

# STRESS SHIFT AND PROSODIC FOCUS MARKING IN L1 AND L2 ENGLISH

Nadja Schauffler<sup>1</sup>, Margaret Zellers<sup>2</sup>, Sabine Zerbian<sup>1</sup>

<sup>1</sup>University of Stuttgart, Germany <sup>2</sup>University of Kiel, Germany

<sup>1</sup><firstname.lastname>@ifla.uni-stuttgart.de, <sup>2</sup>mzellers@isfas.uni-kiel.de

## ABSTRACT

Speakers of both English and German prefer an alternation of strong and weak syllables. In cases of stress clash, repair strategies may be employed to restore alternation (*thirtéen* → *thirteen mén*), a process referred to as the "rhythm rule". It is not entirely clear how the rhythm rule interacts with prominences above the lexical level, such as in the prosodic marking of focus. We investigate how English L1 speakers make use of stress shift in sentences where the target word is either the only corrective focus or followed by a second corrective focus. We find that English L1 speakers often shift stress even when prominences are not adjacent on the lexical level. Giving the same stimuli to German learners of English in a second experiment, we find that L2 speakers shift stress in a wider variety of prosodic circumstances, but less often overall.

**Keywords:** Stress clash, rhythm rule, double-focus, L2 prosody

## 1. INTRODUCTION

Both German and English speakers have been found to disprefer stress clashes, which occur when two lexically stressed syllables are adjacent as in the prominent phrase *thirtéen mén* (e.g. [6, 18, 17, 19]). An alternating pattern can optionally be restored by shifting stress in *thirteen* to the initial syllable (→ *thirteen mén*) [15, 12]; this process is referred to as the "rhythm rule" (RR, [12]).

Previous studies have found that decreasing the prominence of the primary stressed syllable is the dominant repair strategy in rhythm rule contexts in English [6, 9, 18], suggesting that a stress shift is actually stress reduction and only perceived as shift by the changed prominence relation between primary and secondary stressed syllable. Listeners have often been found to perceive an early prominence even in sentences without stress clash on the lexical level, as in *Chinese canoes* (e.g. [18, 3]). This may be explained by assuming that stress shift is a shift [16] or deletion [7] of a pitch accent, in order to avoid not a

lexical stress clash, but a pitch accent clash.

How the RR interacts with the prosodic marking of focus is still not entirely clear. According to predictions by [7] and findings by [3] there will be no prominence reversal when the target word is contrastively emphasized.

In German, where shift is possible in phrases (*ánziehen* → *den Róck anziehen*), compounds (*Báhnhof* → *Háuptbahnhòf*) and after prefixation (*síchtbar* → *únsichtbàr*) [10, 19, 4], stress shift is not as regularly used, and is less grammaticalized than in English [19]. Therefore we expect that German speakers will also make less use of the rhythm rule in their L2 English.

This study empirically investigates the interplay of the RR in different focus scenarios. In particular we ask the following questions:

1. How does the RR operate under (corrective) focus marking? Does corrective focus accent override the RR?
2. Do L2 speakers apply the RR? If so, how do they make use of stress shift in different information-structural environments?

## 2. STIMULUS DESIGN

The experimental stimuli were designed to elicit adjacent pitch accents via double-focus environments (see Ex. 1, capital letters indicate focus expected to be marked by pitch accent, square brackets indicate focus). The first focus consisted of a word with secondary stress on the first, and main stress on the last syllable. The second focus had lexical stress on the first syllable in the *clash* condition, resulting in a stress clash on the lexical level, and on the second syllable in the *no clash* condition, i.e. with an unaccented syllable between the two potential pitch accents. In addition to the double-focus conditions, two single focus conditions were tested (*S-Foc* and *given*). Both conditions include a stress clash on the lexical level, but in *S-Foc* (= "single focus") the target word is focused and the following word given; while in *given*, the target word is given and the following word focused.

- (1) *Did Anna say that she met an Indian programmer?*  
No, she said that she met...

**clash** ... [a JapANESE][ARCHitect].

**no clash** ... [a JapANESE] [aCCOUNTant].

**S-Foc** ... [a JapANESE] programmer.

*Did Anna say that she met a Japanese programmer?*

No, she said that she met...

**given** ... a Japanese [ARCHitect].

### 3. L1 ENGLISH SPEAKERS

#### 3.1. Participants

Sixteen (12 women) Australian English speakers (henceforth L1 speakers) participated in the experiment. Their mean age was 27.38 (range: 19 to 36).

#### 3.2. Procedure

Twenty sentences per condition were distributed over 4 lists using a Latin Square Design. The experimental sentences in each list were pseudo-randomized and interspersed with 20 sentences for an experiment with a similar design (not presented here) and 100 filler items. The context questions for each question-answer pair had been previously recorded spoken by a native speaker of Australian English who was instructed to read the questions in a neutral and natural way. The mini-dialogues were presented on a screen, preceded by a context story designed to make the question-answer pairs more plausible. Participants were instructed to first silently read the dialogue, listen to the context question and then to produce the answer. After the dialogues, the participants read a list containing the target words in isolation interspersed with filler words with various stress patterns. Thus 320 target sentences and 320 isolated words were recorded. 3 sentences were excluded due to hesitations and verbal errors so that 317 sentences were analysed.

#### 3.3. Stress-shift annotation

Three phonetically trained listeners (two German speakers and one American English speaker, two of them among the authors) listened to the target words (removed from context) and the words produced in isolation, and judged the location of the main stress; each recording was presented twice in the course of

the judgment task. Intra- and inter-annotator agreement were determined using Fleiss' Kappa [5]. All annotators had substantial to almost perfect agreement within their own ratings; inter-annotator agreement was moderate ( $\kappa=0.49$ ; cf. [11]). We considered stress to be shifted when at least 4 out of the 6 listener judgments marked main stress on the first syllable. In 4.5% of cases neither *shift* nor *no shift* could be determined. We removed these cases from the analysis when 4 out of 6 judgments agreed on equal prominence.

#### 3.4. Pitch-accent annotation

In order to understand the interaction of stress clash, stress shift and pitch accent placement, the annotators judged the presence of pitch accents, operationalized as whether they perceived the words involved in the RR as prominent or not. All tokens were played without the respective context question, and in randomized order. Each recording was played three times in the course of the annotation task. Intra-annotator agreement was substantial to almost perfect, and inter-annotator agreement was moderate ( $\kappa=0.62$ ). We considered a constituent to be pitch accented when a prominence was perceived at least 4 times, i.e. by at least two annotators.

#### 3.5. Statistical analyses

Statistical analyses were performed in R 3.5.0 [13], using the function `glmer` from package `lme4` [2]. To investigate the relationship between stress shift and the four conditions, we performed a generalized linear mixed effects analysis using the logit link function, with *stress shift* as the dependent variable, *condition* as a fixed factor, and random intercepts for *subjects* and for *items*. To investigate the correlation between stress shift and pitch accent placement, a second analysis was performed on a subset of the data comprising the two double-focus conditions (*clash* and *no clash*) using the presence of two pitch accents as dependent variable, with an interaction between *condition* and *stress shift* as a fixed factor, and random intercepts for *subjects* and *items*.

#### 3.6. Results

In condition *clash*, where two focus-marking pitch accents are on directly adjacent syllables, stress was shifted in 75% of the cases. In condition *no clash*, stress was also shifted in the majority of cases (68%), even though the two foci were in this case separated by one syllable, i.e. there was no stress clash on the lexical level. The two double-focus

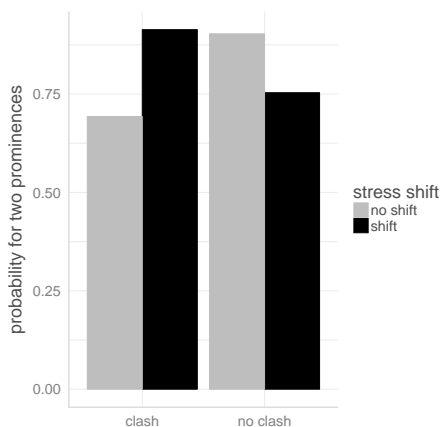
**Table 1:** stress shifted words in % by condition in English L1

	stress shift	no stress shift
clash	75%	25%
no clash	68%	32%
S-Foc	23%	77%
given	90%	10%
word in isolation	16%	84%

conditions were not significantly different ( $\beta=-0.42$ ,  $SE=0.38$ ,  $p=.27$ ). Stress was shifted even more often (89%,  $\beta=1.22$ ,  $SE=0.48$ ,  $p<.05$ ) when the target word was given and the following word focused (*given*). Stress was **not** shifted in 77% of cases when the target word was focused and the following word given (*S-Foc*) ( $\beta=-2.68$ ,  $SE=0.41$ ,  $p<.0001$ ), and in 84% of the cases when the word was produced in isolation ( $\beta=-3.19$ ,  $SE=0.35$ ,  $p<.0001$ )

Looking at the interaction between stress shift and pitch accent placement in the double-focus conditions, we found that while shifting stress tendentially increases the probability for the presence of two pitch accents from 69 % to 91% (estimated) in condition *clash* ( $\beta=1.54$ ,  $SE=0.81$ ,  $p=.06$ ), it decreases it in condition *no clash* from 90% to 75% ( $\beta=-2.66$ ,  $SE=1.09$ ,  $p<.05$ ). See Figure 1.

**Figure 1:** The probability for two pitch accents by condition and stress shift in the English L1 data



## 4. GERMAN LEARNERS OF ENGLISH

### 4.1. Participants

Sixteen (14 women) German learners of English (henceforth L2 speakers) participated in the experiment. Their mean age was 23.25 (range: 19-28). All L2 speakers have been learning English as a foreign language for at least 7 years. 14 speakers were

students of English, ten of them within a degree programme leading to secondary teacher accreditation. According to their own judgment, they were proficient to highly proficient in writing, reading, speaking and listening to English.

### 4.2. Procedure and analyses

Data elicitation, annotations and statistical analyses followed the same procedure as in the L1 experiment described 3.2 to 3.5, except that the context questions were produced by an American English native speaker. Concerning the judgment of stress shift, annotators of the L2 data agreed with themselves substantially to almost perfectly, and moderately with each other ( $\kappa=0.59$ ). In 4.2% of target words both syllables were rated as having equal stress. We removed these cases from the statistical analysis when at least 4 ratings agreed on this. For the pitch accent annotation, intra-annotator-agreements were substantial to almost perfect, and inter-annotator agreement was substantial ( $\kappa=0.70$ ). Nine cases were excluded due to hesitations and verbal errors.

### 4.3. Results

We found that among the items, three (*home-grown*, *hotel*, *Hong Kong*) were frequently (>50%) realized with initial stress when read in isolation. Since we cannot exclude the possibility that this is due to learners' misperception of the stress pattern, we removed all sentences containing these items (accounting for 15% of the data) from the analysis.

Like the L1 group, the L2 speakers mostly (78%) did not shift stress when the target word was uttered in isolation, and shifted stress in the majority of the *given* cases, where the target word is given (67%). In the double-focus conditions (*clash* and *no clash*), L2 speakers shifted stress in about 50% of the cases. The difference in metrical context between the conditions did not affect the probability of stress shift ( $\beta=0.19$ ,  $SE=0.40$ ,  $p=.65$ ). Overall, the L2 speakers shifted stress considerably less often across the double-focus conditions compared to the L1 speakers. When the target word was focused and the following word was given (*S-Foc*), L2 speakers also often shifted stress (43% of cases), which is not significantly different from the double-focus conditions ( $\beta=-0.35$ ,  $SE=0.41$ ,  $p=.38$ ). This is unlike the English L1 speakers, who mostly did not shift stress in this condition. There was no interaction between stress shift and pitch accenting: neither stress shift nor condition (*clash*, *no clash*) affected pitch accenting in the double-focus conditions. L2 speakers realized both focus accents in 73% of the *clash* cases

and in 80% of the *no clash* cases.

**Table 2:** *Stress shifted words in % by condition in English L2*

	stress shift	no stress shift
clash	49%	<b>51 %</b>
no clash	<b>52%</b>	48%
S-Foc	43%	<b>57%</b>
given	<b>67%</b>	33%
word in isolation	22%	<b>78%</b>

## 5. DISCUSSION

Both L1 and L2 speakers in this study often shift stress not only when corrective focus accents are located on directly adjacent syllables, but also when the corrective focus accents are separated by one syllable, similar to findings by [18] and [3]. This suggests that stress shift is not only triggered by adjacent lexical stresses, but also by prominences on a higher level in the prosodic hierarchy such as pitch accents used for focus marking. In the single focus conditions, we found that L1 speakers hardly ever shift stress when the target word is focused and the following word is given (*S-Foc*). Concerning our research question whether a corrective focus accent overrides the rhythm rule, we can therefore say that it does override the RR when it is the last accent in the phrase, and that it does not when it is followed by another pitch-accented syllable. It seems that a weak-strong asymmetry of prominences is indeed necessary in order to trigger stress shift, as is also the case in *given*, while in *S-Foc*, the weaker prominence in the postnuclear word is not able to trigger the stronger prominence to shift (cf. [15]). It is, however, possible that initial stress in the *given* context was primed by the stress pattern used in the context question.

For L1 speakers, there is a correlation between stress shift and pitch accent placement: if stress is shifted, we more often find two prominences in the *clash* condition, whereas if stress is not shifted, we find more instances where the pitch accent on the first focused word is omitted. This suggests that alternation preferences can interact with the prosodic marking of focus such that pitch accents are not realized in order to avoid a clash. This result, however, barely achieves significance and the proposal needs further testing. As to why the correlation of pitch accent placement and stress shift goes in the other direction in the *no clash* condition where the adjacent pitch accents are separated by one syllable, we have no explanation so far. A more fine-grained analysis of the realized pitch accents may be needed to draw further conclusions.

Regarding our second research question, we find that L2 speakers do make use of stress shift, albeit less often than L1 speakers, as expected given that the RR is not used as regularly in German [19]. Differences in RR application could also result from a difference in phrasing compared to L1 speakers, since L2 speakers have been found to produce shorter intonation phrases [8]. A phrase break between the two foci would lead to less shifting since the target word would be the last accent in the phrase, and the RR only operates within a prosodic phrase [12]. Another explanation may lie in the nature of non-native speech: Tilsen [17] found that repair strategies in stress clash contexts are more often used in read and prepared speech than in spontaneous speech. Given the greater cognitive load for non-native speakers, L2 speech may be comparable to less prepared speech, and therefore less prone to rhythmic adjustments.

An additional difference between our L1 and L2 speakers is that L2 speakers frequently shifted stress when the following word was given and deaccented (*Indian programmer? No, Japanese programmer!*)—corrective focus did not override the RR even though it was the last accent of the phrase. It is possible that some L2 speakers overgeneralize the RR to contexts in which a weak-strong asymmetry of prominences is not given. Overgeneralization of accent rules by L2 speakers has been found by various studies (cf. [14]). Non-native speakers have also been found to differentiate less between accented and unstressed syllables (cf. [1]). If this was the case in our study, the given word may have triggered stress shift due to its unreduced form.

## 6. CONCLUSION

This study investigated the application of the RR under corrective focus marking in L1 and L2 English. We found that the RR also operates under corrective focus marking when the word is followed by another prominent word even when there is no stress clash of lexically stressed syllables. We take this as evidence that stress shift is not only triggered by adjacency of lexical stresses, but also by pitch accent clashes. While L1 speakers do not shift stress when the target word is focused and the following word is given, L2 speakers were found to frequently shift stress in this context, suggesting an overgeneralization of the optional rule.

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