ACQUISITION OF THE /v/ - /w/ CONTRAST BY L1 GERMAN CHILDREN AND ADULTS

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ABSTRACT

This study investigated the acquisition of the contrast between the voiced labiodental fricative /v/ and the labiovelar approximant /w/ in L2 English and L3 Polish by 16 native German-speaking children and adults, whose L1 does not have this contrast. In a longitudinal design spanning the first ten months of learning their L3 Polish, the study focused on the role of age in the multilingual acquisition of this contrast. Auditory analyses showed that the adults have higher accuracy rates for L2 English /v/ and /w/ than the children at all three data points. By contrast, the children outperform the adults in the accuracy of Polish /v/ and /w/ during the first ten weeks of learning. Acoustic measurements of F2, the median of the harmonics-to-noise ratio and the centre of gravity showed both learner groups consistently use F2 but only the children use voicing/friction to distinguish the /v/-/w/ contrast in Polish.

Keywords: age, L2/L3 phonological acquisition, labiovelar approximant, voiced labiodental fricative.

1. INTRODUCTION

The acquisition of the contrast between the voiced labiodental fricative /v/ and the labiovelar approximant /w/ has been shown to be challenging for adult L1 speakers of German, both in perception ([1], [8]) and production ([8], [12], [14]). One reason for the observed difficulties of German learners with the /v/-/w/ contrast might not only lie in the fact that /w/ does not occur in the German phoneme inventory, but also in the different phonetic realizations of the phonological category /v/ in the languages concerned. For instance, syllable-initial /v/ is realized differently in English and German: while English /v/ is produced with more energy and stronger contact between the articulators ([3]), the typical German realization of it is a weak labiodental approximant [ʋ] ([13], [6]). It is thus possible that the shared manner of articulation between English and Polish [w] and German [ʋ] for /v/ leads to an initial overlap between the two categories.

German learners' production of this contrast has been shown to vary with proficiency: [14], in a cross-sectional study, compared L1 German adult learners of English of different proficiency levels and found that the accuracy of /w/ increased from 25-65 % for beginners to 90 % and more for advanced learners. Likewise, the accuracy of /v/ increased from an average of 10% to 70 % with substitutions of /v/ by [w] peaking at about 10 % for learners with intermediate proficiency. However, cross-sectional group comparisons do not provide reliable data for the description and prediction of speech learning processes. In order to investigate the acquisition process of this contrast by L1 German speakers, longitudinal data will be analysed in this study.

One further factor that may influence the process of phonological acquisition is the age of learning. The few studies that have compared phonological abilities of younger and older instructed learners offer conflicting evidence: Some found an advantage of younger learners in formal L2 learning ([2], [11]), while others found an advantage of older learners in various phonological domains ([4], [5], [9]). Any comparison of these results is made difficult by the different learning conditions and differences in the amount and quality of input that were experienced by the learners in each of them.

Finally, the learners' broader linguistic experience has rarely been considered in studies into non-native acquisition of phonology in formal learning contexts, despite the fact that today's language classrooms almost never engage a learning constellation in which the target language is the only non-native language acquired by the young and even more so the adult learner. Findings from the field of third language (L3) acquisition indicate that all the languages of the multilingual will interact and affect the nature and course of further phonological learning of both young and adult learners (e.g. [7], [10]). The present study thus compares child and adult learners' production of the /v/-/w/ contrast in both their L2 English and L3 Polish, languages that share the existence of this contrast and were acquired in the classroom by the two learner groups.

In summary, we investigated the following research questions:

- How does the production of /v/ and /w/ in English and Polish by German L1 speakers

change over time and with increasing proficiency?
- Do L1 German children differ from their adult counterparts in the production of the /v/-/w/ contrast over time?

2. METHOD

2.1. Participants

A total of 16 L1 speakers of German participated in the study, 9 children (aged 12-13) and 7 adults (aged 21-39). Both the children and the adults had learnt English in school (average starting age 6 and 9 years, respectively) and had just begun learning Polish. Five of the adults had learned further languages such as French and Spanish.

2.2. Materials and procedure

All participants were recorded three times: after five weeks (T1), after ten weeks (T2) and after ten months of learning Polish (T3). They were recorded on hand-held devices with a 44.1 kHz sampling rate, while carrying out the following tasks:

- T1: picture naming, delayed repetition, story telling in their L2; simplified delayed repetition in their L3
- T2: picture naming, delayed repetition, story telling in their L2 and L3
- T3: picture naming, delayed repetition, story telling in their L2 and L3.

For the picture naming task, participants were presented with pictures on a PowerPoint screen and asked to name them at their own pace. Occasional prompting by the experimenter occurred. For the delayed repetition task, participants heard a word in a carrier phrase (e.g. 'I say X again' in English) and were asked to repeat the entire phrase after hearing a prompt (e.g. 'And what do you say' in English). At T1, they only heard the target word without a carrier phrase in their L3 Polish. For the story telling task, participants were presented with a picture story and asked to describe what they saw. The experimenter sometimes asked additional questions about the pictures in order to elicit specific words. The recordings for each of the languages were done on separate days by L1 speakers of the respective languages to create appropriate language modes.

Syllable-initial and syllable-medial /v/ and /w/ were elicited in the following target words across the tasks:

- *English* /w/: one, wolf, water, wine, wind, woman, weather, walking, rewind; /v/: vet, vest, van, very, vanilla, over, novel, living;
- *Polish* /w/: ład, ława, ładna, mała, brała, szkoła; /v/: woda, waza, wino, kawa, drzewo, piwo, rower.

2.3. Analyses

All instances of /v/ (n = 639) and /w/ (n = 908) produced in all tasks and both languages by the participants were transcribed, using the entire IPA, and analysed auditorily by two independent phonetically trained raters (a native speaker of German and a native speaker of Czech with advanced Polish skills, both with near-native competence in English). In case of disagreement, a third rater (a native speaker of German, near-native speaker of English and learner of Polish) was consulted. In addition, all /v/ and /w/ produced by the learners as well as those produced by the native speakers of English and Polish who were recorded for the stimuli in the tasks were analysed acoustically as follows:

- average F2 of the interval (see [15]; F2 values in Hz were converted into a Bark scale, using the conversion formula by [16], p. 99)
- median of the harmonics-to-noise ratio (see [6]), measuring the ratio of friction vs. periodicity
- centre of gravity (see [6]), measuring the average of frequencies over the entire frequency domain weighted by the amplitude (with the power spectrum).

Due to the small sample size, non-parametric tests for between-subjects (Mann-Whitney *U*-test) and within-subjects (Wilcoxon signed-rank test) designs were used to examine the results of both the auditory and acoustic analyses.

3. RESULTS

3.1. Auditory analysis of pronunciation accuracy

Tables 1 and 2 illustrate the accuracy rates of /v/ and /w/ for the adults and children at T1, T2 and T3, as based on the auditory analyses. Mann-Whitney *U*-tests showed that the two groups overall produce /v/ and /w/ equally accurately in both L2 English and L3 Polish at both T1 and T2. At T3, the adults improved their accuracy of Polish /v/ compared to T1 and T2 ($Z = -2.032$, $p < .042$ and $Z = -2.201$, $p < .028$, respectively), whereas children's accuracy of Polish /w/ dropped from T1 and T2 at T3 ($Z = -2.106$, $p < .035$ and $Z = -2.028$, $p < .043$, respectively).

Table 1: Accuracy (in %) of /v/ and /w/ in L2 English and L3 Polish produced by the adult learners at all three data collection points.

	English		Polish	
	v	w	v	w
T1	84.6	86.6	77.8	84.6
T2	70.9	90.4	84	81.8
T3	75	90.3	94.9	78.3

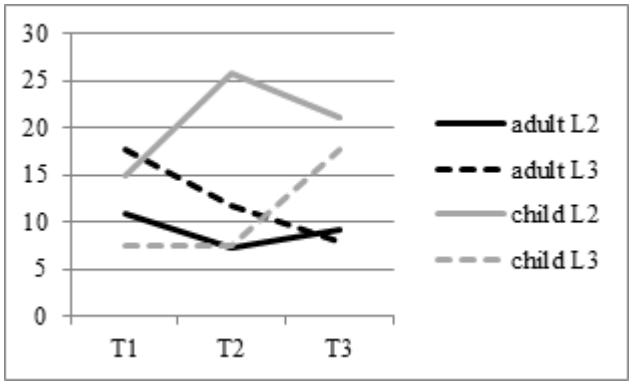
Table 2: Accuracy (in %) of /v/ and /w/ in L2 English and L3 Polish produced by the child learners at all three data collection points.

	English		Polish	
	v	w	v	w
T1	77.8	76.7	95.6	85.7
T2	60.8	75.3	90.2	84.6
T3	74.4	73.8	82.7	69.4

Figure 1 shows the mispronunciation rates of the /v/-/w/ contrast, i.e. the percentage of [v] produced for /w/ and vice versa by the adult and child learners across time.

In general, confusion of [v] and [w] in L2 English occurs more often for the children (ranging from 15-26 %) than the adults (9-11 %) at all times. By contrast, the children confuse the two sounds less in their L3 Polish at T1 and T2 (7 %) in comparison to the adults (12-17 %). At T3, however, the children's mispronunciations increase while the adults' drop. When comparing L2 and L3 mispronunciation rates, reverse patterns emerge for the two groups at the first two testing times: The children have higher mispronunciation rates in their L2 and the adults in their L3. Interestingly, the mispronunciation rate in the two languages becomes more similar at T3 for both groups.

Figure 1: Percentage of /v/ produced as [w] and vice versa in L2 English and L3 Polish by the adult and child learners at all data collection points.



3.2. Acoustic analyses

Table 3 shows within-speaker statistics for the native speaker of English (7 /v/, 12 /w/ tokens) and the native speaker of Polish (10 /v/, 8 /w/ tokens), whose speech was used as stimuli in the data elicitation tasks. The speakers both produce /w/ with a significantly lower F2 than /v/. The English native speaker further shows a significantly lower centre of gravity for /w/ than for /v/, while the native speaker of Polish produces /w/ with a higher harmonicity than /v/ in both initial and medial positions.

Table 3: Median of harmonics-to-noise ratio, mean centre of gravity and mean F2 of /v/ and /w/ produced by the native speaker of English and of Polish (*=p<0.05; **=p<0.01; ***=p<0.001).

	English		Polish	
	v	w	v	w
harmonicity initial pos.	14.1	18.4	13.7	19.3*
harmonicity medial pos.	12.4	11.4	5.2	8.5*
centre of gravity	3903	825**	1512	776
F2	1829	981***	1532	1001***

Figure 2 provides F2 values of the adults and children's productions of /w/ and /v/ at T1, T2 and T3. It shows that both the children and the adults produce /w/ with a lower F2 than /v/ in both their L2 and L3 and across all testing times ($p < .001$).

Figure 2: Mean F2 (in Bk) of /v/ and /w/ in L2 English and L3 Polish produced by the adult and child learners at all three data collection points.

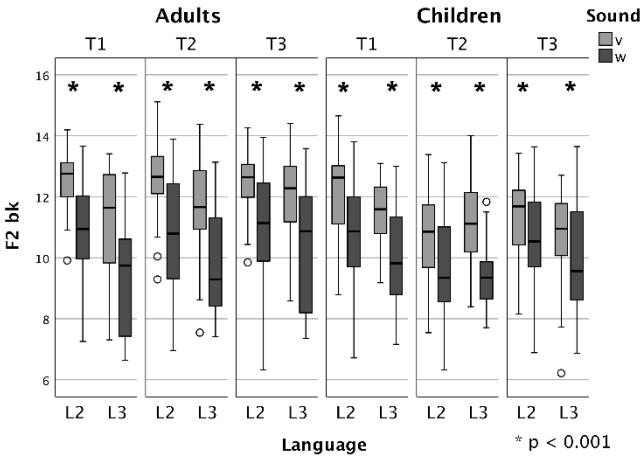


Figure 3 illustrates the mean values for centre of gravity (in Hz), indicating that the adults made a distinction between their /v/ and /w/ on this measure in English at T1 ($Z = -2.366$, $p < .018$), and in Polish at T2 and T3 ($Z = -2.366$, $p < .018$ and $Z = -2.366$,

$p < .018$, respectively). The children distinguished the contrast only in English, namely at T1 ($Z = -2.429$, $p < .015$) and at T3 ($Z = -2.192$, $p < .028$), in terms of centre of gravity values.

Figure 3: Mean centre of gravity of /v/ and /w/ produced by the adults and children in their L2 and L3 across all testing times.

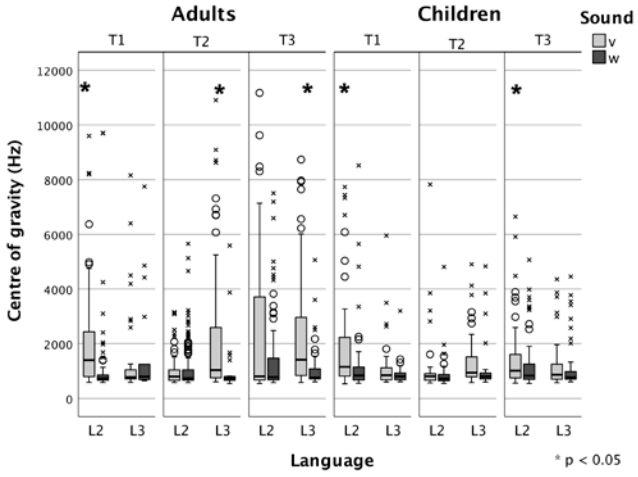


Figure 4: Median of the harmonics-to-noise ratio of /v/ and /w/ produced by the adults and children in their L2 and L3 across all testing times.

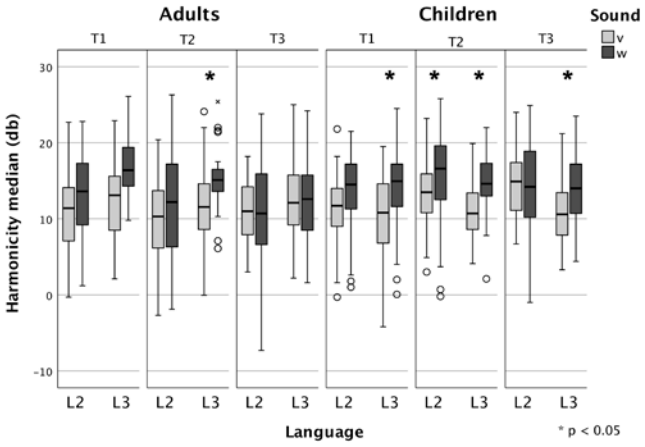


Figure 4 shows the results of the third acoustic measurement, the harmonicity median. Here, adults only distinguished between Polish /v/ and /w/ at T2 ($Z = -2.197$, $p = .028$). The children, in contrast, showed significant differences between their Polish /v/ and /w/ at all testing times (T1: $Z = -2.67$, $p = .008$; T2: $Z = -2.547$, $p = .011$; T3: $Z = -2.429$, $p = .015$), but only distinguished between these sounds using the friction vs periodicity parameter at T2 in English ($Z = -2.073$, $p = .038$). Unlike the native Polish speaker, neither the adults nor the children made a distinction between initial and medial /v/ and /w/ in terms of the harmonicity median.

4. DISCUSSION

Our results show that the acquisition process of the /v/-/w/ contrast in English as an L2 and Polish as an L3 by the L1 German speakers differs both between languages and across the two learner groups. During the first ten months of learning their L3 Polish, the adults show an increasing acoustic differentiation of the contrast between the fricative /v/ and the approximant /w/ and confuse these sounds less as learning progresses. Conversely, the children's production of L3 Polish /w/ is less accurate at T3 than before and the confusion between /v/ and /w/ increases. In contrast to the adults, however, the children do not only mark the /v/-/w/ contrast in Polish by differences in F2 but also in the harmonicity median across all testing times.

The two learner groups also differ in their production of /v/ and /w/ in their L2 English. The adults have a lower mispronunciation rate of these two sounds than the children across all three testing points, and in general show very little development over the ten-month investigation. The children's phonological system of their L2 English, in contrast, is less stable and seems to be affected by the learning of the L3 Polish: they show a steep increase of the mispronunciation rate in the production of English /v/ at T2, after ten weeks of learning Polish. Moreover, at this testing time, the children do not, like the native speaker, distinguish the two sounds by the centre of gravity as they did at T1, but produce a difference in friction/periodicity instead, which is used by the Polish native speaker for the Polish /v/-/w/ contrast. Both learner groups use F2 consistently to distinguish English /w/ from /v/, but neither have acquired the differences in the amplitude of frequency ranges between these two sounds.

5. CONCLUSION

The results of the present study indicate that the F2 distinction is acquired first as a marker of the /v/-/w/ contrast in both the L2 and the L3 of L1 German children and adults. By contrast, the acoustic parameters centre of gravity and the friction vs periodicity ratio are used more variably: as a group, the L1 German children mark the distinction between L3 Polish /v/ and /w/ by the harmonicity median and the distinction between L2 English /v/ and /w/ by the centre of gravity (at least at T1). The L1 German adults rather show consistently different centres of gravity in their L3 Polish and no consistent pattern in their L2 English.

6. ACKNOWLEDGEMENTS

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