Knowledge-Based Systems 71 (2014) 15–24

Contents lists available at ScienceDirect

Knowledge-Based Systems

journal homepage: www.elsevier.com/locate/knosys

Time for laughter

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ARTICLE INFO

Article history:
Received 30 November 2013
Received in revised form 19 April 2014
Accepted 20 April 2014
Available online 28 April 2014

Keywords:
Social signals
Laughter
Topic change
Discourse analysis
Conversational analysis
TableTalk
AMI

ABSTRACT

Social signals are integral to conversational interaction and constitute a large part of the social dynamics of multiparty communication. Moreover, social signals may also have a function in discourse structure. We focus on laughter, exploring the extent to which laughter can be shown to signal the structural unfolding of conversation and whether laughter may be used in the signaling of topic changes. Recent research supports this hypothesis. We investigate the relation between laughter and topic changes from two different points of view (temporal distribution and content distribution) as visible in the TableTalk corpus and also in the AMI corpus. Consistent results emerge from studies of these two corpora. Laughter is less likely very soon after a topic change than it is before a topic change. In both studies, we find solo laughter significantly more frequent in times of topic transition than in times of topic continuity. This contradicts previous research about the social dynamics of shared versus solo laughter considering solo laughs as signals of topic continuation. We conclude that laughter has quantifiable discourse functionality concomitant with social signaling capacity.

1. Introduction

We begin with the observation that laughter is only sometimes purely the vocalization of mirth. One difference between unbridled mirth and controlled laughter may be in the internal structure of the laughter: controlled laughter does not exhibit random structure but repetitions; uncontrolled spontaneous laughter has been found to have random internal structure [1]. Some have sought to classify laughter according to the visual appearance and have found evidence in artworks sufficient to separate four types of laughter: joyful, intense, schadenfreude laughter, grinning [2]. It may be a response to what has preceded in conversation or in the external context of the conversation in which it appears. Laughter may also signal what is to follow in conversation, perhaps an explanation of the outburst. In a different dimension, laughter can be understood as a joint activity: one interlocutor may laugh alone, or a number may join the laughter. Previous authors [3] have described laughter as an action in its own right, the occurrence of which may be independent from the presence of humor. In this context, laughter has been seen as a highly ordered phenomenon, internally and externally. In this sense, it is also relevant to explore the timing of laughter with respect to other elements of interaction in dialog. We wish to explore hypotheses about the differential signals effected by shared laughter and solo laughter in conversation. We think that the timing of mirthful laughter is effectively random, given the distribution of potential triggers.[1] However, we believe that when laughter functions as a social signal, its timing is structured and conveys information about the underlying discourse structure. Previous works have explored other non-verbal features that can be predictive of discourse structure [5–7]. Luz et al. [5,6] investigate the potential of non-verbal signals such as silences (among two speakers vocalizations as well as within the same speaker turn) and overlaps in predicting topic changes in meetings. Results show that pauses and overlaps on their own are good estimators of the topic structure of meetings conversation, reaching performance comparable with lexical based methods.

In this work, we extend a previous analysis of the TableTalk corpus [8,9] to the AMI corpus [10].[2] Both corpora involve communication in English, where English is a *lingua franca* in one

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[1] While we see distinction between instances of mirthful laughter and structural laughter we do not here seek functional (or automatic) discrimination nor attempt to understand speakers' emotive state (others, of course, do attempt to infer speaker emotions [4]); rather, we treat all instances of laughter as instances of the category 'social signals'.

[2] Our research is anchored in available multimodal corpora. While the number of corpora available with annotations appropriate to our purposes is not vast, it is possible to note qualitative differences in two such possibilities and hold the results which obtain for them as representative of their types until more instances of those types can be annotated and studied, along with instances of other types, as well.

http://dx.doi.org/10.1016/j.knosys.2014.04.031
0950-7051/

setting and a native language in the other. Politeness dimensions to laughter in conversation might have different manifestations in the two corpora given other aspects. In the TableTalk conversations, recorded in Japan, the dialog includes five participants, sitting around the table, chatting. They included one native speaker of Japanese, one of Finnish, one of French (Belgian), and two native speakers of English (one Australian, one British). The Japanese participant and her Australian friend were rewarded for taking part in the conversation, while the others were visiting researchers in the lab directed by the native English speaker. This dialog had no particular structure, but tended to be around the theme of life in Japan (see Section 3.1). In the AMI corpus, participants are presumed to be unfamiliar with each other (at least they were recruited in that way), and paid to talk to each other for the data collection. The conversations in this corpus was structured as collaborative tasks (see Section 3.2). We take these corpora as exemplars because neither was constructed with the specific purpose of studying laughter.

In a previous study we analysed TableTalk [9] and showed a relation between laughter and topic changes in spontaneous conversations; laughter did not appear to be a random or exclusively content-driven event, but we detected a tendency for higher probability of laughter, particularly shared laughter, towards topic ends. Conversely, we found longer periods without laughter immediately after a topic change. Such findings support the hypothesis of the existence of a discourse function of laughter. In the same work, we analyzed laughter also with respect to the information flow. We distinguished two types of discourse segments and examine laughter as a discourse marker, signaling the onset of a topic termination segment [11], or the end of a topic-onset segment. We found that topic termination segments thus marked tend to have higher lexical variety than topic onsets.

Our present investigations are twofold. We extend our previous analysis and we explore on both corpora: (i) the temporal distribution of topic changes, (ii) the temporal distribution of laughter in structured and unstructured conversations, seeking to answer the following questions:

(1) Is there a pattern in the temporal distribution of laughter (and of shared and solo laughter)?
(2) How does information flow vary in topic termination and topic beginning segments?

The paper is structured as follows: an introduction is given in Section 1. Section 2 provides operational definitions that will be used in the rest of the paper. Section 3 describes the two corpora, and Section 4 shows the correlation between frequency of laughter and topic changes. Experiments are described in Section 5. Section 5.1 answers question 1, and Section 5.2 answers question 2. Results are discussed in Section 6, and conclusions are drawn in Section 7.

2. Definitions and measurements

Understanding whether laughter has a function in the discourse structure plays a crucial role in the framework of discourse segmentation, as laughter could constitute an informative feature to boost topic segmentation efficacy. For the present work, we have considered topic at a discourse level characterized by a chunk of coherent content.

2.1. Definition of topic

A formal definition of "topic" is surprisingly difficult to provide (cf. "subject", [12]), as it is understanding where borders stand between topics and subtopics. Topic can be seen to cover different levels of granularity and different contexts. The linguistics literature has distinguished two levels of granularity: a sentence level [13], and a discourse level [14]. On the other hand, in the context of topic segmentation algorithms, topic has been mostly referred to at a discourse level, as segments of the discourse sharing coherent information (*about the same thing* [15]). Passonneau et al. [16], interpret topic as speakers' *intentions*, and topic changes in conversations as changes in the participants' activities (information-giving, decision-making). In topic segmentation applications, such as information retrieval from broadcast news, topics have been referred to as lexically coherent segments of the discourse [17], often having completely different themes. Many different topic segmentation algorithms have been developed on the basis of the lexical coherence approach described in [17]; others have exploited clustering approaches [18], others discourse markers that provides clues about the discourse structure [19], but few have tackled the difficult problems of casual conversational speech. In this work we consider topic a fragment of discourse about the same subject, relying on the topic annotation of the corpora at hand. Details on the topic annotation used in the present work are given in Section 3.3.

2.2. Temporal definitions and measurement

Laughter and topic boundaries serve as conversational landmarks. We work with an abstraction of topic changes (T-events) as instantaneous points of topic shift in conversation. We consider the laugh events in relation to T-events. First we explore the distance between laughter in general and T-events, looking at the time spans between the last laugh in topic A and T-event (namely LT) and the T-event and the first laugh in topic B (namely TL) (Fig. 1). Then, we analyze the behavior of types of laughter, shared vs. solo, with respect to T-events. In this case, our foci are the last solo (SO) and shared (SH) laughs prior to a T-event (named LL: SoLL or ShLL, respectively). See Fig. 2.

We denote the measure of the distance (in seconds) between T-events and boundary laughs with μ. Below we consider the differences between μ(LT) and μ(TL) as well as between μ(SoLT) and μ(ShLT).

Finally, we concentrate on the distinction between topic continuation moments and topic transition moments, analyzing the distribution of laughter among those segments. We construct operational models of topic continuation segments, calling them *wi* segments, and topic transition segments, calling them *wo* segments. We define these as follows (see Fig. 3):

- *wi* segments: the central half of each topic;
- *wo* segments: the final quarter of one topic and first quarter of the next topic;

By construction, *wi* segments represent the core of a topic and have topic cores *within* them, while *wo* segments do not contains the core of a topic, but do contain a transition between two topics. Both are defined in relation to the duration of a sequential pair of topics, not absolute durations. We find this decomposition of

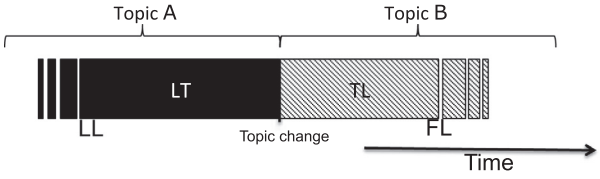

Fig. 1. Topic boundary neighborhood. LL and FL represent last and first laugh. LT and TL represent respectively a topic termination segment and a topic beginning segment.