Acoustics and discourse function of two types of breathing signals

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Breathing is fundamental for living and speech communication, and has long been a subject of linguistic research (see [6] for a review). One major issue in earlier respiratory research concerned the communicative function of breathing signals [2, 3]. Recently, there has been a renewed interest in tackling this problem [1, 6, 7].

Our study set out to determine the acoustic markedness and potential communicative function of two types of silent pauses that differ in terms of speakers' breathing behaviour: (1) pauses with sustained breathing (breathing pauses), and (2) pauses with breath-holds (non-breathing pauses). Our first hypothesis postulates the existence of an *articulatory reset* in case of a breathing pause and an *articulatory hold* in case of a non-breathing pause. We operationalise an articulatory reset by an audible lack of anticipatory coarticulation.

In a production experiment, nine native speakers of German were recorded reading 40 sentences containing two phonetic environments preceding and following the pause (/a/ | /p/ and /p/ | /p/, where /a/ or /p/ represent the segments and | represents the silent pause). Half of the pauses coincided with plausible IP-boundaries. Sentences were recorded three times, each time with different respiratory behaviours in the pauses: (1) breathing, (2) non-breathing and (3) natural, i.e. typically without pauses. Next, we calculated spectral similarity [4] between segments immediately before and after each pause as an assessment of the level of coarticulation or articulatory reset.

Subsequent ANOVA analyses of the similarity scores did not confirm our first hypothesis. The type of pause has no significant impact on the acoustic similarity of segments before and after pauses, while the similarity is significantly higher in the natural reading condition without pauses ($F(2,16) = 7.50$, $p = .005$, $\eta^2 = 0.29$). However, it was observed that participants frequently omitted the burst release of the segment preceding the pause in the environment /p/ | /p/. A χ^2-test revealed highly significant differences in the omissions of burst releases between all three respiratory behaviour conditions (χ^2 (2, $N = 146$) $= 56.93$, $p < .001$). Thus, we have some evidence in favour of the articulatory reset hypothesis. Our findings corroborate assumptions from previous research that pause types fulfil a communicative function, by signalling turn yields (breathing pauses) or holds (non-breathing pauses). This question will be the subject of subsequent research.

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