PHONETICS AS A LAUGHING MATTER

Jürgen Trouvain[1] & Nick Campbell[2]

[1]Saarland University, Saarbrücken, Germany | [2]Trinity College Dublin, Ireland
trouvain@coli.uni-saarland.de | nick@tcd.ie

ABSTRACT

Laughing is a phonetic activity that is often observable in spontaneous discourse. Forms of laughter go far beyond a "haha"-like vocalisation with a great variability regarding duration, fundamental frequency, voice quality, and intensity. In contrast to common belief that laughter has nothing to do with linguistic aspects of phonetics there is evidence that laughter can be strongly tied to linguistic structure, e.g. in speech-laughs or as discourse markers for topic termination or as shared vocalisation in turn transitions. Based on data of conversational corpora we argue that laughter plays an important role also for phonetics and that it deserves more detailed research from the perspective of production, acoustics, and perception.

Keywords: laughter, interaction, spontaneous speech, non-verbal vocalisation

1. INTRODUCTION

Research investigating the production, acoustics and perception of laughter is still rare. This is striking because laughter occurs as an everyday and highly communicative phonetic activity in spontaneous discourse. In common belief laughter has no place in phonetics as a linguistic discipline that focuses primarily on segmental and prosodic properties of words and sentences, but we argue otherwise.

In contrast to speech as verbal vocalisation laughter is a non-verbal vocalisation, a group of different types of sounds and utterances such as vegetative sounds or affect bursts. Laughter can carry affective information, often linked with a positive valence such as joy and happiness but it can equally be observed when expressing nervousness and maliciousness on the negative side of valence. So, laughter can be a display of very different things including amusement, positive surprise, hilarity, pleasure, non-seriousness, affiliation but it can also be used as a face-saving or threatening action, see e.g. [19].

Two common synonymous usages of the notion *laughter* relate to humour on the one hand and smiling on the other. Although laughter can undoubtedly occur in humorous situations, humour (as a cognitive concept) and laughter (as a phonetic activity) should be clearly discriminated. Smiling and laughing may share several functions but they are often considered as distinct categories rather than gradual differences of the same category. Moreover they can be distinguished in the way of production, and in perception when smiling is combined with speech.

Since the main function of laughter seems to generate social bonding it primarily occurs in social interaction. "Is the other laughing with me or at me?" is probably the most important question for the interpretation of laughs in every-day interaction. Laughter can be used for social inclusion as well as social exclusion.

As laughter is a high-frequent vocalisation in every-day conversation with a communicative load it is not surprising that phonetic aspects of laughing have attracted researchers outside mainstream phonetics, e.g. from psychology [2, 3, 4, 21], clinical neuroscience [16], signal processing [20, 32] or conversation analysis [8, 11, 13].

The following sections are devoted to phonetic descriptions of varying laughter forms and data elicitation before presenting three examples where laughter is key also for linguistic phonetics.

2. PHONETIC ASPECTS OF LAUGHTER

In contrast to speech sounds as the product of the control of articulatory gestures in the vocal tract, the vocal production of laughter mainly reflects modulations of phonatory and respiratory movements. This means that vowels that can be observed in laughter are not produced with a specific articulatory target [3]. Invasive physiological measurements of laughing with a focus on the respiratory apparatus or on glottal activities in the larynx [12] have the advantage of observing laughter directly at the source of generation.

Non-invasive kinematic studies of rib cage and abdominal movements in spontaneous dialogues show how tightly coupled the inhalation and exhalation activities of both conversational partners can be [17]. Though not each inhalation results in an audible noise, many song-like laughs have such an inbreath noise as an offset [8]. Sometimes they co-occur with linguistically motivated inhalation noises between major prosodic phrases which usually reflect syntactical and discourse structure.

However, from a phonetic point of view it is still underexplored how the respiratory, the glottal and the vocal tract activities interact for different types of laughter. The control of the vocal apparatus while laughing is not only a mechanical manoeuvre at different places but requires also neurological routines that allow quick reactions in interactional laughing.

Largely unexplored is how we perceive laughter. This topic includes also the visual aspects of laughing. Often we use contextual information to interpret the laughing signal. Thus, from an interactional linguistic point of view it is interesting to learn more about pragmatic functions laughter can have in spontaneous discourse.

There is so far no standard of laughter categories but the division into song-like (voiced), snort-like and grunt-like laughs [2, 26] provide a first orientation. Likewise, there is no established procedure how to segment and name the different elements of laughs [26].

Compared to speech, laughter can show dramatic differences with respect to prosodic dimensions of fundamental frequency (pitch) and intensity (loudness). It is the usual tendency for song-like laughs to be higher and louder than spoken language. There seems to be a difference between males and females: men produce much more unvoiced laughter than women [3].

A paper by Bachorowksi & Owren [2] is entitled "Laughs are not alike" – this statement is valid for the different acoustic characteristics of laugh productions but also for the effect of laughter when perceiving it. The prototypical "haha"-like laughter can be described as a sequence of very similar laugh 'syllables' in a staccato manner. However, it was shown that a strict rhythmicity by repeating the same syllable has been perceived as less natural than introducing some variation in this rhythmic pattern [14]. With regard to the participation of the voice it is interesting to see that unvoiced laughs are considered as less positive than voiced forms [9]. Variation in the prosodic parameters duration (length), fundamental frequency (pitch) and intensity (loudness) as well as variation regarding voice quality [12] can have very different effects – of which we have so far nearly no exact knowledge. Apart from quantitative and qualitative aspects it seems to be the case that laughter – as other affective triggers as well – does influence perceptual dimensions such as the memory in the sense of "laugh – and you will be remembered" [1].

The short overview in this section shows that the diversity of laughing clearly goes beyond "haha"-like laughs. Laughter should be considered as a bundle of different acoustic outputs that go back to different phonetic strategies that are mainly based on respiratory and glottal activity and only marginally on supra-glottal activity.

3. HOW TO GET LAUGHTER DATA

Studies on the phonetics of laughing range from highly controlled to less controlled data. In extreme lab situations (comparable to most recordings of read speech in phonetics) laughter is intentionally produced by actors only with an imaginary communicative context, e.g. [4, 21, 22]. The phonetic variation is rather limited compared to recordings where subjects had to watch funny video clips [3; 32]. The variational range of laughter forms increase when observing speakers in spoken interaction, e.g. in task-based conversations [30] or everyday dialogues [8].

Prototypical and isolated forms of laughter were performed by actors in order to 'laugh for joy' or 'laugh for schadenfreude' etc. [22] or these acted laughs have been used in perception tests for various vocalisations of emotional categories [4, 21]. Despite the reasonable research questions the ecological validity and, subsequently, relevance for real communication can at best be said to be unclear.

To get a larger variety of types of laughter, a release of control cannot be avoided. Observing people watching funny video clips is such an approach to evoke spontaneous laughter, either with single subjects [32] or with two persons [3]. The latter approach contains social interaction, albeit without speech vocalisations. Although subjects were not actors (as in the 'lab laughter' recordings described above) they were aware of being observed – thus Labov's observer's paradox [15] was not avoided and a certain amount of 'acting' cannot be ruled out.

Laughter in conversations was investigated with various corpora [5, 6, 8, 10, 11, 13, 25, 28, 29, 31]. Often, task-based dialogues were recorded involving games like such as describing routes on a map or spotting differences in pictures. The great advantage of these corpora is that annotations of non-verbal vocalisations is already at hand, unfortunately with substantial differences between the annotation schemes [30].

What becomes again clear after studies with various styles is that laughter is not a staccato-like voiced-voiceless alternation alone but a bundle of very different phonetic and complex entities, un-veiling for instance different types of production modes. For instance, in [3] a three-way distinction has been proposed: song-like laughter with voiced elements, voiceless grunts with laryngeal and oral friction, and snort-like laughter with turbulences in the nasal cavity. In line with [3] we claim that the variability of laughs would never have been observed in 'stereotypical lab laughter' and a pure reliance on

'acted laughter' would have failed to uncover both a large set of surface varieties and the pragmatic functions of laughing in conversations beyond the expression of emotion or attitude, for instance when speaking and laughing happen at the same time, when topic changes and turn changes are organised with the help of laughter.

4. LAUGHTER AND LINGUISTIC STRUCTURE

4.1. Speech-laughs

Investigating spoken interaction usually leads to the observation of speech-laughs, i.e. laughing during articulation or 'laughed speech' (not to be confused with 'smiled speech'). Speech-laughs were first described by Nwokah et al. [18] who studied laughter in mother-child interaction. There, speech-laughs made up to 50% of all laughs, whereas in an analysis of a German adult conversational corpus [25] nearly all laughs were speech-laughs. However, it is important to note that the investigated corpus consisted of dialogues recorded in a 'push-to-talk mode' (no visual contact between the speakers whose turns were regulated by pushing a button and keeping it pressed for the duration of the turn). Thus, overlaps of speakers were not possible which again represents an unusual conversational situation. But also conversations with a possible cross-talk still show a substantial number of speech-laughs [30].

Typical phonetic features of speech-laughs are a reinforced expiratory activity reflected 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). In voiced segments, especially vowels, an increased fundamental frequency and a tremor-like voice quality can be observed. Speech-laughs often do not extend over two syllables and they tend to start or end simultaneously with articulatory phases, in the latter case with the possibility to be continued as an isolated laugh.

Speech-laughs could be considered as a type of tone of voice or as a voice qualifier which resembles but is not identical with smiled speech. Presumably, speech-laughs are often used as short and subtle comments (including self-comments) and are perceptually not extremely salient.

4.2. Topic change

Laughter, as a component of social interaction, has attracted interest within conversational analysis [8, 11, 13]. While laughter can be expressed in different contexts, voluntary or involuntary [16], and diverse in function and degree of functionality [2], it is not random. Gilmartin et al. [10] explored the role of laughter in a large corpus of casual informal conversations where the participants had no formal instructions or assigned roles but were forced to fall back on learnt social behaviour in recorded conversational interactions. They found laughter, both solo and shared, to be common and to serve as an indicator of both social role and stage of the dialogue; with shared laughter being a clear marker of a forthcoming topic change. This confirmed the earlier findings of Bonin et al. [5, 6] who put forward a notion of 'interactional entropy' with laughter being one of five social signals that represented a general level of social activity in the conversation. The beginnings of new topics showed a lower presence of social activity, fewer speakers, but a greater amount of lexical content. In contrast, topic terminations showed higher social activity and lower lexical volume. They confirmed that in two spontaneous-speech corpora there is a drop of interactional entropy when a new topic begins, and this is frequently signalled by shared laughter. In one corpus, 90% of topic changes were found to occur within 5 seconds of the end of an interval of shared laughter. They interpret this as a social ordering introduced by the new topic: from a situation of high social interaction, with a higher number of overlaps, feedback, laughter, the new topic brings on a monological situation, in which one speaker takes the floor, reducing the interactivity among the participants. Laughter may not always be transcribed when annotating such dialogue turns, perhaps being thought of as 'noise' in the signal, but it clearly serves a pragmatic function in signalling topic completion at the group level.

4.3. Turn transitions

Jefferson [13] proposes that "Laughter can be managed as a sequence in which speaker of an utterance invites recipient to laugh and recipient accepts that invitation. One technique for inviting laughter is the placement, by speaker, of a laugh just at completion of an utterance, and one technique for accepting that invitation is the placement, by recipient, of a laugh just after the onset of speaker's laughter." This type of laughter invitation and acceptance nicely fits to the cases illustrated in the respiratory study by McFarland [17]. Studies with larger data sets in conversational corpora investigated the patterns when both interlocutors overlap with their laughter [29, 31]. Usually, speakers avoid overlaps, except for feedback utterances – and laughter, which seems to serve as an excellent opportunity for a joint vocalisation.

The results in [29] show that a substantial amount of laughter occurs at a time when other interlocutors are laughing as well. Although most laughs are not shared in the sense of temporal overlap, the amount of overlapping laughs ranges from one third of all laughs to two thirds. The principle "one speaker at a time" which is often assumed to be valid in conversation does obviously not hold for laughing in conversations. A phonetic comparison of overlapping versus non-overlapping laughs reveals that overlapping laugh tokens are generally longer, have fewer unvoiced portions, and are produced with a higher fundamental frequency and a higher intensity.

Among the overlapping laughs the pattern of the "invited laugh" as described by Jefferson [13] seems to occur substantially more often than the case of the "anticipated laugh", where the recipient laughs before the onset of the "inviting" speaker. Obviously there is a majority of occasions where people show a tendency to "wait" to be invited to a shared laugh rather than anticipating an overlapping laugh. Thus, "laugh invitations" resulting in overlapping laughs do indeed provide an outstanding combination of organising the turn change between speakers (discourse level) and tightening their social bonds (phatic level).

5. CONCLUSIONS

In this review and positional paper we have shown that a) laughter is a highly frequent non-verbal vocalisation in spontaneous discourse, b) laughter can show phonetic forms that go clearly beyond "haha"-like laughter, and c) laughter is intertwined in different ways with linguistic structure in conversations in which timing of laughing plays an important role. In our view more detailed research of laughter from a *phonetic* perspective is needed. This concerns particularly talk-in-interaction but also speech technology and non-verbal vocalisations in general. Moreover, in line with [33] we advocate for a consideration of multiple speech styles and registers in phonetics where still read speech (and mostly single sentences) is the primary domain of research. As soon as non-scripted speech is investigated, there is a high probability that researchers are confronted with laughter in their speech data.

Speech technology can benefit from the phonetic insights of laughter by enriching the expressivity in interactive speech synthesis [7] in general, e.g. for personalised synthetic voices for people who lost their speaking abilities. Overcoming poor realisations of laughs would need some modelling at which intensity and pitch a laugh should be added to some synthesised utterances in order to have an appropriate effect [27]. Another example is the development of computer-assisted training material for autistic persons and other people who have problems recognising and/or interpreting certain types of laughter, e.g. [19, 23]. In order to develop appropriate and suitable interactive technology using laughter, we must first gain a good understanding of what laughter is – particularly from a phonetic perspective.

Laughter research is a good example that we should also work towards a better understanding of non-verbal vocalisations [28]. Laughter is not only highly relevant for conversations but also for studying the phonetics of laughter production of deaf persons, infants, across cultures, and other species such as primates.

We do not claim that phonetics should leave its linguistic origins but we plea for investigating a wider scope in which vocal communication takes place, i.e. not only sentences, and not only read speech. The example of the multi-disciplinary object of laughter also shows that the questions and answers of *phonetic* matters will be treated outside the phonetic community, if needed. Considering initiatives such as the series of workshops on laughter and other non-verbal vocalisations [34] and an upcoming paper collection [24] we claim that phonetics is showing itself open to a wide range of researchers from different disciplines who all have an interest in this speech event in common.

6. REFERENCES

[1] Armony, J.L., Chochol, C., Fecteau, S. & Belin, P. 2007. Laugh (or cry) and you will be remembered: influence of emotional expression on memory for vocalizations. Psychological Science 18, 1027-1029.

[2] Bachorowski, J.-A., Smoski, M.J. & Owren, M.J. 2001. The acoustic features of human laughter. Journal of the Acoustical Society of America 111(3), 1582-1597.

[3] Bachorowski, J.-A. & Owren, M. J. 2001. Not all laughs are alike: Voiced but not unvoiced laughter elicits positive affect in listeners. Psychological Science 12, 252-257.

[4] Belin P., Fillion-Bilodeau, S. & Gosselin F. 2008. The Montreal Affective Voices: A validated set of nonverbal affect bursts for research on auditory affective processing Behavior Research Methods 40(2), 531-539.

[5] Bonin, F., Campbell, N. & Vogel, C. 2012. Temporal distribution of laughter in conversation. Proc. Workshop on Laughter, Dublin, 25-26.

[6] Bonin, F., Campbell, N. & Vogel, C. 2015. The discourse value of social signals at topic change moments, Proc. Interspeech, Dresden, 1967-1971.

[7] Campbell, N. 2006. Conversational speech synthesis and the need for some laughter. IEEE Transactions on Audio, Speech, and Language Processing 14(4), 1171 – 1178.

[8] Chafe, W. 2007. The Importance of Not Being Earnest. Amsterdam: Benjamins.

[9] Cirillo, J. & Todt, D. 2005. Perception and judgement of whispered vocalisations. Behaviour 142, 113-128.

[10] Gilmartin, E., Hennig, S., Chellali, R.. & Campbell, N. 2014. Exploring sounded and silent laughter in multiparty task-based and social interaction – audio, video and biometric signals. Proc. European Symposium on Multimodal Communication.

[11] Glenn, P. 2003. Laughter in Interaction. Studies in Interactional Sociolinguistics. CUP.

[12] Esling, J. 2007. States of the larynx in laughter. Proceedings of the Interdisciplinary Workshop on "The Phonetics of Laughter", Saarbrücken, pp. 15-20.

[13] Jefferson, G. 1979. A technique for inviting laughter and its subsequent acceptance/declination. In: Psathas, G. (ed), Everyday Language: Studies in Ethnomethodology. New York: Irvington, 79-96.

[14] Kipper, S. & Todt, D. 2001. Variation of sound parameters affects the evaluation of human laughter. Behaviour 138, 1161-1178.

[15] Labov, W. 1972. Sociolinguistic Patterns. Philadelphia: University of Pennsylvania.

[16] Mendez Mendez, M.F., Nakawatase, T.V. & Brown, C.V. 1999. Involuntary laughter and inappropriate hilarity. The Journal of Neuropsychiatry and Clinical Neurosciences (11), 253–258.

[17] McFarland, D.H. 2001. Respiratory markers of conversational interaction. Journal of Speech, Language and Hearing Research 44(1), 128-143.

[18] Nwokah, E.E., Hsu, H.-C., Davies, P. & Fogel, A. 1999. The integration of laughter and speech in vocal communication: a dynamic systems perspective. Journal of Speech, Language and Hearing Research 42, 880-894.

[19] O'Donnell-Trujillo, N. & Adams, K. 1983. Heheh in conversation: some coordinating accomplishments of laughter. The Western Journal of Speech Communication 47, 175–191.

[20] Ruch, W.F., Platt, T., Hofmann, J., Niewiadomski, R., Urbain, J., Mancini, M. Dupont, S. 2014. Gelotophobia and the challenges of implementing laughter into virtual agents interactions. Frontiers in Human Neuroscience, 8, 928.

[21] Sauter, D.A., Eisner, F., Ekman, P. & Scott, S.K. 2010. Cross-cultural recognition of basic emotions through nonverbal emotional vocalizations. PNAS – Proceedings of the National Academy of Sciences 107(6), 2408-2412.

[22] Szameitat, D.P., Alter. K., Szameitat. A.J., Dietrich. S., Wildgruber. D., Sterr. A., Darwin C.J. 2009. Acoustic profiles of distinct emotional expression in laughter, Journal of the Acoustical Society of America 126, 354-366.

[23] Tanaka, H. & Campbell, N. 2014. Classification of social laughter in natural conversational speech. Computer Speech and Language 28(1), 314-325

[24] Trouvain & Campbell (eds) (in press). The Phonetics of Laughing.

[25] Trouvain, J. 2001. Phonetic aspects of "speech-laughs". Proc. Conference on Orality & Gestuality (ORAGE) 2001, Aix-en-Provence, 634-639.

[26] Trouvain, J. 2003. Segmenting phonetic units in laughter. Proc. 15th International Congress of Phonetic Sciences (ICPhS), Barcelona, 2793-2796.

[27] Trouvain, J. & Schröder, M. 2004. How (not) to add laughter to synthetic speech. Proc. Workshop on Affective Dialogue Systems, Kloster Irsee, 229-232.

[28] Trouvain, J. 2014. Laughing, breathing, clicking — The prosody of nonverbal vocalisations. Proc. Speech Prosody (SP7), Dublin, 598-602.

[29] Trouvain, J. & Truong, K.P. 2013. Exploring sequences of speech and laughter activity using visualisations of conversations. Proc. Workshop on Affective Social Speech Signals, Grenoble.

[30] Truong, K. & Trouvain, J. 2012. Laughter annotations in conversational speech corpora – possibilities and limitations for phonetic analysis. Proc. 4th Int'l Workshop 'Corpora for Research on Emotion Sentiment & Social Signals', Istanbul, pp. 20-24.

[31] Truong, K. & Trouvain, J. 2012. On the acoustics of overlapping laughter in conversational speech. Proc. Interspeech, Portland.

[32] Urbain, J. et al. 2010. The AVLaughterCycle Database. Proc. Int'l Conference on Language Resources and Evaluation, Malta, 2996-3001.

[33] Wagner, P. Trouvain, J. & Zimmerer, F. 2015. In defense of stylistic diversity in speech research. Journal of Phonetics 48, 1-12.

[34] Workshops on Laughter and Other Non-Verbal Vocalisations.http://pages.isir.upmc.fr/~pelachaud/site/LaughterWorkshop18.html