Authentic and Acted Responses to Physical and Emotional Distress

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1 BACKGROUND

One of the tasks often asked of forensic phoneticians is to assess the psychological states of victims in recorded attacks. However, such evaluations are currently not advocated by the International Association of Forensic Phonetics and Acoustics, most likely due to a lack of sufficient research on which to form an opinion (IAFPA Code of Practice, clause 9). Previous studies investigating emotional speech have concerned speech technology applications (Erickson, 2005) and/or observed vocal cues of emotion in everyday speech using actors (Scherer, 2003). Few attempt to characterise extreme emotion and fewer use authentic data. The present study represents a first step towards results that might ultimately be used to substantiate expert opinions in this area.

2 AIMS

1. investigate the limits of the individual's vocal performance
2. identify vocal cues of authentic distress
3. compare and contrast authentic and simulated distress

3 METHOD

Data: productions from victims of violent attack:

• *Authentic* = 8 x 999 recordings. Injuries include stabbings, shootings and burnings.

• *Acted* = radio plays and commercially available DVDs. Characters had been shot, burned, beaten or chased. Material extracted using *SmartRipper, Soundforge* and *DVD-Decrypter.*

Method: Data digitised - sampling rate of 44.1kHz , 16 bit depth. Auditory & acoustic analyses conducted using *SoundForge* and *Praat.*

Parameters: fundamental frequency (F_0),
tempo,
intensity,
vowel quality.

Conditions: Given the high amount of inter- and intra-individual variation in data, a four-way taxonomy was employed in order to compare like productions across all material.

CATEGORY	Control speech	Distress speech	Distress vocalisation	Scream
FEATURES	non-emotionally aroused speech, e.g. regular conversation	intelligible, emotionally aroused speech	emotionally aroused, questionable intelligibility	emotionally aroused, devoid of linguistic content

4 FINDINGS

F0:

For both acted & authentic data:
• Distress productions have a higher F_0 than the individual's control data/expected range.
• Productions increase in F_0 as individuals progress through the taxonomy (Figure 1).
• Females have a higher F_0 than males, though vocalisations and screams tend to be beyond expected ranges for both sexes.

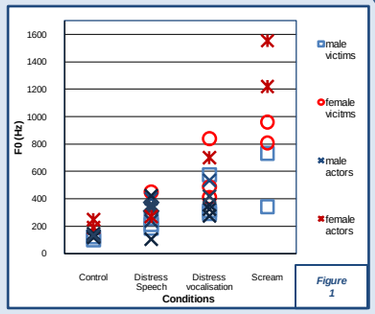

Figure 1

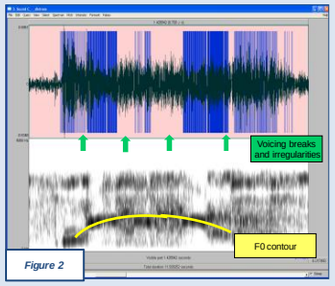

Figure 2

• Distress vocalisations and screams are characterised by a rise-fall F_0 contour, often containing voicing irregularities and breaks in phonation (Figure 2).
• Pitch jumps also occur, e.g.
i) ♀ victim = 510Hz → 1270Hz during a vocalisation;
ii) ♂ actor = 559Hz → 810Hz during distress speech.

Intensity

For both acted & authentic data:
• Intensity levels mimic F0 contours.
• Some recordings show signs of a plateau effect - most likely due to the limitations of the recording equipment (Figure 3).

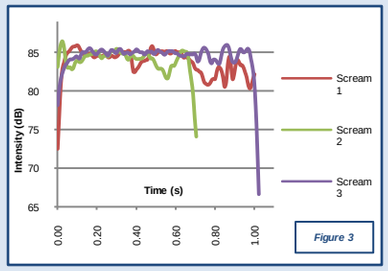

Figure 3

Vowel quality

• Where vowels in the distress speech condition could be compared with control data, F1 and F2 measurements were taken.
• In the acted data, a contraction of the vowel space can be seen (Figure 4).
• In the authentic data, distress vowels show a shifting of the vowel space towards the front dimension (Figure 5).

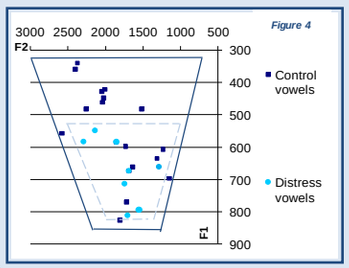

Figure 4

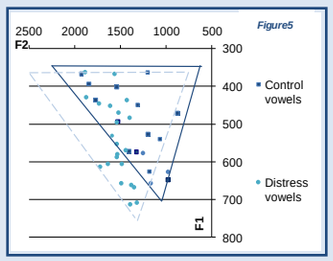

Figure5

5 FINDINGS (cont.)

Tempo:

• Articulation rates decrease as individuals progress through the categories of the taxonomy (Figure 6).
• Male actors have a slower AR than male victims whereas female actors tend to have a faster AR than female victims.

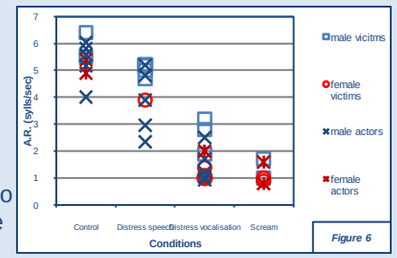

Figure 6

6 Discussion

Acoustic changes in control and distress conditions may in part be caused by unconscious physiological responses to stress, namely changes in respiration rates and muscle tension (Hansen & Patil, 2007), giving rise to a faster tempo, an increase in intensity, and a tensing of the vocal folds with a consequent increase in F_0.
Sources of variation between the sets of data may be both external, e.g. due to different injuries and circumstances surrounding the victim/actor, or internal, since individuals may appraise sources of stress differently (Andreassi, 2007).
A further consideration is to what extent are distress productions in victims voluntary? It is not always clear if linguistic content is present in the productions. Involuntary responses are presumably purely physiological with little variation. Voluntary responses, on the other hand, will most likely be greater in range. Whereas distress responses are similar in both data sets, actors, whose voluntary productions are emulating both voluntary and involuntary responses, may be reflecting an awareness of both a physiological response and the presence of variation amongst victims. In some cases, they seek to exaggerate these features for the benefit of the audience. Where responses differ across the data sets, actors may themselves be unsure of what they are trying to emulate.

7 Summary

Tendencies common to both real and acted distress responses are an increase in overall F_0 and intensity, an increase in variability of F_0 and intensity, with a decrease in speech tempo. Acted distress responses tend to use a contracted version of the vowel space, whereas authentic responses see an increase in F1 and F2 leading towards a shift in the front dimension. Acted distress responses differentiate themselves not only in regard to vowel quality, but also in the extent in which the F_0 increases – acted responses may be exaggerated versions of authentic distress responses.

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