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Word stress is obviously a relevant prosodic aspect in teaching German as a foreign language (L2), among other things because the majority of German words are polysyllabic. On the other hand, "a large number of morphemic words [… in Vietnamese] are monosyllabic" (Nguyễn 1967: 325). Based on this fundamental difference between the two languages, this study investigates the aspect of word stress in 39 German compounds, read by 10 Vietnamese learners, compared to another group of 10 German native speakers. The relations in pitch, intensity and duration between vowels with primary and subordinate stress were taken into account. Results show significant differences in the parameters of pitch and intensity between the two groups of speakers. While the German group produced clearly higher pitch and intensity on the primarily stressed vowels in comparison to the ones with subordinate stressed, the two types of vowels were realized with nearly equal level of pitch and intensity by the Vietnamese group. Analysis of the relation of vowel duration showed diverse results. The study claims a lack of contrast between these two types of stresses in German compounds produced by Vietnamese learners. It is further proposed that a transfer of typical prosodic features in Vietnamese caused the attested interference in the target language.

1. Introduction

Errors relating to lexical stress have been reported to be caused not only by a faulty stress placement but also by an unclear stress contrast, in that syllables with a primary stress are not perceived as prominent enough relative to syllables with a subordinate stress in the same word. While the latter sort of error might not dramatically affect the intelligibility of the corresponding word in the way a wrong stress placement does (Bond 1999, Field 2005), it still largely contributes to a non-native accent of L2 learners, since native speakers clearly differentiate syllables with primary from those with subordinate stress (Flege & Bohn 1989, Lee et al. 2006). In many studies investigating the production of word stress by L2 learners, hardly any clear distinction is made between the two manifestations of word stress errors. The first of these is wrong

stress placement, which relates to a deficit in the knowledge of word stress patterns or regularities in the L2. The second is unclear word stress, which can be caused either by the lack of the aforementioned knowledge or by the absence of the ability to produce stress in the way native speakers do. As noted in Zhang et al. (2008), this results in the confusion of phonological and phonetic issues (stress placement vs. production of a native-like stress).

With regard to L2s as non-accentual tonal languages, some studies have not only reported evidence for the similar issue of stress placement but have also focused on the different acoustic features of stress produced by learners. These different acoustic features are largely attributed to the different natures of the native languages L1s from the L2s. With respect to Mandarin, Juffs (1990) reported both speakers' mistakes in sentential stress placement and difficulties with the phonetic manipulation of specific correlates of stress, whereby the Mandarin high tone was supposed to be superimposed onto English stressed syllables. Chen et al. (2001) controlled the factor of stress placement by making sure that their speakers were aware of the location of stress and found that although Chinese learners employed the same acoustic correlates (namely the fundamental frequency, intensity and duration, to realize the prominence effect of stressed syllables), they marked the sentential stress with significantly higher F0 than American speakers do. They suggested that this deviation was due to a greater pitch range with many fluctuations observed in the Mandarin speakers. In a different study, Zhang et al. (2008) found similar results in a smaller context of lexical stress. They attributed the deviant production of word stress by Mandarin speakers to the influence of the vowel inventory in their language, which is different from that of the L2 English.

The production of word stress by Vietnamese learners of English has recently been studied by Nguyễn & Ingram (2006), who claimed that Vietnamese learners could manipulate pitch and intensity as acoustic cues for word stress, but not duration and vowel reduction. This finding was repeated in a latter study (Nguyễn et al. 2008), in which the acquisition of word stress by Vietnamese learners was investigated not only at the level of compound words but also phrases with broad-focus and narrow-focus nouns. On the one hand, the authors confirmed the ability of Vietnamese learners to employ F0 and intensity to lend different contrast levels to stressed syllables. On the other hand, they stated that the learners "[…] failed to realize the timing contrast between compound words and phrases and the syntagmatic contrast of accent in larger

units, such as polysyllabic word or phrases […]". Again, a possible transfer of prosodic features from the mother tongue Vietnamese, namely the lexical tonal pitch and the paradigmatic tonal patterns, was proposed to be the underlying mechanism. In the case of Vietnamese learners of German, no instrumental study has been observed. Therefore, this study aims to address the acoustic aspect and focusses on the question of how Vietnamese learners of German differentiate the primary and the subordinate stress in German.

2. Word stress in German and Vietnamese

The acoustic manifestation of word stress in German has been investigated in some studies through minimal stress pairs such as ˈ*umfahren* vs. *um*ˈ*fahren*, ˈ*überlegen* vs. *über*ˈ*legen*, where the acoustic correlates of the primary stressed syllables in these superficially identical words were compared in pairs (Dogil & Williams 1999, Schneider & Möbius 2006). In these studies, duration has repeatedly been stated as the primary cue to the production and perception of German word stress. Intensity doesn't seem to play an important role as is reported in the studies with English (Kochanski et al. 2005, Lieberman 1960). Neither is vowel quality considered to be a relevant correlate as it is in English, especially in comparative studies with non-native speakers (Fokes & Bond 1989, Lee et al. 2006, Zhang et al. 2008). Nonetheless, Jessen et al. (1995) proposed the hierarchy of duration, fundamental frequency, intensity and vowel quality for the acoustic correlates of word stress in German.

Only in the last decade has subordinate stress gained more attention in several acoustic studies. These however were conducted based on an underlying phonological research interest. Kleber et al. (2006) investigated 36 Germanic loanwords, uttered by 6 female native German speakers, to search for the acoustic cues of rhythmic subordinate stress. Having found insufficient differences between the two examined non-main stress positions, the authors stated that "none of the analyzed parameters give evidence for a third level of word stress occupying an intermediate position between stressed and unstressed." In contrast to this however, Knaus et al. (2011), who based their ERP-study (Event-Related Potentials) on the perceptive processing of word stress in noun-noun compounds, saw the existence of a level of secondary stress in German and claimed that the preferred position for this stress is the word-initial syllable. However, they did note that explicit acoustic correlates of subordinate stress, especially in the relationship to the

primary stress in the same determinative compound, haven't been studied. Other studies have explored the rhythmic rules or patterns for subordinate stress in German compounds or phrases but not its phonetic manifestation (Bohn et al. 2011).

Word prosody in Vietnamese differs from that of German in many ways. As opposed to German as a stress-timed language, Vietnamese is generally considered syllable-timed (Kelz 1984). Syllables in Vietnamese haven't been found to show systematic difference in duration or vowel quality (Nguyễn et al. 2008). This means that the distinction between stressed and unstressed syllables stated in stress-timed languages like German (where unstressed syllables are supposed to have a shorter duration and a reduced vowel quality) has not been observed for Vietnamese. Another difference, according to Nguyễn (1967) and Michaud (2012), is that most syllables function as independent morphemes. Thus Vietnamese is considered to have a monosyllabic character, an attribute that is partly even manifested in its orthography. German, on the contrary, has numerous polysyllabic words. As such, German has a system of culminative word stress, which plays a distinctive role. In Vietnamese, this phenomenon has not been found (Nguyễn 2010) and word stress has not generally been recognized as a relevant element of the prosodic system of Vietnamese.

Despite its minor role, word stress in Vietnamese has been investigated in some studies., There haven't been many systematic acoustic studies on the manipulation of phonetic features to realize stress in Vietnamese. A full realization of the lexical tone of the stressed syllable was generally considered to be a main cue (Đinh & Nguyễn 1998, Nguyễn 2010). Michaud & Vũ (2004) investigated the influence of stress on the two variants of the *nặng*-tone: glottalized in closed syllables (i.e. with a final unreleased plosive) and non-glottallized in half-open ones (i.e. with a final nasal). They claimed that the increase in the slope of the F0 curve and/or in F0 register were stable correlate(s) of stress, for which the term "curve amplification" was proposed. Syllable lengthening, on the other side, appeared to be speaker-independent. According to Nguyễn et al. (2008), every syllable in a compound word, as in a phrase, contains a full vowel and a specific lexical tone, where "tone sandhi" generally isn't supposed to occur in Vietnamese (Nguyễn & Ingram 2006). These features suggest that neither vowel reduction nor tone neutralization due to sandhi can be considered as factors correlating to word stress in Vietnamese. In sum, a full tonal realization has generally been

regarded as an important parameter for word stress in Vietnamese, despite this being inadequately supported by instrumental studies.

Based on these findings of previous studies, it can be hypothesized that Vietnamese learners of German will have difficulty in using duration and intensity to make a distinction between these two levels of stress and, as a consequence, will employ F0 in order to impart prominence on the syllable with primary stress in German determinative compounds in comparison to those with subordinate stress.

3. Method

Two groups of speakers were used. One comprised 10 native Germans and the other 10 native Vietnamese. The Vietnamese speakers (8 female, 2 male) were freshmen of a German Faculty aged between 17 and 19 years. The German speakers (5 female, 5 male) were from 21 to 43 years of age, and none of them showed an effect of dialectal pronunciation.

Each speaker received a list of 39 German determinative compounds, which were randomly taken from the workbook *Tangram aktuell 1* (level A1) and were, therefore, familiar to Vietnamese learners. For an adequate analysis, informants were instructed to read every single word on the list with a terminal intonation. Tokens produced by Vietnamese learners with obvious misplacement of stress or hesitation as well as interruption were not chosen.

For the analysis, despite the many acoustic correlates for investigating the phenomenon of word stress reviewed in the above section, this study relied on the most frequently applied parameters: intensity, fundamental frequency and duration. Due to certain unreleased final stops produced by Vietnamese learners, (which were probably caused by the transfer of the Vietnamese unreleased final stops), the duration of the whole syllable would not be comparable but instead the duration of the main vowel itself. For a correction of the effect caused by the sex difference, the absolute data were normalized according to the following statistic formation:

$$z = \frac{X - \mu}{\sigma}$$ (Kreyszig 1979: 880)

Based on this z-score-transformation, the normalization of fundamental frequency (F0) and intensity (I) was calculated as follows:

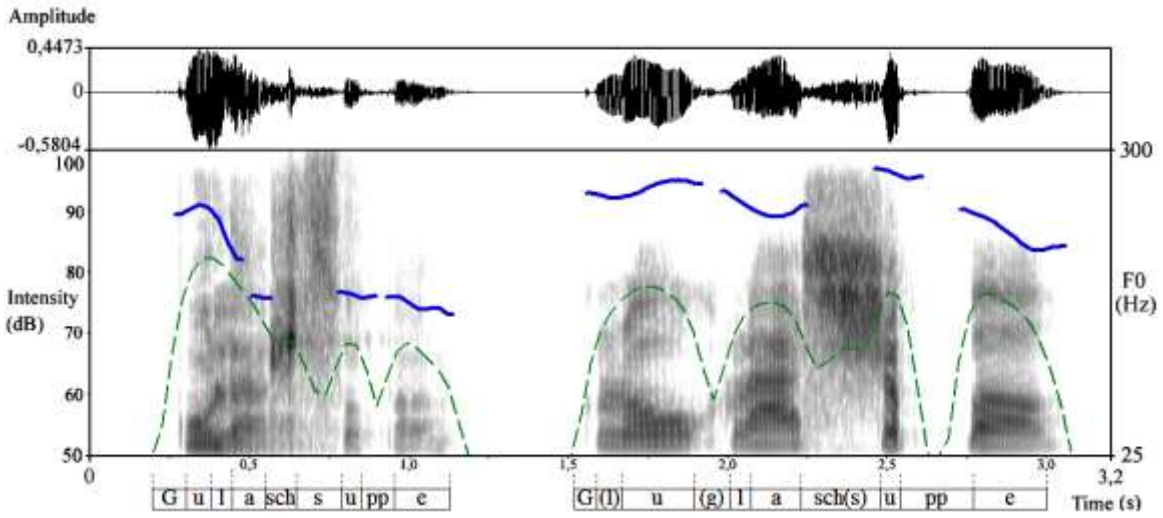
$$F0^N = \frac{F0 - \bar{F}0}{SD_{(F0)}} \qquad I^N = \frac{I - \bar{I}0}{SD_{(I)}}$$

where $F0^N$ and I^N are the normalized fundamental frequency and intensity respectively, F0 and I are the raw values measured on a certain vowel, $\bar{F}0$ and $\bar{I}$ are the means measured from the whole recording of each subject and $SD_{(F0)}$ as well as $SD_{(I)}$ are the corresponding standard deviations.

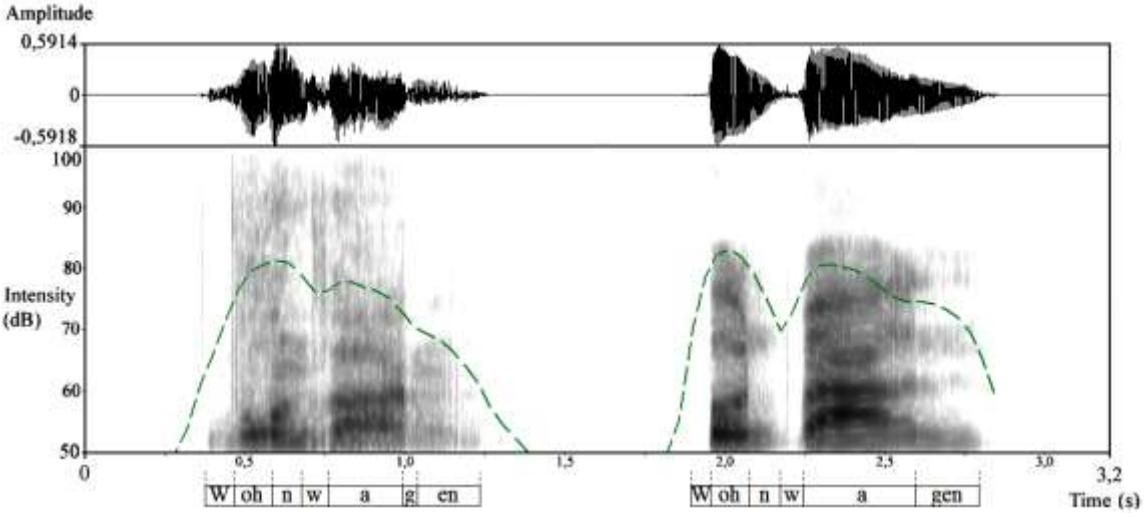
In order to investigate the correlation between the vowel with primary stress (Vo1) and the one with subordinate stress (Vo2), the corresponding differences in the normalized fundamental frequency ($F0^N_{Vo1} - F0^N_{Vo2}$) and intensity ($I^N_{Vo1} - I^N_{Vo2}$) were calculated. In terms of duration, this parameter was directly normalized as the percentual quotient of ~~(?)~~ the two examined vowels of each token (t_{Vo1}/t_{Vo2}). In sum, regarding word stress in German determinative compounds, the considered correlates were $F0^N_{Vo1} - F0^N_{Vo2}$, $I^N_{Vo1} - I^N_{Vo2}$ and t_{Vo1}/t_{Vo2}. All comparisons were attested by statistical two tailed T-tests.

4. Results

4.1 First observations



(a) *Gulaschsuppe*, uttered by the speakers D01w (left) and V05w (right).



(b) *Wohnwagen*, uttered by the speakers D03w (left) and V07w (right).

Figure 1: Oscillograms and spectrograms of the German compounds *Gulaschsuppe* and *Wohnwagen* uttered by the German (left) and Vietnamese (right) speakers. The thick curves represent the change in fundamental frequency, while the dashed ones the intensity movement.

Figure 1a exhibits a clear difference in F0 between the German and the Vietnamese subject, in that the utterances show different curves. In the utterance of the German speaker, the F0 curves tend to gradually fall from the primarily stressed syllable over the one with subordinate stress and to the end of the compound. The primary syllable ‹Gu-› in *Gulaschsuppe* is produced with the highest F0 level. In contrast, there is a more dynamic curve observed in the utterance of the Vietnamese speaker. After the rise in the primary syllable, the F0 rises again in the syllable with subordinate stress ‹-sup-› and reaches even a higher level than in the primarily stressed one. Consequently, there is no such gradually falling curve from the primarily stressed syllable to the end as produced by the German speaker. This F0 curve of the Vietnamese speaker shows that the differentiation by F0 between the syllables with primary and subordinate stress in the German compound is not realized as clearly as with the German speaker. Furthermore, the melodic performance of this Vietnamese speaker seems to be independent of the specific stress pattern of the examined compound.

With respect to the intensity, the oscillograms of the two German utterances in figures 1a-b clearly show a reduced intensity relative to the primarily stressed ones. In contrast, this distinction does not seem to occur with the Vietnamese speakers at all. In addition, the utterances of the German and Vietnamese speakers differ from each other through

the shape of the intensity curve. As opposed to the German speaker, the intensity in the utterances of the Vietnamese speaker falls sharply right after the primarily stressed syllables and then, right before the ones with subordinate stress it rises sharply again into these syllables. The intensity in the utterances of the German speakers tends to fall gradually from the primarily stressed syllables over the ones with subordinate stress to the end of the compounds. In comparison, such a gradual reduction of intensity throughout the compounds does not seem to occur in the utterances of the Vietnamese speakers, since not until after the last stressed syllable does the intensity start to fall clearly. In particular, the curve of the syllable with subordinate stress ‹-wa-› in *Wohnwagen* uttered by the German speaker D03w almost merges into the fall of the primarily stressed syllable ‹Wohn-›, so that there is no clear intensity peak in that syllable with subordinate stress. The intensity curve of the Vietnamese speaker V07w still clearly shows two peaks on the syllables with primary and subordinate stress respectively. In sum, it has been shown that the Vietnamese speakers, as opposed to the German ones, performed hardly any reduction of the intensity in the syllables with subordinate stress relative to the primarily stressed ones. It has also been shown that the intensity in the utterances of the Vietnamese speakers shows more sharp ups and downs, whilst the German speakers exhibit a less dynamic curve of intensity.

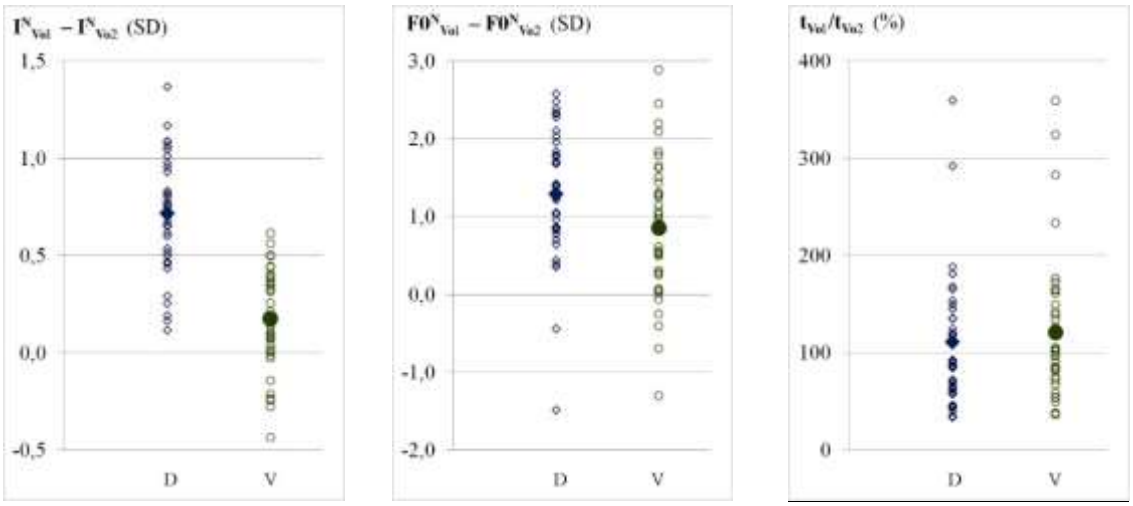
Generally, in their utterances of the two German compounds *Gulaschsuppe* and *Wohnwagen* the Vietnamese speakers exhibit a greater relation of the syllables with subordinate stress to the primarily stressed ones in the same compounds. Consequently, the primarily stressed syllables are acoustically not prominent enough compared to the ones with subordinate stress.

4.2 Analysis

Table 1 and figures 2a-c show the average differentiation between the primarily stressed vowels and the ones with subordinate stress in terms of the differences in normalized fundamental frequency, normalized intensity and duration~~s~~.

	D	V	
$I^N_{Vo1} - I^N_{Vo2}$	0,72	0,17	***
(SD)	*0,29*	*0,3*	
$F0^N_{Vo1} - F0^N_{Vo2}$	1,29	0,85	***
(SD)	*0,84*	*0,88*	
t_{Vo1}/t_{Vo2}	111,1	120,0	
(%)	*68,2*	*75,5*	

Table 1: Overall difference in normalized intensity and fundamental frequency as well as duration ratio between the vowels with primary and subordinate stress realized by the German (D) and Vietnamese (V) groups. Corresponding standard deviations are given as italicized. The asterisks indicate the level of significance (*: $p < 0,05$; **: $p < 0,01$ and ***: $p < 0,001$).



(a) Difference in intensity. (b) Difference in F0. (c) Duration ratio.

Figure 2: Differentiation between the vowels with primary and subordinate stress in 39 German determinative compounds, realized by the German and Vietnamese groups. The larger symbols mark the overall means; the smaller the means in each individual compound.

Figure 2a shows clearly that the German group has a greater mean difference in intensity between the vowels with primary and subordinate stress than the Vietnamese group. This discrepancy between the two groups is supported by a corresponding T-test (0,72 $SD_{(D)}$ vs. 0,17 $SD_{(V)}$, $T(38) = 11,4$, $p < 0,001$, see also Tab. 1). These results indicate that the German speakers differentiated the primarily stressed vowels from the ones with subordinate stress in the same compounds by means of intensity to a greater

extent than the Vietnamese speakers did. Due to the attested minimal difference in the intensity of the Vietnamese group (0,17 SD), it is questionable whether the Vietnamese speakers made any conscious distinction between these two types of vowels in German compounds by means of intensity. What are the potential reasons for this obvious difference between the two groups?

In German, each compound is treated as one lexical unit and, accordingly, produced with one expenditure of energy. The Vietnamese language, on the other hand, has a large number of monosyllabic words and a syllable-timed rhythm. Even the few polysyllabic words have their syllables orthographically separated by spaces. Based on these differences, it is assumed that Vietnamese learners will treat each single German compound as a series of constituents which, in respect of prosody, would then be independent of each other. Thus, Vietnamese learners would pronounce German compounds according to the many independent constituents and with repeated energy. The number of the expenditures of energy would depend on how many constituents Vietnamese learners would perceive a certain compound to contain. This would probably affect the performance of intensity as well as loudness (for an illustration, see figures 1a-b). In all cases, the vowels with subordinate stress would, therefore, be produced with an increased intensity, so that no clear distinction in intensity might exist between these two types of stressed vowels.

Regarding the fundamental frequency, figure 2b also shows a clearly greater difference in the German than in the Vietnamese group. A corresponding T-test supports this observation (1,29 $SD_{(D)}$ vs. 0,85 $SD_{(V)}$, $T(38) = 4,27$, $p < 0,001$, see also Tab. 1). Based on this result, the German speakers, in comparison to the Vietnamese ones, are claimed to perform a greater distinction of the vowels with primary and subordinate stress in the same compounds by means of a higher F0. A further observation showed that when read with a falling intonation, the primarily stressed vowels were produced by the German speakers with an F0 level clearly higher than the ones with subordinate stress. This was found even in each examined compound, so that this seems to be independent of any of these compounds. However, the melodic relation between these two kinds of vowels among the Vietnamese speakers appeared to be remarkably diverse. This observation was supported by a closer investigation of the Vo1-Vo2-difference in the following two sound contexts. Similar results were found across the contexts for the German group, whilst for the Vietnamese group, there were diverse results:

- 1,42 $SD_{(D)}$ vs. 0,71 $SD_{(V)}$ in 10 compounds, whose primarily stressed syllables are non-closed and whose syllables with subordinate stress are closed and
- 1,51 $SD_{(D)}$ vs. 1,68 $SD_{(V)}$ in 6 compounds, in which both types of stressed syllables are closed.

These results indicate that the distinction between the primarily stressed vowels and those with subordinate stress in compounds produced by the Vietnamese speakers is, on the contrary to the German ones, greatly dependent on the sound context. Concerning the melodic performance of Vietnamese learners in closed syllables, Nguyễn (1970) and Nguyễn & Ingram (2004) claimed that Vietnamese learners of English tend to produce a kind of Vietnamese high tone (sắc) on these syllables. Accordingly, this sắc tone might also have been transferred to the syllables with subordinate stress in the 10 German compounds mentioned above, reducing the Vo1-Vo2-distinction by F0. In the other 6 compounds, the primarily stressed syllables are also closed, so that in this case, the high tone sắc might have been transferred to these primary syllables, whilst the ones with subordinate stress might have been performed with the low tone nặng. Due to this transfer of the high and the low tones (sắc and nặng), the distinction in F0 between these two types of vowels among the Vietnamese speakers in this given context was much greater even than that of the German speakers.

Contrary to the above two aspects of intensity and fundamental frequency, figure 2c and table 1 reveal no significant difference in the Vo1-Vo2-duration ratio between the German and the Vietnamese groups. Accordingly, the Vietnamese group is assumed to differentiate the primarily stressed vowels from those with subordinate stress by means of the same timing as the German group.

However, it is questionable if this performance of the Vietnamese speakers was based on an intentional production of word stress by means of duration. In other words, did the Vietnamese speakers purposely take use of the duration as a means to accentuate the vowels with primary stress from those with subordinate stress?

A deviation from the corresponding relation produced by the German speakers was reported in Kelz (1984), where long vowels in German closed syllables in Vietnamese speakers' speeches can be performed as too short. On the other hand, due to Vietnamese phonotactics German short vowels can be produced as too long in half-open syllables with a final lateral or nasal. In order to illustrate these two opposite performances of

German vowels by the Vietnamese speakers, examples with *Rotwein*, *Notfall*, *Weltflug* and *Fluggast* (engl. *red wine*, *emergency*, *round the world flight*, *airline passenger*) are provided in table 2.

	Rotwein			Notfall			Weltflug			Fluggast		
	o:	aɪ	o:/aɪ	o:	a	o:/a	ɛ	u:	ɛ/u:	u:	a	u:/a
D01w	125	220	56,8	119	109	109,2	81	131	61,8	103	141	73,0
D02w	157	247	63,6	164	137	119,7	85	174	48,9	153	158	96,8
D03w	99	186	53,2	142	97	146,4	67	120	55,8	111	139	79,9
D04w				162	94	172,3	109	113	96,5	84	147	57,1
D05w	159	190	83,7	157	74	212,2	85	142	59,9	113	142	79,6
D06m	112	176	63,6	113	79	143,0	50	85	58,8	65	118	55,1
D07m	158	217	72,8	157	113	138,9	92	133	69,2			
D08m	112	212	52,8	123	82	150,0	45	73	61,6	70	107	65,4
D09m	119	220	54,1	148	112	132,1	86	126	68,3	82	127	64,6
D10m	152	158	96,2	143	67	213,4	48	86	55,8	98	134	73,1
D	132,6	202,9	66,3	142,8	96,4	153,7	74,8	118,3	63,7	97,7	134,8	71,6
V01w				149	***276***	54,0	***161***	159	101,3	135	186	72,6
V02w	119	***339***	35,1	***101***	***255***	39,6	***193***	***137***	140,9	***61***	126	48,4
V03w	***66***	***293***	22,5	***75***	***177***	42,4	84	***275***	30,5	***42***	***208***	20,2
V04w	***111***	***314***	35,4	***94***	***227***	41,4	***170***	***176***	96,6	***54***	***240***	22,5
V05w	***98***	171	57,3	114	***179***	63,7	113	103	109,7	157	162	96,9
V06w	125	***257***	48,6	108	142	76,1	***167***	102	163,7	165	157	105,1
V07w	168	***422***	39,8	***115***	***330***	34,8	***263***	111	236,9	140	189	74,1
V08w	136	***525***	25,9	129	***160***	80,6	***256***	***217***	118,0	***146***	162	90,1
V09m	118	***326***	36,2				***167***	***149***	112,1	***63***	***174***	36,2
V10m	***106***	***349***	30,4	146	***276***	52,9	***127***	99	128,3	61	***274***	22,3
V	116,3	332,9	36,8	114,6	224,7	53,9	170,1	152,8	123,8	102,4	187,8	58,8

Table 2: Duration (in ms) of the vowels with primary or subordinate stress and the corresponding duration ratios (in %) in *Rotwein*, *Notfall*, *Weltflug* and *Fluggast* (engl. *red wine*, *emergency*, *round the world flight*, *airline passenger*). The vowels of the Vietnamese learners that are considered deviant from the German counterpart are given in bold type. The arrows between the long vowel /u:/ indicate a remarkably larger variation in the duration of this vowel between the two contexts *Weltfl**u**g* and *Fl**u**ggast* as compared to the German speakers.

According to the duration of the two types of vowels as well as the corresponding Vo1-Vo2-duration ratios, the following observations were made:

- The long vowel /o:/ preceding the final plosive /t/ in *R**o**twein* and *N**o**tfall* was performed clearly shorter by the Vietnamese speakers V03w, V04w, V05w and V10m than by the German group.
- The short vowel /a/ in *Notf**a**ll* was pronounced too long by all the Vietnamese speakers as compared to the German speakers. A longer duration was also

found for the short vowel /ɛ/ in ***We**ltflug* as pronounced by every Vietnamese speaker (excluding V03w and V05w).

- In relation to the primarily stressed vowel /uː/ in *Fl**ugga**st*, the vowel with subordinate stress /a/ was produced too long by the speakers V03w, V04w, V09m and V10m as compared to the German group.

- The long vowel /uː/ in the morpheme ‹-flug-›, occurring in the two different contexts *Weltfl**ug*** and *Fl**ug**gast*, was produced by the Vietnamese speakers V02w, V03w, V04w and V08w with a clearly greater deviation than the German speakers. In the first compound, this vowel of these Vietnamese speakers has about twice the duration of the second. Such a difference was not observed in the German group.

- The final nasal /n/ following the diphthong /aɪ̯/ in *Rotw**ein*** was omitted by 8 out of 9 Vietnamese speakers. As a result, this diphthong shows a greater duration in relation to the primarily stressed vowel /oː/ for these Vietnamese speakers.

These observations support the assumption that the Vietnamese speakers used a different timing for the vowels with primary and subordinate stress in compounds from the German speakers. Where did this difference come from? There are some related sound patterns which can be mentioned in conjunction with Vietnamese phonetics and phonology (cf. Đinh & Nguyễn 1998):

- All monophthongs, except for the long ones /aː/ and /ɤː/, are to be pronounced short in closed syllables. The long vowel /aː/ as ‹a› is always pronounced long.

- All monophthongs, except for the short ones /a/ and /ɤ/ as ‹ă› and ‹â›, are to be pronounced long when they occur in half-closed syllables with the final apical nasal /n/.

- The apical nasal /n/ does not occur as a final sound after the diphthong /aɪ̯/.

- The lateral /l/ does not occur as a final sound at all.

These phonotactic and phonetic patterns in Vietnamese might have been transferred into German, so that the long vowel /oː/ in ***Ro**twein* and ***No**tfall* was pronounced short by the Vietnamese speakers, whilst the short vowel /a/ in *Flugg**a**st* was pronounced long. The omission of the final nasal /n/ in *Rotwei**n***, probably due to the influence of the phonotactics in the mother tongue, results in an exaggerated long variant of the preceding diphthong /aɪ̯/. Besides this, most of the Vietnamese speakers replaced the syllable-final lateral /l/ in *We**l**tflug* and *Notfa**ll*** by an apical nasal /n/, which also could be caused by the corresponding pattern in Vietnamese. Given this replacement, the short

vowels /ɛ/ and /a/ were pronounced long, probably in accordance with the second pattern described above.

In general, there was a smaller Vo1-Vo2-duration ratio in *Rotwein*, *Notfall* and *Fluggast* among the Vietnamese speakers compared to the German ones, since the primarily stressed vowels were pronounced too short and the ones with subordinate stress too long. These observations support the assumption that the Vietnamese speakers, due to the influences from the timing patterns in the mother tongue, produce a different duration ratio than the German speakers. Accordingly, the performance of these two types of vowels in German compounds produced by the Vietnamese speakers depends little on the given word stress, but largely on the actual sound context of the individual constituents of compounds.

In sum, the analysis has clearly shown that the Vietnamese group made a significantly smaller distinction between the vowels with primary and subordinate stress in read compounds than the German group did. Based on these findings, we can posit a tendency towards unclear word stress by the Vietnamese speakers in German read compounds. This word stress problem is attributed to the lack of a salient prominence of the vowels with primary stress by means of intensity or fundamental frequency as compared to the corresponding ones with subordinate stress in the same compounds.

5. Discussion

The results of this study show some conflicts with the findings reported in previous studies on the production of word stress in an accentual L2 by Vietnamese learners. Unexpectedly, it was ~~in~~ the parameter of intensity in which the L2 learners showed the most notable deviation from the native German speakers. While the German speakers consistently used intensity to differentiate the primarily stressed vowels from those with subordinate stress, the Vietnamese speakers barely distinguished these two kinds of vowels in such a manner. This finding contradicts the claim that Vietnamese learners could employ intensity as a cue to stress, for it highly correlates with F0, a property that Vietnamese learners are accustomed to manipulate in their own native language (Nguyễn et al. 2008). On the other hand, this study shows accordance with the finding in Fokes & Bond (1989) on the production of English words by a Mandarin speaker, in that "the amplitude differences [between the two types of stressed syllables] are typically quite small or even reversed". In fact, based on these findings, it is question-

able that speakers of a non-accentual tonal language with a syllable-timed character such as Vietnamese or Mandarin Chinese can intentionally use the dimension of intensity to superimpose prominence onto stressed elements.

As hypothesized, the Vietnamese speakers were able to manipulate fundamental frequency as a cue to stress, which repeats the findings in Nguyễn (1970) and Nguyễn et al. (2008). In particular, both the transfer of the Vietnamese rising tone sắc onto the stressed syllables noted in Nguyễn (1970) as well as the effect of tonal transfer provoked by closed syllables observed in Nguyễn & Ingram (2006) were supported by evidence found in this study. However, I claim that the performance of Vietnamese learners depends largely on the specific sound context of the syllables. In cases where not the primarily stressed syllable but the one with subordinate stress is closed, the sắc tone would not be superimposed on the former but on the latter syllable, causing a pitch prominence on the syllable with subordinate stress, which, consequently, contributes to an unclear word stress. When both syllables are closed, the sắc tone is not necessarily transferred onto both syllables but only onto the primarily stressed one, while the syllable with subordinate stress may be accompanied by the low tone nặng. This claim is in accordance with the finding on the perception of English stress by Vietnamese learners in Nguyễn (2003). In this work, it was suggested that a perceptual transfer of the Vietnamese high and low tones depended on the syllable structure (closed or non-closed) and the stress levels (stressed or unstressed).

With respect to duration, the results of this study showed no general difference in the timing between the German and the Vietnamese groups, and thus indicated at first sight that the Vietnamese speakers could use this parameter to realize an adequate duration ratio between these two types of stressed vowels in German compounds. However, it was then argued that this manipulation was constrained by phonetic and phonotactic patterns transferred from the native language. Therefore, the hypothesis that Vietnamese learners have difficulty in using duration as a cue to stress (cf. Nguyễn et al. 2008) can generally be confirmed.

6. Conclusion

This study investigated the differentiation between primarily stressed vowels and those with subordinate stress in German determinative compounds in terms of intensity, fundamental frequency and duration as uttered by Vietnamese learners of German. With compounds read with a falling intonation, the results showed that while the German speakers clearly accentuated the primarily stressed vowels from those with subordinate stress ones by means of intensity, this distinction wasn't made saliently enough by the Vietnamese speakers. In respect of F0 and duration, the learners did not consistently and systematically differentiate these two types of stressed vowels. These parameters were considerably dependent on the specific sound context of the compounds. For this reason, a wide range of variations of the melodic as well as timing performance among the different German compounds was observed. These results showed deviations in contrasting the primary and the subordinate stress among Vietnamese learners.

The lack of phonetic contrast between the two types of syllables can probably be attributed firstly to the transfer of the Vietnamese syllable-timed character into German, which leads to a production of the syllables in German compounds with roughly equal intensity. Secondly, the issue might also be due to a negative transfer of the melodic and timing patterns from the mother tongue, since in inconvenient cases, this influence will also contribute to an insufficient prominence of the primarily stressed vowels.

The study took the production of stress by Vietnamese learners of German into account but left the perceptive dimension uninvolved. Future research should also consider perception, which will not only help understanding which phonetic cues Vietnamese learners use to perceive prominence in German, but also shed more light on their production. Moreover, influence from other acquired foreign languages, especially English, should be considered.

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