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VOT production in multilingual learners of French as a foreign language: cross-linguistic influence from the heritage languages Russian and Turkish

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Abstract: *We analyze the production of [±voiced] stops in French as a foreign language by multilingual learners who speak Russian or Turkish as a heritage language along with their dominant language, German. Control data produced by monolingually raised German learners are taken into account. It is shown that the bilingual learners perform more target-like than the monolinguals for the voiceless stops /p t k/, but not for their voiced counterparts /b d g/. This suggests that the (non-)aspiration of voiceless stops is perceptually more salient for the learners than the presence or absence of pre-voicing in the realization of voiceless stops. We interpret our overall results as an example of an at least partial multilingual advantage in foreign language learning.*

Résumé : *Nous analysons la production d'occlusives (non-)voisées en français langue étrangère par des apprenants plurilingues parlant ou le russe ou le turc comme langue d'origine en plus de leur langue dominante, l'allemand. Les données de contrôle proviennent d'enregistrements réalisés avec des apprenants monolingues allemands. Les résultats montrent que les apprenants plurilingues sont avantagés en comparaison des monolingues par rapport à la production d'occlusives sourdes, ce qui n'est pas valable pour leurs contreparties voisées. Cela suggère que la (non-)aspiration de /p t k/ est perceptivement plus saillante pour les apprenants que la présence ou l'absence du pré-voisement de /b d g/. Nous interprétons nos résultats généraux comme un avantage, du moins partiel, du plurilinguisme lors de l'apprentissage de langues étrangères.*

Keywords: French as a foreign language, heritage languages, transfer, stop consonants

Mots-clés : Français langue étrangère, langues d'origine, transfert, occlusives

1. Introduction

While recent studies in third language (L3) phonology largely focus on the consecutive learning of foreign languages (FL) (Llama & al. (2010), Wrembel (2014) as well as Cabrelli Amaro & Wrembel (2016) for an overview), still little is known about the acquisition of L3 phonetics and phonology in learners who acquired more than one language in early childhood. This particularly holds true for the learning of FLs in migrant children who speak a heritage language (HL) (Montrul 2016) in addition to their dominant language, which is also the surrounding language and the language of instruction at school. The present study aims to fill this research gap by investigating the patterns of Voice Onset Time (VOT) in French as a FL, produced by three different learner groups. Our subjects are young multilingual learners who speak either Russian or Turkish as an HL along with their dominant language, German. To determine the effects of the learners' plurilingual background, the materials produced by the two experimental groups are compared with data gathered from a monolingually raised German control group. All of the learners' languages, i.e. German, their respective HL

(Russian/Turkish), and the FL addressed here, French, are taken into account. Our contribution is structured as follows. In Section 2, we provide general information on the VOT patterns of the languages of our sample as well as on previous research on VOT in multilingual constellations. Section 3 introduces the participants and the methodology, presents the results of our study and discusses them. Section 4, finally, offers some concluding remarks.

2. Background and review of the literature

In what follows we provide the reader with general information on the VOT patterns of French, German, Russian, and Turkish (Section 2.1.), before giving an overview of relevant studies on VOT in different multilingual constellations (Section 2.2.).

2.1. VOT patterns in the languages of our sample

VOT, which is considered the most salient feature that differentiates the language-specific realizations of stop consonants, refers to the time that elapses between the release of the plosive and the voicing onset (Lisker & Abramson 1964, 389; Cho & Ladefoged 1999). Three types of VOT are commonly distinguished: voicing lead or pre-voicing (voicing onset (VO) before the release), short lag (VO with or shortly after the release), and long lag (VO late after the release). Most languages show a two-way phonological (*fortis-lenis*) contrast which is cross-linguistically associated with different VOT types. In Table 1 we summarize the characteristics of the stop consonants and their respective VOT patterns in the languages of our sample.

Table 1. *Characteristics, VOT patterns and orthographic representations of stop consonants in French, Russian, Turkish, and German.*

	pre-voicing	short lag	long lag
French, Russian	[b d g] <b d g>, <б д г> voiced	[p t k] <p t k>, <п т к> voiceless	
Turkish	[b d g] <b d g> voiced		[p t k] <p t k> voiceless
German		[b̥ d̥ ɡ̊] <b d g> voiced	[p ^h t ^h k ^h] <p t k> voiceless, aspirated

In German, which is the dominant language of our participants and the language of school instruction in the learning setting we address, the underlyingly voiced stops /b d g/ (*lenes*) are produced with a short lag, while their voiceless counterparts /p t k/ (*fortes*) display longer VOTs (long lag). In contrast to the latter, the former are commonly produced without aspiration, which does not occur in consonant clusters and is strongest before stressed vowels (Wiese 1996, 270). For German /k/, where VOT is highest, earlier studies have reported VOT durations of between 37 and 67 ms (Stock 1971; Fischer-Jørgensen 1978), but these values might have been influenced by dialectal variation and methodology, e.g. the non-consideration of the distinction between unstressed and stressed syllables (see Lein & al. (2016) for an in-depth discussion of older work). More recent studies such as Van de Weijer and Kupisch (2015) detected higher VOTs, so that it can be assumed that German largely

patters along with English, which is also learnt as a FL by the subjects of the present study.¹ The variety of German referred to in the context of the present contribution is Northern Standard German (NSG), which is the surrounding variety of our learners. Note that Southern varieties such as Standard Austrian German differ from NSG in that they generally display lower VOT values for all stop consonants, which range from 5 to 20 ms for the voiced plosives and lie between 40 and 60 ms for their voiceless counterparts (Moosmüller & al. 2015, 341; see also Brenner (2004) for an in-depth study of the German varieties spoken in Western Hungary, and Braun (1996) for a comparative overview of VOT patterns in several German dialects). The German VOT values produced by the participants of our study, which will be used as a benchmark for comparison, are displayed in Section 3, below.

In French, the FL learnt by the participants of our study, voiced plosives are characterized by a voicing lead with negative VOTs, ranging from -91 to -62 ms for /b/, from -100 to -49 ms for /d/, and from -88 to -40 ms for /k/ (Caramazza & al. 1973; Gabriel & al. 2016; Netelembos & al. 2016), while /p t k/ show a short voicing lag. Lein and colleagues (2016, 735), who summarize the outcomes of ten previous studies, report ranges of 14–32 ms for /p/, of 18–35 ms for /t/, and of 32–49 ms for /k/.² This suggests that the VOT values for French voiceless stops are substantially lower than those reported for German and that French largely patterns with other Romance languages such as Italian, Portuguese, or Spanish (see Section 2.2.).

Interestingly, the two HLs spoken by our participants, Russian and Turkish, rather pattern with French, the FL under discussion here, than with German. For Russian, recent studies report short lag VOT values for the voiceless plosives (/p/: 17–18 ms, /t/: 19–20 ms; /k/: 34–38 ms); the values reported for their voiced counterparts range between -100 and -70 ms for /b/, between -105 and -75 for /d/ and between -81 and -78 for /g/ (Kulikov 2012; Ringen & Kulikov 2012; Dittmers 2017). Turkish, finally, patterns with French and Russian regarding the pre-voiced production of the voiced stops (/b/: -66 ms, /d/: -53 ms, /g/: -10 ms), but differs from these languages in presenting somewhat greater VOT values for the voiceless plosives (/p/: 41 ms, /t/: 50 ms, /k/: 69 ms; Ögüt & al. 2006).

2.2. VOT patterns in multilingual speech

The characteristics of VOT patterns in the speech of individuals who use more than one language on a regular basis can hardly be claimed to be an understudied phenomenon (see Laeufer (1997) for an earlier overview of the field and Kupisch and Lleó (2017) for a summary of recent studies). While simultaneously bilingual children who acquire two languages that differ from one another regarding their VOT patterns (e.g. English and Spanish) tend to separate the phonologies of their languages with respect to this feature (Deuchar & Clark 1996), evidence for cross-linguistic influence (CLI) on VOT patterns was found in many other multilingual constellations. Fowler and colleagues (2008), for instance, investigated the production of voiceless stops in sequential bilinguals of English and Canadian French and showed that the VOT values of the language acquired later were considerably influenced by the speakers' first language. CLI was also reported to occur in speakers of heritage languages: As shown by Kupisch and Lleó (2017), both heritage speakers of Italian living in Germany and heritage speakers of German living in Italy had developed

¹ The VOT values for native English reported in the literature range from 62 to 75 ms for /p/, from 70 to 85 ms for /t/, and from 79 to 90 ms for /k/ (Caramazza & al. 1973; Neary & Rochet 1994; Dittmers & al. 2018). Regarding the production of voiceless stops in English as a FL by the participants of the present study, see Dittmers & al. (2018, 43).

² Note that Berns (2013) reports occasional instances of aspirate-like productions of voiceless stops for contemporary metropolitan French.

compromise values for /k/ in their respective heritage language, situated between the ones reported for monolingual German/Italian. Interestingly, the authors also showed that, at least in some speakers, not only the heritage language, but also the dominant language was affected by CLI. Finally, VOT transfer was extensively attested in FL learning, e.g. in English learners of Spanish, who transfer the long realizations of voiceless stop from their L1 to the FL (Zampini 2014).

As opposed to the settings discussed so far, research is sparse when considering the acquisition of VOT patterns of a FL in learners whose linguistic background comprises a HL. To our knowledge, only few studies investigated this property of stop consonants in the speech of this specific group of multilingual learners: Tessmann Bandeira and Zimmer (2012) addressed bilingual learners of English who speak Pomeranian, a diaspora variety of Low German, along with Brazilian Portuguese (BP) and showed that their production of voiceless stops in L3 English was more target-like as compared to the VOT values produced by the monolingual BP control group. In addition, they found convergence between the (Germanic) system of Pomeranian and the (Romance) system of BP in their bilingual subjects, who had developed compromise values for both of their languages. With respect to the production of voiced obstruents in French as a FL produced by learners who speak Swiss German as their dominant language, there is anecdotal evidence for positive transfer in subjects with Italian as a HL and of negative transfer in a subject with Finnish as an HL (Schmid 2012, 648). Gabriel and colleagues (2016) investigated the production of stops in French as a FL by bilingual Chinese-German learners in contrast to German monolingual and Chinese monolingual learners of French. Based on their findings, they did not establish a general advantage for the multilinguals, but found evidence for a positive effect of pronunciation training in language instruction (Gabriel & *al.* 2016, 11). Llama and López-Morelos (2016), finally, analyzed the characteristics of stop production in French as a FL, produced by learners who speak Spanish as a HL along with (Canadian) English and found target-like production in both of their subjects' background languages, but no positive transfer from the HL Spanish to the target language, French, as one might expect against the backdrop of the similar patterns of stop production in the two languages.

3. Empirical study

Based on the VOT patterns outlined in Section 2 and given that FL and HL data provide a fruitful testing ground for the analysis of cross-linguistic influence (CLI), we aimed to test the following three hypotheses.

- H1 Regarding the production of both voiced and voiceless stops in German, the Russian-German and Turkish-German bilinguals have developed compromise values situated between those of monolingual German and of monolingual Russian/Turkish.
- H2 In Russian and Turkish, respectively, the Russian-German and Turkish-German bilinguals have developed compromise values situated between those of monolingual German and of monolingual Russian/Turkish.
- H3 The Russian-German and Turkish-German learners produce both the voiced and voiceless stops in French as a FL in a more target-like way than the monolingually raised German learners do.

3.1. Data and methods

We collected our data using a picture naming task and recorded items with the target sound in the onset of the stressed word-initial syllable followed by the cardinal vowels /a/, /i/, and /u/ (16–20 items per language, e.g. *parc* 'park', *pile* 'battery', *poule* 'chicken' for French; *bal*

'honey'; *bin* 'thousand', *buz* 'ice' for Turkish; *Dame* 'lady', *Dienstag* 'Thursday', *Dusche* 'shower' for German; *бабушка* (*babushka*) 'grandmother', *булочки* (*bulochki*) 'rolls (Pl.)' for Russian³); a complete list of the target items for all languages is given in the appendix in Rahbari & al. (2018). 30 subjects (ages: 15–17; levels A2/B1 according to the *Common European Framework of Reference for Languages*; 3–5 years of instruction from mainly non-native teachers) took part in the experiment, in particular each 10 bilingual Russian-German and Turkish-German learners and 10 monolingually raised German learners. The participants were tested not only in French, but also in their background languages, i.e. in German and in their respective HL, to determine possible CLI from those languages. The data collection was carried out in different senior high schools in Northern Germany between June and November 2016. In sum, 600 items were recorded for German (with our three groups of speakers, i.e. with $3 \times 10 = 30$ participants), 570 for French ($3 \times 10 = 30$ participants), 160 for Russian and 180 for Turkish (with each 10 participants). Only few items had to be excluded from the analysis because of misproductions as in (German) *eine Dusche* 'a shower', where the target segment was not produced utterance-initially (in total, 10 German, 3 French and 10 Russian items were discarded). VOT was measured using *Praat* (Boersma & Weenink 2018). The closure point was placed at 50ms before the release of the burst (Mok & Dellwo 2008); all boundaries were set at positive zero-crossings. Figure 1 provides an example of the VOT measurements performed on the data.

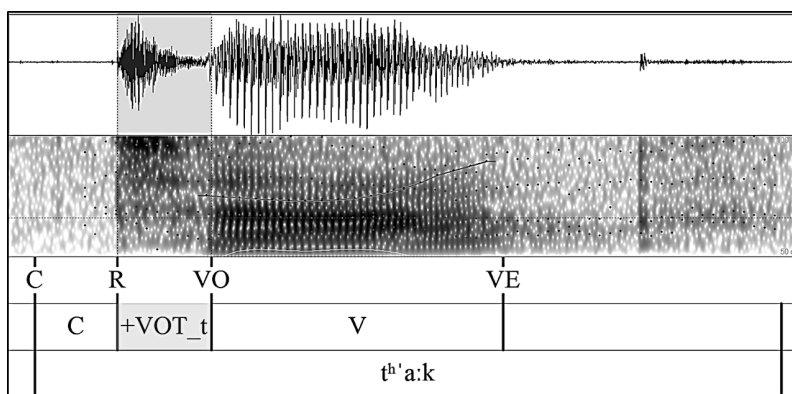


Figure 1. Measurement of VOT (highlighted in light grey) using Praat with the example of the German item *Tag* 'day' produced with an aspirated [t] (C = closure, R = release, VO = vowel onset; VE = vowel end).

3.2. Results

In what follows we present and discuss the outcomes of the analyses performed on our data. The results of the VOT measurements are summarized in Table 2 (represented as medians, which are more robust to outliers than means). The values for the voiced stops are displayed on the left in columns 2–4; those for the voiceless stops are given in the three rightmost columns. The reference values for native monolingual Russian, Turkish, and French we use for cross-linguistic comparison are taken from the literature, as outlined in Section 2.1. (arithmetic means, highlighted in *Italics*). For German, no values from former studies are

³ For the collection of the Russian data, the sequence stop+/i/ was excluded because of the palatalization effect that for most Russian consonants occurs in the position before high front vowels.

included in the table; instead, the VOTs produced by the monolingually raised German speakers from our study are used as a benchmark for comparison.

Table 2. *VOT values in milliseconds (medians) for voiced and voiceless stops in German, Russian (HL), Turkish (HL), and French (FL); mean interquartile ranges are given in brackets. LI reference values (arithmetic means; Italics) are taken from the literature.*

	German					
	/b/	/d/	/g/	/p/	/t/	/k/
German (monolingual)	15 (11)	22 (12)	29 (15)	70 (15)	79 (16)	94 (13)
Russian/German	16 (93)	20 (11)	27 (19)	56 (11)	81 (11)	90 (13)
Turkish/German	15 (6)	20 (9)	26 (9)	51 (8)	69 (9)	76 (10)
	Russian as a HL					
	/b/	/d/	/g/	/p/	/t/	/k/
Russian/German	-59 (112)	-66 (98)	24 (104)	47 (18)	51 (12)	63 (19)
<i>LI reference value</i>	<i>-100 –</i>	<i>-105 –</i>	<i>-81 – -78</i>	<i>17–18</i>	<i>19–20</i>	<i>34–38</i>
	Turkish as a HL					
	/b/	/d/	/g/	/p/	/t/	/k/
Turkish/German	16 (11)	19 (9)	36 (21)	71 (11)	74 (14)	87 (17)
<i>LI reference value</i>	<i>-66</i>	<i>-53</i>	<i>-10</i>	<i>41</i>	<i>50</i>	<i>69</i>
	French as a FL					
	/b/	/d/	/g/	/p/	/t/	/k/
German (monolingual)	20 (12)	24 (11)	28 (13)	96 (19)	80 (15)	84 (11)
Russian/German	20 (10)	20 (9)	30 (12)	71 (14)	72 (14)	86 (21)
Turkish/German	16 (10)	23 (8)	30 (17)	70 (17)	64 (15)	78 (15)
<i>LI reference value</i>	<i>-91 – -62</i>	<i>-100 – -</i>	<i>-88 – -40</i>	<i>14–32</i>	<i>18–35</i>	<i>32–49</i>

Turning first to the background languages of the learners, we can identify several instances of CLI, although not to the same extent as regards voiced and voiceless stops. Furthermore, certain differences between the two groups of bilingual learners can be found. For German, the results given in Table 2 show that both the Russian-German and Turkish-German bilinguals produce shorter VOTs for the voiceless stops than the monolingually raised German speakers do, presumably under the influence of their HLs. In Figure 2 (lower panel) we display the values for German /p/, produced by the three groups of speakers; the differences between the values produced by the monolingually raised German speakers and those of the two bilingual groups are highly significant ($p_{p/} = 0.000$; post-hoc Kruskal-Wallis test)⁴. Regarding the production of the voiced plosives, the Median values hardly differ across the groups, e.g. for /b/: 15 ms (German monolinguals), 16 ms (German-Russian bilinguals), and 15 ms (Turkish-German bilinguals). However, the large interquartile range of 93 for the production of /b/ by the Russian-German bilinguals indicates that CLI also operates in the realm of voiced stops, though with a high degree of inter- and intraspeaker variation: Several items are produced by some speakers with a negative VOT (pre-voicing), a phonetic feature of stop production which is perceived as typical of a Slavonic accent in German. This phenomenon, which is restricted to the production of the bilabial voiced stop /b/ in our data, is depicted in the boxplot given in Figure 2 (upper panel). As opposed to the Russian-German speakers, the Turkish-German bilinguals pattern with the monolingually raised German

⁴ Similar results were obtained for /t/ and /k/ ($p_{t/} = 0.001$, $p_{k/} = 0.000$).

participants with respect to the production of the voiced plosives and only differ from the latter regarding their pronunciation of the voiceless stop consonants.

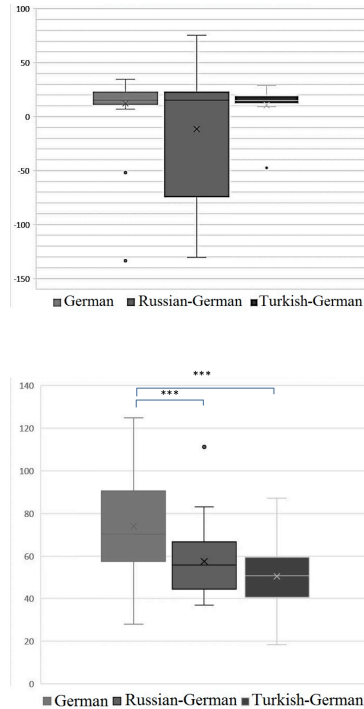


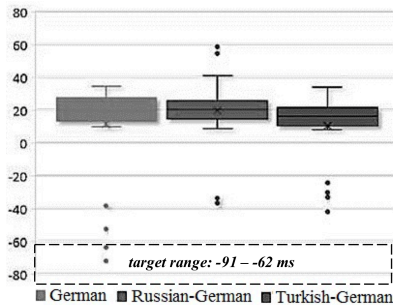
Figure 2. VOT values for German /b/ (upper panel) and /p/ (lower panel) produced by (from left to right) monolingually raised German speakers, Russian-German bilinguals and Turkish-German bilinguals.

Generally speaking, both groups of bilingual speakers partly differ from the monolingually raised German learners regarding their production of the voiceless plosives in German: Their VOT values are lower than in monolingual production, but higher than in Russian and Turkish, respectively (e.g. for /p/, monolingual German: 70 ms, Russian-German: 56 ms, Turkish-German: 51 ms, Russian: 17–18 ms, Turkish: 41 ms; see Table 2). They thus have developed compromise values in their HLs. However, this only holds true for the voiceless stops. Their voiced counterparts are affected by the HLs to a considerably lesser degree; pre-voicing only partly occurs in the production of German /b/ by the Russian-German participants. H1 is thus partially confirmed.

As for the learners' HLs, Russian and Turkish, our results confirm the picture that arises from the German data in that our Turkish-German learners show a greater influence from German than the Russian-German participants do: As for the voiced stops, the latter have preserved the typical feature of pre-voicing when pronouncing Russian /b d g/, though to a lesser extent than in monolingual production (e.g. for /b/, monolingual Russian: -100 – -70 ms, Russian-German: -59 ms). As for the voiceless stops, again, their VOTs values differ from those produced by monolingual Russian speakers in being considerably higher than the latter, e.g. 47 ms for /p/ (vs monolingual Russian: 17–18 ms), 51 ms for /t/ (vs monolingual Russian:

19–20 ms) and 63 ms for /k/ (vs monolingual Russian: 34–38 ms; ranges according to Kulikov (2012), Ringen & Kulikov (2012), Dittmers (2017)). The Russian–German speakers thus seem to have developed compromise values between the two languages also in their production of Russian stop consonants. As opposed to this, the Turkish–German bilinguals have largely adapted their Turkish system to the German one: No pre-voicing occurs in their production of voiced plosives in Turkish (in contrast to Russian /b d g/ produced by the Russian–German bilinguals) and their Turkish VOTs for the voiceless stops are in part even greater than the ones they produce in German (see Table 2). H2 is thus only confirmed for the Russian–German bilinguals, but not for our Turkish–German participants who seem to have adapted their Turkish system to the one of the surrounding language, German.

Regarding French as a FL, finally, the values displayed in Table 2 reveal that for the voiced stops all three learner groups behave similarly in that they produce (short lag) positive VOT values instead of articulating the respective consonants with negative VOTs (pre-voicing). For the monolingually raised German learners, this comes as no surprise since their native system does not present pre-voiced /b d g/. The same holds true for the Turkish–German participants of our study, who have adapted their production of Turkish voiced stops to the German system (see above). Interestingly enough, the Russian–German learners, who do present negative VOTs in their production of Russian /b d g/, do not show any pre-voicing in French as FL either. This is shown in the boxplot with the example of the bilabial voiced stop /b/ (see Figure 3, upper panel). This is in sharp contrast with the results obtained from the measurements performed on the items starting with the voiceless stop /p/; consider the boxplots given in Figure 3, lower panel. Although all participants considerably overshoot the target range of 14–32 ms (Lein & al. 2016, 735), a striking difference between monolingual and bilingual learners becomes evident in that both bilingual learner groups show lower VOT values and thus a pronunciation closer to the French target. The difference between the monolingually raised German learners and the Russian–German group is highly significant, the one between the monolinguals and the Turkish–German learners is at least significant ($p_p=0.001$; post-hoc Kruskal–Wallis test).⁵



⁵ Similar results were obtained for /t/ ($p_v=0.007$); the results for /k/, however, show no significant differences ($p=0.807$).

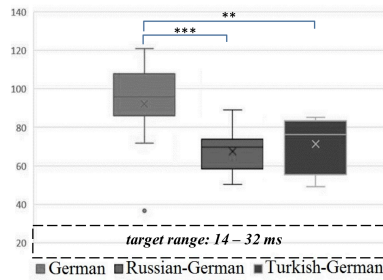


Figure 3. VOT values for /b/ (upper panel) and /p/ (lower panel) in French as a FL produced by (from left to right) monolingually raised German, Russian-German bilinguals and Turkish-German learners.

3.3. Discussion

According to Flege's (1981, 1987, 1995) Speech Learning Model (SLM)⁶, the cross-linguistically different surface realizations of the phonological [±voiced] (or *fortis-lenis*) contrast qualify as so-called 'similar sounds', which constitute a source of negative transfer and thus a challenge for learners. In addition, its gradual nature favors convergence – in the sense of Thomason (2001)⁷ – of phonological categories across languages in HL speakers. This clearly shows up in the production of stops by our HL speakers, though to a different extent: The emergence of compromise values situated between the ones of (monolingual) NSG and of the HL (and hence phonological convergence) was widely attested in the pronunciation of both German and Russian stop consonants by our Russian-German participants (see Section 2). In contrast, the Turkish-German speakers only show such intermediate VOT values for their production of voiceless stops in German, but otherwise seem to have largely adapted their Turkish HL system to the one of the surrounding language (NSG). Cases of phonological convergence as show up in the stop production by our Russian-German participants are attested in the (to date still sparse) literature on HL phonology. In this context, it was shown that heritage speakers of Polish in Toronto exhibit mixed devoicing patterns, situated between Polish (a language with final devoicing) and English (Łyskawa & al. 2016). Within the realm of research on Romance languages, Rao and Ronquest (2015) investigated unstressed vowel reduction in speakers of US Spanish and showed that bilingual Spanish-English speakers reduce the vowels in unaccented syllables in their HL Spanish to a greater extent than monolingually raised speakers of Spanish do, but to a lesser extent than they do in their English.⁸

⁶ According to Flege's SLM, phonological learning is fundamentally guided by the learners' perception of the FL, meaning that learners can easily acquire L2 sounds which are notably different from the L1 categories (so-called 'new sounds'), while they experience difficulties with phonological categories that are similar to those of their L1 and are thus not perceived as being different (so-called 'similar sounds').

⁷ We follow the author in applying the term convergence to phenomena of linguistic contact that are characterized by the fact that 'both [...] languages change in ways that make them more similar. In this context, the point of talking about convergence is to emphasize the fact that the interference is mutual, not unidirectional, and the fact that the resulting convergent structures have no single source' (Thomason 2001, 89).

⁸ It is worth mentioning, however, that not only convergence, but also divergence has been found in HL phonology; see e.g. Chang & al. (2011) who investigated the surface production of several phonological contrasts in heritage speakers of Mandarin Chinese living in an English-speaking environment and

Turning to the learning of French as a FL, the measurements performed on the items starting with a voiceless stop revealed that the VOT values produced by both groups of bilingual learners were closer to the French target than those produced by the monolingually raised German learners. Against the backdrop of the German VOTs, which were lower for the voiceless plosives in the production of both bilingual groups as compared to those produced by the monolinguals (and thus closer to French), this might be interpreted as a disadvantage for the monolingually raised German learners and, in turn, as a (slight) advantage for the bilinguals – at least as concerns the acquisition of the specific feature of French pronunciation addressed here. However, this finding can be interpreted as a positive effect of transfer from the HL only in the case of the Russian-German bilinguals, since the VOT values of the voiceless plosives produced by the Turkish-German learners rather pattern with those produced by the monolingual German group. This comes as no surprise, given that the Turkish spoken as a community language in the German context, so-called *Almaya Türkçesi* ('Germany Turkish'), is often perceived being foreign-accented when judged by monolingual raters from Turkey (Stangen & al. 2015). For the voiced stops, however, no positive effect of the HLs was detected at all across both learner groups. For the Turkish-German bilinguals, again, this outcome is anything but surprising, given that their Turkish system rather patterns with the German one, at least as regards the specific feature under investigation. The Turkish-German learners thus pattern with the monolingually raised German learners in that they present CLI from their background languages when producing the voiced stops of French erroneously with a short lag instead of pre-voicing them, which is a well-known phenomenon in foreign language learning and which we interpret as an instance of negative transfer from NSG German and the (German-influenced) heritage Turkish spoken by the bilinguals, respectively. By contrast, it seems to be unexpected that the Russian-German bilingual learners on the hand successfully transfer the lower VOT values produced in both of their background languages, i.e. German and Russian, to the FL, but on the other completely fail in positively transferring the pre-voiced articulation of the voiced stops, which occurs in their production of Russian (and even partially in their German, see Section 3.2.), to French. To explain this outcome, we refer to the concept of perceptual salience according to which the (audible) aspiration of long lag stop consonants is considered a feature of initial fortition (Genetti & al. 2014, 62-63). A possible explanation of the different behavior of voiceless and voiced stop consonants we found in our learner data might thus be that the (non-)aspiration of voiceless stops such as /p/ is perceptually more salient for the learners than the presence or absence of pre-voicing in the realization of voiceless plosives such as /b/. The greater perceptual weight of the (non-)aspiration might result from the number of (perceptually relevant) cues and their estimated relative functional load (Chang 2018). Alternatively, the difference between voiceless and voiced plosives might be explained on purely phonetic grounds, since the aspiration sequentially adds to the target segment a discrete phase of noise which is dispersed all over the spectrum, while negative VOTs simultaneously overlies only some intensity in the lower frequency bands.⁹

4. Concluding remarks

We have shown that instances of both positive and negative transfer from the HLs occur in our learner data, depending on the VOT patterns of the interacting languages. However, the amount of CLI that might be interpreted in terms of positive transfer from the HLs is smaller than one could expect against the backdrop of the similarities between the target language,

showed, among other things, that they produced the back vowels of English and of their HL with a greater separation than late learners of English with L1 Mandarin Chinese do.

⁹ We thank one of the anonymous reviewers for highlighting this possible explanation.

French, and the two HLs considered in the present contribution, Russian and Turkish (see Section 2). Outcomes such as these raise the question of why the potential linguistic resources of our multilingual learners are not fully explored when it comes to fruitfully applying different phonological systems from their linguistic background in the course of FL learning. One obvious reason for that is clearly to be seen in the HLs themselves: As soon as the speakers have adapted their HL system to the surrounding language with respect to a specific feature (in our case the VOT patterns of stop consonants), the respective HL cannot provide any basis for positive transfer – in contrast to the variety of the same language spoken by monolinguals. This is the case for our German-Turkish learners, whose stop production in Turkish does not present the pre-voicing typical of voiced plosives in monolingual Turkish and patterns with German regarding the long lag realization of voiceless stops. By contrast, the VOT values of the voiceless stops in French as a FL produced by our Russian-German learners (whose production of voiceless stops in their HL is characterized by values lower than those of German, see Section 3.2.), are closer to the French target range than those produced by the Turkish-German bilinguals. This suggests that the maintenance of pronunciation features that distinguish the HL from the surrounding language has a positive effect on the learning of foreign languages and should thus be encouraged in the teaching of HLs in school education. A second reason that might explain the modest positive effect of the HLs on the acquisition of stop production in French as a FL refers to the concept of perceptual salience, already addressed in Section 3. While a slight bilingual advantage can be identified concerning the production of voiceless stops, no such advantage shows up regarding the realization of (pre-voiced) /b d g/, even though the Russian-German bilinguals could positively transfer their negative VOTs from their HL to their FL, French. This suggests that phonological awareness and in particular the perception of subtle phonetic differences should be fostered in FL classrooms. However, this is only possible when the FL teachers (i) dispose of an at least minimal knowledge of the phonetics and phonology of their students' HLs, and (ii) attempt to apply this knowledge within the scope of FL teaching. As shown by Gabriel and Thiele (2017) in a questionnaire study with German teachers of English, French, Italian, and Spanish most FL teachers hardly possess any knowledge of the sound shape of the most numerous HLs spoken in their multilingual classrooms and just as little include their modest understanding of different phonological systems in their teaching programs. This, in turn, strongly suggests that contrastive phonology, not only with respect to the FL learnt and the students' surrounding language, but also regarding the similarities and differences between the FL taught and the HLs spoken by the learners should be promoted in teacher training. Put more generally, the outcomes of our study should be understood as a clear plea for a stronger interaction of empirical research in L3 phonology and pronunciation training (Thomas & Derwing 2015) on the one hand and practical language pedagogy on the other.

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