THE EFFECT OF VERBS ON THE PROSODIC MARKING OF INFORMATION STATUS: PRODUCTION AND PERCEPTION IN GERMAN

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ABSTRACT

The aim of the present paper is to investigate the encoding and decoding of informativeness of verbs in German. Pairs of target verbs and nouns were either semantically unrelated (i.e. new) or related to each other in different ways. In a production study using read speech, these differences in semantic relatedness were found to be expressed in the prosodic realisation of the target words, nuclear accents being more frequent on less related targets. This preference was reflected in appropriateness ratings in a follow-up perception study that controlled for nuclear accent placement. These results provide evidence for the informativeness of verbs and their relevance for the prosody of information packaging.

Keywords: information status, activation, non-/referring expressions, prosody, nuclear accent

1. INTRODUCTION

In intonation languages like German the marking of information status is an important linguistic function of prosody. Information that is 'informative' is usually expressed in relation to information that is already 'known' by the interlocutors (cf. [5]). There is a crucial distinction between information about states and events on the one hand, and information about referents or referring expressions on the other. A possible reason for this distinction might be the transitory nature of states and events in a person's active consciousness, since they are constantly replaced by other states and events. Referents, by contrast, remain active for a longer period and serve as anchor points for new information over a larger stretch of discourse (cf. [8]).

Our notion of information status/givenness is based on a (cognitive) activation cost approach as proposed by Chafe [7], [8] and Lambrecht [16]. They define givenness as the degree of activation of a proposition or a referent that the speaker assumes to be in the listener's consciousness at the time of utterance. This means, a referent that is stored in the listener's long-term memory is considered activated, or given, only if it is activated in the listener's consciousness by the discourse context. In addition to *given* (active) and *new* (inactive) information Chafe and Lambrecht propose an intermediate level of cognitive activation that can be referred to as *accessible* (semi-active) information. This concept of givenness also implies 'activation cost' (e.g. expressed by prosodic means), relating to the effort a speaker has to make in order to transfer an idea from a previous (less active) state into an active state: the lower the activation of an item, the higher the cost, assuming a potentially continuous scale of cognitive activation.

Recent annotation schemes are able to capture fine-grained differences in an item's information status (e.g. different types of accessible information). They tend to concentrate on the information status of noun phrases (NPs), denoting relations between two referring expressions (usually argument categories like NPs/DPs, PPs and pronouns). Some systems (e.g. by [18], [12], [3], [4]) also include verbs and verb phrases (VPs) as a possible source of a referent's accessibility. For instance in the sentence *We were travelling around Yucatan, and the bus was really full.* the NP *the bus* could be linked back to the previously mentioned VP *travelling around Yucatan* (cf. [18]). However, due to their non-referential character, verbs are usually not assigned an information status themselves.

With regard to prosody, differences in reference relations between NPs have been shown to be marked by nuclear pitch accent placement (e.g. [1], [23], [10], [4]) and/or pitch accent type (e.g. [19], [15], [2], [9], [22], [20], [21]): The less activated or given the referent, the higher the prosodic prominence produced (e.g. [14]). The role of verbs in the prosodic marking of information status has not been investigated so far.

The present paper examines the effect of different semantic relations between verbs and nouns within the same discourse on their prosodic realisation. In a production experiment and a follow-up perception experiment on read German we investigate two types of reference relations - **(a)** nouns that can be linked back to a preceding verb (verb ← **NOUN**) and **(b)** verbs that can be linked back to a preceding noun (noun ← **VERB**). For both reference types we distinguish five types of information status by using different verb-noun

pairs. We assume that the level of activation or givenness of a target verb/noun differs in relation to its semantic relation to a preceding element. In turn, we expect this difference to be reflected in the prosodic marking of the target element, in particular in terms of nuclear accent placement. By the same token, we assume that the listener is able to interpret an element's information status by means of its degree of prosodic prominence.

2. PRODUCTION EXPERIMENT

In a carefully controlled reading experiment we embedded the investigated verb-noun pairs (see Table 1) in constructed mini dialogues, presenting them in consecutive sentences in both orders.

Three transitive active verbs denoting an event of intentionally creating an element serve as targets. For each of these we chose three nouns that differ in their semantic relation to the verb. The corresponding nouns either denote an *instrument* for creating a related element or the created element itself, namely the *result* (semantic relations based on [11]). The noun denoting the result is either morphologically unrelated to the verb or displays the same word stem (labelled *result-stem*).

Table 1: Target verbs and nouns.

VERBS	NOUNS		
intentionally create sth.	**instrument**	created entity	
		result	**result-stem**
backen to bake	*Rezepte* recipes	*Kuchen* cakes	*Gebäck* pastries
fotografieren to photograph	*Kameras* cameras	*Bilder* pictures	*Fotografien* photographs
malen to paint	*Farben* paints	*Kunstwerke* artworks	*Gemälde* paintings

The structure of the mini dialogues is simple and kept constant for all semantic conditions (see Table 2). The mini dialogues consist of three sentences, with the target sentence last. Target sentences are embedded clauses consisting of a pronominal subject, a verb, the adverb *gerne* and a definite noun as direct object. We used two syntactic constructions to test the target elements in medial and final sentence position (1).

(1) *Ich habe gehört,*
a.   ***sie   verkaufen   gerne   die Bilder****.*
           subject verb   adverb   object

b. ***dass   sie   gerne   die Bilder   verkaufen****.*
       compl. subject adverb   object   verb

The first sentence of a dialogue provides a thematic frame and contains the element to which the target element can be linked back to. The second sentence

is a simple question eliciting a broad focus structure over the following target sentence.

Table 2: Sample mini dialogues in English translation (close to the German version) for target elements of the result condition.

(a) NOUN	A:	At the beginning of the annual charity event the students frequently <u>photograph</u> the guests.
	B:	And then?
	A:	I've heard **they like to sell the <u>pictures</u>**.
(b) VERB	A:	Besides studying the students frequently sell <u>pictures</u> of miniature buildings.
	B:	Why?
	A:	I've heard **they like to <u>photograph </u>the buildings**.

While the information status of the target element varies in the target sentences with respect to the preceding text, the subject is always given and the adverb is (at least lexically) new. In target sentences with the noun as the target element (reference type (a)), the verb can also be classified as new. In target sentences with the verb as the target element (reference type (b)), the noun is given due to previous mention. If the noun was *not* given it would always attract the nuclear accent since discourse-new arguments are structurally stronger than their predicates in German (cf. [6]).

For the information status of the target elements we distinguish between three different types of accessible/given information corresponding to the different semantic relations between the verb-noun pairs: *instrument*, *result* and *result-stem*. A further condition involves *new* information, i.e. verbs and (*result*) nouns that are not derivable from the previous text, distinguishing between target sentences with definite and indefinite nouns. Indefinite nouns are said to have a generic character and can therefore be interpreted as being less specific than definite nouns.

The following list of the investigated types of information status/semantic relations reflects the assumed degree of activation of our target elements (arrows indicate the type of reference relation):

- **new (indefinite object)**:
  (a) Ø (no antecedent) ← *Fotografien,*
  (b) Ø ← *fotografieren (Bauwerke)*
- **new (definite object)**:
  (a) Ø ← *die Fotografien,*
  (b) Ø ← *fotografieren (die Bauwerke)*
- **instrument**: *fotografieren ↔ die Kameras*
- **result**:   *fotografieren ↔ die Bilder*
- **result-stem**: *fotografieren ↔ die Fotografien*

From *result-stem* to *result* through *instrument* to *new (definite object)* and *new (indefinite object)* the target element is assumed to be less given or activated. Based on this assumption we hypothesize that the decrease in the level of activation involves an increase in activation costs for the target elements. That is, we expect the nuclear accent to be placed increasingly often on the target element the less given it is.
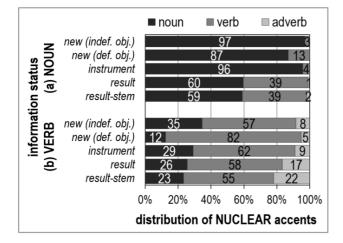
2.1. Subjects and analysis

Ten female and four male native speakers of Standard German aged between 18 and 39 years (mean = 25.8, SD = 5.1) read out the material (twice in pseudo-randomized order) in a contextually appropriate manner. A total of 120 target sentences per speaker entered into the analysis. We analyzed the accent placement (nuclear accent, prenuclear accent, no accent) and the realized accent types according to GToBI [13] on the **noun**, **verb** and **adverb** of the target sentences.

2.2. Results

A descriptive analysis of the prosodic marking of the target sentences showed an effect of the examined semantic relations on nuclear accent placement.

Figure 1: Relative distribution of nuclear accents (x-axis) on the noun, the verb and the adverb of the target sentences ordered according to the assumed level of givenness of the target elements (y-axis). All sentence types, context types and subjects are pooled (n = 168) for each information status.

Results for nuclear accent placement as a function of the *noun's* level of givenness (see Figure 1(a)) show that in the two *new* conditions as well as in the *instrument* condition the noun is almost always marked by the nuclear accent. This distribution changes clearly with a higher level of givenness of the noun: When the nouns denote a *result* of the preceding verb the nuclear accent is placed more often (about 40%) on the verb instead of on the noun.

Results for nuclear accent placement as a function of the *verb's* level of givenness (see Figure 1(b)) are less distinct, but show clear tendencies. With increasing givenness of the verb, the more often the nuclear accent is placed on the least given element in the sentence, the adverb. Furthermore, indefinite/generic nouns turned out to be stronger attractors for the nuclear accent compared to definite nouns (see *new* conditions).

The distribution of accent *types* did not show an effect of information status, but did show speaker-specific preferences. Speakers generally use high and rising pitch accents more often than falling pitch accents, whereby falling pitch accent types are more common in final sentence position.

3. PERCEPTION EXPERIMENT

In order to verify the results of the production study from the listener's perspective we conducted a follow-up perception experiment using a web-based appropriateness rating task implemented with the 'SoSci Survey' software [17].

We tested three variants of each target sentence from the production study, with the nuclear accent on either the noun, the verb or the adverb (90 stimuli per reference type). In order to keep the overall prosodic variation of the target sentences to a minimum we chose target sentences with the nucleus as the only accent in the phrase, which is realized as a high or rising pitch accent.

The task was to evaluate how well the melody of a target sentence matches the corresponding context (see production study). Subjects were told to give their judgements by placing a roll bar on a continuous horizontal line (visual analogue scale) with the left pole labelled 'not at all' and the right pole labelled 'very well'. The responses are encoded as interval data ranging from 1 (left pole) to 100 (right pole). Accordingly, higher ratings reflect a higher degree of appropriateness. After a short practice section the evaluation was carried out for each target sentence separately and in randomised order. While the target sentence was presented acoustically, the preceding context was presented orthographically. Subjects were able to control when and how often to play a stimulus.

The two types of reference relations were tested separately with different groups of native German speakers: (a) 29 subjects (72% female), aged between 19 and 28 years (mean = 21.8, SD = 2.4); (b) 32 subjects (81% female), aged between 18 and 30 years (mean = 21.9, SD = 3.1). All subjects were

second semester bachelor students at the linguistics department of the University of Cologne with basic expertise in general speech analysis.
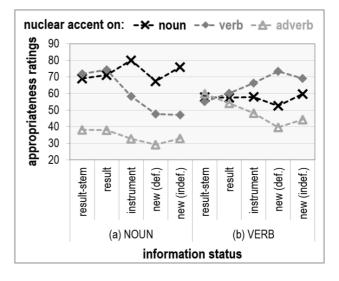
Given the results of the production study, we hypothesize that a decrease in the target element's level of activation involves higher appropriateness ratings for nuclear accents on the target element and lower appropriateness ratings for nuclear accents on other sentence elements.

3.1. Results

Statistical analysis (likelihood ratio tests of a linear mixed effects analysis with perceived appropriateness as dependent measure: random intercepts = subjects; fixed effects = accent placement, information status, sentence type, context (verb-noun group); interaction = accent placement and information status) revealed a significant effect of the interaction between nuclear accent placement and information status on the perceived appropriateness: (a) $\chi^2(8) = 126.7$, $p < 0.0001$; (b) $\chi^2(8) = 119.8$, $p < 0.0001$.

Appropriateness ratings of the nuclear accent placement as a function of the *noun's* level of givenness (see Figure 2(a)) do not show much variation for nuclear accents on the noun and the adverb. Nuclear accents on the noun are generally rated as being appropriate, whereas nuclear accents on the adverb are generally rated as being less appropriate. However, sentences with a nuclear accent on the verb do show a clear difference in their appropriateness as a marker of different semantic relations. A nuclear accent on the verb is more appropriate in sentences with *result* nouns than in sentences with *instrument* and *new* nouns. Similar to the results of the production study, we find that nuclear accents are equally preferred on the noun or verb in sentences with *result* nouns, whereas a nuclear accent on the noun is clearly preferred if it displays a lower level of givenness (i.e. *instrument* and *new* nouns).

Appropriateness ratings of the nuclear accent placement as a function of the *verb's* level of givenness (see Figure 2(b)) also reflect the prosodic marking of the production study. With an increase in the verb's level of givenness, nuclear accents on the verb are increasingly less appropriate and nuclear accents on the adverb (least given sentence element) are increasingly more appropriate. A nuclear accent on textually given nouns is rated as being medially appropriate for all semantic conditions. Generally, the *result* conditions do not show a clear preference in prosodic marking, whereas a nuclear accent on the verb is clearly preferred in the *instrument* and *new* conditions.

Figure 2: Mean appropriateness ratings (y-axis) of nuclear accents on the noun, the verb and the adverb in the target sentences ordered according to the assumed level of givenness of the target elements (x-axis). All sentence types, context types and subjects are pooled.

4. SUMMARY AND CONCLUSIONS

In a production and a perception experiment on read German we found nuclear accent placement to be a decisive marker of different semantic relations between a verb and a noun.

In the production data, *result* nouns have been shown to be less often marked by a nuclear accent than *instrument* and *new* nouns. This reflects a stronger semantic relatedness of both types of *result* nouns to the corresponding verb, as well as a difference in activation between *result* and *instrument* nouns. Moreover, an increase in the verb's level of givenness is reflected by an increase in the number of nuclear accents on the least given sentence element (the adverb). Appropriateness ratings in the perception study confirmed the different preferences in prosodic marking for each of the semantic relations.

To conclude, we provide evidence for the informativeness of verbs and their relevance for the prosody of information packaging. Differences in a verb's information status are reflected by variation in nuclear accent placement. Our results thus suggest that verbs should be integrated into a wider notion of information status.

5. ACKNOWLEDGEMENTS

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