Teaching the pronunciation of sentence final and word boundary stops to French learners of English: distracted imitation versus audio-visual explanations.

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Abstract
Studies on stop unrelease in second language acquisition have hitherto focused on the productions of Slavic learners of English (Šimáčková & Podlipský, 2015) and experiments on Polish learners of English; the latter show the tendency to release stops on a more regular basis depending on the type of stop combinations (Rojczyk et al. 2013). In the present study, we aim to test the efficiency of audio-visual explanations as opposed to distracted imitation in pronunciation teaching amongst French learners of English. While unreleased stops are rather frequent in French and English - especially in plosives clusters (Byrd, 1993; Davidson, 2010), unreleased plosives in final positions are less common in French (Van Dommelen, 1983). During phase 1 of the experiment, three groups of 12 native French learners of English (level A1/A2, B1/B2 and C1/C2) were asked to read idiomatic expressions containing both homogeneous and heterogeneous sequences of voiceless stops straddled between words, namely, in sequences like "that cat" [ðæt˺ kæt˺], and stops at the end of sentences like "I told him to speak" [tə spiːk˺]. In the second phase of the experiment, one half in each group was given a different task. The first group heard recorded versions of phase 1 sentences and before reading them out loud, counted up to five in their L1. Stimuli for imitation contained no release in the contexts under scrutiny. The other half had to watch a video explaining the phenomenon of unreleased stops with a production of phase-two expressions propped up by hand gestures. They were then asked to re-read the sentences given in phase 1. Based on these results the current study makes recommendations about what working environment should be prioritized in pronunciation teaching both in class and online (Kröger et al. 2010), and suggests ways to assess students and visually keep track of their progress.

Keywords: Second-language acquisition, unreleased stops, imitation, audio-visual teaching, L2 pronunciation, e-learning, pronunciation teaching

1. Introduction

The current study investigates the efficiency of two teaching methods, aimed at online learning. Namely, a distracted imitation task versus the use of a video with an instructor explaining the articulatory features of stops and stop unrelease, when not to unrelease and sociophonetic implications of stop unrelease. It also indicates hand gestures to assist the learners in the acquisition of a new articulatory exercise. The latter method aims at reaching more "learner types" (Skehan, 1991). The aim was to test whether awareness raising (Łyda & Szcześniak, 2013) with the help of hand gesture (Goldin-Meadow & Wagner, 2005) (Fig. 2) was as efficient as imitation regarding L2 acquisition of this segmental phenomenon and whether learners at specific stages of learning are advanced enough to learn stop unrelease.

2. Imitation and gesture in learning

Ranging from repetition tasks in language labs in the 1960s to today's smartphone and tablet applications to enhance pronunciation with model speakers, imitation has long played a major role in second language acquisition, is "an undisputed factor" (Rojczyk, 2013: 5) in order to achieve native-like pronunciation, and has proven to yield significant improvement in L2 phonetic acquisition. As Babel (2012) states in her study on phonetic imitation "gradient acoustic information encountered in auditory processing carries over into the fine details of speech production" (p. 189). A recent study by Rojczyk (2013) on unreleased stops amongst Polish learners of English showed that, indeed, both immediate and distracted imitation led to significant converging towards the model speaker, compared to a pre-test baseline of the same speakers. Similar results were found by Šimáčková & Podlipský (2015) on Czech learners of English. In this study we opted for distracted imitation, namely, when a distractive task is inserted between the sound heard and the repetition by the participant.

Gesture in language learning has also demonstrated its efficiency in various studies (Kelly et al., 2002, Goldin-Meadow, 2003). It is also used as a major tool in the Silent Way approach, a method developed by Gattegno (1963) in the 1950-60s on language learning. In this method, silent articulatory gestures are used to trigger production on the part of the learners – guessing by trial and error – while imitation is avoided as much as possible. More recently (Messum, 2012; Messum & Young, 2012), the Silent Way approach raises phonetic awareness thanks to the use of MRI or spectrographic representations of sounds and schematized models of the mouth and tongue so as to understand speech processes.

We also aims at following Wrembel's framework on pronunciation teaching. It involves a combination of techniques that lead to phonetic awareness, namely

"investigating the general nature of pronunciation through e.g. developing physical awareness of word stress, walking the rhythm, internalizing intonation through recognising moods and acting out tales, exploring physical features of sounds as well as personalising sounds through movements, sound metaphors and similes" (Wrembel, 2005: 3). Wrembel's longterm study demonstrated that "meta-awareness raising and conscious acquisition of explicit knowledge contribute to the development of L2 phonological competence" (Pawlak et al., 2011: 174). Our study focuses only on one phonetic aspect of English which concerns stop unrelease. As opposed to imitation, awareness raising of the phonetic phenomenon under study seems an efficient option especially since unrelease is barely perceived by learners in a perception task and since models by native speakers are not always available once the students continue learning their L2 in full autonomy. Bergier's study (2010) on stop unrelease amongst Polish learners of English showed that adequate phonetic awareness and training can yield native-like proportions of unrelease. Our preliminary study indicates that this can also be the case for French learners of English.

3. Plosive unrelease in L1 French and English: a difference in sentence final stops
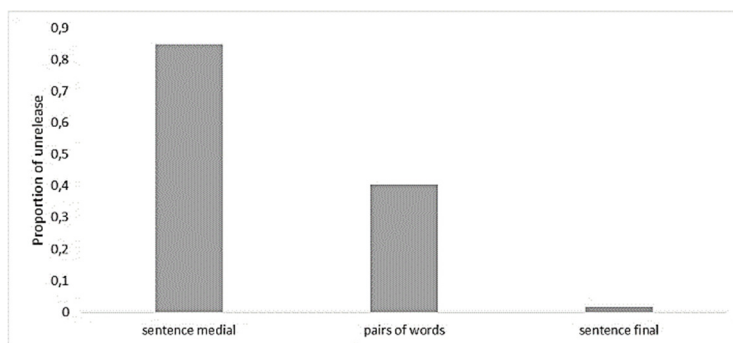

Figure 1. Proportion of stop unrelease in French: pairs of words, sentence medial and final.

Word final pre-pausal stops in English are known to be often unreleased: Davidson's study on spontaneous American English from the StoryCorps corpus showed that unrelease occurred between 50 and 60% of the time in pre-pausal positions (2011). Sequences of two stops across word boundaries are often realized with the first stop being unreleased (Ladefoged, 1974; Roach, 2000). Davidson revealed that manner of articulation had an impact on unrelease: before another stop /k/, /p/ and /t/ were unreleased 70%, 57% and 93% of the time. Other studies showed that no matter the environment, bilabials tend to be more often unreleased than alveolars and velars (Byrd, 1993; Crystal and House,

1988). Moreover, unrelease is generally higher in spontaneous speech than in read speech (Davidson 2010) and while formal speech is often expected amongst L2 speakers, the production and perception of spontaneous speech idiosyncrasies like stop unrelease should not be overlooked. Regarding French, very little has been published directly on stop unrelease (Haines, 2007) but similarly to Polish native pronunciation (Rojczyk, 2008; Rojczyk et al., 2013) pre-pausal stops are mostly released in native French whereas stops in a C#C sequence are more generally unreleased in spontaneous speech. In order to examine stop release in French we carried out another study with 18 French native speakers who were asked to read the same combinations of stops in the French language as the present study on French learners of English, i.e.: pairs of words across word boundaries and sentences with pre-pausal and medial stops with a total of 741 stops measured. In full sentences 84% of stops were unreleased but in the artificial combination of words like "un tap**pe p**orte" /pp/ or "un bra**que c**oude" /kk/, it amounted to only 40% (Fig. 1). Only 2% of pre-pausal stops were unreleased as opposed to 80% and 63% for homorganic and heterorganic pairs respectively. We therefore expected the unrelease of sentence final stops to be a bigger challenge for French learners since this pattern is much less common in their L1 than unrelease in stop clusters. But while "textbooks on English pronunciation tailored for Polish learners include exercises in this area (Bałutowa 1974; Mańkowska et al., 2009; Sobkowiak, 2001)" (Rojczyk, 2013: 6), the French syllabus in English studies focuses more on phonological rules, word stress or vowels and stop unrelease is often absent (Viel & Lilly, 1998; Ginésy, 2005).

4. Experiment

The current study investigates the degree of stop unrelease in pre-stop word final stops and sentence final stops by French learners English (ranging from beginners to advanced L2 speakers) before and after receiving two different types of training: distracted imitation, namely, the insertion of a distractive task before uttering the imitation of words, or phonetic awareness. Distracted imitation was aimed at increasing the difficulty of the repetition task since immediate imitation "may bypass the influence of native articulatory habits and that distraction in imitation results in incomplete recovery of native phonetic patterns" (Rojczyk, 2013: 5). Our research questions are as follows: which group of speakers produce more unreleased stops in the pre-testing phase? In which environment is unrelease more frequent? Is an eight minute video training on phonetic awareness as efficient as a distracted imitation task to increase the learner's proportion of unreleased stops? And from there, at which level should stop unrelease be introduced in a pronunciation course and which method should be prioritized in a course?

4.1. Participants

This preliminary study comprised 16 participants split into four different groups: secondary school teenagers (group A), adults with a high school level in English (group B) and students in their second year of English studies (group C). The last group involved French teachers of English (group C2).

5. Methods and procedure

Learners were recorded with Praat (Boersma, 2001) at a sampling frequency of 44 000Hz, in a quiet room using a V7 J151648 headset microphone. In a pre-test session, the subjects were asked to read a list of words containing voiceless stops (/p/, /t/, /k/) across word boundaries as in "tap pan". A total of 1 249 stops were analyzed: 9 combinations in pairs of words (288), 12 sentences with plosives in a final position (384) and 18 sentences comprising all pairs of stops twice (576). During phase 1, students were requested to read all sentences so as to establish a baseline on stop unrelease. In phase 2, one half of the participants read the same sentences with distracted imitation: they heard a model speaker and then were asked to count to five in their L1 before repeating the utterance. The script was always shown to the participants. The other half had to watch a video raising awareness on stop unrelease –which native speakers do it more frequently, in which context unrelease takes place and how to do it. It provided gestures to help the learners coordinate their mouth movement with a simpler hand movement like closing fingers into a fist or by placing the finger tips close to the mouth thus feeling the presence and absence of a burst (Fig. 2). They were then given the same list of words and sentences to read in full autonomy, namely, without having heard a model speaker first.
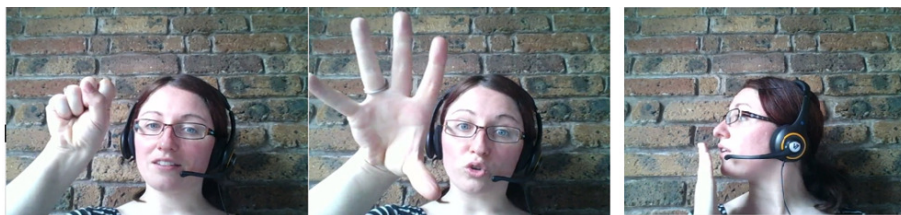

Figure 2. Screenshot of the video presented to learners. Suggestions of hand gestures (from left to right): unrelease of stop 1, release and aspiration of stop 2, feeling the flow of air in bursts and aspiration.

Results were analyzed using spectrographic representations of the plosives in Praat (Fig. 3 & 4). Although Henderson and Repp (1982) suggested a five-stage continuum ranging from unrelease to strongly released, we divided the output into two sets (released and unreleased). Stops which had an auditorily detectable

burst and were visible on a spectrogram as a sudden rise of energy were
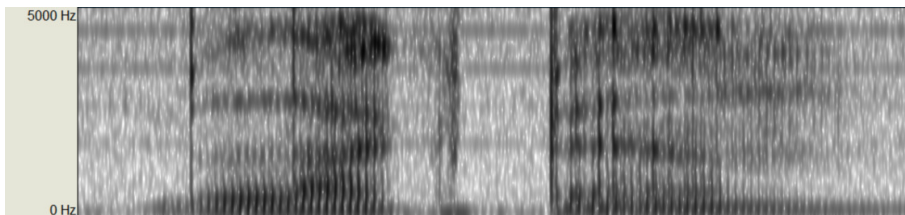classified as released, otherwise they were considered as unreleased.

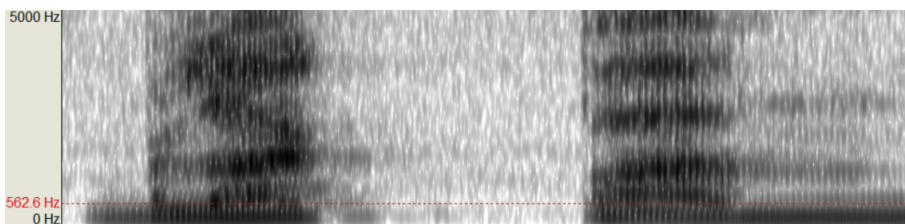**Figure 3**. Production of "black pan" with a released /k/ (level A speaker).

Figure 4. Production of "black pan" with an unreleased /k/ (level B speaker). No aspiration
in stop 2.

6. Results & Discussion
6.1. Pre-test *vs*. post-test

A conditional tree with the R package {party}, based on a non-parametric class
of regression gives an overview of the determining factors influencing stop
unrelease in the present data (Fig. 5). For each inner node, the Bonferroni
adjusted P-values are given and the proportion of release/unrelease (coded R/U)
is displayed for each terminal node (Hothorn et al., 2006). It is useful understand
which factors are crucial in the pronunciation of stop unrelease in the data and
which groups of speakers produce similar proportions of unrelease. Since we are
mostly interested in learners and not teachers, we excluded C2 from the
regression model. Phonetic environment proves to be the most influential
variable (node 1). As shown above, release in finals differs significantly from
pairs of stops, be they heterorganic or homorganic (labelled "heter" and "hom"
in Fig. 5). Regarding finals, there is a significant before/after training effect
(node 2). Overall, level C is not affected by the type of method used contrarily to
level A and B – the video being more efficient than imitation, especially among
level B (node 6). As to heterorganic and homorganic pairs, the level of the
students prevails over both the phonetic environment and the training (node 13).
Level C improves significantly after both types of training (node 14), producing
equivalent amounts of unrelease in heterorganic and homorganic pairs. Levels A

and B produce a little more unrelease after both types of training in homorganic pairs (node 25). Regarding heterorganic pairs however, there is no before/after training effect in level A (node 20), as opposed to B. Indeed, while there are no significant differences between the pre-test session and the imitation session, the video yields better results in the latter group (node 22).
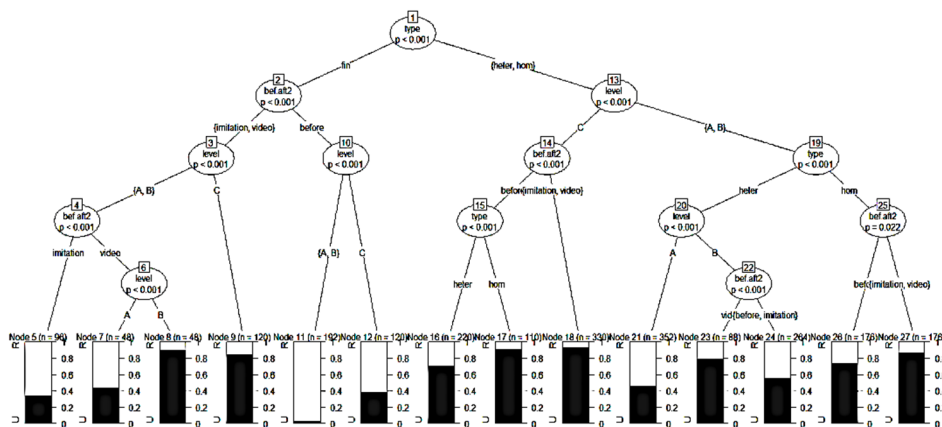

Figure 5. Conditional inference tree based on phonetic environment, level and teaching method. Nodes contain Bonferroni-adjusted P-values (alpha = 0.05 as stopping criterion). The higher the variable on the tree, the greater the impact on the proportion of release.

Similarly to our results on French, pairs of plosives within sentences were generally better executed than in the pairs of words or in the sentences ending with a plosive: 70.24% and 55% of unrelease in pairs against 15.47% in finals (Table 1). This clearly showed the need to focus on sentence final plosives in the training.

Table 1. Proportion of voiceless burst unrelease by exercise before and after both types of training.

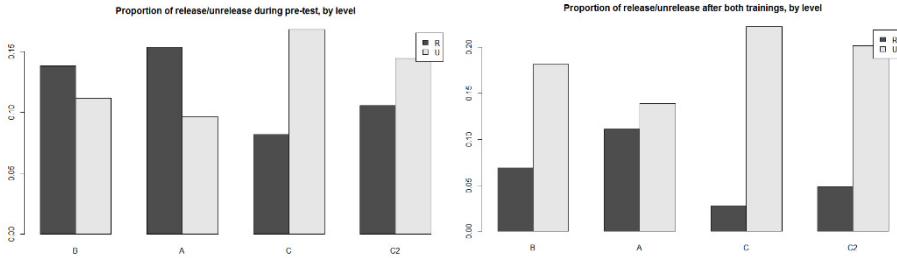|	Sentence final	Sentence medial	Pairs of words
Before	15.47%	70.24%	55%
After training	56.71%	80.67%	66.36%

Figure 6. Overall proportion of release/unrelease (R/U) by level during pre-test (left) and post-tests (right).

As expected, the level of English did have an impact on the results before training [X^2 (3) = 89.29, p < .001]: the higher the level the higher the proportion of unrelease. (Fig. 6). A McNemar test revealed that overall unrelease showed to be significantly higher after training no matter the teaching method [X^2 (1) = 197.30, p < .001]. Since the conditional inference tree indicated different pattern between pairs and finals, we compared the proportion of release in each type: release in finals dropped from 86.45% to 42.19% during the imitation task and down to 30.2% with the video (all levels taken into account). This indicates that the video was generally more efficient than imitation on the hardest task for L2 learners and suggests that when the pronunciation task in L2 is further away from patterns in L1, imitation may not be enough and awareness with the use of gestures provided by the video yield better overall results on finals (Fig. 7). Looking at the data by level, however, we notice significant progress only on the part of level B with a rise from 5% to 90% amongst those who received the awareness training (against 27% for imitation) outperforming levels C and C2 – one speaker in the teachers' group had results that differed significantly from the other teachers and later admitted having had language therapy trainings in the past, but we decided to keep her within our study.
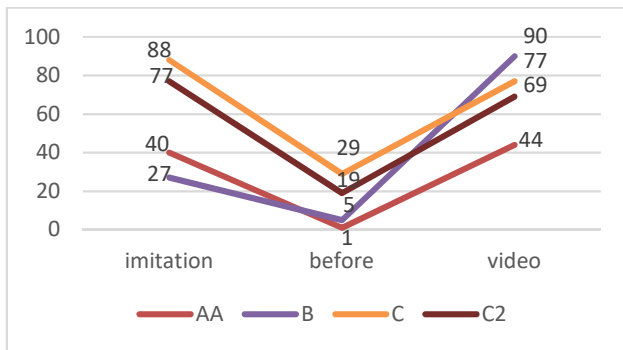

Figure 7. Proportion of unrelease in finals by level, pre and post-tests.
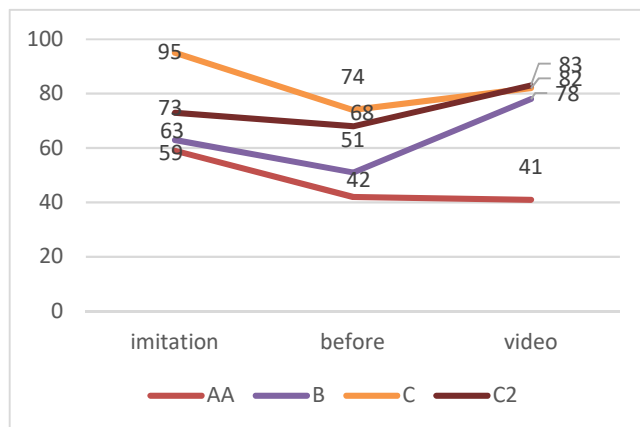
Figure 8. Proportion of unrelease in heterorganic pairs by level, pre and post-tests.

As to pairs (Fig. 8), both methods helped decrease the number of homorganic stops in C#C sequences. Distracted imitation led to a slightly higher proportion of unrelease in heterorganic pairs rising from 58.8% to 72.44% against 71% with the video. Interestingly, results by level indicated that A and C did better with imitation in heterorganic pairs (39.39% against 27.27%) while B and C2 produced more unrelease after watching the video.

Unrelease in anterior stops was privileged over the velars for groups A and B. For instance, unrelease in /t/ soared from 1% to 20% in both methods for group A. Conversely, B improved differently according to the type of training: video subjects manage to raise their proportion of /t/ unrelease from an overall 0% to 33.33% against 8% only for imitation subjects. The latter did not improve their unrelease in /k/, which remained around 0%, but those who watched the video managed to control twenty times as many bursts. Once again this indicates that the video may be helpful especially when the difficulty is high.

7. Suggestions for feedback

After testing, students should be getting feedback and be shown their progress. Bar plots and marks could be one way of doing it, but we suggest the use of multiple component analysis to map the students' improvement. Figure 9 depicts the results of a multiple correspondence analysis with the variables teaching method and release taken into account. Only finals were retained for the MCA since they are harder to master for French students than pairs and since this is where the greatest amount of progress is expected. The map on the left depicts pre-test results. Individuals are divided according to the type of training they will receive. The video group is on the left hand-side of the map (film icon) and the imitation group is on the right side of each graph (loudspeaker icon). The second

axis relates to stop release. Students are deemed to master unrelease once they enter the coloured zone which indicates that they produced a greater proportion of unrelease during the reading task. Before training, most people were in the "release" area. Only one English teacher (C+1) and two second year students (C1 and C3) produced a greater proportion of unrelease while the rest appeared to need training.
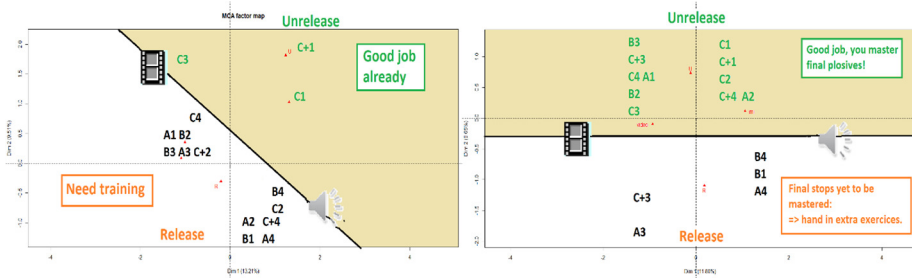

Figure 9. Suggestion for using MCA {FactoMineR} (Lê *et al*. 2008) to map the students' progression before (left) and after training (right) by method (video on the left and imitation on the right side of the axis). If the students manage to cross the black boundary into the coloured unrelease zone, they reach the aim for this task.

During the post-test phase, most subjects moved towards the unrelease zone – 11 out of 16 as opposed to 3 during pre-test. Subject A3 in the video group did worse after training, and so did C+3, a teacher, who had language therapy sessions in the past. A4, B1 and B2 subjects improved but not enough to reach the unrelease zone. Visualization techniques are likely to be used as teaching aids; resorting to MCA maps could be a straightforward way of helping the students and teachers keep track of individual progress at reaching specific goals along, thus maintaining motivation thanks to visual records of one's improvement.

8. Conclusion

Results revealed the efficiency of both methods for levels A, B and C even though the environment is shown to have significant impact on the learner's stop unrelease strategy. As shown in other studies (Rojczyk, 2013), the place of articulation plays a significant role in stop release: stop 1 in heterorganic and homorganic is more easily unreleased since the pattern already exists in the learners' L1. Bilabial and alveolar final stops are also more often unreleased than velars, but this remains to be tested more thoroughly. Stop unrelease seems to be too challenging for secondary school students, despite interesting results in sentence final plosives and a significantly higher score thanks to the video. Intermediate adult learners and students of English responded well to training in

both finals and pairs. In practice, one may suggest to work on aspiration before stop unrelease with level A students (cf. lack of aspiration in Fig. 3). Level B responded much better to the video than to imitation. This suggests that awareness is best suited for intermediate learners who may not audibly perceive stop unrelease in the imitation task. Level B appears not to be sensitive enough to all minute segmental phenomena – especially stop unrelease. Indeed, only one C2 subject in the imitation group told us he had become aware of stop unrelease and tried to control the bursts. Therefore, phonetic awareness can be the key to faster progress. Another group B imitation subject, who had studied Berber phonetics was also intrigued by not hearing bursts in final plosives, made long pauses before repeating, but released nearly every final stop. The phonetic awareness approach could have given these two speakers the means to reproduce with confidence what they were perceiving during imitation. Level C made progress during the test sessions, but one should probably level up the task by asking to unrelease the first stop and aspirate the second one in pairs straddled between words. The data shows frequent lacks of aspiration, which is even more the case in level B (Fig. 4). While we suggest the use of combined imitation and awareness tasks in a class or an online course, we would prioritize the awareness method, which led students to produce stop unrelease at similar rates than imitation but with full autonomy. Mapping the students' progress and resorting to a spectrographic representation of their own speech as feedback (presence or absence of a burst as in Fig. 3 & 4) also has a role to play in the sustainability of the acquisition of stop unrelease and should be more often integrated into pronunciation training modules as teaching aids.

References

Babel, M. 2012. Evidence for Phonetic and Social Selectivity in Spontaneous Phonetic Imitation. *Journal of Phonetics* 40. 177-189.

Bałutowa, B. 1974. *Wymowa Angielska dla Wszystkich*. Warszawa: Wiedza Powszechna.

Bergier, M. 2010. 'The Occurrence of Unreleased Oral Stops in English Voice Agreeing Plosive Clusters Straddling Word Boundaries. Production Experiments with Polish Advanced Learners of English.' Unpublished M. A. Thesis. University of Silesia.

Boersma, P. 2001. Praat, a System for Doing Phonetics by Computer. *Glot International* 10. 341-345.

Byrd, D. 1993. 54,000 American Stops. *UCLA Working Papers in Phonetics* 83. 1-19.

Crystal, T. H. and A. S. House. 1988. The Duration of American-English Stop Consonants. *Journal of Phonetics* 16. 285-294.

Davidson, L. 2010. Variation in Stop Releases in American English Spontaneous Speech. *Journal of the Acoustical Society of America* 128. 2458-.

Gattegno, C. 1963. *Teaching Foreign Languages in Schools: The Silent Way Reading*. Educational Explorers.

Goldin-Meadow, S. 2003. *Hearing Gesture: How Our Hands Help Us Think*. Cambridge, MA: Harvard University Press.

Goldin-Meadow, S. and S. M. Wagner. 2005. How our Hands Help Us Learn. *Trends in Cognitive Science* 9. 234-241.

Ginésy, M. 2005. Mémento de phonétique anglaise. Paris : Armand Colin.Haines, R. 2007. Des Occlusives en Coda ? Une étude comparative du français et de l'anglais britannique. 1èresJournées des Sciences de la Parole.

Henderson, J. B. and B. H. Repp. 1982. Is a Stop Consonant Released When Followed by Another Stop Consonant? *Phonetica* 39. 71-82.

Hothorn, T., K. Hornik and A. Zeileis. 2006. Unbiased Recursive Partitioning: A Conditional Inference Framework. *Journal of Computational and Graphical Statistics* 15. 651-674.

Kelly, S. D. et al. 2002. A Helping Hand in Assessing Children's Knowledge: Instructing Adults to Attend to Gesture. *Cognition and Instruction* 20. 1-26.

Kröger, B. J. et al. 2010. Audiovisual Tools for Phonetic and Articulatory Visualization in Computer-Aided Pronunciation Training. *Development of Multimodal Interfaces: Active Listening and Synchrony Lecture Notes in Computer Science* 5967. 337-345.

Ladefoged, P. 1974. *Elements of Acoustic Phonetics.* Chicago U P.

Lê, S., Josse, J. and F. Husson. 2008. FactoMineR: An R Package for Multivariate Analysis. *Journal of Statistical Software* 25. 1-18.

Łyda, A. and K. Szcześniak. 2013. *Awareness in Action: The Role of Consciousness in Language Acquisition.* Springer.

Mańkowska, A., M. Nowacka and M. Kłoczowska. 2009. *How Much Wood Would a Woodchuck Chuck?: English Pronunciation Practice Book*. Kraków: Wydawnictwo WSE

Messum, P. 2012. 'Teaching Pronunciation Without Using Imitation.' Paper presented at the Proceedings of the 3rd Pronunciation in Second Language Learning and Teaching Conference, 154-160. 7-8 October 2011. Ames, IA: Iowa State University.

Messum, P. and R. Young. 2012. Non-Imitative Ways of Teaching Pronunciation: Why and How. *IATEFL Fielded Discussion and Report, Pronunciation Science*. London.

Pawlak, M., E. Waniek-Klimczak and J. Majer (eds.). 2011. *Speaking and Instructed Foreign Language Acquisition*. Bristol: Multilingual Matters

Roach, P. 2001. *English Phonetics and Phonology. 3rd edition*. Cambridge: Cambridge University Press.

Rojczyk, A. 2008. Release Burst in Polish Homorganic Stop Geminates. *Linguistica Silesiana* 29. 75-86.

Skehan, P. 1991. Individual Differences in Second Language Learning. *Studies in Second Language Acquisition* 13. 275-98.

Šimáčková, Š. and V. J. Podlipský. 2015. 'Pronunciation of L2 Sounds at Word Boundaries: Stop-Stop Sequences in Czech English.' Paper presented at the EPIP4 4th International Conference on English Pronunciation: Issues & Practices, 21-23 May 2015. Prague.

Sobkowiak, W. 2001. *English Phonetics for Poles*. Poznań: Wydawnictwo Poznańskie.

Van Dommelen, W. 1983. Parameter Interaction in the Perception of French Plosives. *Phonetica* 40. 32-62.

Viel, M. and R. Lilly. 1998. *La prononciation de l'anglais. Règles phonologiques et exercices de transcription*. Paris : Hachette Supérieur.

Wrembel, M. 2005. 'Phonological Metacompetence in the Acquisition of Second Language Acquisition.' Unpublished PhD thesis. Adam Mikiewicz University, Poznań, Poland.