Corpus Data vs. Experimental Results as Prosodic Evidence: On the Case of Stressed *auch* in German

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1 Introduction

It is a well known fact that the stressed variant of the German additive focus particle *auch* 'also' – in contrast to its unstressed counterpart – associates with a constituent to its left. The associated constituent (AC), which is not confined to a specific syntactic position, represents the element that is added to a contextually given set by means of the particle – in (1), *Martin* is added to the set of hungry beings.

(1)   [Martin]$_{AC}$ hat AUCH Hunger.
        Martin   has also   hunger
        'Martin is hungry, too.'

The syntactic, semantic, and information structural properties of constructions containing stressed *auch* have been subject to much discussion, see Reis and Rosengren (1997) and Krifka (1999), among others. At the same time, the relevance of prosodic factors did not go unnoticed. Krifka (1999) argues that ACs of *auch* are contrastive topics, which, however, are not obligatorily marked by a rising contrastive accent. This hypothesis gives rise to a number of questions concerning the optionality of the prosodic marking and its specific realization, which suggest an empirical approach to the problem. Evidence from two different sources will be addressed in this paper: data from a spoken language corpus and the results of several controlled speech production and perception experiments.

2 Corpus study

The analyzed corpus consists of 225 utterances containing stressed *auch* extracted from 9 movies and 12 episodes of a TV series. The ACs were determined on the basis of

context information, and the utterances were prosodically annotated using the GToBI system (cf. Grice et al. (2005)). The utterances show great diversity with respect to their syntactic structure (verb-first, verb-second, verb-final and elliptical constructions) as well as with respect to the syntactic function and position of the ACs. Two questions are of particular interest: (i) Is the AC of *auch* accented, and if yes, what kinds of accents can ACs possibly carry? (ii) What is the overall intonational pattern of the utterances?

As for (i), we found that in 48% of the utterances, the ACs are not accented at all. The ACs in the remaining cases are marked by high or rising accents (49% LH*, 32% L*H, 19% H*). An inspection of the discourse contexts revealed no relation between the accent types and the semantic or information structural properties of the respective utterances. On the other hand, the pronominal vs. non-pronominal status of the ACs is an important factor. The group of unaccented ACs exclusively contains pronouns, whereas the accented ACs include pronominal as well as non-pronominal elements. The optionality of an accent on the AC is thus limited to pronouns.

Concerning (ii), the majority of utterances is characterized by a falling nuclear accent on *auch* (H*L or HL*), hence the cases with accented ACs exhibit the so-called bridge contour intonation. In addition to these general tendencies, a number of phenomena that are only exemplified by a few cases in the corpus are relevant for the analysis: utterances with conjoined ACs, utterances where the (pronominal) AC in sentence initial position is dropped, and cases which contain an unaccented pronominal AC, but involve an accent on a non-associated fronted element.

3   Speech production experiment

The exploratory corpus analysis cannot go beyond a categorical classification. To be able to capture the individual parameters involved in marking ACs of stressed *auch* quantitatively, an experimental study with balanced materials controlled with respect to their phonetic properties was carried out. The expectation was that constructions with two potential ACs to the left of *auch* should call for a disambiguation in terms of prosodic marking. In Experiment 1, sentences like (2) were embedded in two different contexts, each triggering one of the possible readings. The independent variables were the position (prefield vs. middlefield) and the syntactic function (subject vs. temporal adverbial) of the intended AC.

(2)   [Der Rudi]$_{AC1}$ hat [im Juni]$_{AC2}$ wahrscheinlich auch einen Vortrag gehalten.
         the Rudi   has in June   probably   also   a   talk   given
         'In June, Rudi probably gave a talk, too.'

The materials were controlled in a way that allows comparisons of the potential ACs both between and within utterances with respect to the following dependent variables: f0-minimum, f0-maximum, f0-excursion, duration, and temporal alignment of the f0-minimum and -maximum. 7 subjects each received 20 experimental items for production, which were randomized and interspersed with fillers. A total of 107 utterances entered the analysis.

An inspection of the f0-contours, which were very consistent for utterances with an identical association position, revealed that the majority of the potential ACs are characterized by a rising f0-movement. Crucially, statistical comparisons show that the ACs have a significantly lower f0-minimum preceding the rise, higher f0-maximum, greater f0-excursion, longer duration, and later peak alignment than their non-associated counterparts. The differences between the associated and the non-associated constituent within one sentence are significantly greater if the AC is located in the prefield, as non-associated prefield constituents show a stronger prosodic marking than non-associated middlefield constituents.

4   Speech perception experiments

Most of the differences in f0-excursion, duration, and alignment between ACs and non-ACs observed in the production data cannot be expressed in terms of different GToBI labels. Whether they have an impact on the interpretation of the utterances was examined in two subsequent speech perception experiments. Subjects were auditorily presented with realizations of potentially ambiguous sentences without contexts and had to disambiguate them by selecting one of two possible continuations, cf. (3).

(3)   (via headphones:)
        Der Rudi hat im Juni wahrscheinlich auch einen Vortrag gehalten.

        (on the screen:)
        a.   ... und nicht nur   im Mai.
               ... and not   only in May
        b.   ... und nicht nur   der Martin.
               ... and not   only the Martin

Experiment 2 (32 subjects) was based on the original utterances (experimental and filler items) elicited in the production study. We found a significant correlation between the strength of the prosodic marking (defined on the basis of the prosodic variables mentioned above) and the percentage of correct responses.

For Experiment 3 (44 subjects), we used manipulated stimuli to facilitate a balanced design. 11 versions of one utterance were resynthesized, with the two extremes being

relatively unambiguous cases of prefield and middlefield association, and the remaining stimuli regularly distributed in between (the relevant parameters were jointly varied). Subjects had to judge each version 6 times. The experimental items were randomized and separated by fillers. The outcome confirms the correlation between prosodic realization and interpretation. In addition, the results do not show an s-shaped curve typical for categorical perception, but a linear relationship between the number of decisions for a particular association position and the parameter settings of the individual stimulus versions.

5   Discussion

The two sources of evidence with their specific data types allow to examine the prosodic marking of ACs from different perspectives: The corpus analysis is based on discrete categorical distinctions applied to natural speech data, which, however, do not necessarily correspond to interpretational categories in the case of our phenomenon. The experimental results, on the other hand, support a description in terms of continuous phonetic parameters, in line with conclusions drawn by Braun and Ladd (2003) and Braun (2004) with respect to the prosody of contrast marking in German. The combination of the corpus and experimental results shows that an element cannot be identified as the AC of stressed *auch* on the basis of its own prosodic properties alone. Depending on the context, the identification may be governed by the relative strength of the prosodic marking that the candidates for association show. Thus, although a 1:1 mapping between the association status and the prosodic realization cannot be maintained, prosody clearly interacts with the interpretation of the utterances.

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