

## **Voice quality methodology: a review of voice quality analysis techniques**

Voice quality has been noted in a number of grammars written on Australian Aboriginal languages (e.g. Nash 1990). In order to further investigate 'special voice qualities' we will need to draw from other linguistic studies that have focused on these 'phonetic settings' (Laver, 1980). These include cross-linguistic, clinical, language acquisition and sociophonetic studies. Each of these areas of study will be addressed in this paper, with an emphasis on methods and techniques that will help investigation of Australian Aboriginal languages going forward.

Previous reviews have reported as many as 67 terms for vocal quality in the literature (Pannbacker, 1984). In addition, researchers classify these types of voice quality with a range of measurements utilising a number of different linguistic techniques from phonetic labelling, to acoustic or aerodynamic measures. Unlike pitch and loudness, which are easily quantifiable as they have single acoustic correlates, voice quality is influenced by a range of factors.

Voice quality has been evaluated from a descriptive viewpoint in order to notate suprasegmental changes alongside segmental transcription. Multiple systems such as those by Laver (1980, 1994, 2000) and Ball, Esling and Dickson (2000) have endeavoured to capture the phonation types evident cross-linguistically and clinically.

Phonemic voice quality distinctions have been studied in a number of languages, for example Bai (Edmondson and Esling, 2006) or Gujarati (Esposito, 2006). These languages exhibit phonation patterns that provide phonemic distinctions that are both produced and perceived by native listeners. Contrasting phonation types can differ along multiple acoustic dimensions, and different languages utilise different strategies in order to produce the contrast. Listeners therefore have multiple perceptual cues to the contrasts and those with different language experience attend to different cues (Keating and Esposito, 2006). Research in this area has primarily focused on the acoustic correlates of voice quality (e.g. fundamental frequency, H1-H2, Cepstral Peak Prominence) or on how these voice qualities are physically produced (Esling, Fraser and Harris, 2005).

Disordered voice quality is another major area of study. Aerodynamic measures are used extensively in the clinical environment and are used to diagnose and examine the differences pre- and post-treatment (e.g. Hartl et al., 2003; Giovanni et al., 1999). Acoustic measures (e.g. jitter and Long Term Average Spectrum) are also utilised in both diagnosis and treatment evaluation.

Language acquisition studies have also examined voice quality concentrating on developmental trends of features (e.g. Benner et al., 2007; Gregory, 2013). These studies have used a combination of acoustic and auditory-perceptual methods to understand how voice quality changes over time.

Analysis of voice quality for sociophonetic purposes focuses on long-term cues, those features that can be detected more constantly throughout the stream of speech. Individuals are compared and those features of voice quality that are shared by a number of speakers (and therefore typify a given linguistic, regional or social group) can be taken as an indicator or a marker of that group (Esling and Edmondson, 2010; 131). Studies have used articulatory, auditory and acoustic methods to analyse voice quality in these situations. All of these areas of study provide great insight into the processes of voice quality control and the techniques to label and measure voice quality.

This paper provides a methodological review of current practices in investigating voice quality. It makes some suggestions in terms of both phonetic labelling techniques and instrumental measures that can be utilised when investigating voice quality in Australian Aboriginal languages.

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