

# Inhalation Noises as Endings of Laughs in Conversational Speech

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## Abstract

In this study we investigate the role of inhalation noises at the end of laughter events in two conversational corpora that provide relevant annotations. A re-annotation of the categories for laughter, silence and inbreath noises enabled us to see that inhalation noises terminate laughter events in the majority of all inspected laughs with a duration comparable to inbreath noises initiating speech phases. This type of corpus analysis helps to understand the mechanisms of audible respiratory activities in speaking vs. laughing in conversations.

**Keywords:** inhalation, laughter, respiratory control

## 1. Introduction

In this study we investigate the role of inhalation noises in laughter events in corpus data of conversational speech. The (German) GRASS corpus (Schuppler et al., 2014) provides annotations on laughter and inbreath noises which were helpful for the further analysis of audible respiratory activities in speaking vs. laughing in conversations. It is hypothesised that inhalation noises mark the end of many laughs whereas in speech production, inhalation noises usually mark the beginning of speech sections. The aims of this preliminary investigation are threefold: 1) to learn more about control mechanisms of audible inhalation, 2) to refine our knowledge of the composition of complex laughs, and 3) to develop routines for re-annotations of laughter events in corpora.

Laugh events can show a great range of diversity and variability or as (Bachorowski and Owren, 2001) put it: “Not all laughs are alike”. This is also reflected in various degrees of complexity (Truong et al., 2019). Noises of inhalation (or inbreath) but also silent phases can be important constituents of laughs.

During tidal breathing, i.e. when not speaking, inhalation is usually not acoustically audible. However, while talking, inhalation is often (but not necessarily) reflected as noise. Inhalation noises usually occur shortly before a speech section starts or in pauses of larger speech sections, but very infrequently after speech sections (Werner et al., 2021). In contrast, informal observations of complex laughs show that those laughs are often accompanied by a terminating inhalation noise (Truong et al., 2019) with a stretch of silence between the voiced phase and the inhalation phase, as illustrated in Fig. 1. It should be borne in mind that full-fledged isolated “laughter consistently lead to sudden and substantial decrease in lung volume” and that returning to regular tidal breathing needed two to three breath cycles after the laugh (Filippelli et al., 2001).

Silences preceding inbreath noises were analysed as part of the entire laugh event (Truong et al., 2019), i.e. that silence does not mean that the laugh is over. However, in conversational corpora often silences and inbreath noises are marked as own categories that are not belonging to the laugh (Truong and Trouvain, 2012). Although labelled as “silence”, it should not be regarded as strict silence in an acoustic-phonetic sense since there are sometimes nearly unnoticeable acoustic events which might be reflections of nearly quiet chuckling.

In general we can assume that in conversations, speakers obviously have different patterns of control on the inhalation for speaking, laughing and being quiet. It is thus the question how often laughs are terminated with inhalation noises and to determine the temporal shapes of those inhalation noises and their preceding silences.

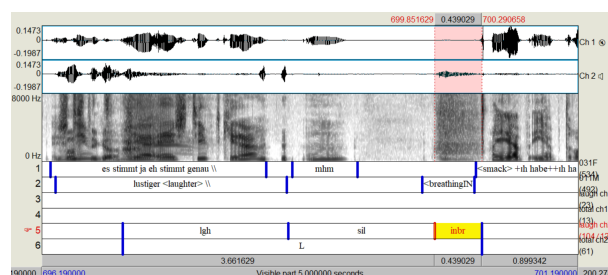


Figure 1: Example of a laugh from the GRASS corpus (Schuppler et al., 2014), speaker 2, dialogue 3, 696–700 sec. The intervals for “laughter” and “breathing IN” were copied from the original annotation (tier 2) to the laugh elements on tier 5, now with the core element (“lgh”), the silence (“sil”) and the inbreath noise (“inbr”). All elements form the entire laugh (“L” on tier 6). The interval for “inbr” (in colour) was slightly corrected.

## 2. Methods

For this purpose, we investigated a subset of the main part of the GRASS corpus (Schuppler et al., 2014) containing conversational speech in German (between friends or relatives). From there the beginning sections of 900 sec of 3 dyadic conversations were taken. Laughter and inbreath noise were annotated with extra labels, many times within larger intervals. Often, the inbreath noise was not in the same annotation interval as the laugh, and possible silent phases preceding an inbreath noise and the final inbreath noise were not regarded as parts of the laugh. Thus, a separate annotation and a re-annotation for the laugh including the breath noise was needed (cp. also (Truong and Trouvain, 2012)).

Single elements of a laugh were either the core element of a laugh (copied from the original annotation), speech-laugh, silent phase, and inbreath noise. Laughs were then categorised as either with a final inbreath noise or not. There were also sequences of laugh-inhalation-speech where the inbreath noise could be theoretically regarded as part of the laugh or of speech or as we did of both. Those cases occurred in about 10% of all cases with an inbreath noise.

## 3. Results and discussion

Counting the frequency of laughs shows that laughs with terminating inbreath noises are in the majority (two out of three) compared to those laughs that do not contain a final inbreath noise. Silent phases occurred in about three quarters of all cases before a final inbreath noise in those laughs. All inspected individual speakers showed terminating inbreath noise when laughing. However, for some individuals this type of laughter was not dominant.

Looking at the duration of the entire laugh events reveals that laughs with terminating inbreath noises are generally longer than those without inbreath noises. On the one hand this can be easily explained by the fact that inbreath noise and the potential preceding silence considerably contribute to the total duration of individual laughs. On the other hand, longer laughs can have a natural tendency to more intense air consumption which requires a deeper and therefore audible inhalation. There is also a tendency that the 'core' element in laughs with an inbreath noise ending is longer than in laughs without an inbreath noise.

Concentrating on the duration of the inbreath noises we can see rather constant average values for individual speakers: from 250 ms up to 480 ms with standard deviations of around 100 ms. These numbers are in line with average values for inbreath noises for speech (Werner et al., 2021): in utterance-initial position, i.e. after a longer silence where speakers switch from tidal to speech breathing, the inbreath noises took 535 ms on average, in contrast to pauses within speech sections with a mean duration of 408 ms.

As a side observation we can report that the intensity in inbreath noises at the end of laughs is rather high compared to inbreath noises preceding speech. We assume that the air leakage during laughter requires deep inhalation which is not only reflected in shorter inhalation but also in a more salient acoustic shape.

## 4. Conclusions

Inbreath noises usually represent challenges when annotating laughs in corpora of conversational speech. Laughs with inbreath noises often need a re-annotation (Truong and Trouvain, 2012)(Truong et al., 2019), as it was done here for one corpus. For such a procedure it is of great help to have a first annotation.

This study reveals that inbreath noises as final element of laughs seem to be an important component immanent to many and probably most laughs. Very often a silent period links the "core" of the laugh with the final inbreath noise.

In contrast to speaking, where inbreath noises usually occur at the beginning of a vocalisation section, in laughing they mark their end. Our explanation so far is that audible inhalation for speech is mainly a consequence of the planning of upcoming information whereas audible inhalation in laughter is a consequence of unplanned air leakage due to spontaneous vocalisation.

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