German Sentence Accent Revisited[*]

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Results of a production experiment on the placement of sentence accent in German are reported. The hypothesis that German fulfills some of the most widely accepted rules of accent assignment—predicting focus domain integration—was only partly confirmed. Adjacency between argument and verb induces a single accent on the argument, as recognized in the literature, but interruption of this sequence by a modifier often induces remodeling of the accent pattern with a single accent on the modifier. The verb is rarely stressed. All models based on linear alignment or adjacency between elements belonging to a single accent domain fail to account for this result. A cyclic analysis of prosodic domain formation is proposed in an optimality-theoretic framework that can explain the accent pattern.

Keywords: Prosody, Syntax, Information structure

1 Introduction

As predicted by most models of sentence accent placement, all-new German VPs consisting of an argument and a verb often have their main accent on the argument. Sentences in which a modifier is inserted between the argument and the verb are also accented on the modifier in addition to having a prenuclear accent on the argument. The verb is rarely accented. Selkirk's (1995) theory accounts for this pattern since the pitch accent on the argument is allowed to project on the whole VP, even if the modifier intervenes between argument and

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verb, but Gussenhoven's Sentence Accent Assignment Rule (SAAR), or any other theory which claims that a focused (or new) adjunct can never project its accent—and most theories make this prediction—fail to explain this pattern. SAAR requires constituents to be adjacent in order to form a focus domain and all OT theories making use of Alignment constraints fall into this trap as well. A remedy could lie in a revision of the absolute prohibition of accent projection from an adjunct, or, alternatively, small focus domains (on the modifier) could be allowed to be embedded in larger ones (the VP) on a regular basis. To this aim, a cyclic account of prosodic domain formation is necessary. This paper first gives a review of past approaches to sentence accent (section 2). It then identifies the problem to be solved and presents the results of a production experiment (section 3). Finally, it gives a solution in terms of a cyclic OT analysis (section 4).

2   Background

2.1 Nuclear Stress Rule

From the 1960s on, German has played a prominent role in the discussion of sentence stress in a generative perspective, because, despite some similarities, stress location differs in crucial ways from English. The Nuclear Stress Rule (NSR), as formulated by Chomsky & Halle (1968), assigns main stress to the rightmost constituent (major-class word) in the sentence, on the basis of the surface linear ordering. This very simple principle accounts for most English utterances. In an optimality-theoretic model (OT, Prince & Smolensky 1993, McCarthy & Prince 1993a), the tendency can be formulated as a straightforward Alignment constraint (see McCarthy & Prince 1993b, Truckenbrodt 1999, and Samek-Lodovici 2004 for applications), requiring sentence stress to appear on the rightmost Prosodic Word, as in (1).

(1)   ALIGN-R (Intonation Phrase, main stress, Right)

        Main stress is on the last Prosodic Word of the Intonation Phrase.

German has two classes of sentences, those fulfilling the NSR and those violating it.[1] Krifka (1984) lists minimal pairs, illustrating both behaviors of sentence stress placement.

(2) a. NSR is fulfilled   b. NSR is violated
        Lena liegt auf dem SOFA.   Lena hat auf dem SOFA gelegen.
        Lena lies on the   sofa   Lena has on the   sofa   laid

        Ede fährt jeden Tag drei STUNDEN.   Ede ist nach FRANKFURT gefahren.
        Ede drives each day three hours   Ede is to Frankfurt driven

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[1] According to Kiparsky (1966:81ff) the German syntactic constructions really divide into two groups. One group of syntactic constructions (called Nom, D and Sentence) gets final stress, and the other group (called VP and S) is initially-stressed. Kiparsky's examples are reproduced here.

Kiparsky (1966)

	2	1	2	1	2	1
Nom:	die dicke	Emma,	Karl der	Große,	der Mann	aus Rio
	the fat	Emma,	Charlemagne,		the man	from Rio

		2		2		1		
D:	dass (ein	Schüler	jede	Woche	einen	Aufsatz)	schreiben	muss
	that (a	pupil	every	week	a	report)	write	must

	2		1		2	1
Sentence:	Waldemar	spielt	Theater;	die	Katze	lief weg
	Waldemar	plays	theater;	the	cat	ran away

		1	2
VP:	Er hat	(schimpfen	wollen)
	He has	(to curse	wanted)

		1	2
S:	Er wird	(Purzelbäume	schlagen)
	He will	somersaults	beat

     Es ist drei Gramm GOLD.   Es ist drei GRAMM schwer.
     It is three grams gold   It is three grams heavy

Align-R (and the NSR) makes the right predictions for the expressions in (2a), but for the examples in (2b), this constraint fails. The more complex behavior of German sentence stress as compared to English has been met in different ways by different authors. Beside Kiparsky's solution (see footnote 2), Bierwisch (1968) has proposed to assign sentence stress in German at a non-surface level. Before transformations, stress is rightmost, after transformations, it is not necessarily so any longer (see also Fanselow, this volume, for a movement-based analysis of stress in German).

The assumption that stress is assigned at a deeper representation in the grammar has also been defended by Bresnan (1971, 1972) for English to account for examples like those listed in (3) to (6), first discussed by Newman (1946). In the (a) version, stress is non-final, but in the (b) sentences, it is final.

(3)   a.   George has PLANS to leave.

      b.   George has plans to LEAVE.

(4)   a.   Helen left DIRECTIONS for George to follow.

      b.   Helen left directions for George to FOLLOW.

(5)   a.   Whose UMBRELLA have I taken?

      b.   Whose umbrella have I TAKEN?

(6)   a.   I asked what BOOKS Helen had written.

      b.   I asked what books Helen had WRITTEN.

In Bresnan's account, stress assignment in (3a) to (6a) fulfills the NSR, but only at deep structure, in which the capitalized constituents are final. After stress assignment has applied, equi-deletion applies in (3a) and (4a), and wh-

movement in (5a) and (6a), delivering a surface structure in which stress is somewhere else than the final position.

Numerous counterexamples, both to the NSR and to Bresnan's amendment, have been discussed in the literature (see for instance Berman & Szamosi 1972 and Gussenhoven 1992). Gussenhoven (1992) shows that an example like (7b) cannot be accounted for in Bresnan's framework. Before wh-movement, NSR assigns stress to *countries*, but *coffee* bears the nuclear accent on the surface.[2]

(7) a.   Coffee is grown in tropical countries.
     b.   In which countries is coffee grown?

Even if the NSR applies strictly at the surface, the accent pattern is still unaccounted for. It is not *grown* which is mainly stressed, though it should be if one takes the fact that it is the final major class word into account. Gussenhoven shows that both Chomsky & Halle's and Bresnan's analyses are based on the wrong premises, and proposes that accent placement is assigned non-cyclically and at least in part according to the predicate-argument structure of the sentence.

2.2   Argument-stressing (integration)

Schmerling (1976) observes that the predicate-argument-structure plays a crucial role, both in English and in German. The fact that the NSR applies more successfully in English than in German is explained by the more frequent occurrence of an argument in the sentence-final position in English. Because of the verb-final pattern of the German embedded clauses and the placement of

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[2]   Gussenhoven considers not only the nuclear stress (the sentence final one), but also the prefinal ones. He differs in that from Bresnan and many other researchers who assume that there is only one main accent in a sentence. In all accounts, however, main sentence accent is assimilated to the nuclear stress, which is the last pitch accent.

nonfinite verbs in final position in all clauses, arguments of verbs are often non-final in German and, since they are the depository of sentence accent, NSR is violated. In the first pair of sentences in (2), violation of the NSR correlates with the placement of the verb in the final position and with the simultaneous locations of the arguments in the preverbal position. As a further example, consider the sentences in (8). The first sentence, a V2 sentence, has a final argument, but the second sentence has a final participle, and two pre-verbal arguments (or a complex one if the whole journey is considered as one argument). The preverbal argument bears main sentence stress.

(8)   a.   Mein Flugzeug   hatte zwölf Stunden VERSPÄTUNG
           my   plane   had   twelve hours   delay

      b.   Ich bin nämlich gestern   von Berlin nach BEIJING   geflogen
           I   am namely yesterday from Berlin to   Beijing   flown

Krifka (1984), von Stechow & Uhmann (1986) and Cinque (1993) among others have formulated different versions of a rule assigning stress to the argument in a German predicate-argument structure. In terms of constraints, the accenting of an argument can be formulated as in (9), see also Büring (2001).

(9)   Stress-Argument

       In a predicate-argument structure, stress lies on the argument.

If an argument cannot be stressed—because it is a function word, because it is part of the background, or because there is no argument in the sentence—the location of the main stress is decided by ALIGN-R. Rightmost stress is thus not eliminated from the analysis, but is a case of Emergence of the Unmarked: everything else being equal, stress is on the rightmost constituent.

Many researchers after Schmerling have claimed that English also relies on the predicate-argument structure to assign sentence stress, much in the same way as German does. But because of the different linearization of the constituents, the predictions of the NSR and those of STRESS-ARGUMENT only rarely differ. We have seen Bresnan's examples in (3) to (6). Returning to Gussenhoven's counterexamples in (7), *coffee*, as an argument of the passive verb *grown* gets the main stress.

Another context which reveals the stable preference for argument stressing in English has been discussed by Selkirk (1995). Like many other researchers, she assimilates the focused part of a sentence to the answer to a preceding question, the remainder of the sentence being backgrounded. In many cases, part of a focused domain, for instance the rightmost constituent, can be deaccented as a consequence of being given, pre-mentioned or somehow salient in discourse or consciousness (see also section 2.4). Selkirk's example of such a case is reproduced in (10). According to her, since the question asks for the whole VP, it is this constituent which is focused. However, since *about bats* is given, it is deaccented. Notice that under "normal" circumstances (when the whole VP is new), *about bats* would get the sentence accent: it is the rightmost constituent, it is embedded deeper than *book* and it is part of an argument. As a result of the deaccenting of *bats*, the accent shifts on *book* (and not on the verb), but still remains on the argument of the verb.

(10)   (*about bats* is "given")
        What did they do?
        Mary [bought a [BOOK]F about bats]F

An important component of Selkirk's analysis concerns the assignment of F-marking (the subscripted F in (10)) and how it projects. The focus-marking

originating from the pitch accent on *book* can project on the whole verbal phrase, making the sentence a felicitous answer to the question. Notice that it does not say anything about the possible presence of additional accents in the VP domain. This is a crucial point to understanding our data, discussed in the next section. However, an accent on an adjunct or a modifier cannot project in this way, at least according to Selkirk's rules, reproduced here.

(11)   Basic Focus Rule (Selkirk 1995:555)
        An accented word is F-marked

(12)   Focus Projection
        (a) F-marking of the head of a phrase licenses the F-marking of the phrase

        (b) F-marking of an internal argument of a head of a phrase licenses the F-marking of the head.

In sum, Selkirk's projection rules have initiated a productive line of research: the conditions under which a non-normal accent can stand for a larger accent domain.

2.3   Projection and integration

What emerges from the discussion in the preceding sections is that accent domains and their heads are constructed according to certain rules and principles. One instantiation of such principles is Gussenhoven's (1983, 1992) Sentence Accent Assignment Rule (SAAR), formulated in (13) for English and Dutch, but also applicable to German.

(13)   Sentence Accent Assignment Rule (SAAR) (Gussenhoven 1992)
        If focused, every predicate, argument, and modifier must be accented, with the exception of a predicate that, discounting unfocused constituents, is adjacent to an argument.

This rule says that adjuncts make up their own focus domain, and that an argument-predicate-complex is integrated into one focus domain, in which the accent on the argument counts for the entire domain, at least when they are adjacent, or when only nonfocused material intervenes between them. In (14), stress on *Tangos* projects up to the entire VP (14a), but stress on *Finnland* does not (14b). *Tangos* is a complement of the predicate *komponieren*, but *Finnland* is an adjunct, which, crucially, cannot be interpreted as selected by the verb (see section 4 for discussion). If an argument and a predicate which would normally be integrated in one domain are separated by such an adjunct, they can each form a domain, as well as the adjunct. This is illustrated in (14c), where the domains are signaled with subscripted P (for Phonological Phrase). In our experiment, presented in section 3, we wanted to first test this prediction of SAAR for similar examples.

(14) a.   weil   Halina [$_P$ TANGOS komponiert]
            because Halina   tangos   composes

     b.   weil Halina [$_P$ in FINNLAND] [$_P$ KOMPONIERT]

     c.   weil Halina [$_P$ TANGOS][$_P$ in FINNLAND] [$_P$ KOMPONIERT]

     d.   weil Halina [$_P$ MEHRSTIMMIGE] Tangos komponiert

In its function as an indicator of new material, an accent can signal focus on more than just one word. Following Fuchs (1976), Jacobs (1993) and others, we use the term "integration" to denote the construction of accent domains (or Phonological Phrases). Crucial for Gussenhoven (and also for Selkirk) is the observation that stress on an attributive adjective or on an adjunct cannot project in this way. In (14d), stress on *mehrstimmige* 'polyphonic' only denotes a focus

domain on the adjective. The remaining constituents are backgrounded constituents.

The example in (15) shows that unfocused material between an argument and a predicate is invisible, and does not disrupt the formation of an accent domain in the same way as focused material does (compare (14d)). Our experiment also bears on this issue.

(15)   Warum will Malte in Finnland wohnen?
         why   wants Malte in Finland   live
         'Why does Malte want to live in Finland?'

         weil Halina [PhP TANGOS in Finnland komponiert]

In an OT model, accent domain formation can be expressed with the help of universal constraints, like those first proposed by McCarthy & Prince (1993b) and Truckenbrodt (1999) and adapted for German by Samek-Lodovici (2002).

(16) a.   ALIGN: The edge of a syntactic phrase falls together with the edge of an accent domain

     b.   WRAP: A syntactic domain has to be included entirely in an accent domain.

These constraints integrate a predicate and one of its arguments into a single accent domain, and assign separate accent domains on modifiers. Through the mentioning of syntactic constituents, they ensure that syntactic and prosodic constituents fall together by blocking the formation of accent domains not corresponding to syntactic constituents.

Projection (and integration) has been a productive way to investigate the placement of sentence accent, but it is doubtful that letting accents project in a

purely automatic way is the best conceivable approach to sentence stress assignment. In the following, we consider alternatives.

2.4   Givenness

Until now, the discussion has been centered on sentences uttered in a broad focused (or all-new) context, but, as was briefly mentioned in the preceding section, constituents can be salient in the context, or they may have been mentioned before. In the latter case, the question of projection and integration appears in a new light. Selkirk's sentence (10) shows that a constituent which would normally carry the main stress in an all-new sentence can be deaccented because of its given status. In this case, another constituent, argument or head, carries the stress instead, and the question arises as to what are the principles governing this new accent assignment. In Selkirk's account, only arguments and heads can carry such a default accent: adjuncts and non-heads (like adjectives) do not allow projection. In other words, an accent on an adjective or on any other non-head only signals a focus domain not larger than themselves. But what if there is no argument and no head after elimination of the given constituents?

Schwarzschild (1999) shows that, in this case, adjectives do project their accent, if the other constituents of the focus domain are given (see also Büring 2004). Schwarzschild's example, in (17), is comparable to (7), with the difference that the accented constituent is an adjective. Even if Schwarzschild considers only English, his examples are immediately applicable to German.

(17)   (John drove Mary's red convertible. What did he drive before that?)
         He drove [her [BLUE]_F convertible]_F. / Er fuhr [ihr [BLAUES]_F Cabrio]_F.

Crucial for the placement of the accent is of course the fact that both *Mary* and *convertible* have been mentioned in their respective thematic role in the question. Because of that, they are eliminated as candidates for accenting.

Schwarzschild provides a quasi-OT analysis of the sentence accent. In his model, the constraint Avoid F in (18), which avoids accents, is crucial. The other important constraint influencing accent placement is called GIVENness, and is formulated as in (19). This constraint interprets a constituent without F-marking. The effect of this constraint is that constituents which are not given (new, or whose role in the sentence is not entailed) have to be F-marked.

(18)   Avoid F

         F-mark as little as possible, without violating GIVENness.

(19)   GIVENNESS

         If a constituent is not F-marked, it must be given.

In Gussenhoven's account, by contrast, the given status of a constituent has a different effect on the accent structure of the other constituents. A modifier inserted between an argument and a predicate, if new, forces the forming of three accent domains: one on the argument, one on the adverb and one on the predicate. If the modifier is given, all three constituents are phrased together and only one phrase is constructed.

        This section has briefly reviewed different perspectives on the phonology of sentence accent placement regularities. All of them take the syntactic structure as input, as well as the status of the constituents as new or given. These approaches make some crucially different predictions about the prosodic pattern of a sentence consisting of an argument, a modifier and a verb, in this order. In order to check which approach makes the better assumptions, we conducted an experiment, described in the next section. We return to theoretical issues in section 4.

3   Experiment

3.1.1   Hypotheses

We developed an experiment to test some of the predictions of sentence stress placement rules. More specifically, we were interested in the way Gussenhoven's, Selkirk's and Schwarzschild's predictions are implemented in concrete accent patterns. The models presented in section 2 formulate precise hypotheses for the assignment of accents on some constituents as placeholders for larger domains. The hypotheses we wanted to verify were the following (a stands for argument, v for verb, m for modifier, a capital letter stands for a predicted pitch accent and brackets delimit phonological phrases)

Hypothesis 1: a verbal argument is assigned an accent when both the verb and the argument are under focus (new constituents). (Av)

Hypothesis 2: a new modifier is stressed and does not project its accent further, and as a consequence, when the verb is new, it also has to be stressed to signal its status as new. (A)(M)(V)

Hypothesis 3: when the modifier is given, it carries no stress and in this case, the accent of the argument projects up to the verb. (Amv)

We constructed sentences consisting of a verbal argument, an optional modifier and a verb (see an example in (21)). The sentences were inserted in three different contexts: two eliciting VP-focus (20a,b), and one in which the modifier was given (pre-mentioned in the question, (20c)). Context a was followed by a sentence consisting of an argument and a verb, whereas contexts b and c were followed by the same sentences plus a modifier, new or given respectively.

(20)   Robert ist auf dem Wannsee (mit seinem Katamaran) gesegelt.
         'Robert sailed on the Wannsee (with his catamaran).'

a.   All-new (no modifier): Robert ist doch ein richtiger Wassersportler. Was hat er diesen Sommer gemacht?
      'Robert is really keen on water sports. What did he do this summer?'

b.   All-new (with modifier): Robert ist ein echter Outdoorfan. Was hat er denn bei seinem letzten Trip gemacht?
      'Robert is a real fan of the outdoors. What did he do on his last trip?'

c.   Modifier given: Robert hat doch jetzt einen Katamaran gekauft. Wie hat er ihn denn eingeweiht?
      'Robert has now bought a catamaran. How did he christen it?'

Following Gussenhoven (1983, 1992), our examples were constructed in such a way that the modifiers could not be interpreted as selected by the verb, and, as a result, the word order in our sentences is rather marked. In the default word order, such adverbials are located before the argument. An example of the kind of sentences that we wanted to avoid is *seinen Regenschirm im Zug vergessen* 'forget one's umbrella on the train.' In such a construction, the underlined adjunct can be interpreted as selected by the verb, and, as a result, it is preferably located before the verb. In this way, it differs from our examples, since in our sentences, the adjunct would be preferably located before the argument. The marked, or scrambled, word order of our sentences is certainly componential in the explanation of our results, since scrambled constituents, as has been originally observed by von Stechow & Sternefeld (1988), are triggered by a marked information structure, and are thus prosodically marked, as well (see also Féry & Samek-Lodovici 2004 for this issue). We feel, however, that a syntactic explanation in terms of scrambling is not sufficient to explain the puzzle of sentence accent assignment and that a carefully conducted production experiments will ultimately help to elucidate the role played by the prosody.

3.2 Method

3.2.1 Experimental set-up

The context sentences were spoken by a trained speaker in a sound-proof booth and recorded on a Sony TCD-D100 DAT recorder. The speaker was instructed to speak naturally, in a normal tempo. There were 8 sentences, each of them with three contexts, thus 24 utterances altogether. The context sentences were digitized into individual sound files. The sentences consisted of 6 neutral expressions, and 2 idiomatic expressions[3] (see appendix).

A set-up was conceived in which the subjects were in a quiet room with a Power-Point presentation running on a computer. The experimenter gave brief initial instructions on beginning and ending the session. The subjects worked through the presentation in a self-paced manner. It led them through a set of carefully worded instructions, practice utterances, and finally the experiment itself. The instructions made it clear that the aim of the experiment was to elicit natural language. The experiment was under the subjects' control, who had to press the return key in order to start and continue the experiment. The contexts were presented both auditorily and visually. The subject heard and read first a context, and had to read aloud the sentence appearing on the screen, which was an adequate answer to the question they had just heard. After hitting the return key, a new stimulus appeared. The whole session was recorded on a DAT recorder.

The stimuli were presented in a randomized order and were interspaced with fillers from another experiment bearing on elicitation of natural language, but with a different pattern.

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[3] Idiomatic expressions are such that their meaning has been conventionalized and cannot be reconstructed—or only partly so—from the meaning of their parts.

3.2.2 Subjects

28 subjects took part in the experiment. They were native speakers of Standard German, students at the University of Potsdam, and had no known hearing or speech deficit. All were paid or acquired credit points for their participation in the experiment.

3.2.3 Analysis

Three people (the authors and a student assistant) listened carefully to the 672 sentences (24 sentences x 28 speakers) and established a list of accents. In most cases, all three judges agreed, but sometimes one of the judges had a different opinion from the other two. When this happened, the two authors listened together carefully to the controversial sentences, and could usually decide on the presence or absence of an accent rapidly, but in some other cases (about 50 sentences, or about 7%), we had to examine the pitch track of the sentences, using PRAAT (© Boersma & Weenik). Our criterion for pitch accent was an excursion on the lexical stress of at least 15 Hz for females and 20 Hz for males.

3.3 Results

1) First, the sentences consisting of an argument and a predicate (sentences a) have a single accent on the argument in the overwhelming majority (see Figure 1). Sometimes the verb is also accented (13%), but when the verb is stressed, the argument is stressed, as well. In other words, the argument is always stressed. (Only in a single utterance we had the impression that just the verb was stressed). For the a sentences, our hypothesis 1 (Av) is thus fully confirmed.

2) In the sentences in which the argument and the verb were separated by a modifier, the givenness status of the modifier plays a role. As can be seen from Figure 2, it was stressed in 91% of the sentences when new (b sentences) and only in 58% when given (c sentences).

In both cases, the argument was nearly always stressed (99% and 97%). The interesting and surprising result is the dimension of variation in the accentuation of the verb. Remember that our hypotheses 2) and 3) predict that the verb is stressed when the modifier is stressed (b sentences), and unstressed when the modifier is unstressed (c sentences). These hypotheses could not be confirmed. We found that the conditional probability for an accent on the verb, given an accent on the modifier (in the all-new context), is only 0.163, which is much lower than would be expected if hypothesis 2 were true. The probability of an accented verb, given no accent on the modifier, is relatively low (0.048), as predicted by hypothesis 3. However, a two-sample z test for proportions showed that the difference between these two conditional probabilities is not significant (z = 1.40, p = 0.162).
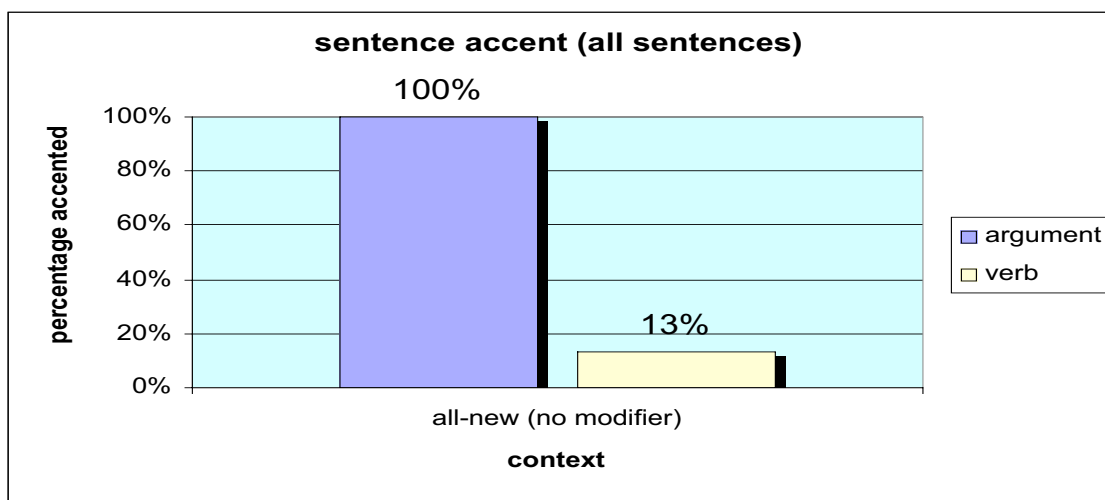

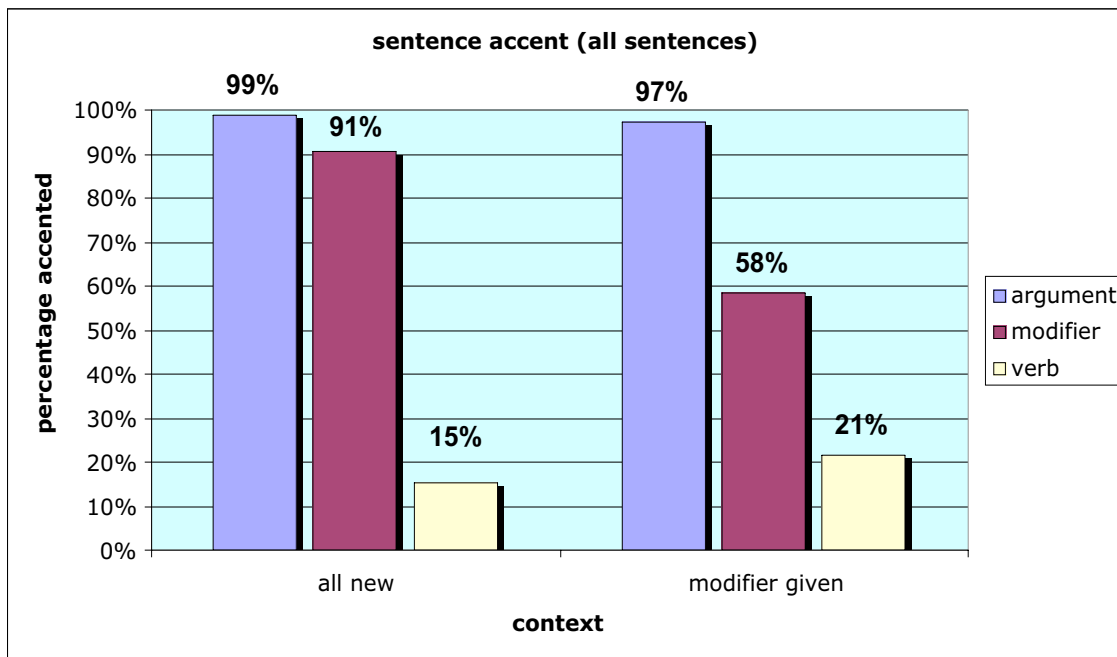
Figure 1

sentence accent (all sentences)

Figure 2

Overall, a new argument is nearly always stressed. When new, the modifier is also mostly stressed, and when given, less so, but still nearly 60% of the time. In sentences with an accented modifier, speakers have thus a tendency to form two accent domains, one on the argument, and one on the modifier plus verb.

The idiomatic and non-idiomatic sentences elicited different results and in the following, we consider them separately.

Non-idiomatic sentences

The non-idiomatic sentences show the effect just described even more clearly. Compare Figures 3 and 4 and Figures 1 and 2 respectively.
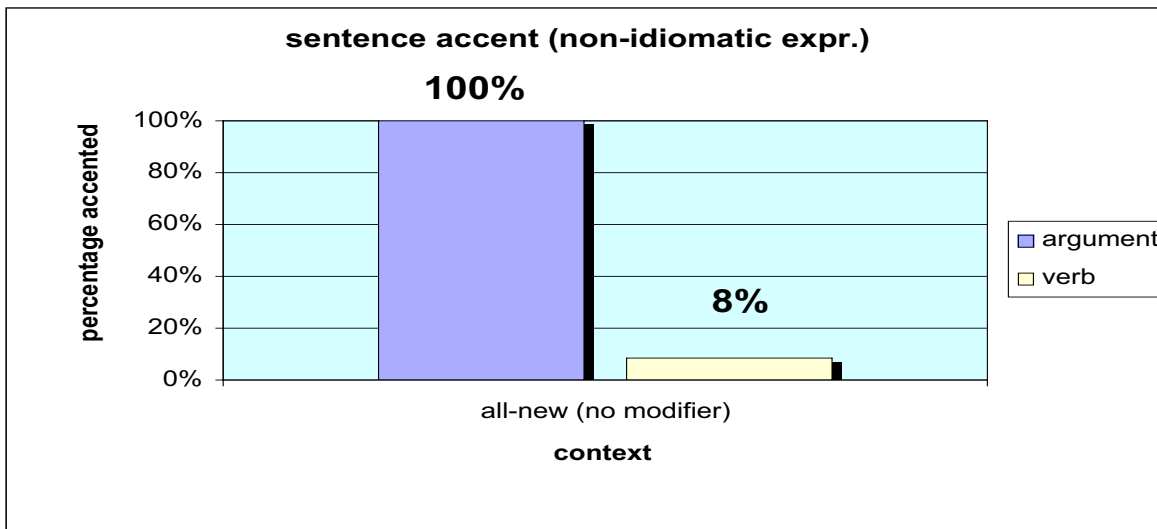
sentence accent (non-idiomatic expr.)

100%

8%

Figure 3

sentence accent (non-idiomatic expr.)
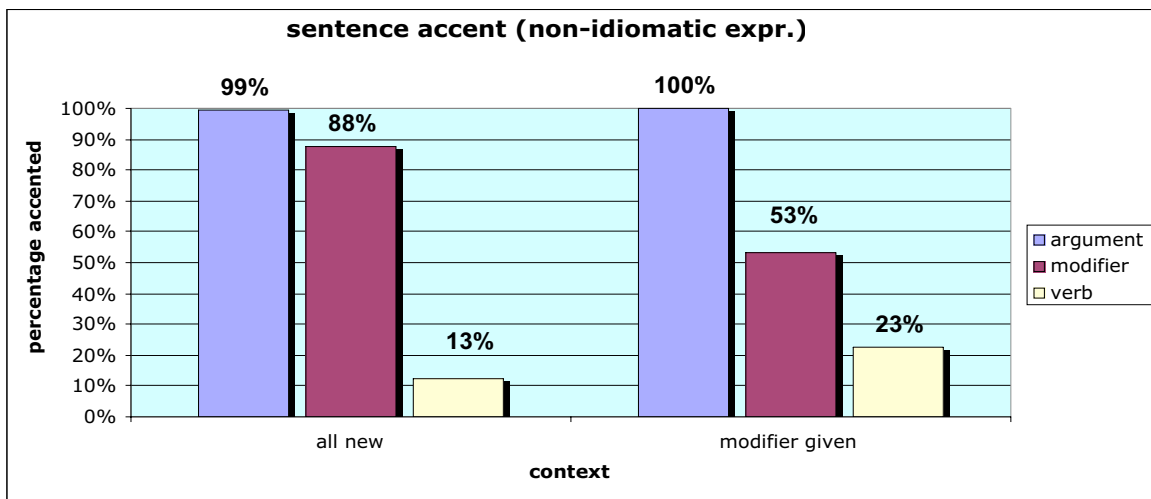
99% **88%** **100%**

53%

13% **23%**

Figure 4

The modifier is stressed in 88% of the cases when new, and 53% when given. The accent of the verb correlates more strongly with this distribution (13% vs. 23%) than in the general overview.[4] And of course, here too, the argument is nearly always stressed (99% and 100%).

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[4] Most cases of the AMV-pattern (accents on all three constituents) are due to one sentence (sentence 6): 13 out of 20 (for all-new context) and 13 out of 30 (for modifier given) contexts. The verb *schwärmen* 'be mad about' could be non-representative for a reason unknown to us.

Idiomatic sentences

In the idiomatic expressions, the pattern is slightly different. As for sentences with an argument and a verb only, Figures 3 and 5 show that the verb is stressed more than three times more in the idiomatic expressions than in the non-idiomatic ones (29% vs. 8%). This could reflect a property of the sentences chosen for the experiments, or, alternatively, it could also be a general fact about idiomatic vs. non-idiomatic expressions. The last possible explanation—and from an experimental methodology point of view also the most likely one—is to be found in the size of the small corpus used: only two sentences, which means that the result is accidental. More investigations are necessary to settle this issue. A last fact worth mentioning is that the modifier is nearly always stressed, more so when it is new (100%) than when given (75%).

All in all, the idiomatic expressions present a different pattern of stressing, in which the most obvious property is the presence of additional stresses as compared to the non-idiomatic expressions.
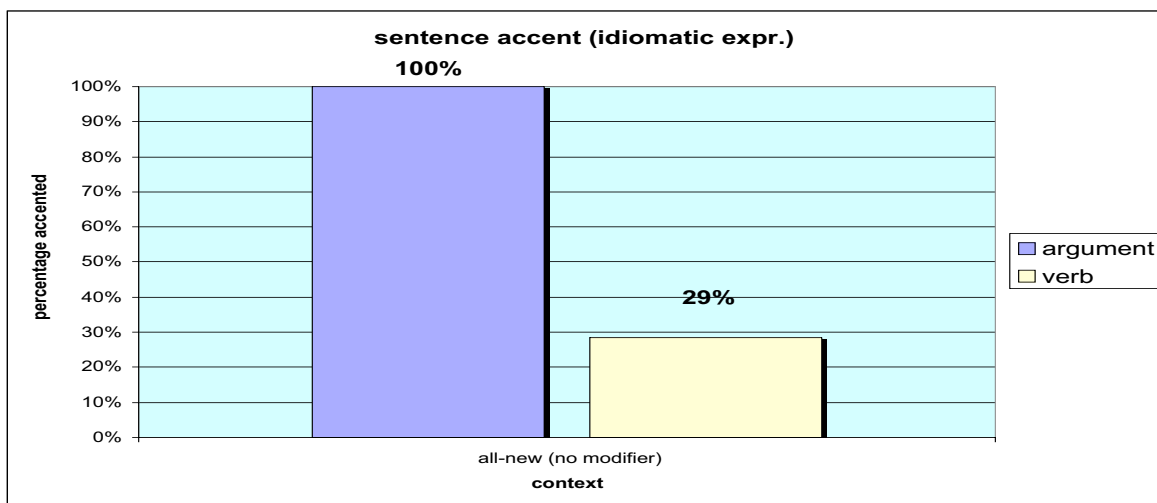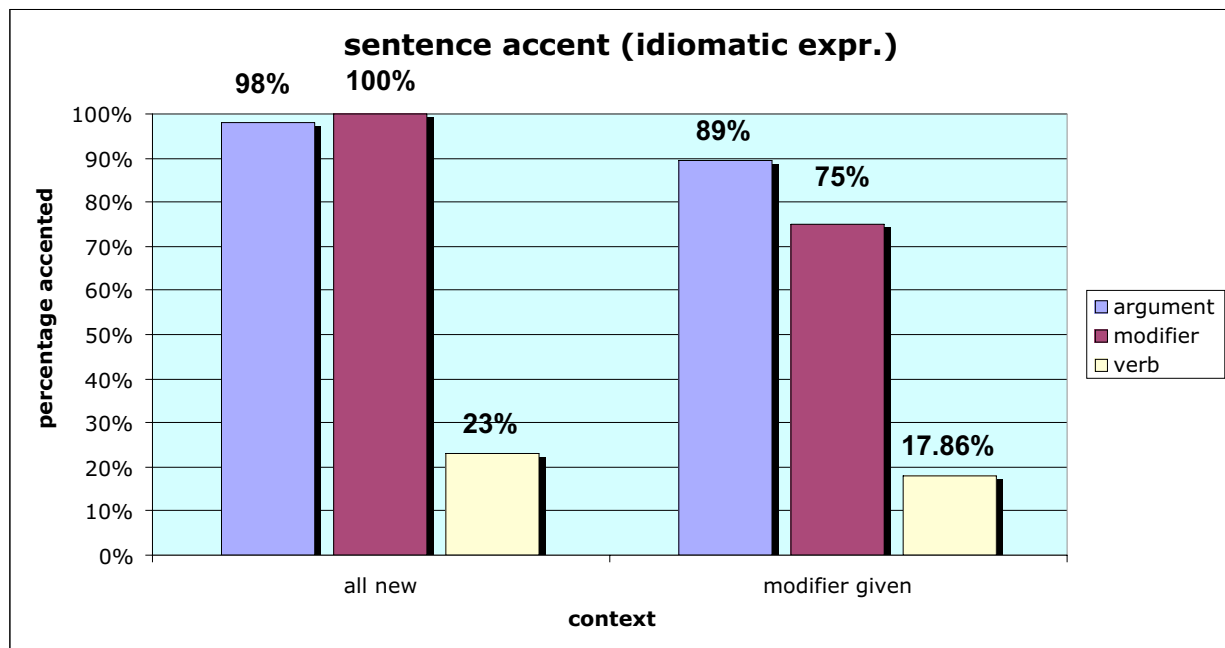

Figure 5

Figure 6

We performed a MANOVA analysis for all sentences, in which the accents on A, M and V were the dependent variables, and the factors were modifier status (new vs. given), and the style of the expressions (idiomatic vs. non-idiomatic).

The MANOVA revealed a significant effect for both modifier status (Wilks' λ = 0.312, $p < 0.001$) and style (Wilks' λ = 0.003, $p < 0.001$) in a by-subjects analysis, but only for modifier status in a by-items analysis (Wilks' λ = 0.306, $p = 0.006$), and not for style (Wilks' λ = 0.699, $p = 0.289$). However, this may be due to the small sample size, as there were only two idiomatic sentences.

In a subsequent ANOVA, the effect of modifier status on accent was found to be significant for the modifier ($F_1 (1,27) = 45$, $p = 0.000$, $F_2(1,12) = 6.787$, $p = 0.023$, $minF'(1,16) = 5.90$, $p = 0.028$), but not for the argument or verb.

4 Discussion

In terms of the hypotheses formulated in section 3.1, we can sum up our results as follows: (Av) has been experimentally confirmed, and (Amv) only partially. Since in the case of a new modifier, the modifier was tendentially accented, but not the verb, (A)(M)(V) has proven to make wrong predictions and should be replaced by a more adequate representation. A first possibility amounts to allowing a prosodic phrase corresponding to an adjunct to be embedded inside of a larger VP, thus (A(M)v). The accent on the argument could then project to the verb, even though projection takes place across a stressed adjunct. The second possibility projects the stress of an adjunct to an adjacent verb: (A)(Mv). In this configuration, the modifier and the verb are included into one accent domain. The pattern exemplified in (21) is relevant to help us to decide between these two options since it shows that when there is no object, the verb is accented, even though the adjunct is also accented: (M)(V).

(21)   Melina hat [auf der WANDERUNG GESUNGEN]_F (*Melina hat auf der WANDERUNG gesungen) 'During the walk, Melina sang an aria.'

In order to test this pattern, it is again necessary to carefully distinguish between modifiers which seem to be selected by the verb, as in *im Bett liegen* 'to lie in bed', *nach Berlin fahren* 'to go to Berlin', *wegen ihrer Freundin weinen* 'to cry because of one's friend', etc., which have an argumental character, and are readily forming one accent domain with the following verb, and those which are truly sentence modifiers, like *Hans hat auf der Reise geweint* 'Hans cried while on travel' as an answer in a context in which neither *auf der Reise* nor *weinen* are in the background, or *sie hat trotz ihres Unfalls geschlafen* 'she has slept in spite of her accident', in which somebody inquires about her welfare, etc. Only

the latter structures, in which modifier and verb cannot be understood as being included into one meaning unit, allow us to test the modifier-verb pattern.

The stress structure of (21) shows that (A)(Mv) is based on a wrong assumption: when both are in focus, projection from the modifier to the verb is not possible. As was shown in section 2, adjuncts are usually assumed to form their own accent domain, and are not supposed to project their accent to a larger constituent.[5] This is an important insight that we wish to implement into our model, but in an approach without cyclicity, it would have to be abandoned. The second problem related to (A)(Mv) is that it predicts that the prosodic structure can be non-isomorphic to the syntactic structure on a regular basis, an assumption that we do not want to have to defend. Therefore we do not pursue this alternative any further, and instead, explore the first option in some detail.

As mentioned in section 2, Selkirk's bottom-up model can account for the projection of an accented argument to a following verb across an accented modifier. In this respect, it differs from most current accounts of German sentence accent placement, which are based on the linear organization of constituents. In her model, phonetically realized pitch accents project to syntactic domains, and if a certain syntactic domain consists of more than one projecting constituent, its focusing can be obtained by several different accent patterns, depending, among other things, on the givenness of the constituents. In more conventional top-down approaches, it is the focusing of a syntactic domain that is decisive and which leads to a single accent pattern (Cinque 1993, Gussenhoven 1992, Büring 2004, etc.). Envisaged under another perspective, it is the direction of the mapping between accent and focus domain which is responsible for the possible projection of an accent across another accent:

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[5]   In section 2.4, it was shown that Schwarzschild (1999) and Büring (2004) discuss apparent exceptions. Their examples involve givenness of all alternative bearers of pitch accents and are thus irrelevant for the present discussion.

climbing the tree upwards incidentally permits two or more accent patterns to elicit the same focus domain, whereas descending the tree, only one accent pattern for a single focus structure is ever possible. In sum, Selkirk's model is definitely more indeterminate, as far as sentence accent placement is concerned. This is, on the one hand, a desirable consequence, since it readily accounts for (A(M)v). The accent on the modifier projects no further than to the whole adverbial and the accent on the argument singles out the VP as the focus domain. On the other hand, however, Selkirk's approach also allows an additional accent on the verb, or on another argument, when one is present and, as a result, it is too unconstrained. For this reason, we turn instead to alternatives.

In the remainder of this section, we develop the main lines of an optimality-theoretic account of sentence accent placement. The point of departure of our analysis is that the presence of a modifier between an argument and a verb has no effect on the accent structure of (Av). Recall that Figures 1 and 2 delivered exactly this result: the argument is stressed, but the verb is not, and this regardless of an interfering stressed modifier.

In an OT model, the constraints AVOIDF and GIVENness (Schwarzschild 1999) restrict the number of accents: there is only one accent per domain, and backgrounded constituents may not be accented (22a-b). GIVENness must be ranked very high, but AVOIDF must be in a position in the hierarchy where it can be violated. STRESS-ARGUMENT (see Büring 2001) imposes a stress on the argument. This constraint is higher-ranked than ALIGN-STRESS-R which assigns an accent to the rightmost constituent (22c-d). Finally, the role of WRAP (Truckenbrodt 1999) is to make sure that a syntactic phrase is included as a

whole in a prosodic phrase (22e),[6] and HEAD takes care of the association between a prosodic domain and a head. There must be at least one head in a prosodic domain (22f).[7] In the tableaux shown below, GIVENness does not play any role. ALIGN-STRESS-R has to be lower-ranked than STRESS-ARGUMENT, because, otherwise, candidate b. would win in Tableau 1.

(22) OT constraints

    a.   AVOIDF: Avoid accents.

    b.   GIVENness: Given constituents are not accented.

    c.   STRESS-ARGUMENT: An argument is accented.

    d.   ALIGN-STRESS-R: The rightmost constituent of a phrase is accented.

    e.   WRAP: A syntactic phrase is included in a phonological phrase.

    f.   HEAD: A prosodic constituent has a head.

Tableau 1 shows that the constraints introduced in (22) account straightforwardly for a syntactic domain involving an argument and a verb. Candidate a which violates only AVOIDF and ALIGN-STRESS-R, is optimal because all other competitors violate higher-ranking constraints. Candidate C. also violates AVOIDF, but once more than candidate a.

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[6] In this paper, we do not discuss the prosodic structure in any detail. Higher prosodic domains may be the result of recursive phonological phrases, or preferably, just higher phrases, like Intonation Phrases.

[7] For our tableaux, we choose WRAP as the constraint responsible for the creation of prosodic phrases, but our data are compatible with an edge-based model, in which the right edge of a maximal projection falls together with the right edge of a maximal projection (McCarthy & Prince 1993b).

Tableau 1. Argument-Verb (*Melina hat* [*eine ARIE gesungen*])

[av]$_F$	HEAD	WRAP	STRESSARG	AVOIDF	ALIGN-STRESS-R
☞ a. (Av)				*	*
b. (aV)			*!	*	
c. (AV)				**!	
d. (av)	*!		*		*
e. (A) (V)		*!	*		*

A structure in which the adjunct is located between the argument and the verb is more problematic. As it is formulated, WRAP prefers a single accent on the whole VP, since, at least on the surface, the VP includes all relevant constituents, thus (Amv), but, as we saw above, (AMv) with two accents is preferred by the speakers. An OT analysis based on ALIGN-XP cannot account for the required AMv pattern, because a high-ranking ALIGN constraint would assign an additional stress to the verb: The maximal projection of the modifier is aligned to its right edge with a prosodic phrase, and, as a result, the verb has to be phrased alone, and has a head. To counter this problem, induced by the presence of an interfering modifier, we propose that the optimality-theoretic model allows a cyclic derivation. The most deeply embedded maximal projections are subject to a first cycle, as illustrated in Tableau 2 for the modifier. Cyclic OT has already been introduced in different guises (see for instance Heck & Müller 2000 for a fully-fledged proposal of successive wh-movement in terms of cyclic OT) though we are not aware of such a proposal accounting for sentence accent.

Tableau 2: Modifier ([*auf der WANDERUNG*])

[m]$_F$	HEAD	WRAP	STRESSARG	AVOIDF
☞ a. (M)				*
b. m	*!	*		

At the next cycle, complex projections like the kind of VPs considered in this paper, are computed, but at this level, the adjunct is inserted into the input with its prosodic pattern, as the output of the lower cycle. The pattern (av) is thus a prosodic domain, independent of the presence of an adjunct, as observed in our data. Tableau 3 subsumes both Tableau 1 and Tableau 2 into one, in which M is one domain and (av) another one. Our model allows A to be computed at the lower level, as well, and to enter the higher cycle with its own accent. Merging the verb with its argument could result in a pattern in which the already present accent on the argument is sufficient for the argument-verb complex. As shown in Tableau 3, both the option of computing first the accent of the argument, as well as letting the argument and the verb enter the competition without any previous accent structure would deliver the same accent pattern, and it is thus not possible to decide between the two options. The only difference is that assigning an accent on A on a previous cycle results in a more elaborate prosodic structure. This is shown in Tableau 3 only for candidate a.

Tableau 3: Argument-Modifier-Verb (Melina hat [eine ARIE ([auf der WANDERUNG]) gesungen])

[a(M)v]$_F$ [(A)(M)v]$_F$	HEAD	WRAP	STRESSARG	AVOIDF
☞ a. (A(M)v) ((A)(M)v)				**
b. (a(M)V)			*!	**
c. (A(M)V)				***!
d. (a(M)v)	*!		*	*

5 Conclusion

In this paper, we have shown that one of the assumptions made by standard theories of sentence accent assignment in German which rests on strict linear adjacency between the constituents is not supported experimentally, while others are confirmed. More specifically, we have shown that in sentences consisting of a 'new' argument and a 'new' verb, the sentence accent goes to the argument, as predicted by these theories. The same pattern is also valid when a modifier intervenes between the argument and the verb, regardless of the accentuation of the modifier (the modifier is stressed when new and unstressed when given). This is unexpected under the assumption, mentioned explicitly by Gussenhoven's SAAR, but also present in other models, that a new phrase is created on the verb as soon as the modifier is wrapped in its own, non-projecting phrase.

In order to account for this accent pattern, we have proposed an optimality-theoretic model of German sentence stress assignment that is allowed to apply cyclically. Alternatively, a minimalist model of the prosody-syntax interactions, such as has been proposed by Wagner (2004) for German and by

Ishihara (2003) for Japanese, could turn out to make the best predictions for German. In a first step, the most deeply embedded syntactic projections create accent domains, and in a next step, higher projections are taken into account. These higher projections can then properly contain the accent domains created by the deeper projections. Further investigations will confirm or reject this view of accent domains formation.

Appendix

The question a. elicits an av sentence, where a = Argument and v = Verb, b. elicits amv with m as a new modifier, and c. amv with a given modifier.

1. Julia ist nach Berlin (mit ihrem Freund) gefahren.
   'Julia went to Berlin (with her boyfriend).'

   a/b. An Wochenenden macht Julia gerne Städtereisen. Was hat sie gestern gemacht?
   'On weekends, Julia enjoys going on city outings. What did she do yesterday?'
   c. Julia unternimmt ja immer viel mit ihrem Freund. Was hat sie dieses Wochenende gemacht?
   'Julia always does a lot with her boyfriend. What did she do this weekend?'

2. Robert ist auf dem Wannsee (mit seinem Katamaran) gesegelt.
   'Robert sailed on the Wannsee (with his catamaran).'

   a. Robert ist doch ein richtiger Wassersportler. Was hat er diesen Sommer gemacht?
   'Robert is really keen on water sports. What did he do this summer?'
   b. Robert ist ein echter Outdoorfan. Was hat er denn bei seinem letzten Trip gemacht?
   'Robert is a real fan of the outdoors. What did he do on his last trip?'
   c. Robert hat doch jetzt einen Katamaran gekauft. Wie hat er ihn denn eingeweiht?
   'Robert has now bought a catamaran. How did he christen it?'

3. Lisa hat eine Sonne (in ihrem Baumhaus) gemalt.
   'Lisa painted a sun (in her tree house).'

   a/b. Lisa ist so ein kreatives Kind. Was ist ihr denn heute eingefallen?
   'Lisa is such a creative child. What did she do today?'
   c. In ihrem Baumhaus macht Lisa immer schöne Dinge für uns. Was ist ihr denn heute eingefallen?
   In her tree house, Lisa always makes nice things for us. What did she do today?

4. Melina hat eine Arie (auf der Wanderung) gesungen.
   '(During the walk), Melina sang an aria.'

a/b. Melina ist ein echter Entertainer. Womit hat sie Euch denn diesmal unterhalten?
   'Melina is a real entertainer! How did she entertain you this time?'

c. Ich habe gehört, ihr hattet viel Spaß auf der Wanderung mit Melina. Was hat sie denn gemacht?
   'I've heard you had a lot of fun on the walk with Melina. What did she do?'

5   Laura hat bei einer Operation (in der Notaufnahme) zugeschaut.
      'Laura watched an operation (in the emergency room).'

a/b. Laura macht doch gerade ihr freiwilliges soziales Jahr. Was hat sie denn gestern so im Krankenhaus erlebt?
   'Laura is doing her voluntary year of social service at the moment. What did she see in the hospital yesterday?'

c. Laura macht bei ihrem Krankenhauspraktikum gerade Station in der Notaufnahme. Was hat sie gestern erlebt?
   'At the moment Laura is working in the emergency room as part of her internship at the hospital. What did she see yesterday?'

6   Daniel hat von seiner Heirat (voller Freude) geschwärmt.
      'Daniel went on (excitedly) about his wedding.'

a/b. Du hast doch Daniel gestern getroffen. Was hatte er denn zu berichten?
   'You met Daniel yesterday. What did he have to tell you?'

c. Als Du gestern mit Daniel telefoniert hast, klang er so voller Freude. Was hat er denn erzählt?
   'When you were talking to Daniel on the phone yesterday, he sounded so happy. What did he tell you?'

7   Jana hat den Braten (beim Meeting) gerochen.
      'Jana smelled a rat (at the meeting).'

a/b. Jana war gestern Nachmittag so unfreundlich zu den Kollegen. Was ist denn passiert?
   'Yesterday afternoon, Jana was so unfriendly towards her colleagues. What was the matter?'

c. Jana ist seit dem gestrigen Meeting so schlecht gelaunt. Was ist denn passiert?
   Since yesterday's meeting, Jana is so ill-tempered. What was the matter?

8   Der Millionär hat den Löffel (zum falschen Zeitpunkt) abgegeben.
      'The millionaire kicked the bucket (at the wrong time).'

a/b. Die junge Blondine hat sich mit dem alten Millionär wohl verrechnet. Letzte Woche ist es passiert:
   'The young blonde was mistaken about the old millionaire. It happened last week:'

c. Manche Dinge passieren einfach zum falschen Zeitpunkt. Letzte Woche ist es passiert:
   'Some things just happen at the wrong time. It happened last week:'

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