

Investigating the communicative function of breathing and non-breathing “silent” pauses

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Abstract

In this study we investigate the communicative function of two types of “silent” pauses according to breathing behaviour. Taking into account the hypothesis by [1], we expected breathing pauses to be interpreted as a turn-taking cue. A question-answer study in which participants were asked to react to a question as soon as possible was conducted to test this hypothesis. Subsequent analyses of the data revealed that in comparison to non-breathing pauses, breathing pauses are significantly more often interpreted as a turn-keeping signal, which contradicts the working hypothesis. Our results corroborate recent findings by [2].

Index Terms: respiration, breathing, conversation, reaction times.

1. Introduction

Respiration is not only a prerequisite of life, but also of speech itself. Despite its vital importance, breathing is often overlooked in everyday life. This importance and entailed complexity has, nevertheless, sparked a considerable amount of linguistic research on the topic of respiratory behaviour. Connections of respiratory behaviour with e.g. pausing [3], structure of prosodic boundaries [4] and utterance planning [5] have been previously shown (see [6] for an overview). A rather new trend in this field of study revolves around the question if one can assign a communicative function to respiratory behaviour in discourse.

1.1. Theoretical Framework

When it comes to respiratory behaviour during pauses, previous research has classified two types of “silent” pauses: (1) breathing and (2) non-breathing pauses. In [1], apart from making the distinction between the two pauses’ types (there: ‘holding’ and ‘trail-off’), the authors propose a possible existing communicative function of respiratory behaviour in “silent” pauses. It is hypothesised, that a ‘glottal hold’ in a pause indicates a turn-holding event and, likewise, a ‘trailoff’ a possible speaker turn-yielding event. Recent work addressing the possibility of an existing communicative function of respiratory behaviour has been done in [7, 8, 2, 9], [10] also investigated turn-management and its link to breathing.

1.2. Current Study

In this paper, we examine the effect speculated by [1] using the task developed by [11]: The authors conducted a perception experiment examining turn yielding based on phonetic cues in German. In this experimental design, participants were asked to make a short verbal response to resynthesized questions as soon

they thought they were given the floor. In each such interactions there were 1-2 introductory sentences prior to the relevant target question to which a response was to be given. The target questions were sometimes followed by an optional alternative question starting with “or”, thus each target question could be either turn-medial or turn-final. In our study, we assume respiratory behaviour to be a relevant cue for floor management, i.e. in turn organisation during discourse. Following the analysis by [1], we therefore expect a non-breathing “silent” pause or “glottal hold” to be turn-keeping and a breathing “silent” pause or “trail-off” to be turn-yielding.

2. Method

To elicit verbal reactions to different types respiratory behaviour, we used the general design by [11], but only manipulated the presence or absence of breathing after turn-medial or turn-final target questions.

2.1. Stimulus Recordings

Nine utterances spoken by one male native speaker of German were recorded. Each utterance consisted of an introductory context and two follow-up questions which are separated by an intermediate pause – symbolised by # – , e.g.:

1. *Ich hab richtig Lust mal wieder aus Deutschland rauszukommen. Was meinst du, würdest du mit mir reisen? # Oder bist du zu beschäftigt?*

I would really like to get out of Germany for a while. What do you think, would you travel with me? # Or are you too busy?

2. *Der Termin unserer Präsentation wurde vorverlegt. Glaubst du, wir werden das noch zeitlich hinkriegen? # Oder müssen wir den Termin komplett neu legen?*

The date of our presentation has been moved forward. Do you think we will manage this in time? # Or do we have to set a completely new date?

The recordings were made in two reading conditions. In the first, the speaker was asked to make a pause at the # boundary and to inhale while doing so (= breathing pause). In the second reading condition, he was asked to hold his breath during the pause (= non-breathing pause). The recordings were made in a sound proof booth and the respiratory behaviour was controlled using two respiratory inductance plethysmography (RIP) belts.

2.2. Question-Answer Study

2.2.1. Stimuli

The obtained recordings were segmented and the pauses between alternative questions were manipulated to be of equal length (1.5 seconds). The complete set consisted of nine utterances in two breathing conditions. In order to prevent the listeners from expecting and waiting for a second question after the pause, the second question was removed for these utterances, thus obtaining an additional number of 18 stimuli. This resulted in a total of 36 stimuli being used in the final question-answer study.

2.2.2. Procedure

20 native German speaking students (undergraduates and graduates) of Bielefeld University participated in the question-answer study. Due to their bilingual background, two of them were excluded from the further analyses. The participants listened to the stimuli via headphones and were asked to respond to each stimulus verbally, i.e. with a short answer, as soon as possible, but making sure not to interrupt the speaker. A familiarisation phase of 10 stimuli was conducted with the participants before their reactions were measured in the main phase. Each session lasted for approximately 30 minutes and took place in a sound proof booth.

3. Results

3.1. Annotation and Measurements

In order to test our hypothesis, two dependent variables were examined: reaction (response) times (as measured from the end of the first question) and too-early-turns, i.e. a response resulting in an “interruption”. A too-early turn could occur in a condition where the second question was asked. We expected the reaction times to be longer after non-breathing pauses. We also expected more too-early turns to occur after breathing pauses. The collected recordings were annotated for response times and too-early turns¹ by two expert annotators. The measurements were subsequently analysed using the statistical software R [12].

3.2. Statistical Analysis

Reaction times were compared with a student’s t-test. The results indicate a highly significant difference between response times after breathing and non-breathing pauses ($t(321) = -11.453, p < 0.001$), see Figure 1. However, the direction of the effect is contrary to our hypothesis, i.e. participants wait longer with a response after pauses that contain breathing.

A chi-squared-test was performed to examine potential differences in frequency of occurrence of too-early turns for the two respiratory conditions. For this analysis, only the stimuli containing the second question were taken into account, as interruptions could only occur in this condition. The test revealed a highly significant difference ($\chi^2(1, N = 132) = 66.939, p < 0.001$) between the two breathing conditions, i.e. there are significantly more interruptions or too-early turns after a non-breathing pause (cf. Table 1). These results again support the hypothesis that the presence or absence of breathing during silent pauses functions as a floor managing device. However, the effect is again in a direction contrary to our initial hypothesis.

¹Like [11], we also annotated late turns, though we did not evaluate those in the analysis.

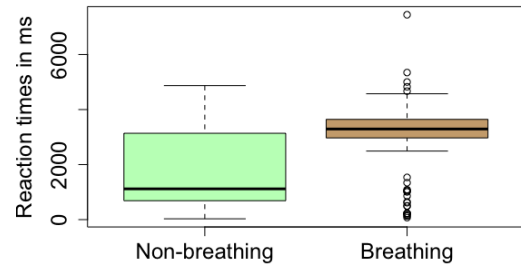


Figure 1: Reaction (response) times of participants after pauses containing breathing or breath-holds (non-breathing).

Response timing	Breathing pause	Non-breathing pause
In time	141	47
Too early	19	113
Sum	160	160

Table 1: Frequencies of occurrence of response timings in the two breathing conditions. Too early responses result in an interruption of the speaker.

4. Discussion

This study investigated the possible communicative function of respiratory behaviour in “silent” pauses as a floor management cue. Using a question-answer study, we analysed speakers’ response times and interruptions after “silent” pauses either containing breathing noises or breath holds. We were able to identify differences in the response behaviors after these two different types of “silent” pauses. However, our data indicate an effect of the presence or absence of breathing noise opposite to our initially stated hypothesis, which expected breathing noise to result in quicker attempts to take the floor. Still, the results go hand in hand with recent findings by [2], where the authors found a difference in pause detection thresholds between breathing and non-breathing pauses: pauses containing breathing noise need to be longer to be perceived. In the present study, the participants appear to use breathing noise as a turn keeping cue, i.e. they interpret an audible inhalation as a signal that the utterance will be continued. An examination of the relations of breathing noise with other turn-taking cues is planned for future work.

5. Bibliography

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