VOCAL VARIATIONS IN SPEECH FOLLOWING COGNITIVE CUEING

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Abstract

Voice plays an important role in signaling speaker affect. Literature has stated many ways to elicit emotional voice sample. All of the methods that have been used have both advantages and disadvantages. The use of cognitive cues as a task elicitation method stems from cognitive-behavioral therapy and focuses on prompting the individual to think and feel about a task prior to its completion. The present study attempted to understand the usefulness of cognitive cueing in eliciting vocal changes in speech, in terms of variations in mean speaking fundamental frequency (MSF0) and related parameters and sentence duration when different emotions were employed. Sentences were constructed for five emotions: neutral, happy, anger, fear and sad and the same were graphically represented on Acards. Cognitive cues were also constructed for each of these sentences. Twenty (equal numbers of females and males) under graduate students of a college, aged between 20 to 25 years who were competent in English language use were the participants of the study. Each participant was asked to read the sentences of different emotions thrice. First trial, uncued condition: without the cognitive cues, cued condition: second and third trials, after the presentations of cognitive cues. Real Time Pitch of CSL 4500 was used for analyzing the read samples. The results in general, revealed changes in means values for the MSF0 and its related parameters and sentence duration in cued conditions compared to uncued conditions for all emotions. Therefore, it could be concluded that cognitive cueing brought about quantifiable changes in vocal attributes. Further, the results of the study strengthen the view that use of cognitive cues stimulates voice patterns that would alter speaking styles of individual. This would have practical implications in management of individuals with communication disorders and professional voice users.

Keywords: *Cognitive cues, emotions, mental imagery, vocal variability*

The human voice is flexible and voice quality changes in different social contexts and situations. Voice plays an important role in signaling speaker affect which can include speaker attitude, mood, emotions, etc. An emotion is a mental and physiological state associated with a wide variety of feelings, thoughts, and behavior. Emotions color the language, and can make meaning more complex. Thus speakers use their voices to express emotions and they can change their voice quality to strengthen the impression of emotions.

To classify the emotive state by a speaker on basis of the prosody and voice quality, there is the necessity to classify acoustic features in the speech as connected to certain emotions. This also implies the assumption that voice alone really carries full information about emotive state by the speaker. Generally materials from three categories are used in investigating emotional speech: spontaneous speech, acted speech and elicited speech. Spontaneous speech contains the most direct and authentic emotions, but the difficulties in collecting this kind of speech are also extensive. The acted speech is merely conforming to stereotypes of how people believe that emotions should be expressed in speech, not how emotions actually are expressed. In elicited speech the idea is that certain emotions are induced. Here the idea is that the speech shall be coloured by the emotion induced. The validity of such elicited, or induced, speech depends to a large extent on how successful the induction process was (Stibbard, 2001).

The use of cognitive-behavioral therapy is not a new concept to the field of voice training. Mental imaging has been used for many years by voice instructors and speech language pathologists to elicit vocal shape for production of song and speech in aspects such as resonant voice therapy and stuttering intervention therapy regimens (Andrews, Shrivastav, & Yamaguchi, 2000). Cognitive cueing is an approach to voice treatment that stimulates voice patterns as a way of changing speakers' voices.

Cognitive cues have been utilized when measureing voice productions (Andrews, Shrivastav, & Yamaguchi, 2000; Bohnenkamp, Andrews, Shrivastav, & Summers, 2002). The acoustic correlates of emotions traditionally investigated are pitch (fundamental frequency, both average and range), duration, intensity and voice quality (Murray & Arnott, 1993). While Andrews, Shrivastav, & Yamaguchi (2000) found no variation in the spectral parameters (MSF0) in the normal adults and an increase in duration in the 'cue' trial, Bohnenkamp, et al. (2002) found cognitive cues to be significant in increasing vocal variations. Cognitive cues have been considered as a promising task elicitation method (Andrews et al., 2000; Bohnenkamp et al., 2002).

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Studies on the effects of emotions on the acoustic characteristics have shown that average values and ranges of F0 differ from one emotion to another. The fundamental frequency can undergo variations that may not be intended or be under overt control of the speaker and hence may provide an indication of the speaker's emotional state. Thus emotional states are said to influence vocal quality as a result of changes in the muscle tonus. These changes are primarily brought about by the functioning of the sympathetic division of the autonomic nervous system.

Cowan (1936) stated that unemotional speech has a narrow pitch range compared to emotional speech, with pitch tending to be normally distributed about the average pitch level. Williams & Steven (1972) reported that in neutral situations, the sentences were generated with shorter duration than for the emotional situations. Cowan (1936) and Öster & Risberg (1986) reported that happiness resulted in an increased pitch and pitch range and a slow tempo, while Fónagy & Magdics (1963) described it as "lively". Williams & Steven (1972) observed that the average fundamental frequency for speaking in sorrow situations and found it to be considerably lower than that for neutral situations and the range of F0 was usually quite narrow. In the review of Johnstone and Scherer (2000); Scherer & Ceshi (2000), sadness was proved to decrease the mean fundamental frequency, F0 range and variability, speed and articulation rate and intensity.

Murray & Arnott (1993) found happy emotion elicited a faster or slower rate, had a higher pitch and a wider pitch range, with smooth upward inflections than neutral emotion. Comparing sad emotion with neutral emotion, it was reported that the average pitch and pitch range was slightly lower with reduced intensity and slower speech rate for sad emotion.

Scherer (1986) concluded that F0, energy and rate may be the most indicative of arousal. Arousal is defined as a subjective state of feeling activated or deactivated (Sanchez, Kirschning, Palacio, Ostrovskaya, 2005). Changes in F0 and rate of speech can be attributed to many factors such as general temperamental and personality characteristics of the individual. Rate can also be a characteristic of the mental state. Slow rate can be a characteristic of mental state such as wonder, doubt, and deep thought and sorrow while rapid tempo is associated with joy, excitement, humor and anger.

As for the emotion of fear, the generally reported features are increased mean F0 and increased F0 range. Fairbanks and Pronovost (1939) analyzed neutral phrase spoken with different emotive expression by non-actors and reported a relatively highest pitch and a widest pitch range, the highest pitch median and noted high speech rate.

According to Stibbard (2001) anger is the emotional category where findings from both spontaneous and elicited material consistently report features such as high mean F0, wide pitch range, high energy and fast tempo. Fairbanks and Provonost (1939) analyzed neutral phrase, acted speech, and reported that anger generally is characterized by high pitch and a wide pitch range. Fónagy & Magdics (1963) using the recordings of spoken Hungarian analyzed subjectively for pitch variations and reported that anger is characterized by mid pitch and a straight rigid melody.

According to Scherer (1986) vocal parameters may be the most indicative of arousal and findings of such variations may indicate the extent of variations that can be present in the subjects who are subjected to cognitive cueing. Hence, in the present study an attempt was made to investigate whether cognitive cueing elicited changes in vocal parameters.

Method

Subjects

Twenty participants (10 males and 10 females) in the age range of 20 to 25 years were considered for this study. All the participants were under-graduate students noted to be fluent and competent in English language use. Participants were excluded if they had a velopharyngeal disorder, or were perceived by a speech language pathologist to have a voice disorder, abnormal oral-peripheral structures, or hearing loss, neurological or psychological problems.

Materials

A total of five emotions were considered in this study; happy, sad, fear, anger and neutral. Two sentences were constructed to depict each emotion and hence a total of 10 sentences were constructed. The sentences were written on A5 size cards. Then for each sentence, cognitive cues were constructed. These cues were targeted to create specific mental images for each concerned emotion.

Procedure

The participants were seated comfortably in a quiet room and instructed to read all the sentences aloud by looking at the card for familiarization. They were asked to read the sentences thrice. Trial 1, the participants were instructed to read the sentences and this was the no cue condition. In the second and third trials,

the subjects were asked to read the sentences after listening to the cognitive cues provided by the author. These were the cued condition. Cognitive cues were presented live for every sentence after the completion of the no cue condition. All the read samples were recorded on to PRAAT uploaded on the Dell Inspiron 1525 laptop computer with headset and collapsible microphone with the microphone-mouth distance of 5" – 6". Only the first and the third trials were considered for acoustic analysis.

Acoustic Analysis

The recorded samples were analyzed using the Real Time Pitch of CSL 4500. The acoustic parameters extracted were mean speaking fundamental frequency (MSF0), standard deviation of fundamental frequency (SDSF0), variability of fundamental frequency (vF0) and sentence duration.

- Mean speaking fundamental frequency (MSF0) – It is the average pitch that is used during speaking and is expressed in Hertz (Hz).
- Standard Deviation of Speaking Fundamental frequency (SD SF0) – The standard deviation reflects the frequency variability for a reasonably large time segment or passage.
- Variation of Fundamental frequency (vF0) - It is the relative standard deviation of fundamental frequency which reflects the variation of F0 within the analyzed voice sample. It is expressed in terms of %.
- Sentence Duration – It is the period of time during which the sentence is spoken, expressed in seconds.

Statistical analysis

All the extracted acoustic parameters in trials 1 and 3 were subjected to statistical analysis. Descriptive measures and repeated measure ANOVA were obtained to check for significance, if any, across the emotions, gender and conditions.

Results

The results are tabulated in tables 1 to 4.

Table 1: *Mean, standard deviation and F values for mean speaking fundamental frequency (MSF0 Hz) across emotions, gender and conditions.*

No cue condition				Cued condition				Overall variations	F	Sig
Emotion	Gender	Mean F0	SD	Emotion	Gender	Mean F0	SD			
Neutral	Female	231.0	8.9	Neutral	Female	254.1	40.3	Across emotions	5.758	0.000*
	Male	131.3	13.7		Male	131.4	16.0			
Happy	Female	218.5	13.1	Happy	Female	275.7*	56.7			
	Male	124.5	15.0		Male	151.3*	15.5			
Afraid	Female	224.0	14.2	Afraid	Female	249.0*	41.4	Across gender	9.120	0.003*
	Male	125.0	12.3		Male	134.9	27.2			
Angry	Female	231.1	14.2	Angry	Female	265.0*	37.6			
	Male	130.1	18.4		Male	152.3*	22.4			
Sad	Female	215.3	19.0	Sad	Female	220.4	26.6	Across conditions	50.682	0.000*
	Male	128.5	17.0		Male	128.0	13.3			
Total	Female	223.9	15.0	Total	Female	252.8	44.1			
	Male	127.9	15.0		Male	139.5	21.4			

Level of significance (*p<0.05)

Table 1 shows the mean values for MSF0 across emotions, gender and conditions. The overall effect between uncued and cued conditions is also portrayed. For the neutral emotion, females obtained a mean value of 231 Hz (SD=8.9) while in the cued condition, there was a significant change in the mean value to 254.1 Hz (SD=40.3). However, for males, there was no change in the mean values across the conditions.

The mean value for the happy emotion changed across conditions for both the genders. Females had a rise from 218.5 Hz (SD=13.1) to 275.7 (SD=56.7) and males had a rise from 124.5 Hz (SD=15) to 151.3 Hz (SD=15.5) between the uncued to the cued condition.

A change in mean values for the emotion of fear was noted for both the genders. Females had an increase in the mean values from 224 Hz (SD=14.2) to 249 Hz (SD=41.4) and males had an increase from 125 Hz (SD=12.3) to 134.9 (SD=27.2) in the two conditions.

For the emotion of anger, a rise in the mean values of MSF0 is noted for both the genders. Females had a rise from 231.1 Hz (SD=14.2) to 265 Hz (SD=37.6) and males had a rise from 130

Hz (SD=18.4) to 152.3 Hz (SD=22.4) across the uncued and cued condition.

For the emotion of sadness, there was no drastic change noted in the mean values of MSF0 in females and males. Females has a mean change from 215.3 (SD=19) to 220.4 (SD=26.6) and the males had a mean value of 128.5Hz (SD=17) to 128 Hz (SD=13.3) from the uncued to the cued condition.

An overall change is noted between the uncued and the cued condition for all the emotions [F (1, 90) = 50.689, p<0.05].

Table 2: *Mean, standard deviation and F values for standard deviation of speaking fundamental frequency (SDSF0) across emotions, gender and conditions.*

No cue condition				Cued condition				Overall variations	F	Sig
Emotion	Gender	SDSF0	SD	Emotion	Gender	SDFS0	SD			
Neutral	Female	34.2	14.0	Neutral	Female	45.5	18.8	Across		
	Male	21.5	9.8		Male	14.9	5.6	emotion	3.214	0.016*
Happy	Female	37.6	10.5	Happy	Female	54.4*	28.0			
	Male	16.3	5.8		Male	26.4*	11.8			
Afraid	Female	35.8	17.0	Afraid	Female	37.1	16.5	Across	0.998	0.320
	Male	20.3	9.0		Male	20.6	9.3	gender		
Angry	Female	39.6	9.6	Angry	Female	46.0	11.8			
	Male	19.4	9.3		Male	28.5	9.3			
Sad	Female	33.1	7.8	Sad	Female	26.1	6.6	Across	6.101	0.015*
	Male	18.2	5.4		Male	17.6	7.9	conditions		
Total	Female	36.1	11.9	Total	Female	41.8	19.6			
	Male	19.1	8.0		Male	21.6	10.1			

Level of significance (*p<0.05)

The mean values for standard deviation in mean speaking fundamental frequency (SDSF0) across emotions, gender and conditions are displayed in table 2. For the neutral emotion, there was a slight rise in the SDSF0 from 34.2 Hz (SD=14) to 45.5 Hz (SD=18.8) for females and a fall in the mean values from 21.5 Hz (SD=9.8) to 14.9 Hz (SD=5.6).

For the happy emotion, both the groups portrayed a rise in the mean SDSF0 values from the uncued to the cued condition. Females had a rise from 37.6 Hz (SD=10.5) to 54.4 Hz (SD=28) and males had a rise from 16.3 Hz (SD=5.8) to 26.4 Hz (SD=11.8).

For the emotion of fear, both the groups did not have much change in the SDSF0 values. Females had a mean value of 35.8 Hz (SD=17) in the uncued trial and 37.1 Hz (SD=16.5) in the cued trial. Males had a value of 20.3 Hz (SD=9) in uncued condition and a value of 20.6 (SD=9.3) in the cued condition.

For the emotion of anger, there is a rise in SDSF0 from the uncued to the cued trial. Females had a mean value of 39.6 Hz (SD=9.6) in the uncued trial and 46 Hz (SD=11.8) in the cued trial. Males had a value of 19.4 Hz (SD=9.3) in the uncued condition and 28.5 Hz (SD=9.3) in the cued condition.

For the emotion of sadness, there was no drastic change of the mean SDSF0 values from the uncued to the cued condition. Females had a change from 33.1 Hz (SD=7.8) to 26.1 Hz (SD=6.6) and males had a change from 18.2 Hz (SD=5.4) to 17.6 Hz (SD=7.9)

There was an overall change in SDSF0 between the cued and the uncued conditions [F (1, 90) = 6.101, p<0.05]. There was also a change across emotions [F (1, 90) = 3.214, p<0.05].

Table 3: *Mean, standard deviation and F values for variation in fundamental frequency (vF0) across emotions, gender and conditions*

No cue condition				Cued condition				Overall	F	Sig
Emotion	Gender	Mean vF0	SD	Emotion	Gender	Mean vF0	SD	variations		
Neutral	Female	14.1	5.2	Neutral	Female	16.8	5.4	across	2.302	0.065*
	Male	15.5	5.2		Male	11.4	3.8	emotions		
Happy	Female	16.7	4.7	Happy	Female	17.5	6.1			
	Male	12.1	3.3		Male	16.2*	6.1			
Afraid	Female	13.4	1.8	Afraid	Female	13.7	6.9	across	0.007	0.933
	Male	14.8	5.0		Male	12.7	2.9	gender		
Angry	Female	16.7	3.7	Angry	Female	16.6	2.7			
	Male	13.6	3.7		Male	17.9*	5.4			
Sad	Female	15.0	3.8	Sad	Female	12.9	4.0	across	0.226	0.636
	Male	13.8	4.3		Male	12.8	5.1	conditions		
Total	Female	15.2	4.1	Total	Female	15.5	5.4			
	Male	13.9	4.4		Male	14.2	5.2			

Level of significance (*p<0.05)

The mean values for variation in speaking fundamental frequency (vF0) across emotions, condition and gender are displayed in table 3. It was observed that there was no significant change for vF0 across the conditions [F (1, 90) = 0.636, p<0.05] and across gender [F (1, 90) = 0.933, p<0.05] but a significant change is noted across emotions [F (1, 90) = 0.065, p<0.05]. For the neutral emotion, there was a slight rise in the vF0 from 14.1 (SD=5.2) to 16.8 (SD=5.4) for females and a fall in the mean values from 15.5 (SD=5.2) to 11.4 (SD=3.8).

For the happy emotion, both the groups portrayed a rise in the mean vF0 values from the uncued to the cued condition. Females had a change from 16.7 (SD=4.7) to 17.5 (SD=6.1) while males had a rise from 12.1 (SD=3.3) to 16.2 (SD=6.1).

For the emotion of fear, both the groups did not have much change in the vF0 values. Females had a mean value of 13.4 (SD=1.8) in the uncued trial and 13.7 (SD=6.9) in the cued trial. Males had a value of 14.8 (SD=5) in uncued condition and a value of 12.7 (SD=2.9) in the cued condition.

For the emotion of anger, there is a rise in vF0 from the uncued to the cued trial. Females had a mean value of 16.7 (SD=3.7) in the uncued trial and 16.6 (SD=2.7) in the cued trial. Males had a rise in vF0 values from 13.6 (SD=3.7) in the uncued trial to 17.9 (SD=9.3) in the cued condition.

For the emotion of sadness, there was no drastic change of the mean vF0 values from the uncued to the cued condition for males. Females had a slight decrease in vF0 from 15.0 (SD=3.8) to 12.9 (SD=4).

Table 4: *Mean, standard deviation and F values for sentence duration (seconds) across emotions, gender and conditions.*

No cue condition				Cued condition				Overall variations	F	Sig
Emotion	Gender	Mean Duration	SD	Emotion	Gender	Mean Duration	SD			
Neutral	Female	1.7	0.6	Neutral	Female	2.0	0.8	across		
	Male	1.4	0.5		Male	2.2	0.7	emotion	1.765	0.143
Happy	Female	2.4	0.3	Happy	Female	2.5	0.3			
	Male	2.2	0.1		Male	3.0	0.4			
Afraid	Female	2.3	0.3	Afraid	Female	2.8	0.3	across	5.230	0.025*
	Male	2.2	0.4		Male	3.1*	0.7	gender		
Angry	Female	2.0	0.5	Angry	Female	2.2	0.3			
	Male	1.9	0.5		Male	2.2	0.7			
Sad	Female	2.0	0.4	Sad	Female	2.8	0.5	across	77.095	0.000*
	Male	2.0	0.3		Male	2.7	0.9	conditions		
Total	Female	2.1	0.5	Total	Female	2.5	0.6			
	Male	2.0	0.5		Male	2.6	0.8			

Level of significance (*p<0.05)

The mean values for sentence duration across emotions, gender and condition. is shown in table 4. As shown above there is a significant difference in the overall mean values the uncued and cued conditions [F (1, 90) = 77.095, p<0.05] and also a change across gender [F (1, 90) = 5.230, p<0.05]. For the neutral emotion, there was a difference of 0.3 seconds between the uncued and cued conditions in females and a change of 0.8 seconds in males.

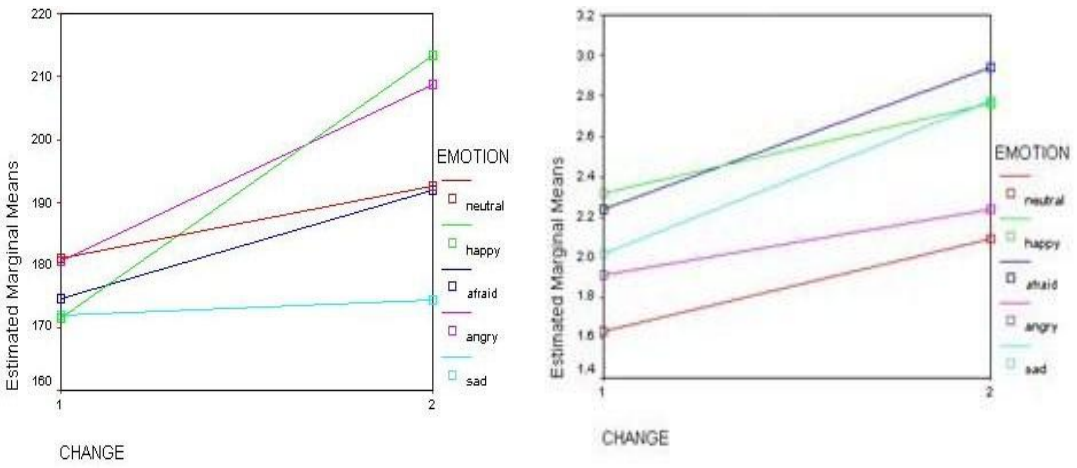
For the happy emotion, there was no change in the mean sentence duration in females while there was a rise from 2.2 (SD=0.1) to 3.0 (SD=0.4) seconds in males.

For the emotion of fear, males had an increase in mean sentence duration from 2.2 seconds (SD=0.4) to 3.1 (SD=0.7) while females had a rise only by 0.5 seconds.

For the emotion of anger, both the groups did not show a significance difference in the sentence duration across the two conditions.

For the emotion of sadness, there was an increase in the duration for both the groups. Females had a rise in mean values from 2.0 seconds (SD=0.4) to 2.8 seconds (SD=0.5) while males had a rise from 2seconds (SD=0.3) to 2.7 seconds (SD=0.9).

Graph 1(a) shows the variation in mean speaking fundamental frequency for different emotions across the 'no cue' and 'cued' condition. Graph 1(b) shows the variation in sentence duration for different emotions across the conditions.



(a) (b)

Graph 1: *Variation in mean speaking fundamental frequency across emotions for 'no cue' and 'cued' conditions*

Discussion

As seen in the tables above, the acoustic parameters varied across the five emotions; neutral, happy, afraid, angry and sad. Variations were noted even across the two conditions, uncued and cued conditions. The graphs (a) and (b) show the variations in MSF0 and sentence duration between the conditions with respect to the emotions. A statistical difference between the emotions and conditions were also noticed.

For *neutral emotion*, the MSF0 and mean sentence duration is lesser than for the other emotions. This was seen as less variation for the neutral emotion in the 'no cue' and 'cued' conditions. Females obtained a significant change in the mean MSF0 value from the uncued to the cued condition. However, for males, there was no change in the mean values across the conditions. Experiments have proved that in unemotional speech such as that of neutral emotion, there will not be much change present in the MSF0 and its related parameters. Cowan (1936) stated that unemotional speech has a narrow pitch range compared to emotional speech, with pitch tending to be normally distributed about the average pitch level. Williams & Steven (1972) also reported that in neutral situations, the sentences were generated with shorter duration than for the emotional situations. The significant variations in MSF0, in females can be because of the cognitive cue that was used. This indicates that females were more expressive in their speech compared to males. This also raises an issue of the nature of constructions of cognitive cues. For example, the sentence 'this is a pen' with the situation of talking to a child elicited more pitch variations in the subjects while the other sentence 'the tests are in the cupboard' with a situation of helping a friend find the test did not yield much variation. By manipulating the cognitive cues presented to the subjects, the vocal parameters could be varied to suit the variations desired by the author.

For *happy emotion*, Öster & Risberg (1986) and Murray & Arnott (1993) reported an increase in pitch irrespective of gender. In the present study, there was an increase noted in MSF0 from the 'no cue' to 'cued' condition. Happy emotion yielded the highest MSF0. Davitz (1964) reported an increase in speech rate for the happy emotion. Same finding was observed in the 'no cue' and 'cued' condition especially in males. It can be thus assumed that the presentation of cognitive cues elicited vocal variability in the direction of emotions. It was evident that the subjects were influenced by the cues given to them and this influence was manifested in the overt vocal expressions.

For the emotion of *anger*, a significant difference was noted in the MSF0, SDSF0 and vF0. There was a rise in all these parameters when this emotion was elicited in both the groups. However, duration did not increase much. Fairbanks and Provonost (1939) reported that *anger* generally was characterized by high pitch which was also evident in the present study. Stibbard (2001) reported of short sentence duration for this emotion but in the present study there was an increase. There was no significant difference in the mean sentence duration between the 'no cue' and the 'cued' trial.

The MSF0 for *fear*, in the present study, was lower than that observed for anger with slower speech rate. There were also more variations in voice compared to the emotion of anger. Williams and Steven (1972) analyzed acted speech in specially written play and reported low SF0, but with occasional SF0 peaks and low speech rate and similar findings were found in the present study.

Sad emotion did not reveal considerable variation from uncued and the cued condition. This emotion yielded the lowest values in the voice parameters among all the emotions. Reduced sentence duration was also observed in the 'cued' trial when compared to the 'no cue'. But contrary reports were reported by Williams & Steven (1972) and Scherer & Ceshi (2000). Williams & Steven (1972) reported that the mean fundamental frequency for speaking in sorrow situations was considerably lower than that for neutral situations and the range of F0 was usually quite narrow. This change in F0 was accompanied by a marked decrease in the rate of articulation and an increase in the duration of an utterance. The increased duration resulted from longer vowels and consonants and from pauses that were often inserted in a sentence. Scherer & Ceshi (2000) opined that sadness was proved to possess decreased mean speaking fundamental frequency, F0 range and variability, speed and articulation rate and intensity. The patterns were contrary to the acoustic patterns in happiness in which a rise in the mentioned patterns was seen.

Scherer (1986) stated that F0, energy and rate may be most indicative of arousal. The participants in the study demonstrated greater mean values for frequency and its related parameters and sentence duration when imagery associated with the cognitive cues was utilized as the task elicitation method compared no cue condition. These parameters are bound to increase in values because when an individual reads the sentences with emotions, there will be a change in the spectral and temporal features of the speech owing to prosodic characteristics than when no emotions are attached to them. These effects warrant further controlled research.

It is interesting to speculate the implications of the study. The mental images attempted in the present study were visual imagery. One may, however, hypothesize that cognitive patterns have some functional relationship to laryngeal movement patterns. The findings of this study indicate some directions in future research concerning the nature of cognitive cueing and how laryngeal motor patterns may be influenced by different types of imagery. Thus exploration of mental practices on laryngeal maneuvers may be a promising line of research.

Conclusion

The observed outcome of the study was that there was a definite effect of cognitive cueing on the vocal variations. The quantitative analysis showed variations across the emotions considered in the study. Gender difference was also observed in the subjects owing to the known fact that females are more expressive than males. Hence, it could be concluded that cognitive cueing brought about changes in vocal attributes which were quantified. This strengthens the view that cognitive cues could help in achieving greater variations in voice and speech thereby, making the speech more expressive.

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Appendix

Instructions ('No cue' trial): Read the sentences on the sheets.

1. This is a pen.
2. The tests are in the cupboard.
3. I got the highest IA in class.
4. The director announced a holiday today.
5. I was stuck in the lift for an hour.
6. I haven't prepared for my exams.
7. He spilt tea on my dress.
8. You made me late again.
9. He cannot walk anymore.
10. The results are out and I failed.

Instructions ('Cued' trial): Imagine these situations I am about to tell you and read the sentences after I tell you each instance.

1. Imagine you see a pen in your room. What will you feel?
2. Imagine you are taking a case in OPD and you do not know which test to administer. You seek help from the staff to find out which test to administer. You search for the test and when you find it you realize that you do not know much about the test. You administer the test in half an hour as you have a class after your postings. The next day, you're posted in therapy and your friend comes looking for you to find out where that test is kept as she /he had to administer the test since you had left out some parts of the test. How would you tell her/he where the test is kept?
3. Imagine you bunked class because of no reason at al. Your friends remind you that the teacher will be covering an important topic. You take it for granted that you have the whole night to read what was taught. But you forget to read that lesson that day. The next day, you come to class just to find that your teacher is giving you a surprise test. You are nervous. You begin to answer the test bearing the guilt that if you had listened to your friends, probably you could have answered better. The time goes by and you answer according to your previous knowledge and logic. The next day, when your teacher comes to class, she calls out your name just to say you topped the class. This means you got the highest IA for the most difficult paper. Keeping this situation in mind, read the third sentence.
4. Imagine you were busy throughout the week with the celebrations in your hostel/home. At the back of your mind you know that there is a test held the day after this celebration. You keep it aside thinking you can read for it after the celebration. The celebrations get over at 11 pm and by the time you settle down, it is 1 am. You think of sitting for studying but you doze off to wake up the next day by the intercom ringing in your corridor. You wake up with a startle and begin to get nervous. The phone keeps ringing and you answer the phone. On the other line, the watchman asks your name and class and conveys that the Director is giving all the students a day of for the wonderful show held the previous week. How would you feel?
5. Imagine you wake up late for your postings. You realize you have a case under the supervision of a staff you are very afraid of. You were once caught in an instance where you got scolded for being late by 5 minutes. You reach the clinic to find you're late by 10 minutes this time. You think of the option of going back to hostel, but you do not have enough attendance to bunk. You go ahead to the clinic to experience the first situation in room number 75. To your luck no one is there. You mark your attendance and proceed for your next situation. Your therapy room is on the first floor. The stairway is jammed by people who are painting the walls and by making children climbing the stairs with their parents. So you decide to take the lift. You enter the lift and press the switch and the lift closes to take you to your destination. All of a sudden, the lights turn off. There is utter darkness and silence. What would you do? The intercom and your mobile are not of any help. You begin to bang the door. No one hears you. 5 minute goes by; 15 minutes goes by; another 20 minutes go by; it's getting stuffy and warm and your finding it hard to breath and you are scared of the darkness. This goes on for an hour. How would you feel?
6. Imagine you are having a study leave for only 6 days and the first paper you will write is difficult for you. You begin to study for that paper. Four days before your exams you get a phone call saying your father is admitted in the ICU. You get nervous and leave for home. You reach your hometown and directly push off to the hospital where your father is. You reach there and you see

your mom terribly upset and decide to comfort her. The next day, your father recovers from his illness, would u know you prefer to stay by your father's side and still take the responsibility of the hospital dealings? You realize that you have to get back to hostel as you have your exam the next day and when you reach, you are nervous because you do not know what you're to write for the exams. How would you feel?

7. Imagine today is your birthday. You had a blast with your friends the previous night. And you are looking forward to meeting your classmates the next day. You go for postings wearing an expensive dress your father had got you. It is your favorite shade and you are looking so adorable in it. Your friends give you gifts and make you feel very special. You decide to treat them in the canteen. As you enter, your other friends sing you the birthday song. You treat them. You then get a phone call from your best friend back in your home town and to your surprise, they give you the news that they will be in front of your institute gate in an hour. How would you feel? You tell this news to your friends sitting closest to you. That moment, a friend you are not very fond off, comes to wish you and grabs a seat next to you. While he/she talks to you, he/she accidently spills tea on your favorite dress. Instead of asking you for forgiveness, he/she gives a very care free attitude. How would you feel?

8. Imagine you picked up a quarrel with you friend as he/she spoilt you dress. You decide to go to hostel and change your dress. But when you are back to the clinic, you realize your case sent a complaint about you to the clinical coordinator. You are called for and you get scolded. You feel so terrible and begin to think this day should not have existed. You go to your chamber and on the way you meet your friend who caused the calamity. How would you feel?

9. Imagine you are posted in OPD. You wait for a case file to land on the table. As you wait, you see a very familiar face among the patients who are waiting. You get a case file and get this patient you feel *u know*. The boy is on a wheel chair and cam along with his mother. You behind to take the case history and over the course of the interview, you realize he was your best friend in school. Time and distance brought separation between you both. You are excited you met him and his mother after several years. You used to be at his home on the weekends to play. On the other hand, you r filled with remorse as he is on a wheel chair. You get to know your friend met with an accident and was diagnosed as having 'global aphasia'. You remember how talented he was. How would you feel?

10. Imagine you are having trouble studying motor speech disorders paper. You study very hard. You write your exam with the expectation you will pass. The days go by and finally the day of the results arrives. You and your classmates run to the notice board to see the results. To your utter disappointment you failed. All your other friends passed. You are left out. You had worked so hard. How would you feel?