

# Phonetic Aspects of "Speech-Laugh"

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## **Abstract**

L'étude examine des "speech-laugh" (rire dans la parole) dans un corpus de dialogues spontanés pour la langue allemande. La majorité des rires étiquetés recouvre la parole au lieu de l'interrompre comme attendu. La qualité phonétique typique pour les "speech-laugh" est une aspiration supplémentaire (différente pour les sons voisés et non voisés), parfois accompagnée par un vibrato dans la phonation et une durée de deux syllabes. L'assomption d'un continuum du sourire au rire n'a pas pu être vérifiée. Les résultats et les problèmes sont discutés en rapport avec des structures paralinguistiques.

## **Introduction**

If we agree with Pike (1945) that "the hearer is frequently more interested in the speaker's attitude than in his words - that is, whether a sentence is 'spoken with a smile' or with a sneer", then expression of attitudes by laughter can play a crucial role in discourse. This becomes clear if we think of rituals of greetings, signalling politeness or friendliness, marking maliciousness or foolishness, overcoming an embarrassing and/or absurd situation, expressing jocular thoughts, or a backchannel utterance, to mention just a few situations and reasons. Laughing is a remarkable universal of human behaviour. There is no reported culture where laughter is not found. The manifestation of laughter takes place in multiple modalities - it is perceived visually as well as acoustically - even those born deaf and blind laugh (Apte, 1985). Laughing is normally linked with amusement and joy (Apte, 1985), which sometimes lead to an erroneous equation of humour and laughter. But laughter can also express negative feelings and attitudes such as contempt (Schröder, 2000) and it can even be found in sadness (Stibbard, 2000). Although many dialogues in everyday communication contain laughter in one way or another it is often not addressed as a typical phenomenon of spontaneous speech. Just as the various communicative functions of laughter deserve more research, very little is known about its different forms of occurrence. Although laughter as well as smiling has been investigated in several disciplines, speech with simultaneous laughter has rarely been the subject of investigation, with the notable exception of the study by Nwokah et al. (1999) on child-mother interaction. Findings reported in the literature are contradictory: Provine (1993) claims that laughter almost never co-occurs with speech, whereas Nwokah et al. (1999) gives evidence that up to 50% of laughs in conversations overlap speech, so-called "speech-laugh".

Although "contaminated" with laughter, speech in speech-laugh appears to be still intelligible. However, it remains unclear whether speech-laugh are just laughter superimposed on speech. Additionally, it remains unclear in what way speech-laugh are distinct from speech spoken with a smile. There are clear differences between smiling and laughing with respect to their role and occurrence in ontogenesis and phylogenesis (Apte, 1985). Also the primary channel is different: a smile is primarily visually transported whereas a laugh is basically linked with an acoustic event. However, a neurophysiological study (Fried et al., 1998) gives rise to the assumption that there is a

gradual change from smiling to laughter. Looking at the lexical reception of both concepts, one can see in many languages that smiling is seen as the "smaller brother" of laugh (cf. German *lachen-lächeln*; Dutch: *lachen-glim lachen*; Romance languages e.g. French *rire-sourire*). So, it is not surprising that at the other end of the amusement axis, smiling also affects speech, e.g. with higher pitch and higher formant values (Tartter, 1980; Ohala, 1994).

The phonetics of isolated laughs is characterised as a consonant-vowel pattern where the consonant is either aspiration (Apte, 1985; Bickley & Hunnicutt, 1992; Rothgänger et al., 1998) or a glottal stop (Schubiger, 1977; Apte, 1983). In contrast to speech the aspiration phase is longer than the vowel in a laugh syllable (Bickley & Hunnicutt, 1992; Mowrer et al., 1987; Rothgänger et al., 1998). Apart from the strong influence of aspiration on the vocalic portions (Bickley & Hunnicutt, 1992; Rothgänger et al., 1998), the average pitch is usually higher for laughter than for speech (Bickley & Hunnicutt, 1992; Mowrer et al., 1987; Rothgänger et al., 1998) accompanied sometimes by very high intensity (Edmonson, 1987; Kori, 1986), there seems to be a typical "laugh vowel" configuration (Bickley & Hunnicutt, 1992; Edmonson, 1987) with a strong tendency to individualisation (Rothgänger et al., 1998; Nwokah et al., 1999), and there seems to be a great intra-individual variability (Hirson, 1995).

This study addresses the questions of how often speakers in dialogues laugh a) during speech and b) separated from speech, and how speech-laugh patterns can be described with its phonetic characteristics. Moreover, the question is raised, whether we can find indications for a continuum from smiling to laughing.

### ***Occurrence of laughter in spontaneous speech***

The database investigated was the German "KielCorpus of Spontaneous Speech" (Kohler et al. 1995), which contains the audio recordings of 117 appointment-making dialogues. Since overlapping speech was excluded no backchannel utterances which could possibly contain some forms of laughter are recorded. 60% of all labelled laughs are instances which overlap speech which confirms the findings in Nwokah et al. (1999) and contrasts Provines' (1993). In total, 82 laughs occurred in 70 dialogue turns, so that 12 turns contain both examined forms, isolated laughs and speech-laughs. Only three out of 16 dialogue sittings, each containing seven dialogues with the same speakers, showed no occurrence of laughter. Interestingly, in each of the six dialogues where the partners were unknown to each other, some laughter occurred.

### ***Perceptual analysis - Towards an acoustic smile-laugh continuum***

A re-analysis of the Kiel data was necessary because informal listening revealed that some labelled laughs overlapping speech could rather be interpreted as a "smile". The labellers had only one category "laugh" for this type of non-verbal vocalisation, so that smiled speech fell under the heading "laugh". In a perception test, all 49 phrases containing speech-laughs were acoustically presented to 10 German native speakers. The subjects were asked to judge each laugh (after a possibly multiple listening) on a bipolar 7-point scale with "smile" and "laugh" at the extremes, but including a separate "neither-nor" option. To give an impression of the range to be expected, two extreme examples were presented first and excluded from the analysis. For purposes of comparison 8 phrases with preceding and/or following isolated laughter occurred in their both forms in the randomised list: with and without the isolated laugh. After the test the subjects were asked for their comments.

The results show that some examples of labelled laugh were not recognised as laughs. Some were localised more at the smile pole while 10 instances were considered neither as a smile nor as a laugh by two or more judges. Some listeners made clear, by their remarks or by scoring, that they prefer two distinct categories. In contrast other listeners chose all degrees between smile and laugh. It is remarkable that for all pure speech-laugh the extreme of the laugh end was very seldom selected. Those phrases that also included the additional isolated laugh were quite often judged at the extreme of the laugh end. It might be that a real laugh is always linked with a pure isolated laugh, with an intensity a speech-laugh can never achieve. This fits well with some subjects' remarks that they ticked on the smile end those instances which they perceived as laughs of lower intensity and less as genuine smiles, which is basically perceived visually. Although smiling and laughing can share some acoustic properties and have similar emotive and attitudinal functions, most subjects reported difficulties with the task. The potentially complex interplay between smiling, laughing and speaking shows one example where the speaker go from presumably smiled speech to a very short breath intake with a laugh which is continued in the immediately following articulation. In another example the speaker's entire turn was felt by many subjects as a very strong smile (shortly before a tension release for laughing), but not as a laugh. So, this token was by some subjects scored as a high intensity "speech-laugh-smile", but others located this token more in the smile-region. A possible improvement of this test could be to work with two separate intensity scales for laugh and smile, respectively, to account for the co-existence of both categories. The comments and results can be seen, ultimately, as a rejection of the hypothesised acoustic smile-laugh continuum.

### ***Phonetic characteristics of speech-laugh***

A closer acoustic and perceptual inspection of the 11 tokens which scored equal or higher than 5.0 revealed, that in all except one cases a reinforced expiratory activity is present. This is noticed either as an increased harmonic noise during periodic portions (perceived as a breathy voice quality) or as stronger aspiration during unvoiced portions (aspiration after plosive release, unvoiced fricatives, devoiced nasals), and in one case even as an aspiratory phase inserted between a vowel and a following nasal. Occasionally a tremor (or vibrato) was found in voiced segments, especially vowels. Pitch can be increased by a potential blending with smiling or by a pure smiling, which is probably the case in the one exception to the strong expiratory activity.

No matter how long the laughed words are, in most cases the speech-laugh is expanded over two syllables (in few cases one or three syllables). The tokens for which the overlapping time is labelled for entire phrases or even entire turns, can be seen as smiled speech. It can be hypothesised that laughed speech is a short-term event whereas smiled speech can be long-term. The labelled speech-laugh can occur in all positions of a phrase. However, eight out of the ten best scored speech-laugh started or ended simultaneously with articulation, three of them were followed by an isolated laugh.

### ***Discussion***

The observations in this study confirm that the powerful paralinguistic signal of laughter does not exclusively occur in its autonomous form, but to a substantial degree simultaneously with speech. That means that linguistic parameters such as pitch, which leads a paralinguistic life on its own can be affected additionally by other paralinguistic parameters such as smile and laughter. Other factors which make a more precise description of laughter very difficult are the great variability between and within speakers. This concerns the timing of speaking with laughing, the perceived intensity reported

here, and the investigated phonetic characteristics for laughter. The perception test does not support the idea of an acoustic smile-laugh continuum, and the relation between laughed speech and smiled speech remains unclear, especially when smiling merges laughing during articulation. It is clear that the simultaneous production of speech and laughter is not simply laughter superimposed on articulation. The articulatory configurations for speaking are continuously maintained during speech-laughs. Traces of laugh can be found in increased breathiness and sometimes vibrato on the voiced portions, and an reinforced expiration on phonologically possible locations (e.g. after a plosive release or during an unvoiced segment). A mere superimposing of laughter on speech would probably destroy the temporal relationship between consonant(s) and vowel in a speech syllable, would severely affect the spectral properties of the consonants, and would destroy the local intensity scaling. The sparse data presented here do not allow powerful statements on the acoustics, the frequency and the location of speech-laughs. Nevertheless it became evident that there is indeed no prototypical pattern for speech-laughs. One can expect that the rather heterogeneous picture sketched here will become more complex if we take into consideration the function of laughing (amused, malicious, nervous, ...) and the individuality of laughing.

Compared to Provine (1993), speech-laughs occur more frequently than expected in dialogues, in our data approximately in half of all laugh cases. Laughter is a natural concomitant of speech production in everyday communication. In our view it is not only important to find out more about the various functions of laughter in communication but also to explore its manifestations, especially with regard to a theory of paralinguistics, which aims to structure and explain the non-verbal aspects of vocalisations regarding emotion, attitude in speech.

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