Creakiness has been observed to systematically accompany phrase and turn ends in several languages, e.g. [1]. Creak is also connected to \( f_0 \) declination and associated with several time-, stress- and focus-related phenomena, see e.g. [2]. Furthermore, creak seems to be influenced by contextual factors, as it is more frequent in informal and relaxed situations [3], and it can easily appear throughout an entire utterance. We hypothesize that the use of creaky voice is additionally motivated by its unique aerodynamic characteristics which give speakers the ability to complete an utterance when running out of air.

Creak is a voice quality associated with tightly adducted vocal folds open along a portion of their length to allow for voicing. Acoustically, it is characterized by irregularly spaced vocal pulses with a decreased acoustic intensity and typically a lower fundamental frequency compared to modal voice [4]. Creak has been found to have higher average glottal resistance values due to increased vocal fold mass, along with significantly reduced peak airflow rates [5]. The average airflow rates for creaky and modal voice have been reported to be approximately 40 ml/sec and 110 ml/sec, respectively, with no overlap in the individual subjects’ average flow rates during the two types of phonation [6]. A study modelling airflow conservation and reduction of respiratory effort of phonation revealed that increasing glottal resistance allows finishing breath groups containing speech at a higher lung volume value, reducing expiratory muscular pressure [7]. They concluded that to maintain a desirable value of subglottal pressure for the average time of a breath group in conversational speech (4 s), glottal resistance may need to be increased or a deeper inhalation is necessary. However, several studies have reported no correlation between inhalation depth and utterance durations, e.g. [8], and that it is usually not necessary to modify respiratory maneuvers for longer sentences in oral reading [9].

Given that creak is a relatively accessible method for increasing glottal resistance, it is plausible that this phonation type can function as a device for using respiratory resources more economically. When incorporating creak, the speaker can finish their utterance at a grammatically and semantically suitable place without needing to increase muscular pressure. We investigate this with an experiment on read Swedish, as it has been noted that many studies looking into Swedish prosody encounter an "extensive use of creaky voice" in adult data [10]. Subjects are asked to read sentences of varied length taken from Karp, the open lexical infrastructure of Språkbanken [11]. Each sentence is presented on a prompt screen in a gradual manner, making sure the subjects are not aware of the sentence length. Respiratory activity is measured using Respiratory Inductance Plethysmography [12] and reading start time for each sentence is controlled through lung volume values. Speech activity is recorded synchronously to respiration and analysed in regard to creaky voice and its interplay with breathing.

References