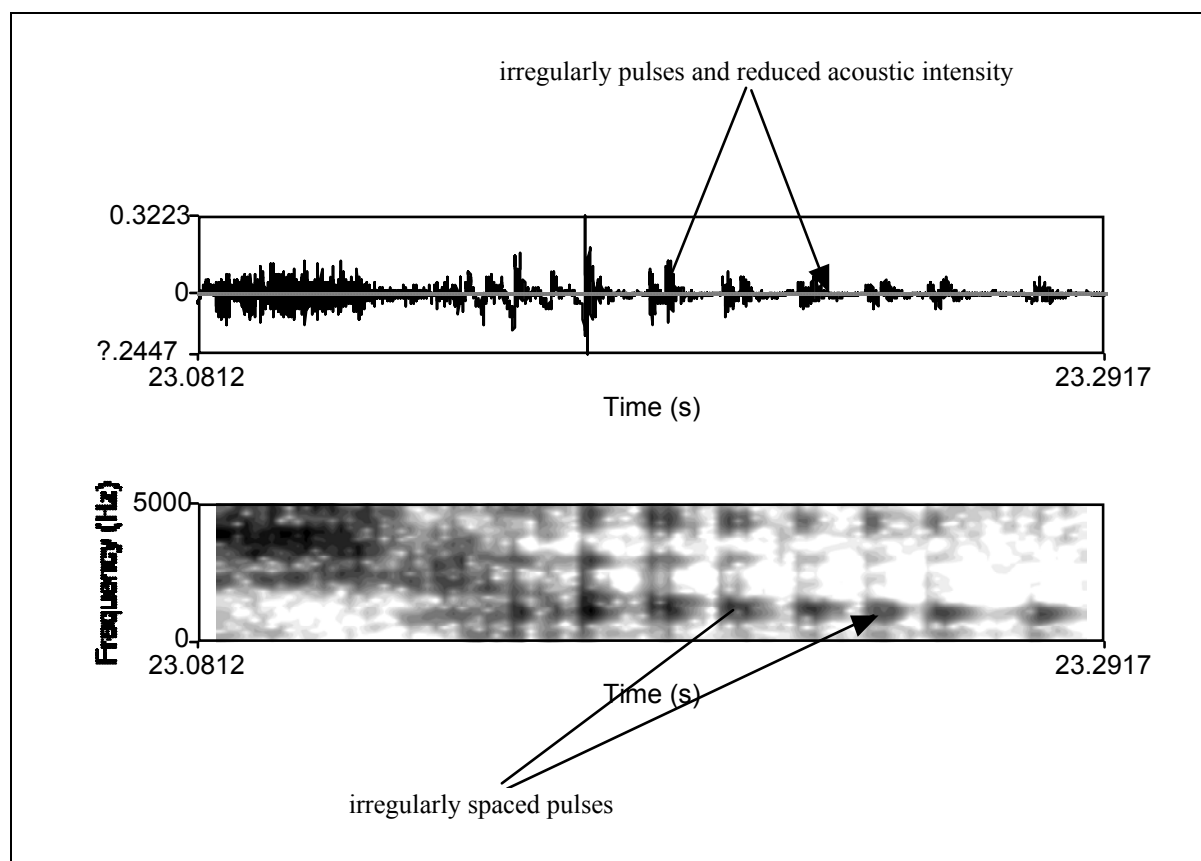
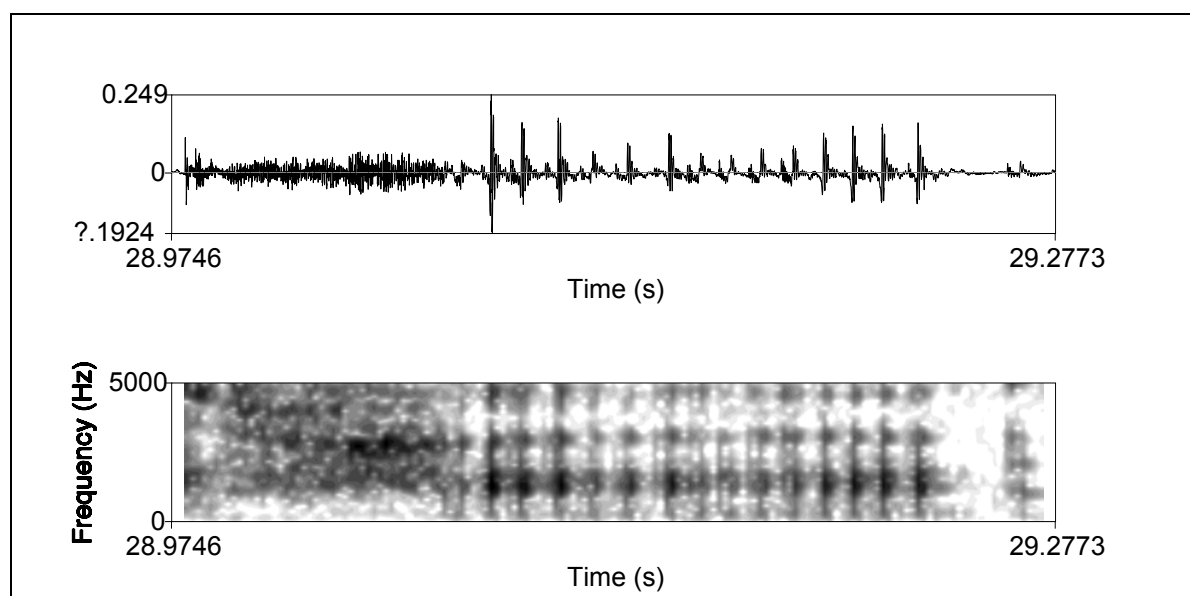


figure 2 : syllable *shao 3* in the word *que1shao3* pronounced with creaky voice phonation



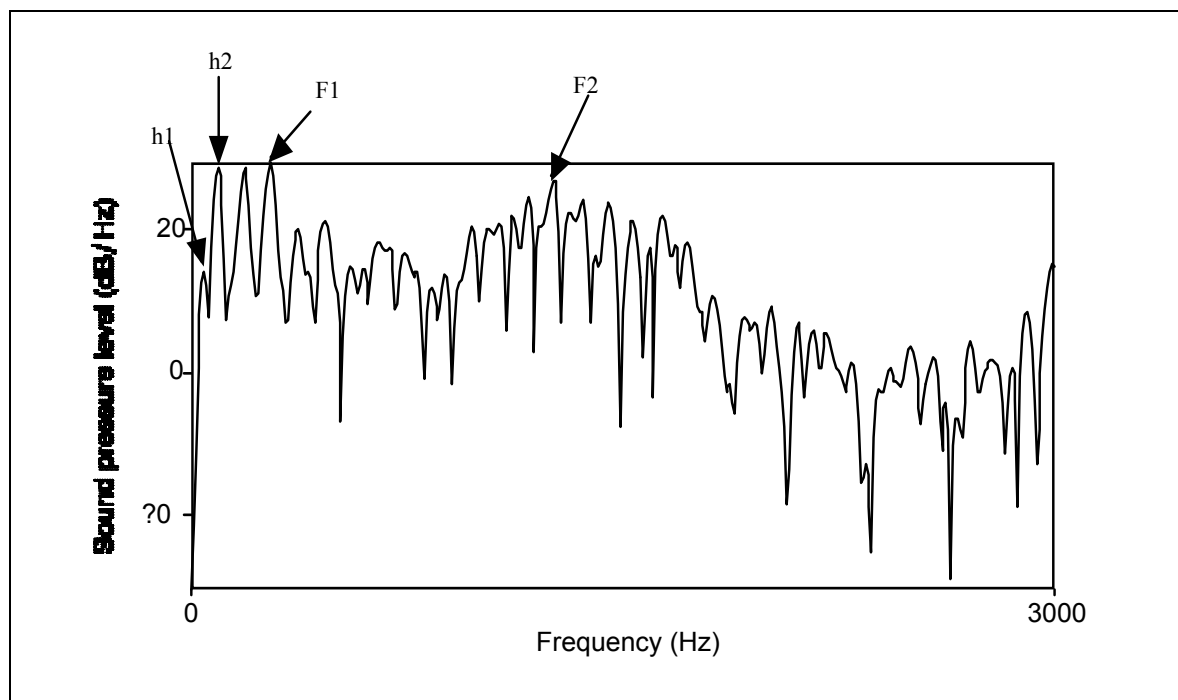


Figure 3 : waveform, spectrogram and FFT spectrum of vowel /a/ in the middle of syllable ka3 (in the word xin4yong4ka3) pronounced with creaky phonation

4 RESULTS

4.1 Tone and creaky voice

In the first corpus TV newscasts pronounced by a female speaker, there is 28 syllables with creaky phonation. The table hereafter shows the repartition of syllables with creaky phonation.

	TOTAL	T0	T1	T2	T3	T4
Number of syllables	297	17	55	40	64	121
Syllables with creaky voice	28	6	0	1	17	4
% of syllables with creaky voice	9,42%	35%	0%	2,5%	27%	3,3%

Table 1 : number of syllables pronounced with creaky phonation in relation to the tones

4.2 F0 and Creaky voice phonation

Creaky voice phonation occurs at the bottom of speaker's pitch range. Creaky voice phonation always appears for very low F0 values.

4.3 What kind of words are pronounced with creaky voice phonation

In table 2 we can see what kind of word or which syllable in the word is produced with creaky phonation.

At first glad it can be seen that more often this is the second syllable of dissyllabic word. A little number of monosyllabic word are produced with creaky phonation.

As it can be seen from table 1, the syllables at tone 3 are more often pronounced (more than 50%) with creaky phonation than other. On the other hand, no tone 1 syllables are associated with creaky voice phonation. This result is not surprising because as we already shown in previous studies, creaky voice phonation is very well correlated with a lowered fundamental frequency values.

these syllables are unstressed ones.

the monosyllabic words that are produced with creaky phonation are words without importance for the message comprehension. Most often they are grammatical particles at neutral tone placed at the end of utterances.

4.4 What is the position of these words in the sentence

In our corpus there are 12 sentences, seven of them are ending with a syllable pronounced with creaky voice phonation. Therefore, proposition and enumeration within sentences often ending with creaky voice phonation. From

this result, we can suppose as for other languages that prosodically creaky voice can be used as a boundary signal, as an “end of utterance” phenomenon.

5 CONCLUSION

In this ongoing research that have to be completed by the analysis of others corpuses, preminarily results show that creaky voice is used by speaker to mark the ends of both paragraphs, sentences within paragraphs and propositions within sentences.

Voice quality variations is typically used with other phonetic cues i.e. drop in F0, decreased intensity, final lengthening and pausing.

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syllable	tone	word	position
lai	2	cong3lai2de0	
de	0	cong3lai2de0	end of proposition
yao	4	zhong4yao4	end of sentence
deng	3	deng3wen4ti3	
ti	3	wen4ti3	end of proposition
tong	3	xi4tong3	
de	0	xi4tong3de	
zhi	0	wei4zhi0	end of sentence
ye	3	ye3wai4	
lǔ	3	lǔ3xing4	
deng	3		
shui	3		enumeration
deng	3		
pin	3	yong4pin3	
shao	3	que1shao3	end of sentence
yi	3	yi3xia4	
pin	3	wu4pin3	enumeration
ka	3	xin4yong4ka3	enumeration
de	0	zi4zhu4 lǔ3you2de0	
shao	3	bu4ke3shao3	end of sentence
yi	3	ke3yi3	
le	0		end of sentence
zhong	3	ge4zhong3	
jie	4	ji4jie4	end of sentence
yu	4	xia4guoyu4	
qi	3	qi3wu4	
de	0		end of text

Table 2 : syllables pronounced with creaky voice phonation in regard to their sentence and word position's