Focus accent, word length and position as cues to L1 and L2 word recognition *

Anke Sennema, Ruben van de Vijver,
Susanne E. Carroll, Anne Zimmer-Stahl
Universität Potsdam

The present study examines native and nonnative perceptual processing of semantic information conveyed by prosodic prominence. Five groups of German learners of English each listened to one of 5 experimental conditions. Three conditions differed in place of focus accent in the sentence and two conditions were with spliced stimuli. The experiment condition was presented first in the learners' L1 (German) and then in a similar set in the L2 (English). The effect of the accent condition and of the length and position of the target in the sentence was evaluated in a probe recognition task. In both the L1 and L2 tasks there was no significant effect in any of the five focus conditions. Target position and target word length had an effect in the L1 task. Word length did not affect accuracy rates in the L2 task. For probe recognition in the L2, word length and the position of the target interacted with the focus condition.

Keywords: bilingual word processing, prosodic prominence

1 Introduction

Focus, as expressed through pitch, has been identified as an important aspect of language comprehension, and a number of factors influence the assignment of focus during sentence comprehension.

It has been shown that rapid and effective processing of the accent placement in an utterance contributes to efficient comprehension of meaning (Cutler & Fodor,

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1979) and that there is a robust advantage for words with predicted accent (Cutler, 1976). Listeners exploit cues in the prosodic contour preceding an accent to locate possible accent points. Since accent falls on semantically crucial, i.e. focused words, listeners actively search for focus to facilitate comprehension. Drawing the listeners' attention to certain parts of the utterance through means of prosodic prominence might lead to more detailed processing of the signal and this might lead to faster word recognition (Cutler *et al.*, 1997).

This evidence from studies of native listening inspired investigations addressing nonnative processing strategies of accentual sentence structures. A consistent and similar interaction of accent and focus was reported for native processing of English and Dutch, although this effect did not show in nonnative listening (Akker & Cutler, 2003). The recognition memory of English sentences was tested in which prosody cued meaning contrasts, and memory performance based on prosodic information was shown to be generally poor (Pennington & Ellis, 2000). After participants' attention was explicitly directed to intonation, the performance improved only on sentences with contrastive focus pairs.

From this it is not yet clear, to what extent the prosodic realization of focus play a role in L2 processing. Therefore, in a comparative analysis we investigated the role of focal accent, word length and the position of the word in the sentence on word recollection in native and nonnative recognition tasks in German L2 learners of English. If it is the case that the realization of focus through pitch enhances processing and recollection than such effects occur in short and long words and independent of the position in the sentence of the target word.

2 Study

We aimed at examining the relationship between effects of focus as realized by accent for native and nonnative listening. Furthermore, we have addressed the influence of sentence position and word length on word recognition in L2.

For L1 it has been established that accented material is processed more efficiently (Cutler, 1976). It has been shown, that L2 listeners attend more readily to the beginning and end of the sentence and that learners show a preference for the sentence beginning (Barcroft & VanPatten, 1997), (Klein, 1992). We will investigate the extent to which prosodic prominence interacts with the Sentence Location Principle of VanPatten. Our hypothesis is, in contrast to VanPatten, that learners will be most sensitive to words which are prosodically marked for focus regardless of its location in the sentence. We expect, therefore, that German L2 learners of English will recognize target words better when these occur at sentence initial or final position.

It has been argued, that stressed syllables are articulated in a clearer fashion (Cutler & Norris, 1988), and that hence it would be easier to represent its phonetics and phonological characteristics. In the case of words of more than one syllable, the listener might be able to accurately represent the properties of the stressed syllable but not of unstressed syllables, making recognition of the whole word more difficult than recognition of a word consisting of one stressed syllable. All of these issues - the influence of focus as realized by accent, position in the sentence and word length - have been addressed in the present study.

2.1 Speech materials

Target words in each language consisted of names of birds, such as *Gohl* (a German target) or *scaups* (an English target). They were judged by three German learners of English for their familiarity and balanced in the lists of

target words. The items were one-syllabled or more-syllabled. For every target one filler item was constructed. Target items were controlled for word length and sentence position, the fillers were not. The items were embedded in sentences.

To study the effects of different focus positions on word recognition, prosodic variation was triggered by using wh-questions for otherwise identical sentences. A wh-question focuses a specific constituent of the sentence and the answer to that question ought to focus the same constituent (Selkirk, 1992).
The following example from the test material shows the relation between pitch accent and focus (pitch accent is marked by capital letters):

(1) a. "AUKS are being affected by the warming of the northern seas because they prefer cold waters. "

would be the answer to the question

b. "Who is being affected by the warming of the northern seas?",

whereas

(2) a. "Auks are being affected by the warming of the northern seas because they prefer COLD WATERS."

would be the answer to the question

b. "Why are auks being affected by the warming of the northern seas?"

Elicited sentences were broad focus sentences (condition B1), narrow focus realised on the target (condition N1, as in example 1a), or narrow focus realised on a constituent other than the target (condition B2, as in example 2a). In the carrier sentence the target words occurred in three different positions, i.e. initial, medial and final.

To evaluate the effect of the cues in the prosodic contour surrounding an accented word, two test conditions with spliced material were constructed. In the

first spliced condition (spliced B1), the target word of a B1 sentence was spliced into the context of a N1 sentence, i.e. an unaccented target word was spliced into the N1 context of focused constituent. In the second condition (spliced B2), the target of a B2 sentence was spliced into a N1 sentence, i.e. an unaccented and unfocused target word was spliced into a sentence with narrow focus on the target. With this material 5 separate experimental conditions with identical set-up were programmed.

2.2 Speakers and Recording procedure

A female speaker of South Eastern British English recorded the English items and a female native speaker of Standard German recorded the items in German.

For each language 24 target items and 24 foils across sentence position and syllable length were recorded in three conditions, i.e. B1, N1 B2. 75 filler sentences were constructed in B1 and B2 sentence conditions, some of which had to be used twice in the experiment to make up numbers. In addition, one token of each target and foil was recorded in isolation. Also, 12 sentences plus 3 target items were recorded for a familiarization phase at the beginning of the experiment. Digital recordings were made in a sound-proof booth, using an Audiotechnica 4033a microphone (audio sampling rate 22.05 kHz).

2.3 Listeners

104 listeners participated in the experiment. They were German students or employees at the University of Potsdam and were at an intermediate to advanced level of English proficiency. The range of age was between 18 and 43 years. All participants had all started learning English after the age of 8 and none had lived in an English speaking country for more than 24 months.

A British English control group of 45 students was tested in the UK. 28 of them were recruited from University College London and 17 from Essex

University, where they were first and second year students of Linguistics.

All participants in both language groups either received points for course requirements or were paid a small sum for their participation. At the time of the experiment no reported normal or corrected hearing and normal or corrected vision.

There were 20 German subjects in each condition N1, B1, B2 and B2 spliced and 24 German subjects in condition B1 spliced. In each condition N1, B2, B1 spliced there were 10 English controls and 13 subjects in condition spliced B2.[1]

2.4 Experimental task and procedure

A closed-set word probe detection task was built for the experiment. The task was explained to the listeners and they were instructed to pay attention to the sentences in order to do well on the word probe detection task. After that they entered a brief training session in which they heard three blocks each of 4 sentences followed by a single word. Listeners were asked to press one key on a computer keyboard when they recognized the word heard in isolation as one having occurred in one of the previous 4 sentences, and another key when the word in isolation did not occur in one of the previous 4 sentences. They were instructed to make their decision as quickly as possible.

In the trial part feedback was given on the correctness of the answers but no feedback was given during the actual test and there was no further communication with the experimenters. Subjects heard the stimuli sentences only once. Two self-timed pauses were programmed within the experiment. Each experiment (German task and English task) took about 30 minutes.

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[1] Due to an error only two subjects were tested for condition B1 unspliced.

The experiment had two separate parts: a part with German stimuli and one with English items. Both parts consisted of 48 blocks of four sentences each. There were 24 blocks with ‘no’ as the correct answer and 24 blocks with ‘yes’ as the correct answer. The targets were equally distributed in terms of presentation order within the blocks (pos. 1-4) and the blocks were presented in randomized order. To compensate for fatigue effects a second list was created with the blocks in the reversed order of the first list. The sentences and probes were presented at a comfortable listening level via headphones. Their responses and reaction times were recorded.

To obtain an independent measure of English proficiency, the Oxford Placement Test was administered. This is a standardized test (multiple choice) divided into two sections, Listening and Grammar. The percentage scores from the sections were used to obtain a relative measure of English proficiency of the German participants. An attempt was made to stratify our learners by proficiency level on the basis of the score achieved in the Listening part of the Oxford Placement Test and to distribute learners equally across the five focus conditions.

The experimental order was as follows: Oxford Placement Test, German part of the experiment (L1 task), and one week later, the English part of the experiment (L2 task). The English control group was tested on the English part only.

2.5 Results

Timed-out responses (a response latency of more than 2500 ms) and responses with reaction times below 300ms were discarded from the analysis. The percentage of correct probe recognition in each part of the experiment (L1 task and L2 task) was calculated for the five test conditions (Table 1).

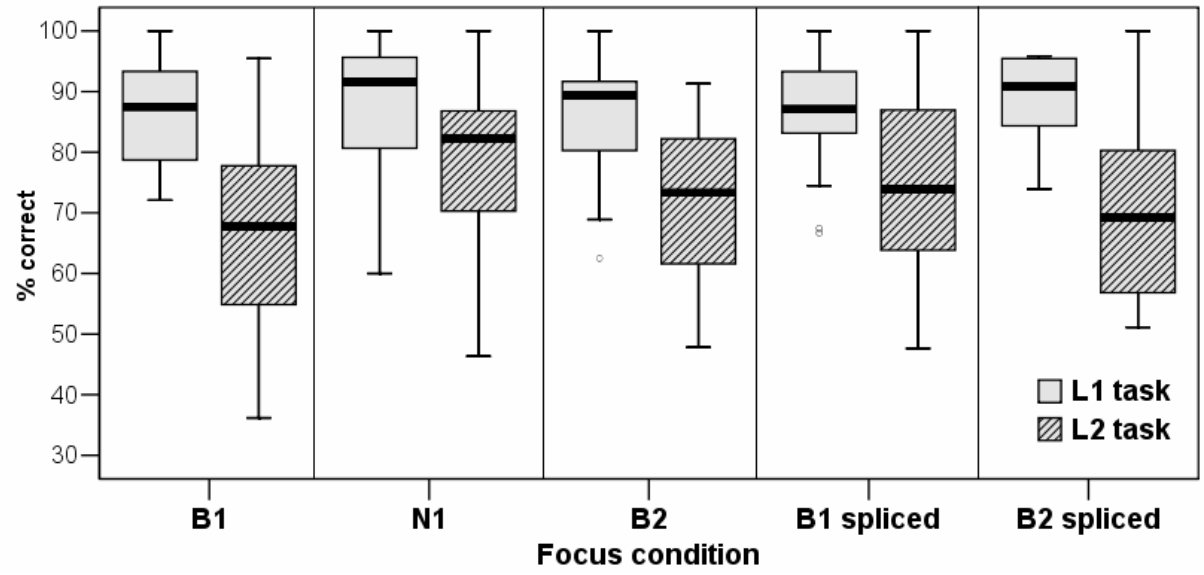
Tab. 1: Scores (% correct) per focus condition and part of experiment for German subjects and English controls

*N=2

German subjects	B1	N1	B2	B1 spliced	B2 spliced
L1 task	93,1%	93,7%	92,9%	93,2%	94,2%
L2 task	82,6%	88,9%	85,7%	87,3%	85,3%
Controls	100%*	93,5%	86,3%	89,4%	85,4%

Accuracy scores were subjected to an analysis of variance with language as the within subjects factor (L1 vs L2) and focus as the between subjects factor. There was a significant difference between L1 and L2 [$F(1,99) = 117.21$, $p < .001$], showing that German subjects performed better in their native language L1 than in L2. Whereas there was no main effect of focus, focus tended to interact with language [$F(4,99) = 2.17$, $p = .08$]. Accuracy scores for the experimental task in the L1 and the task in the L2 in the five focus conditions are shown in Figure 1.

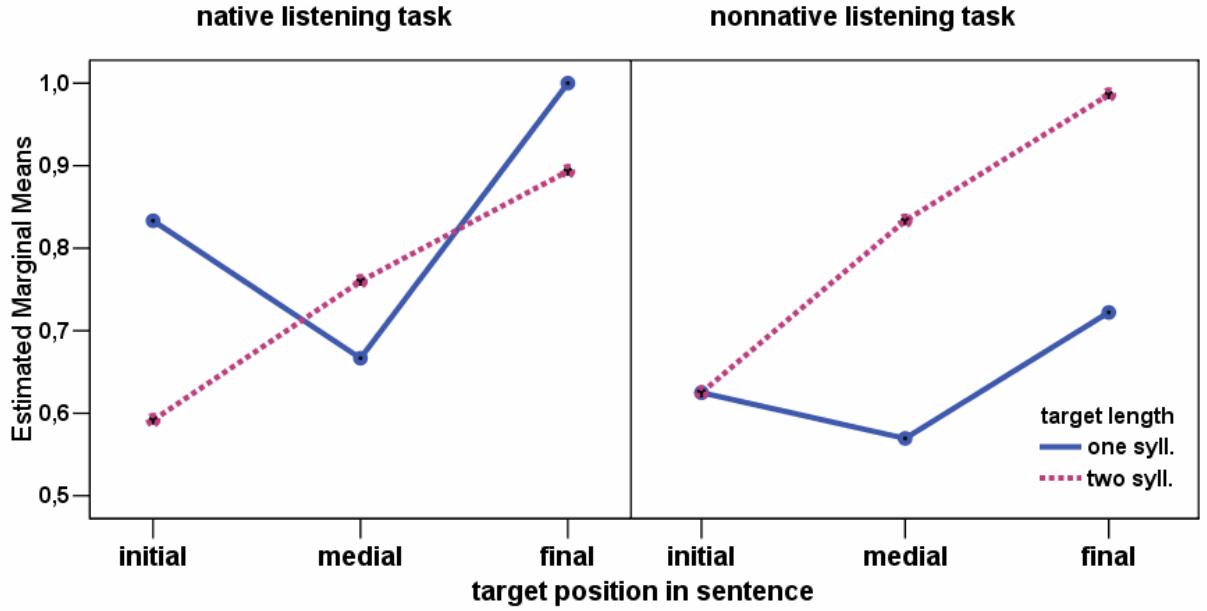
Fig. 1: Boxplots of accuracy scores



Next, the factors of word length and target position in the sentence were examined for the five conditions in each of the two experimental tasks. Accuracy scores for targets occurring in sentences were subjected to an analysis of variance with target length (mono- or polysyllabic) and target position in the sentence (initial, medial, final) as within subjects factors and focus as between subjects factor. Paired comparisons for target position examined initial and medial position against final position.

In the L1 task with broad focus (B1) there was no effect for target length, but a significant difference between the target positions [$F(2,38) = 6.032$, $p = .05$]. Paired comparisons of the final position against initial and medial position revealed a significant difference between initial and final target position [$F(1,19) = 6.032$, $p < .005$] . In the corresponding L2 task, however, there was no effect for target length and also no effect for target position (see Fig. 2).

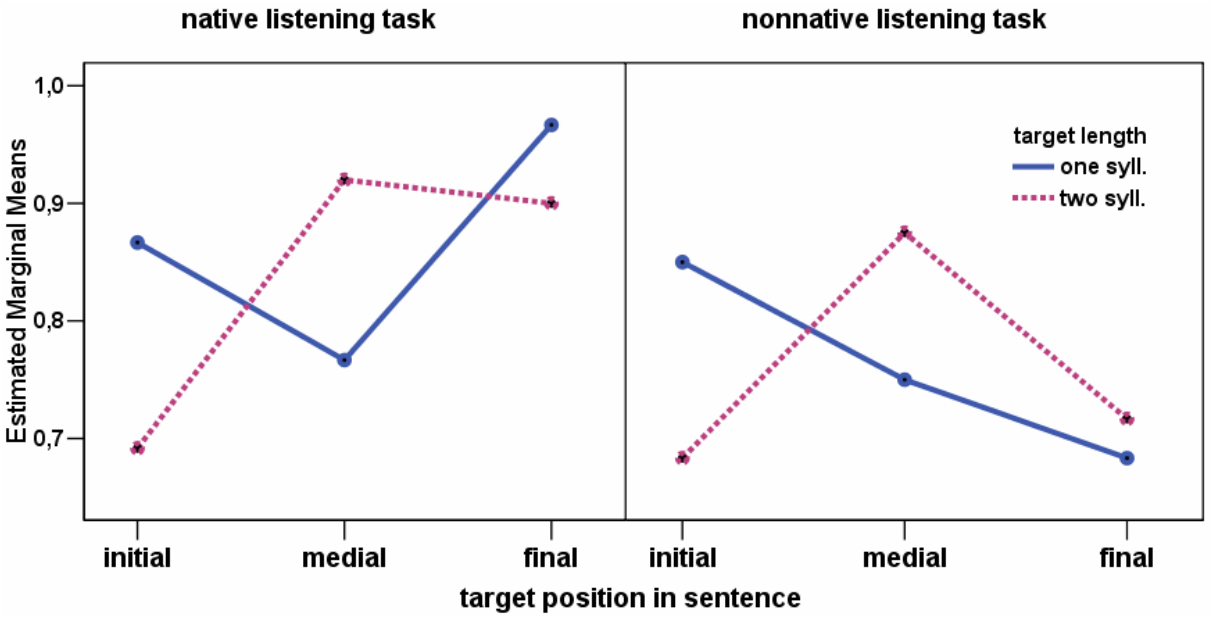
Fig. 2: Performance of German subjects in condition B1 unspliced



In the condition with an accented target (N1), target length did not have an effect on word recognition in either task. In the native listening task, target

position was significant [$F(2,38) = 5.209$, $p = .01$] and interacted with word length [$F(2,38) = 4.358$, $p < .05$]. Paired comparisons revealed a significant difference between initial and final target position [$F(1,19) = 13.470$, $p < .005$]. There was no effect of target position and no interaction with word length in the L2 task. It appeared that the two patterns of responses in condition N1 are differed regarding the final position in the L1 and L2 task (Fig. 3). Final position does not seem to draw additional attention to targets in second language processing whereas this cues better recognition in the first language.

Fig. 3: Performance of German subjects in condition N1 unspliced

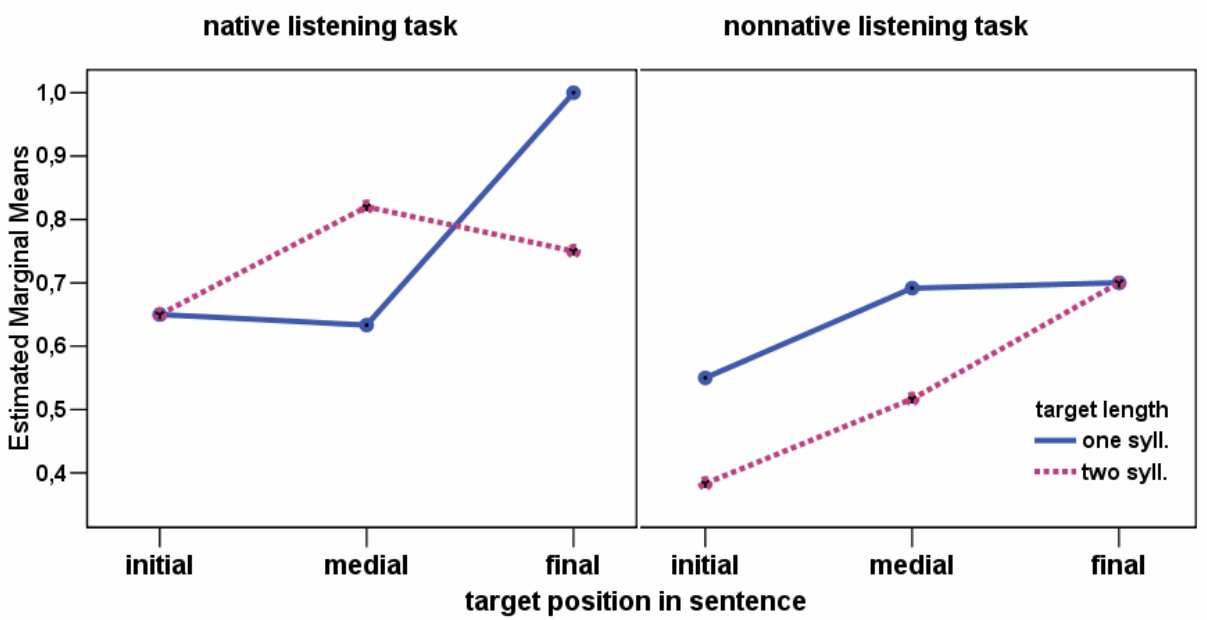


In condition B2 (accent on non-target word in constituent that has the target) there was no effect of word length in the two tasks. In the native listening task, target position was significant [$F(2,38) = 3.261$, $p < .05$] and interacted with word length [$F(2,38) = 4.166$, $p < .05$]. Paired comparisons revealed significant differences between initial and final position of the target [$F(1,19) = 6.265$, $p < .05$] and also between medial and final position [$F(1,19) = 4.388$, $p = .05$]. In

the L2 task the effect of target position was significant [$F(2,38) = 5.028$, $p < .05$] and paired comparisons showed a significant difference between the initial and final position [$F(1,19) = 14.241$, $p < .005$]. There was no interaction of target position with word length in the L2 task.

The response patterns for condition B2 unspliced are shown in Fig. 4.

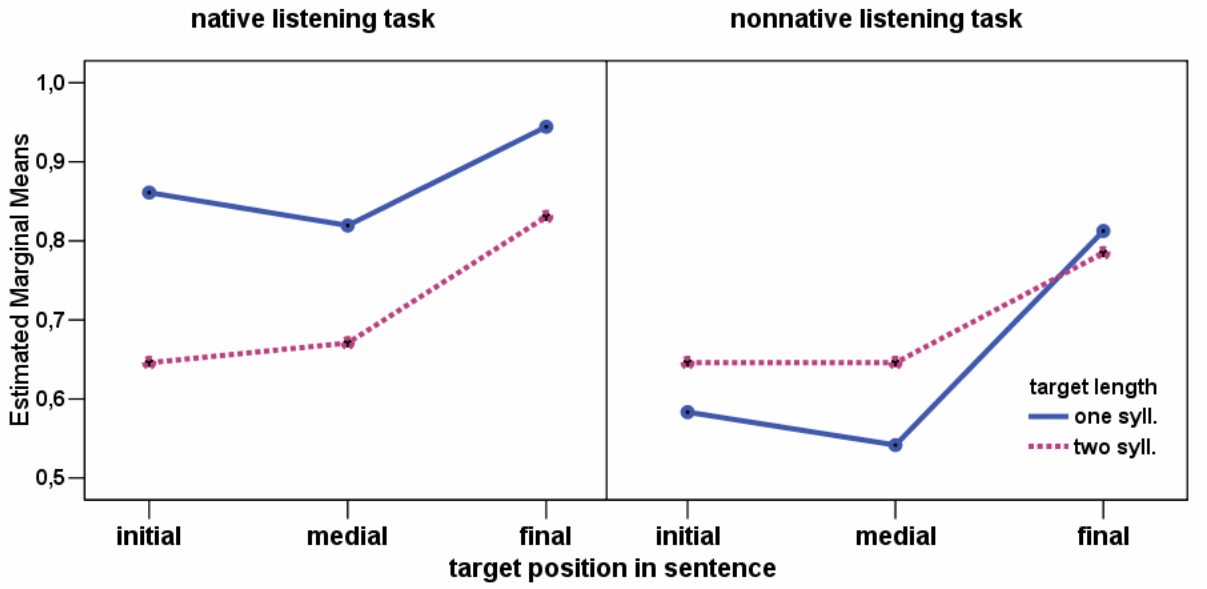
Fig. 4: Performance of German subjects in condition B2 unspliced



Accuracy scores of the spliced conditions were subjected to the same analyses as described above. In the condition B1 spliced (target word of a B1 broad focus sentence spliced into the context of a N1 narrow focus sentence), there was a significant effect in the L1 task for both target length [$F(1,23) = 26.763$, $p < .001$] and for target position [$F(2,46) = 3.253$, $p < .005$]. There was no interaction between the two factors. In the L2 task of condition B1 spliced, only target position had a significant effect [$F(2,46) = 5.153$, $p = .01$] and for this, paired comparisons revealed significant differences between initial and final position [$F(1,23) = 8.013$, $p < .01$] and between medial and final position of the

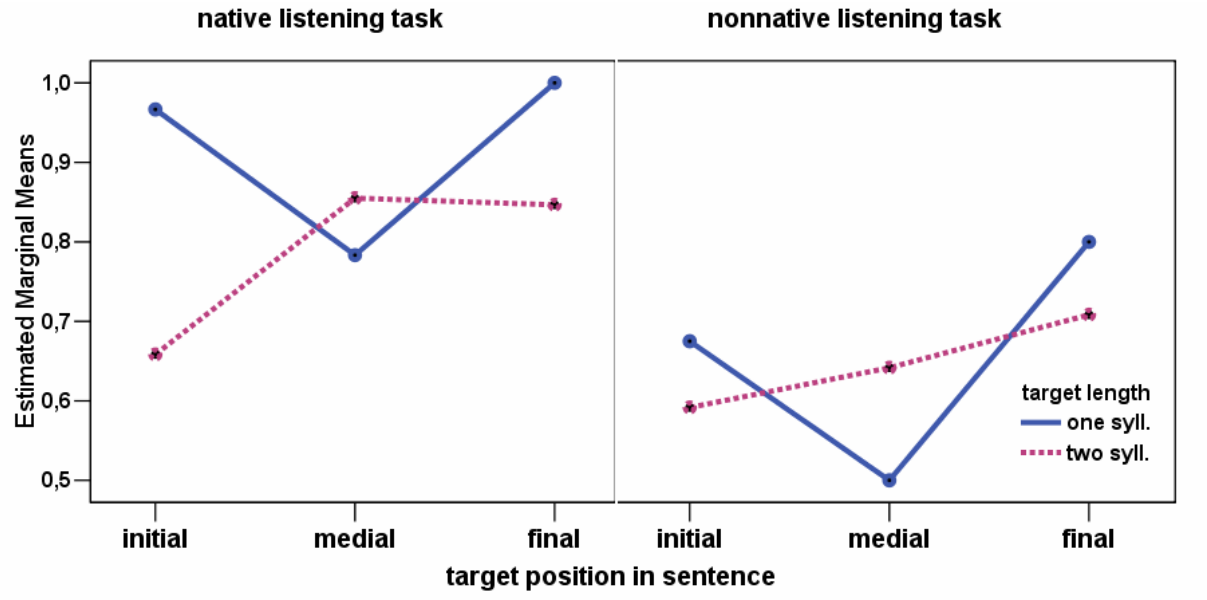
target [$F(1,23) = 10.903$, $p < .005$]. The patterns of responses in condition B1 spliced are similar in the L1 and L2 task, as can be seen in Figure 5.

Fig. 5: Performance of German subjects in condition B1 spliced



In condition B2 spliced, the target had been spliced out of a B2 sentence (with accent on another word in the constituent that contained the target) into a N1 sentence. In the L1 task there was a significant effect for word length [$F(1,19) = 5.391$, $p < .05$] and word length interacted with target position [$F(2,38) = 6.027$, $p = .005$]. In the L2 task, only target position had a significant effect [$F(2,38) = 3.234$, $p = .05$]. This was due to a significant difference between the medial and final position [$F(1,19) = 6.883$, $p< .05$] (see Fig 6).

Fig. 6: Performance of German subjects in condition B2 spliced



It could be argued from the results that the effect of position found for initial and final position obliterates any possible effect of focus. We therefore examined the recognition accuracy of targets in medial position, thus excluding a superimposed effect of sentence position. Irrespective of word length a stronger effect of focus condition was revealed for targets not occurring at the outer ends of the sentences, where a position effect seems indeed to overshadow focus effect.

Tab. 2: Scores (% correct) per focus condition and part of experiment for targets in medial position

German subjects	**B1**	**N1**	**B2**
L1 task	88,5%	92,2%	88,3%
L2 task	78,9%	90,5%	77,6%
Controls	no values	92,1%	84,2%

3 Discussion

It turns out that accent did not help our subjects process the accented word probes more accurately or more efficiently in L2. There was no significant effect for focus condition. This result confirms the findings of Akker & Cutler (2003) and of Pennington & Ellis (2000). Processing a second language might take up so many resources that accent alone is not a strong enough help. The fact, however, that accent did not help listeners in their L1 either is surprising. This might be due to an effect of target position which is possibly stronger than an effect of accent. This is suggested by the fact that target position had an effect in all accent conditions.

The most salient results were the effects of the position of the target. Over all conditions it seems that position is the strongest cue for the word probe detection task: words in initial or final position of the sentence were remembered better and this confirmed the primacy & recency effect found in other studies (Klein). Our results indicate that in order to effectively commit a representation to memory, the position of the word in the sentence is more important than whether or not a word is accented. It also suggests that effective and efficient processing of accented words (Cutler, 1976) in L1 does not necessarily result in successfully committing the word to memory.

We had hypothesized that learners will be most sensitive to words which are prosodically marked for focus regardless of its location in the sentence and had expected, that German L2 learners of English will recognize target words better when these occur at sentence initial or final position. The effect of sentence position of the target was nevertheless clearly more strong than that of focus accent, which seemed to be merely supportive. Examining the results for target words in sentence medial position only, focus appeared to have indeed a

stronger effect.

The splicing procedure revealed no effects for the cues in the prosodic contour surrounding an accented word and the two test conditions did not lead to conclusive results. In the spliced conditions, target position had a significant effect in L2 and L1.

4 Conclusions

In this study, an experiment was conducted to test which aspects of prosodic prominence facilitate word learning in native and nonnative perceptual language processing. As predicted, words under the narrow focus condition tended to be better recognized than words in broad focus condition.

The results obtained in the spliced conditions confirm findings of earlier studies (Akker & Cutler, 2003), as no effects could be established for the cues in the prosodic contour surrounding an accented word.

Results indicate partly different processing strategies for the two language settings L1 German – L2 English.

The probe detection task used in this experiment may have been a more accurate test of the influence of accent, target length and target position on committing a representation to memory than on accuracy and effectiveness of processing. We think that a phoneme detection task is well-suited to test the effectiveness of processing, and are, indeed, carrying out such an experiment.

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Anke Sennema, Ruben van de Vijver, Susanne E. Carroll, Anne Zimmer-Stahl
Universität Potsdam
SFB 632 „Informationsstruktur“
Postfach 601553
14415 Potsdam
Germany
sennema@rz.uni-potsdam.de