

Prosody and Information Structure of German Sentences Containing the Stressed Focus Particle *auch*

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ABSTRACT

This paper presents the results of two experimental studies examining the prosodic and information structural properties of constituents associated with the stressed variant of the focus particle *auch* ('also') in German. The findings of a speech production experiment are compared with the outcome of a subsequent perception experiment. The results are interpreted as supporting Krifka's (1999) Contrastive Topic Hypothesis. Finally, we indicate some possible consequences for the grammatical description of the focus particle *auch* in German.

1 INTRODUCTION

It is a well-known fact that German additive particles like *auch* ('also') and *ebenfalls* ('likewise') can both precede and follow their associated constituents. In the former case, they are unstressed; in the latter, they carry the main stress, cf. (1) and (2):¹

- (1) a. Martin hat wahrscheinlich auch [die HEMden] gebügelt.
M. has probably also the shirts ironed
b. Martin hat wahrscheinlich auch [die HEMden gebügelt].
- (2) [Martin] ist wahrscheinlich AUCH gekommen.
M. aux probably also come

Our paper deals with the stressed variant of the focus particle *auch*.² The starting point of our investigations was Krifka's (1999) Contrastive Topic Hypothesis, which postulates that associated constituents of the stressed particle are the contrastive topics of the respective clauses. As such they can be marked by a rising contrastive-topic accent indicating that there is a (contextually given) set of alternatives, to which the element under discussion is added.

¹ The square brackets without indices serve to indicate the constituents associated with *auch*.

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Given Krifka's hypothesis, it is possible to attribute the syntactic and prosodic differences between sentences containing the stressed and those containing the unstressed variant of *auch* to independently motivated assumptions about their information-structural properties (see also Dimroth (2004) for a proposal along these lines). Consequently, the complementary distribution of associated constituents with respect to the two variants of *auch* can be accounted for in terms of information-structurally driven syntactic movement.³

Crucially, as Krifka (1999) notes, the prosodic marking on the associated constituent is not obligatory, i.e. the rising contrastive accent in sentences like (2) is only optional. The aim of our study was to examine the prosodic properties of constructions with stressed *auch* in more detail to find out whether experimental data support Krifka's hypothesis. The prosodic marking of the associated constituent as a contrastive topic should be expected primarily in cases where more than one constituent can potentially associate with the focus particle, i.e. where the prosodic marking serves to disambiguate the utterance. We used the method of combining a production and a perception experiment, so that both the prosodic realization of the sentences and their prosody-dependent interpretation could be examined.

The paper is organized as follows: section 2 presents some theoretical background assumptions concerning constructions with the additive particle *auch* and their parallels to the so-called *bridge contours*, followed by the hypotheses for our experimental study. In section 3, the results of the production experiment are reported, showing that speakers produce the contrastive accent on associated constituents in potentially ambiguous sentences. Section 4 presents the subsequent perception experiment, the results of which confirm our hypothesis that speakers use the contrastive-topic accent to disambiguate the utterances. In Section 5, some conclusions are given as well as a brief outlook for further research.

2 THEORETICAL BACKGROUND AND HYPOTHESES

2.1 The focus particle *auch*

Auch belongs to the group of additive focus particles and can occur either in a stressed or in an unstressed form. As mentioned above, the two variants are in complementary distribution on the surface: whereas stressed *auch* is obligatorily c-commanded by its associated constituent, unstressed *auch* has to c-command its associated constituent, which carries the sentence accent in this case. As there is no one-to-one mapping between the nuclear accent and the focus of the utterance in German, ambiguities with respect to the association with the focus particle arise, cf. (1). Reis & Rosengren (1997) assume that both variants of *auch* belong to the same lexicon entry. However, they refuse a movement account of the association with the stressed variant of the particle.

The assumption that particles like *nur* ('only'), *sogar* ('even'), and *auch* interact with the focus-background structure of sentences is widely spread,⁴ which is obvious from the commonly-applied label *focus particles*. Reis & Rosengren (1997), however, argue that sentential focus is irrelevant for the determination of the constituent associated with *auch*, because a focus-based account seems not to be able to explain the stressed variant of the particle. The term *focus particle* is regarded as being misleading for this reason. According to

³ But see Reis & Rosengren (1997) for a different view, briefly discussed in section 2.1.

⁴ Cf. Altmann (1976), among others. For a formal analysis in terms of the structured-meaning approach see Krifka (1992).

Reis & Rosengren, the semantic association of *auch* with a constituent does not arise from the focus structure of the utterance, but from comparison with the preceding context.

Krifka (1999: 113) offers an alternative account: “The associated constituent of stressed postposed particles is the contrastive topic of the clause in which they occur.” A crucial assumption is that, according to Krifka, it suffices if the associated constituent semantically fulfils the conditions for a contrastive topic. The rising contrastive accent in sentences like (2’) is not obligatory, as the nuclear accent on the focus particle unambiguously identifies the specific construction:

(2’) (/)[Martin] ist wahrscheinlich AUCH gekommen.
M. aux probably also come

This optionality in the prosodic realization is an open problem requiring a closer look at the interaction between prosody and the association with stressed *auch*.

2.2 Bridge contours

There are clear semantic parallels between constructions with stressed *auch* and the so-called *bridge contours*⁵ (cf. Jacobs (1997), Molnár & Rosengren (1997), Steube (2003), and van Hoof (2003), among others). Bridge contours have two pitch accents: a rising accent on the contrastive topic (which is often, especially in the German literature on bridge contours, referred to as I-topic), and a falling accent within the sentential focus.

Both the I-topic in bridge contours and the constituent associated with *auch* are accompanied by the presupposition of a set of alternatives, i.e. the respective sentence is not a complete answer to an (implicit) question and, therefore, fulfils Büring’s (1997) *Condition of Disputability*.⁶ In contrast, analogous constructions with stressed *nur* (‘only’) are ungrammatical, as they cannot function as partial answers (cf. Krifka (1999): 124f.). A sentence like (3) would immediately answer all (implicit) questions concerning the alternatives. Thus, it does not fulfil the *Condition of Disputability*:

(3) */MARTin hat den Bus wahrscheinlich \NUR verpasst.
M. aux the bus probably only missed

On the other hand, the stressed variant of the negation particle *nicht* behaves similarly to stressed *auch* (cf. Dimroth (2004)). Sentences like (4) show the typical bridge contour semantics: the predicate is negated with respect to *Martin*, but is open with respect to the relevant alternatives to *Martin*. Thus both stressed *auch* and stressed *nicht* mark, respectively, the validity and non-validity of a given predicate for the contrastive topic of the clause:

(4) /MARTin hat den Bus \NICHT verpasst.
M. aux the bus not missed

⁵ The term is used here to refer to the construction as a whole, with its special prosodic, semantic, syntactic and pragmatic properties.

⁶ “Given a sentence *A* containing a Topic, there must be at least one disputable element in $\llbracket A \rrbracket^t$ after uttering *A*. [...] Disputability: A set of propositions *P* is disputable wrt a set of worlds CG (the *Common Ground*) if there is at least one element *p* in *P* such that both *p* and $\neg p$ could informatively and coherently be added to CG.” (Büring (1997: 178)). Büring’s *Topic* refers to I-topics, and $\llbracket A \rrbracket^t$ is the *Topic value* of *A*, i.e. a set of sets of propositions. See Krifka (1999: 122f.) for a discussion of the *problem of the last answer* arising in this context.

It is important to note that I-topics need not be topics in the narrow semantic sense; even non-referential constituents like manner adverbials, directional adverbials, predicatives, non-finite VPs or verbal prefixes can function as I-topics (cf. Steube (2003: 170f)). This is also true for constituents associated with stressed *auch*:

- (5) [/*AN*] hat er das Licht \AUCH gemacht.
on aux he the light also turned

If we follow Steube (2003) and van Hoof (2003) in assuming that the rising accent in bridge contours is a contrastive-focus accent, we can retain the original assumptions about the focus sensitivity of *auch* and account for stressed-particle constructions along the following lines: the relevant constituents undergo movement out of the focus domain driven by the information-structural properties of bridge-contour constructions, but they remain focus-marked and can be associated with the particle, which, as the last remaining element in the focus domain, carries the nuclear accent. The complementary distribution of stressed and unstressed *auch* thus follows from the different information structuring of the two constructions.

2.3 Hypotheses

In contrast to what has been shown for bridge contours, i.e. their typical rise-fall intonation with a clear prosodic marking of the I-topic (cf. Mehlhorn (2001)), the prosodic marking of I-topics in constructions with stressed *auch* is supposed to be optional. However, in sentences with a syntactic structure like (2), the subject is the only candidate for the association with *auch*, and therefore can be clearly identified even without prosodic marking or contextual information. On the other hand, sentences like (6) are potentially ambiguous; here, *auch* can associate both with the subject *Martin* and the direct object *den Bus*, although it is probably easier to construe the focus particle with the prefield⁷ constituents:

- (6) a. Martin hat den Bus wahrscheinlich AUCH verpasst.
M. aux the bus probably also missed
 b. Den Bus hat Martin wahrscheinlich AUCH verpasst.
the bus aux M. probably also missed

Given such potentially ambiguous sentences, we expect less optionality in the prosodic marking of the associated constituents. Consequently, (6a) and (6b) should have the two possible realizations indicated in (7a) and (7b), respectively:

- (7) a. (i) /*MART*in hat den Bus wahrscheinlich \AUCH verpasst.
 (ii) Martin hat den /*BUS* wahrscheinlich \AUCH verpasst.
 b. (i) Den /*BUS* hat Martin wahrscheinlich \AUCH verpasst.
 (ii) Den Bus hat /*MART*in wahrscheinlich \AUCH verpasst.

⁷ In topological accounts of German sentence structure (cf. Höhle (1986), among others), the term *prefield* (*Vorfeld*) refers to the position preceding the finite verb in V2-structures, and *middlefield* (*Mittelfeld*) to the positions between the finite verb and the non-finite verb forms in V2-structures and between the complementizer and the finite verb in verb-final subordinate clauses.

In concrete utterances, the constituent associated with *auch* should be marked by a clear f_0 -rise, whereas the same, but non-associated, constituent should show a much smaller f_0 -rise or none at all. We also expect differences in duration between the two conditions. These assumptions are explicitly given in the following two hypotheses:

- (H1) The f_0 -rise on the constituent associated with *auch* will be greater than the f_0 -rise on the same constituent in the same position, but not associated with the particle.
- (H2) The duration of the constituent associated with *auch* will be longer than the duration of the same constituent in the same position, but not associated with the particle.

We tested the hypotheses in an experiment, in which prosodic parameters (fundamental frequency and duration) of the relevant constituents in produced utterances were measured and statistically compared. Moreover, prototypical contours computed for the utterances enabled us to examine the accent shape on the associated constituents, as well as the bridge contour properties of constructions with stressed *auch* generally. In the subsequent speech perception experiment, the influence of the prosodic information on the interpretation of the utterances was tested.

3 SPEECH PRODUCTION STUDY

In our production experiment, we used the method of comparing lexically identical sentences embedded in different contexts with respect to their prosodic realization.⁸

3.1 Experimental design

3.1.1 Material

Five pairs of sentences were constructed, each pair consisting of two sentences ambiguous with respect to the constituent associated with *auch*, cf. example (8): the production of the stressed variant of the particle leads to association with a constituent to its left, located either in the prefield or in the middlefield. The potential candidates for the association are always the subject and a temporal adverbial, both of them being equally unmarked in the prefield and middlefield in German. The two orderings of the subject and the adverbial were included in order to control possible preferences with respect to the syntactic position of the associated constituent.

- (8) a. Ingo ist am Dienstag wahrscheinlich auch in der Bibliothek gewesen.
I. aux on Tuesday probably also in the library been
- b. Am Dienstag ist Ingo wahrscheinlich auch in der Bibliothek gewesen.
on Tuesday aux I. probably also in the library been

The items were kept as parallel as possible: the subjects are two-syllabic names with stress on the first syllable, the adverbials are three-syllabic PPs with penultimate stress, and the perfective auxiliary (*ist/hat*) is located between them. The first element in the middlefield is followed by a sentential adverb and the focus particle *auch*. The sentences were embedded in two different contexts, each consisting of a question followed by a specification. The

⁸ A similar method has been used in Alter et al. (2001) to examine the differences between contrastive and presentational focus.

contexts primed the speakers to produce the stressed variant of *auch* and they unambiguously identified the associated constituent. The four experimental conditions resulting from the combination of the levels of the two independent variables (position (prefield vs. middlefield) and syntactic function (subject vs. adverbial) of the associated constituent) are shown in (9):

- (9) a. *association with the adverbial in the middlefield* (condition subj-ADV)⁹
- C: Weißt du, wann Ingo letzte Woche in der Bibliothek war? Ich habe ihn nämlich nur am Donnerstag dort gesehen. (*Do you know when Ingo was in the library last week? I only saw him there on Thursday.*)
- T: Ingo ist am Dienstag wahrscheinlich auch in der Bibliothek gewesen.
I. aux on Tuesday probably also in the library been
- b. *association with the adverbial in the prefield* (condition ADV-subj)
- C: Weißt du, wann Ingo letzte Woche in der Bibliothek war? Ich habe ihn nämlich nur am Donnerstag dort gesehen. (*Do you know when Ingo was in the library last week? I only saw him there on Thursday.*)
- T: Am Dienstag ist Ingo wahrscheinlich auch in der Bibliothek gewesen.
on Tuesday aux I. probably also in the library been
- c. *association with the subject in the prefield* (condition SUBJ-adv)
- C: Weißt du, wer aus unserer Gruppe am Dienstag in der Bibliothek war? Ich habe nämlich nur Claudia dort gesehen. (*Do you know who of our group was in the library on Thursday? I saw only Claudia there.*)
- T: Ingo ist am Dienstag wahrscheinlich auch in der Bibliothek gewesen.
I. aux on Tuesday probably also in the library been
- d. *association with the subject in the middlefield* (condition adv-SUBJ)
- C: Weißt du, wer aus unserer Gruppe am Dienstag in der Bibliothek war? Ich habe nämlich nur Claudia dort gesehen. (*Do you know who of our group was in the library on Thursday? I saw only Claudia there.*)
- T: Am Dienstag ist Ingo wahrscheinlich auch in der Bibliothek gewesen.
on Tuesday aux I. probably also in the library been

In addition to the 20 target sentences (5 items in 4 experimental conditions), 10 fillers were included for the perception experiment.

3.1.2 Procedure

The production experiment was carried out in a sound-proof room with 4 female native speakers of German (aged 20 – 24 years). They were trained speakers but linguistically naïve. Their task was (i) to read a context-target item combination silently, (ii) to listen to an acoustic presentation of the context and (iii) immediately produce the target item for digital recording, which was repeated (with the context replayed each time) until the speakers

⁹ Capital letters in the condition names indicate the constituents associated with *auch*.

agreed with their production. The resulting 80 items extracted from their context were acoustically analysed with Praat,¹⁰ while the statistical comparisons were made with SPSS.

3.2 Analysis

3.2.1 Fundamental frequency

The fundamental frequency (f_0) was measured at four points per syllable on the subject, the temporal adverbial and the auxiliary, and at 12 points in the rest of the utterance, i.e. there were a total of 36 measuring points per utterance. First, diagrams displaying the resulting contours for each speaker in each condition were produced. Fig. 1 shows the contours of speaker 1 in condition subj-ADV:

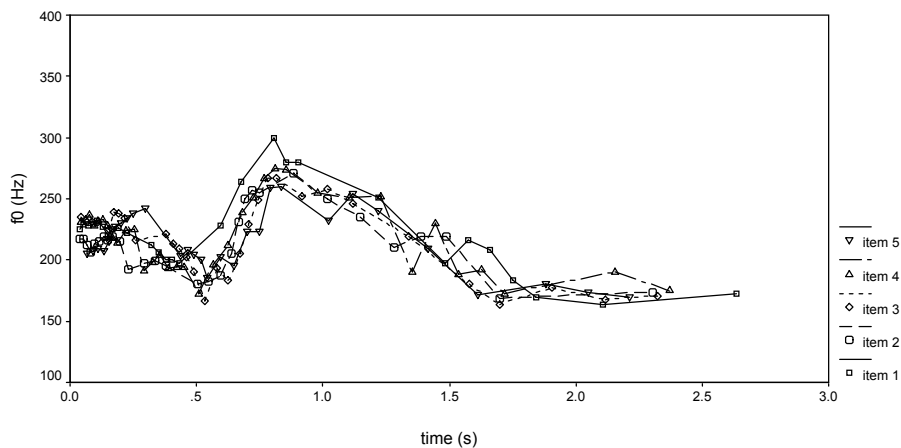


Fig. 1: f_0 -contours of speaker 1, condition subj-ADV

In 14 out of 16 cases (four speakers in four conditions) we found a high degree of consistency between the five items, so that we could use all items to compute mean contours for the speakers in the individual conditions. In the remaining two cases we found four items with consistent intonation patterns and one item completely differing from the others. Therefore, the mean contours for the respective conditions were computed only from the four consistent cases.¹¹ Fig. 2 shows the mean f_0 -contour of speaker 1 in condition subj-ADV:

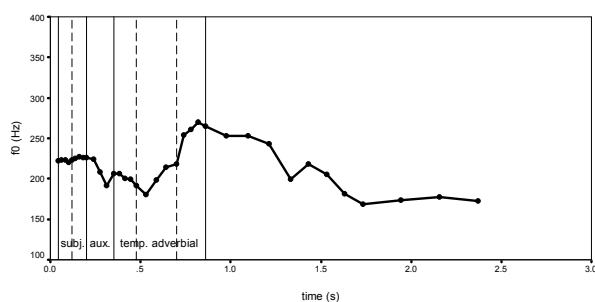


Fig. 2: Mean contour of speaker 1, condition subj-ADV

¹⁰ Praat is freely available at <http://www.praat.org>. We used version 4.0.49 of the program.

¹¹ It would make little sense to compare mean contours computed from items with inconsistent intonational patterns. Crucially, all items were included in the statistical comparisons between the conditions.

The produced contours show the following properties: for condition subj-ADV we expected a clear f_0 -rise on the associated adverbial in the middlefield and a comparatively smaller rise on the subject in the prefield. Whereas the contours of the speakers 1, 2, and 3 correspond to the expected pattern, the contour of speaker 4 shows approximately the same rise on the subject and the adverbial.

For condition ADV-subj we expected a clear f_0 -rise on the associated prefield adverbial and a small or no rise on the middlefield subject. The contours of all four speakers fulfil these expectations.

For condition SUBJ-adv, the contours of speakers 1 and 2 correspond to the hypothesis, showing a clear f_0 -rise on the associated subject in the prefield and no f_0 -rise on the adverbial in the middlefield. Speaker 3 chose a different strategy to mark the associated constituent: instead of a rise, she produced a high peak on the accented syllable followed by a steep fall. The contour of speaker 4 only partially fulfils the expectation: apart from a clear rise on the subject, there is also a comparable rise on the adverbial.

For condition adv-SUBJ, a clear rise on the associated middlefield subject and a comparatively smaller rise on the prefield adverbial were expected. Speakers 1 and 2 again produced contours fulfilling the expectations. In the mean contour of speaker 3, the rise on the subject and the adverbial is approximately of the same size. The contour of speaker 4 shows an intonational pattern which is completely opposite to the expectations: the rise on the non-associated adverbial is much greater than the rise on the subject. The contour resembles the one for condition ADV-subj.¹²

Finally, we computed mean contours for each condition, which are shown in fig. 3 – 6. The contour of speaker 3 in condition SUBJ-adv and the contour of speaker 4 in condition adv-SUBJ had to be excluded because of their fundamentally different shapes.¹³

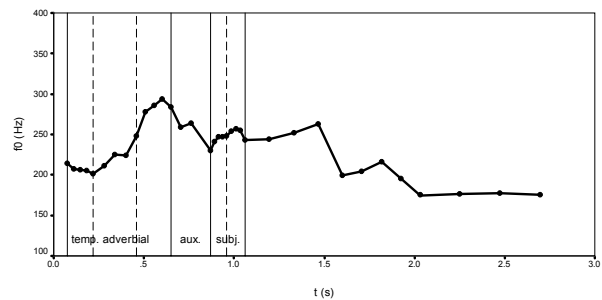
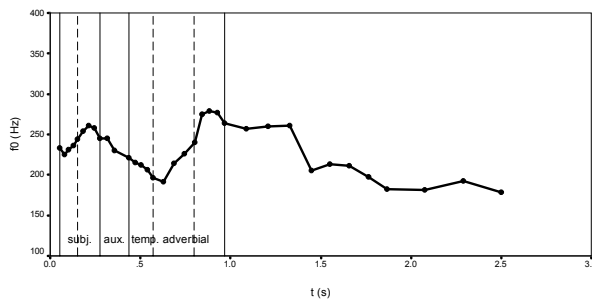


Fig. 3: Mean contour for condition subj-ADV Fig. 4: Mean contour for condition ADV-subj

¹² The perception experiment revealed that the respective utterances of speaker 4 are really interpreted as fitting the opposite context; see section 4.2.

¹³ Again, the decisive rationale was that it is not useful to compute the average of differently shaped contours.

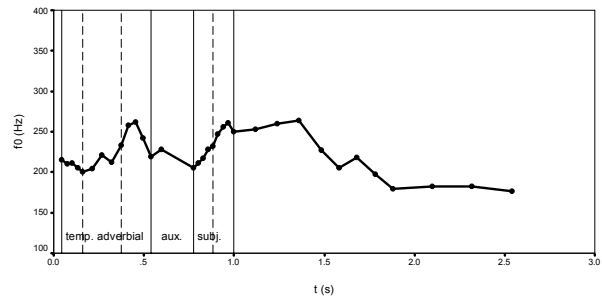
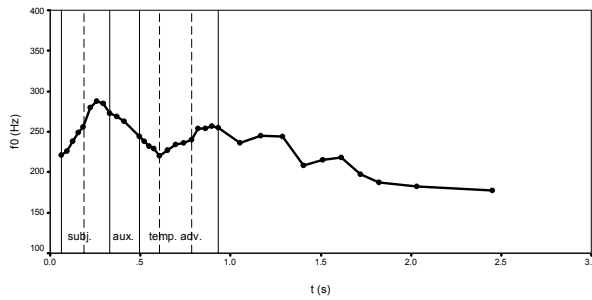


Fig. 5: Mean contour for condition SUBJ-adv Fig. 6: Mean contour for condition adv-SUBJ

The diagrams suggest that our expectations have been substantially fulfilled. Whereas the constituents associated with *auch* are marked by a clear rise, the non-associated constituents show a rather flat contour. Only in condition adv-SUBJ, the difference is not that obvious. The non-associated constituents generally show a greater f_0 -rise if they are positioned in the prefield,¹⁴ but only a minimal or no f_0 -rise at all if located in the middlefield.

The associated constituents in all conditions show an f_0 -rise with a peak delayed into the post-nuclear syllable, i.e. the typical contrastive accent L*H.¹⁵ The stressed particle carries the focus accent H*L, which becomes more salient through a directly preceding short f_0 -fall in all conditions. The remaining part of the contour is relatively flat. The majority of the examined utterances have an intonational pattern typical for bridge contours.

In order to statistically validate the results relevant for our hypotheses (H1) and (H2), we computed the exact f_0 -change (the difference between the f_0 -extremes) for both relevant constituents in all recorded utterances. 151 out of 160 f_0 -differences have a positive sign, i.e. even the non-associated constituents mostly show a (small) f_0 -rise. The 9 f_0 -differences with a negative sign indicating an f_0 -fall belong exclusively to non-associated constituents.

The statistic comparisons were made between associated and non-associated, but lexically identical constituents in identical positions; in other words, we compared the differences in the f_0 -progress (i) on the prefield subject between the conditions subj-ADV and SUBJ-adv, (ii) on the middlefield adverbial between the conditions subj-ADV and SUBJ-adv, (iii) on the prefield adverbial between the conditions ADV-subj and adv-SUBJ, and (iv) on the middlefield subject between the conditions ADV-subj and adv-SUBJ. No comparisons were made between lexically different constituents, different positions or different speakers because of the impossibility to control for various intervening factors (global f_0 -effects, the speakers' individual f_0 -range, effects imposed by the lexical material, etc.).

Table 1 shows the mean values of the f_0 -rise on the relevant constituents. The values correspond to our expectations and confirm the conclusions drawn from the superficial comparison of the mean contours: the f_0 -rise on a constituent associated with *auch* (left column) is greater than the f_0 -rise on the same but non-associated constituent (right column)

¹⁴ This is in line with the results of other studies, cf. Braun & Ladd (2003) who found a prenuclear rise on initial themes in German in both contrastive and non-contrastive conditions.

¹⁵ For the (G)ToBI notation see Ladd (1996) and Grice & Baumann (2002).

in a lexically identical sentence. The differences were shown to be significant for all comparisons by the non-parametric Wilcoxon test for paired samples.¹⁶

relative order of constituents	examined constituent	associated with <i>auch</i>		not associated with <i>auch</i>	
		condition	f ₀ -rise (Hz)	condition	f ₀ -rise (Hz)
subject – adverbial	prefield subject	SUBJ-adv	67	subj-ADV	49
	middlefield adverbial	subj-ADV	106	SUBJ-adv	38
adverbial – subject	prefield adverbial	ADV-subj	127	adv-SUBJ	89
	middlefield subject	adv-SUBJ	60	ADV-subj	23

Table 1: mean f₀-rise

It is somewhat surprising to find that in condition adv-SUBJ, the mean f₀-rise on the non-associated prefield adverbial (89 Hz) is greater than the mean rise on the associated middlefield subject (60 Hz). This can be partially attributed to speaker 4, who produced contours opposite to the expectations in this condition, but it is also obvious from the mean contour (fig. 6) that the other speakers produced less clear intonational patterns in this condition than in the other ones.

3.2.2 Duration

For the same reasons as in the case of fundamental frequency, again only the values of lexically identical constituents in identical positions were compared with respect to duration. Table 2 shows the mean values of the relevant constituents. As expected, the duration of constituents associated with *auch* (left column) is longer than the duration of the same but non-associated constituents in lexically identical sentences. The differences were again significant for all comparisons.¹⁷

relative order of constituents	examined constituent	associated with <i>auch</i>		not associated with <i>auch</i>	
		condition	duration (ms)	condition	duration (ms)
subject – adverbial	prefield subject	SUBJ-adv	276	subj-ADV	228
	middlefield adverbial	subj-ADV	535	SUBJ-adv	439
adverbial – subject	prefield adverbial	ADV-subj	589	adv-SUBJ	520
	middlefield subject	adv-SUBJ	236	ADV-subj	217

Table 2: mean duration

¹⁶ Wilcoxon-Test, $N = 20$: prefield subject, subj-ADV vs. SUBJ-adv: $W = 44.5$, $p < .05$ ($p = .012$); middlefield adverbial, subj-ADV vs. SUBJ-adv: $W = 3$, $p < .05$ ($p = .000$); prefield adverbial, ADV-subj vs. adv-SUBJ: $W = 18$, $p < .05$ ($p = .001$); middlefield subject, ADV-subj vs. adv-SUBJ: $W = 16$, $p < .05$ ($p = .001$)

¹⁷ Wilcoxon-Test, $N = 20$: prefield subject, subj-ADV vs. SUBJ-adv: $W = 26.5$, $p < .05$ ($p = .002$); middlefield adverbial, subj-ADV vs. SUBJ-adv: $W = 10$, $p < .05$ ($p = .000$); prefield adverbial, ADV-subj vs. adv-SUBJ: $W = 15$, $p < .05$ ($p = .001$); middlefield subject, ADV-subj vs. adv-SUBJ: $W = 55.5$, $p < .05$ ($p = .033$)

Significant differences could also be observed by comparing the duration of nuclear syllables only. This can serve as an additional argument for the claim that we are dealing with different accentual patterns, as the accentual differences are mostly carried by the stressed syllables (cf. Ladd (1996)).

3.3 Results

In the examined utterances, the constituents associated with stressed *auch* are marked by at least two prosodic parameters: they show a significantly greater f_0 -rise and a significantly longer duration than corresponding constituents which are not associated with the particle. The accent on the associated constituents has the shape of the contrastive accent L*H. The stressed particle itself carries the falling accent H*L. The realizations of the contours between the two accents differ within and across conditions: in some cases, the fundamental frequency remains at a high level, while in others, there is a short fall between the two accents. Both variants of bridge contours have been described for German (cf. Mehlhorn (2001)).

4 SPEECH PERCEPTION STUDY

The material from the production study served as input for an auditory perception study, which was supposed to show to what extent hearers use the encoded prosodic information for the disambiguation of the utterances. A related question is whether a potential preference for associating stressed *auch* with constituents in the prefield (or with subjects) can be neutralized by the given prosodic realization of an utterance.

The study was based on a completion task, in which the subjects had to choose between two possible continuations of each acoustically presented item. The choice of the continuation indicated which constituent the subjects interpreted as associated with *auch*.

4.1 Experimental design and hypotheses

First, the 80 recorded utterances were classified with respect to whether their f_0 -contours correspond to the expectations for the respective contexts. The criterion used was the difference between the f_0 -rise on the constituent associated with *auch* and the non-associated constituent. The classification resulted in 3 groups. 74% of the utterances have f_0 -contours expected for the given context, in which the rise on the associated constituent is greater than the rise on the non-associated constituent, with a difference of at least 25 Hz. 9% of the utterances have f_0 -contours expected for the opposite context, with the f_0 -rise on the non-associated constituent being greater than the f_0 -rise on the associated one (again with a difference of at least 25 Hz). In the remaining 17% of the utterances, the difference between the rise on the associated and the non-associated constituent is smaller than 25 Hz. We classified these as having ambiguous f_0 -contours.

24 subjects (native speakers of German, aged 19 – 28 years) took part in the experiment. After careful instructions and a short practice session, the subjects worked through a web-based presentation in a self-paced manner. All target items and 40 fillers were presented in a pseudo-randomised order and without context. The task was to listen to the utterance (repetition was possible) and select one of two possible continuations (their left-right order being randomised), cf. the example in (10).

(10) *via headphones:*

Ingo ist am Dienstag wahrscheinlich auch in der Bibliothek gewesen.

I. aux on Tuesday probably also in the library been

on the screen:

- | | |
|-------------------------------------|---------------------------------|
| □ ... und nicht nur am Donnerstag. | □ ... und nicht nur Claudia. |
| ... <i>and not only on Thursday</i> | ... <i>and not only Claudia</i> |

The following hypotheses were formulated, anticipating the decisive role of intonation for the interpretation:

(H3) The results of the decision task will reflect the classification of the items: items with expected f_0 -contours will be matched properly with respect to their original context, items with ‘opposite’ f_0 -contours will be mismatched, and items with ambiguous f_0 -contours will be matched and mismatched at chance level.

(H4) Utterances with expected f_0 -contours will be matched properly with respect to their original context regardless of the syntactic position (prefield vs. middlefield) and function (subject vs. adverbial) of the associated constituent.

4.2 Analysis and results

Altogether there were 73.5% matches and 26.5% mismatches among the 1920 decisions. With respect to the classification of the utterances according to their f_0 -contours, the percentages for each category differed across the four speakers, as shown in fig. 7. Therefore, we expected different results of the matching task for each speaker as well.

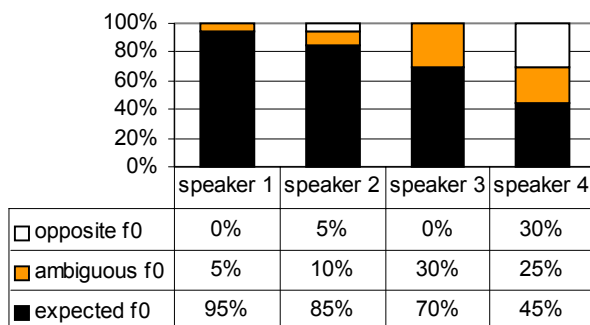


Fig. 7: Classification of utterances across speakers

Indeed, the matching percentages do differ across the individual speakers, as shown in fig. 8.¹⁸ Speaker 4, who produced the smallest number of utterances with f_0 -contours expected for the given contexts, also received the worst matching results:

¹⁸ The differences are statistically significant: χ^2 -Test, $\chi^2 = 100.67$, $df = 3$, $p < .05$ ($p = .000$)

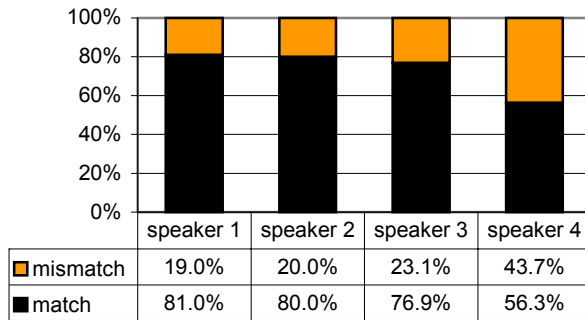


Fig. 8: Matching percentages across speakers

More importantly, the percentages of matches significantly¹⁹ differ across the three categories of utterances (cf. fig. 9), thus confirming our hypothesis (H3): the utterances with expected f_0 -contours show the best matching results, having been interpreted in accordance with their original context in more than 85% of the cases. The utterances having contours opposite to the expectations show the reverse pattern; their interpretation does not correspond to the reading induced by the original context in the majority of the cases. The items categorised as having ambiguous f_0 -contours have chance-level matching results.

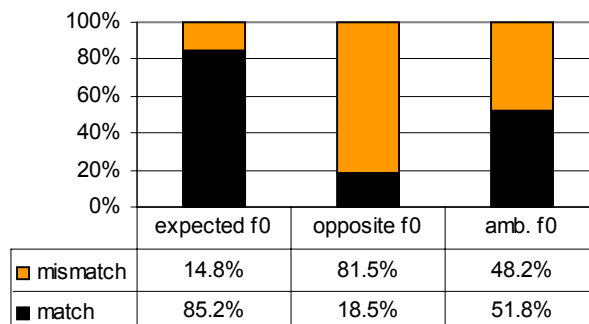


Fig. 9: Matching percentages across categories of utterances

As far as hypothesis (H4) is concerned, we compared the percentage of properly matched items across the four experimental conditions only for the utterances with expected f_0 -contours. The examination of the results of individual subjects did not reveal any special strategies with respect to the different conditions, so the results displayed in fig. 10 can be taken as being representative for the whole group of participants:

¹⁹ χ^2 -Test, $\chi^2 = 443.35$, $df = 2$, $p < .05$ ($p = .000$)

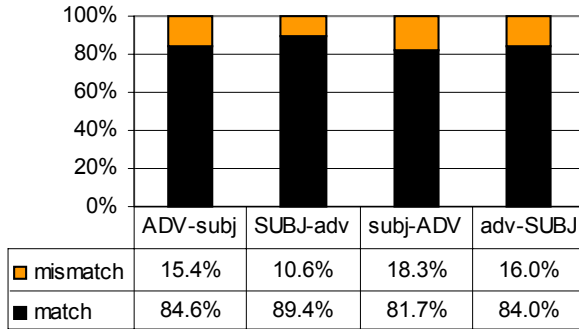


Fig. 10: Matching perc. of the utterances having expected f_0 -contours across conditions

Although the utterances of condition SUBJ-adv have slightly better results, all other conditions show matching percentages higher than 80%, which we take as a confirmation of our hypothesis: intonation plays a crucial role for the interpretation of the utterances and is able to override potential preferences for a syntactic position or function.

5 CONCLUSION

The results of both experiments confirm our hypothesis that prosodic marking of constituents associated with stressed *auch* plays a decisive role in both the production and the perception of potentially ambiguous sentences. In the production study, speakers disambiguated the constructions by a prosodic marking characteristic for I-topics in bridge contours. This contrastive-focus accent on the constituents associated with *auch* was used by the hearers in the perception study to interpret the utterances. In this respect, the prosodic properties of constituents associated with stressed *auch* concur with Krifka's (1999) account.

As indicated in section 2.2, the complementary distribution of stressed and unstressed *auch* can be analysed in the following way: both variants of the particle are base generated left-adjoined to the focus domain, i.e. as VP-adjuncts (cf. Büring & Hartmann (2001)). The associated constituent, corresponding to the sentential focus, can remain in the focus domain and carry the nuclear accent, or undergo movement out of the focus domain. In the latter case, it receives the syntactic (positional variability), semantic (presupposition of the existence of alternatives), and (optionally) the prosodic properties of an I-topic, whereas the focus particle itself has to carry the nuclear accent, as the remaining VP-constituents belong to the background. An illustration of this mechanism for one of our tested items is given in (11):²⁰

(11) Weißt du, wann Ingo letzte Woche in der Bibliothek war? Ich habe ihn nämlich nur am Donnerstag dort gesehen. (*Do you know when Ingo was in the library last week? I only saw him there on Thursday.*)

- a. [_{CP} Ingo_i ist_j [_{VP} wahrscheinlich [_{VP,+F} auch [_{VP} am DIENStag [_{VP} t_{i,-F} [_{PP,-F} in der Bibliothek] gewesen t_{j,-F}]]]]].
I. aux probably also on Tuesday in the library been

²⁰ We assume a structure of the German clause along the lines of Haider (1993), interpreting the V2-phenomenon as movement of the finite verb to C⁰ (cf. den Besten (1989)), with the *prefield* corresponding to [Spec,CP].

- b. [CP Am /DIENStag_k ist_j [VP Ingo_i [VP wahrscheinlich [VP,+F \AUCH [VP t_{k,+F} [VP t_{i,-F} [PP,-F in der Bibliothek] gewesen t_{j,-F}]]]]]]].
- c. [CP Ingo_i ist_j [VP am /DIENStag_k [VP wahrscheinlich [VP,+F \AUCH [VP t_{k,+F} [VP t_{i,-F} [PP,-F in der Bibliothek] gewesen t_{j,-F}]]]]]]].

(11a) shows the unstressed variant of *auch*, with the focussed constituent *am Dienstag* ('on Tuesday') remaining in the focus domain, which is delimited by the sentential adverb *wahrscheinlich* ('probably'). In (11b) and (11c), the focussed temporal adverbial has – as an I-topic – moved out of the focus domain to the prefield and middlefield, respectively. In these cases, the focus particle carries the nuclear accent and the [+F]-trace left within VP is used for the semantic interpretation of the I-topic. Depending on the position of the associated constituent, the background subject *Ingo* can be moved to the prefield, cf. (11a), or scrambled to the middlefield (i.e. adjoined above the sentential adverb), cf. (11b). Although the background PP *in der Bibliothek* ('in the library') has the same information-structural status as the subject, its only syntactic option is to stay within VP (see Haider & Rosengren (1998) and Fanselow (2003), among others, for the constraints on scrambling in German). Crucially, the difference between constructions with stressed and unstressed *auch* can be boiled down to their different information-structural properties, the former including an additional topicalization of the associated element.

From the experimental point of view, our pilot study was designed only to test the basic hypotheses. Their confirmation suggests that further experiments can be carried out with a more controlled material, so that the accents on the associated and non-associated constituents within each utterance can be directly compared (yielding more accurate results with respect to f_0 -movement, duration and peak alignment) and possible interactions between the variables *position* (prefield vs. middlefield), *association* with focus, and *type* of the associated constituent can be investigated. The results will also allow for a more elaborated design of the subsequent perception study. Moreover, we concentrated only on the aspect of obligatory prosodic marking in potentially ambiguous structures. Further research should investigate the prosodic patterns in non-ambiguous sentences like (2) in more detail and clarify whether and how the optionality in prosodic marking can be defined more explicitly.

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