

LEARNING ITALIAN DENTAL AFFRICATES: A FIRST SURVEY ON THE PRODUCTION OF IRISH ENGLISH SPEAKERS

Chiara Meluzzi, Francesca Nicora, Lucia Sbacco

This work investigates the production of Italian dental affricates /ts dz/ by Irish English learners at the National University of Ireland, Galway. Dental affricates are sounds that are difficult for non-native speakers to acquire, and they vary greatly across Italian dialects. Previous works on the topic have demonstrated that learners tend to reduce affricates to fricatives, and that the voiced /dz/ is often substituted with the voiceless in every context. This survey investigates the production of 7 speakers divided into A2 and B1 levels. Participants were asked to complete a background questionnaire and to read a list of 47 sentences containing 52 dental affricates in different phonological contexts. Phonetic annotation was manually conducted on PRAAT, and the analysis focused on durational cues and realization of voicing. The results showed that voiced affricates were rarely produced and were often substituted with their voiceless counterpart, thus leading to the general non-acquisition of voicing for this class of phoneme. Furthermore, the length of the occlusive segment was shorter than the fricative one, particularly in the post-sonorant context; a gap between the occlusive and fricative portion has also been detected. No substantial differences between the A2 and B1 levels emerged.

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1. INTRODUCTION

In this work, we investigate how non-native speakers produce new phonemes that are not part of learners' L1 phonological repertoires. In particular, our investigation focuses on the production of Italian dental affricates by Irish English speakers taking part in an Italian class at the National University of Ireland, Galway. There is a general lack of explicit training on Italian as a foreign language, especially in regard to the great phonetic variability among different Italian regional varieties and dialects. For this reason, we selected two phonemes that show a strong degree of variation in both the productions of native and non-native speakers (see section 2) to verify how these sounds were realized by Irish English speakers. The results contribute to a better understanding of the acquisition of complex sounds which are absent in learners' L1 repertoire, and will furthermore open the path to further research on the explicit teaching of Italian phonetics to LS speakers.

This contribution is organized as follows: Section 2 presents a theoretical section on the phonetics of our target sounds and their acquisition in LS, as well as a general overview of teaching Italian at the higher education level in the Republic of Ireland. Section 3 presents the data on which we based our preliminary work, whereas section 4 analyses the dental affricates produced by our Irish English learners by focusing on the degree of sonority and durational cues. Section 5 discusses the results in terms of the acquisition of new sounds and the teaching of phonetics to LS speakers of Italian. Finally, section 6 draws some preliminary conclusions and opens the path to further investigation on this topic.

2. DENTAL AFFRICATES: PHONETIC REMARKS

We focused on the acquisition of dental affricates /ts dz/ since they are usually classified as two separate phonemes in Italian phonology, rather than a sequence of an occlusive and a fricative. However, previous scholars have differently classified these sounds from a phonological perspective, and have also emphasized their great phonetic variability (see Meluzzi, 2021 for a review).

From a typological perspective, Maddieson (1984) emphasized how dental affricates are rare and marked sounds; the voiced /dz/, in particular, tends to disappear from phonological repertoires and to be reduced to the corresponding voiced fricative /z/. This has happened in almost all Romance languages, with the exception of Italian and, partially, of Catalan (Meluzzi, 2021, pp. 99-100). From an articulatory perspective, Solé (2015) and Žygis et al. (2012, p. 300) have demonstrated how the aerodynamicity of frication contrasts with voicing, thus leading to the general avoidance of voiced affricates in world languages and their progressive reduction into their voiceless counterparts and, eventually, into fricatives.

Meluzzi (2016, 2020) demonstrated the high variability of these phonemes across Italian regional varieties, and how even native speakers at times produced these sounds as a sequence of an occlusive and a fricative, with a sort of ‘gap’ of about 15 msec. in between the occlusive and the fricative phase. The results from Italian L1 have highlighted the following main points on the acoustic cues of dental affricates. Firstly, there is no opposition between graphically singleton and geminate dental affricates: /ts/ is produced with the same duration in both *dazi* ‘duty’ and *pazzi* ‘crazy men’. This contrasts with the general phonological pattern of consonant gemination in Italian, with a shortening of the preceding vowel as a secondary clue (e.g., [‘fa:.to] ‘fate’ vs. [‘fat.to] ‘done’, or also [‘ka:.ʃo] ‘a kind of cheese’ vs. [‘kat.ʃo] ‘I hunt’, cf. Payne, 2005).

Second, a durational difference exists between dental affricates in intervocalic positions as opposed to post-sonorant phonotactic contexts (i.e., after /l/, /n/ or /r/ like in the words *calza* ‘sock’, *manzo* ‘beef’, or *orzo* ‘barley’). Finally, an intermediate degree of voicing has also been found, with the occlusive portion of the affricate realized as voiced, and the following fricative as devoiced. However, this intermediate affricate has been explained as a possible product of language contact between different Italian regional varieties (Meluzzi, 2020).

Only two previous studies have addressed the issue of dental affricates acquisition by non-native Italian speakers. Both Costamanga (2008) and Sorianello (2019) claimed that learners of Italian tend to reduce affricates into alveolar fricatives, in particular in the case of the voiced /dz/. According to these two scholars, only advanced learners manage to accurately produce the target sound. However, to date no in-depth phonetic analysis of the acoustic characteristics of dental affricates as produced by LS speakers of Italian has been carried out.

2.1 Teaching Italian as a foreign language

In the majority of EU Member States, more than three-fifths of all upper secondary education students learn two or more foreign languages. Italian as a foreign language (FL) is currently taught outside of Italy at primary and secondary schools, as well as in tertiary level education. In Ireland, only 13% of pupils decide to study a foreign language, with preference given to French in 53.8% of the cases. In 2017, the Department of Education and Skills (DES) launched the Languages Connect – Ireland’s Strategy for Foreign Languages in Education 2017-2026, the first strategic

plan which aims to support the improvement of foreign language acquisition in the Irish education system and to increase the diversity of provisions for the inherent benefits to individuals, society and the economy.

At the tertiary level, Italian is currently taught at Trinity College Dublin (TCD), University College Dublin (UCD), National University of Ireland, Galway (NUIG), and University College Cork (UCC). However, the number of students enrolling in Italian studies is still limited and this results in the lack of new programs which could offer Italian in combination with linguistics. In other words, while it is not rare to find a module focused on Spanish sociolinguistics, the world of linguistics relating to Italian Studies seems to still be missing in the Republic. Linguistic aspects of the Italian language are usually not considered of the utmost importance in language learning, and consequently neither are the needs of students who may wish to understand how the Italian language works.

In particular, Italian phonetics is not explicitly taught, and its importance is often considered only at the end of the class. This is not surprising considering that pronunciation instruction is rather neglected, especially if compared to other language aspects such as grammar or lexicon. However, a large body of research in second/foreign language acquisition has shown the importance of the teaching of phonetic elements and prosodic features in language learning, as they play a crucial role in speech communication (Chun, 1988, 2002; Derwing et al., 1998; Munro & Derwing, 2015).

3. METHODS AND DATA

3.1 Research questions

The review of the state of the art has highlighted the lack of extensive research on the phonetics of Italian dental affricates by LS speakers, and, at the same time, the lack of emphasis on the teaching of Italian phonetics in class. Therefore, we decided to focus our investigation on a small but compact group of Irish English speakers studying Italian at the National University of Ireland, Galway, but who never received explicit phonetic training.

In particular, we addressed the following research questions:

1. Are dental affricates more frequently preserved or are they reduced to fricatives by LS learners?
2. Is there an alternation between voiced and voiceless affricates across phonotactic contexts and/or across speakers?
3. Do LS speakers differentiate these phones in terms of length across phonological contexts?

On the basis of the two previous studies on dental affricates in non-native speech, we expect a general reduction of affricates into fricatives, especially in terms of the voiced variant. As for durational cues, in light of the interface between graphemes and phonemes, we expect a difference between graphical singleton and geminate affricates, thus reproducing the most widespread phonological pattern of Italian.

3.2 Materials

Participants were presented with a list of 47 affirmative sentences in Italian, all balanced by prosodic contour, with the target word in the initial prosodic position (e.g. *Per lo zio porta un regalo* “For the uncle, take a gift”). The list was identical to the one for that of Italian L1 realized by Meluzzi (2020), which contained 52 dental affricates in real Italian bi- or trisyllabic words, with word stress on the penultimate syllable. The items were balanced by a phonotactic context in which dental affricates could occur in the Italian lexicon, that is, a word-initial (#C- *zio* «uncle»), post-sonorantic context, after either /r/, /l/ or /n/ (SCV *calzino* «sock», *marzo* «March», *Ponzone* city name). Table 1 presents the target words in the list across the different phonotactic contexts.

Table 1

*Distribution of the tokens across phonotactic contexts. * marks cases in which the same words contain two dental affricates in two phonotactic contexts.*

Context	Target word	Engl.	Context	Target word	Engl.
Word Initial (#C-)	zattera	raft	Intervocalic Geminate (VCCV)	zazzera*	shock of hair
	zappa	hoe		mazzetta	bribe
	zio	uncle		spazzino	garbageman
	zanna	fang		buzzurri	boor
	zaino	rucksack		aguzzino	jailor
	zero	zero		zozzo*	dirty
	zampa	paw		cazzotto	punch
	zazzera*	shock of hair		Mazzini	(surname)
	zozzo*	dirty		azzero	I reset
	zanzara*	mosquito		puzzo	I smell
Post-sonorant (SCV)	sferza	whip	pizzo	lace	
	forzuto	muscular	pozzo	pool	
	Ponzone	(name of city)	azzardo	risk	
	arguzia	wit	pazzo	crazy	

	bonzo	Buddhist monk		pezzo	piece
	panzuto	paunchy		piazza	square
	balzato	jumped		azzurro	blue
	orzata	barley water		abbazia	abbey
	sfilza	row	Intervocalic Singleton (VCV)	comizi	political meetings
	colza	rapeseed		dazi	duties
	balza	frill		mazurca	mazurka
	pinza	pliers		Mazara	(name of city)
	panza	belly		negozi	shops
	Vincenzo	(proper male name)			
	orzo	barley			
	zanzara*	mosquito			
	marzo	March			

The distribution of the types in the list mirrors the dental affricates in the Italian lexicon, so that 18 affricates occurred in an intervocalic geminated context, eight in a singleton context, 10 as a word-initial context and 16 after the sonorants /l/-/n/-/r/. It was not possible to balance the list according to voicing, because the distribution of the voiceless and voiced variants is highly variable in Italian, without a clear and shared norm of pronunciation (cf. Meluzzi 2020, 2021).

3.3 Data collection

For this preliminary analysis, we recorded 7 female undergraduate students between 18 and 21 years of age, all born and raised in Galway (Ireland) with Irish English as their L1, who were attending language courses at the National University of Ireland, Galway. According to the language exams, their proficiency level in Italian was between A2 and B1 of the Common European Framework of Reference for Languages (CEFR), which correspond to the Basic User Waystage and to the Independent User Threshold, respectively. No speaker had previous experience or prolonged contact with Italian.

The subjects were informed of the general purposes of the experiment, and they took part in the research voluntarily. They did not receive any monetary compensation for their participation, nor were they awarded extra school credits. The subjects were recorded in a sound-proofed room at the National University of Ireland, Galway, with a TASCAM DR20 recording set at 44.1 kHz with a sampling rate of 32 bit. Due to Covid-19 restrictions, participants remove their face masks only

for performing the sentence-reading task, while the researcher stood at a careful distance with her mask on. After each recording, the environment was cleaned in line with the safety measurements outlined by the Irish government.

A preliminary annotation of the data led to the discarding of completely mispronounced sentences, thus the total analysis is based on 358 tokens. Each token was annotated on PRAAT, complying with the protocol for dental affricate acoustic analysis presented in Meluzzi (2016, 2020). The protocol was based on a three-layered structure: the first tier contains the orthographic transcription of the target words, whereas in the second tier the target sound (e.g., the dental affricates or its different variants) was segmented by referring to acoustic cues such as the beginning of the silence of the occlusive phase and the end of the frication noise. In the case of intervocalic affricatives, the preceding vowel was also annotated based on the movements of the second formant or F2 (Foulkes et al. 2011). Finally, in the third tier the different parts of the dental affricates have been separated: the occlusive phase ended at the beginning of the frication noise, sometimes without the characteristic burst; a sort of gap was also detected between the occlusive and fricative parts, which has been labelled as post-burst aperiodicity or PBA (Foulkes et al. 2011).

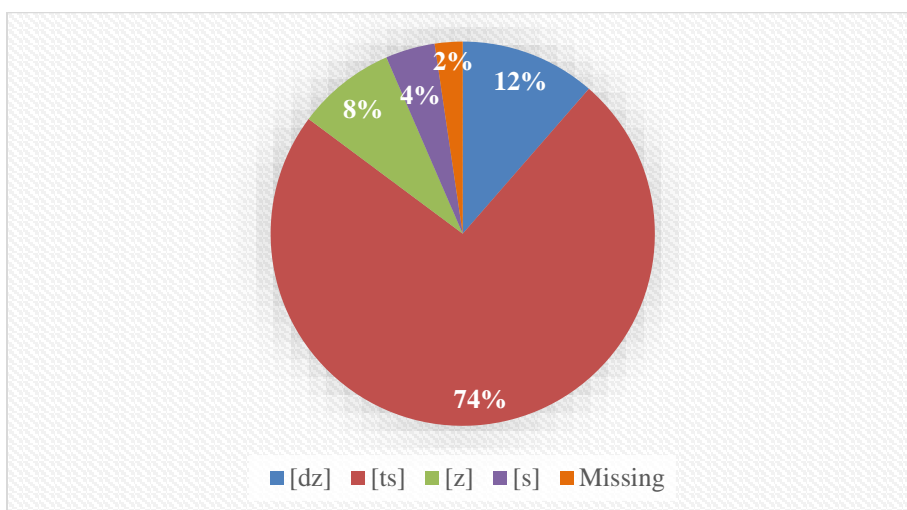
4. RESULTS

4.1 Affricate and voicing

A first investigation of the data (Figure 1) shows that the dental affricate is completely misproduced only in 2.34% of the corpus: in these occurrences, affricates are usually produced as a coronal [t]. The reduction to a fricative is also not very frequent, to either a voiceless [s] (4.16%) or a voiced [z] (8.31%). Most dental affricates are correctly produced, although the lack of voicing opposition is evident, with a preference for the voiceless variant (73.77%).

Figure 1

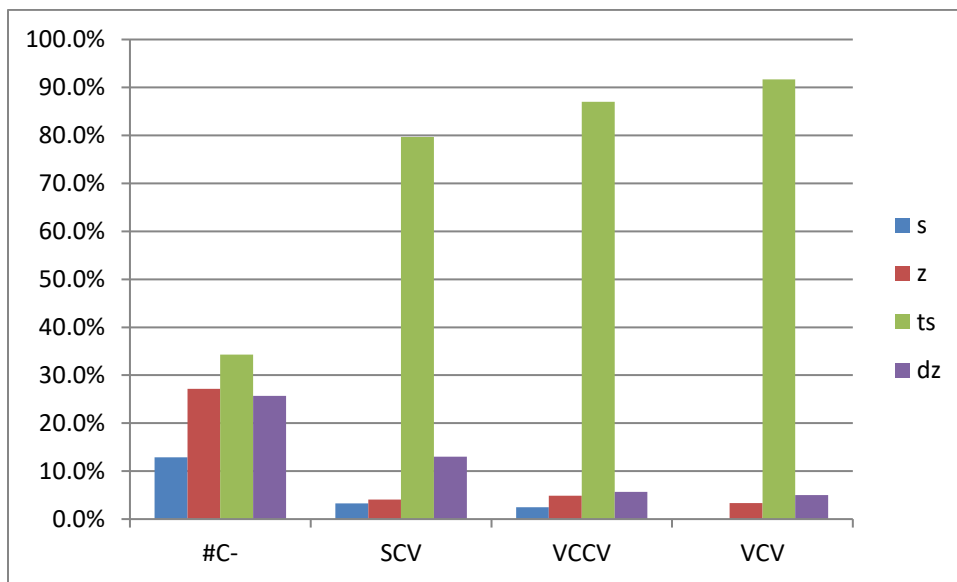
Distribution of dental affricates in the corpus.



Voiced variants were most frequently encountered in the word-initial phonological context (Fig. 2), which appears to be the most variable one. Indeed, in the word-initial context, the affricates could be realized as either voiceless or voiced, as is true of the corresponding voiced and voiceless alveolar fricatives. Conversely, no such variability was recorded in other phonotactic contexts, where the voiceless variant /ts/ is the preferred variant when the affricate appears within the word, regardless of the difference between intervocalic and post-sonorant contexts. Finally, it's worth pointing out how the voiced affricate /dz/ appears not only word-initially but also, albeit rarely, in the other contexts.

Figure 2

The distribution of the main variants of dental affricates across phonotactic contexts ($\chi^2(9) = 89.954, p < .0001, \text{Cramer's } V = .282$)



Another phenomenon that emerged from this analysis was the presence of a short gap between the occlusive and fricative phase, which was labelled as PBA (post-burst aperiodicity), following Foulkes et al. (2011) and Meluzzi (2016, 2020). PBA occurs more frequently in voiceless affricates (60 cases of 224 tokens), with a larger presence in intervocalic contexts (27 cases in VCCV, 17 in VCV) rather than in post-sonorant (13 cases) or word-initial (3 cases) contexts. Four occurrences within 40 tokens of voiced affricates also show the presence of PBA.

4.2 Durational cues

We analyzed the duration of only those phones realized as proper affricates. We measured the duration of the whole affricate sound and of the occlusive and fricative part separately. ANOVAs were run to test whether the variability was significant with respect to the phonotactic context.

Table 2

Duration (in msec.) of the voiceless and voiced affricates, the stop and fricative parts, and the eventual PBA. Numbers between brackets indicate standard deviation. ANOVA results are quoted in the final lines.

Affricate	Context	Affricate Duration	Stop Duration	Fricative Duration	PBA Duration
/ts/	#C-	136.7 (17.6)	75.2 (12.6)	51.23 (8.88)	10.25 (1.01)
	SCV	169.73 (11.53)	52.47 (6.2)	101.51 (8.16)	15.75 (0.93)
	VCV	248.03 (13.51)	94.86 (6.14)	134.46 (10.23)	18.71 (1.5)
	VCCV	221.71 (10.5)	93.11 (4.78)	109.68 /6.5)	18.92 (1.43)
/dz/	#C-	145.95 (26.84)	85.39 (31.71)	49.99 (4.05)	10.62 (0.81)
	SCV	141.52 (16.01)	36.68 (16.96)	85.21 (0.14)	17.63 (0.81)
ANOVA	/ts/	F(3)=24.27, p<.0001	F(3)=38.83, p<.0001	F(3)=9.67, p<.0001	F(3)=2.327, p=.084 !
	/dz/	F(3)=9.183, p<.0001	F(3)=13.11, p<.0001	F(3)=1.36, p=.269 !	F(3)=37.215, p=.026

Irish learners of Italian showed a major contrast in length between intervocalic and post-sonorant contexts, although there was no variability within intervocalic contexts. This is confirmed by both data on the duration of the whole affricate, and those of the closure and fricative phases. The stop closure in post-sonorant contexts shows the shortest values, both in voiceless and voiced affricates. The longest fricative duration was detected for voiceless affricates in an intervocalic singleton context, which could constitute the only significant difference between non-native and native productions as recorded by Meluzzi (2020) and Sbacco (2019).

Finally, the mean duration of the PBA span was between approximately 10 and 19 ms, although the variability across phonotactic contexts was not statistically significant (p=.084). This could confirm Meluzzi's (2016) claim that the duration of the PBA is not as important as the presence of the PBA itself, as a moment of pause between two subsequent articulations.

5. DISCUSSION

Albeit preliminary, the data presented in this work helps further our understanding of the production of dental affricates by non-native speakers of Italian and, furthermore, of the phonological nature of these complex sounds.

Our data has shown that even basic or post-basic learners have generally acquired affricates as a single phoneme: indeed, the cases of reduction of the affricates to the corresponding fricatives were not numerous, nor were the productions of affricates as bi-phonemic sequences (i.e., with the gap between the occlusive and the fricative phase). However, it appears that, as it has been previously shown by Zygis (2008), voiced dental affricates are extremely difficult, since they require the activation of two opposed aerodynamic mechanisms at the same time. That could explain why our learners over-extended the voiceless affricate, thus showing few occurrences of the voiced one.

If we compare learners' productions with those of the Italian L1 native speakers recorded by Meluzzi (2016, 2020) and Sbacco (2019), it appears that the overall length opposition among phonotactic contexts is similar in L1 and FL learners, with no difference between singleton and geminate intervocalic contexts, and with a sensible reduction of the target phone in the post-consonant position. However, this target was reached by learners in a peculiar way, that is by shortening only the occlusive phase in SCV contexts, whereas L1 speakers reduced both the occlusive and fricative part of the affricate. This could possibly point towards the fact that affricate sounds are not completely phonologically acquired by FL speakers as a phoneme, but rather as an allophonic realization of the fricative in certain phonotactic contexts. Only at a further step could affricates possibly be stored in the LS phonological system as a sound different from their fricatives counterparts.

These results could also be explained by considering the role of the frequency of the input, the degree of similarity of the new sounds with previous sounds contained in the L1 of the learners, and the role of the graphic input at the interface between grapheme-phoneme. Indeed, as shown by Ellis and Collins (2009), input frequency is crucial in the acquisition of phonological patterns of a new language: in the case of dental affricates, their presence in Italian lexicon is limited to certain phonotactic contexts, and there is a huge difference in L2 production between high-frequency words (e.g. *marzo* 'March' or *zanzara* 'mosquito') and extremely low frequency or rare words (e.g. *mazurca* 'mazurka'). In terms of graphic input and sound similarity, Escudero et al. (2014) have illustrated the orthographic effect on the learning of pronunciation patterns: this could have influenced the degree of reduction of affricates, especially voiced ones, into fricatives, since the same grapheme stands for [dz] in Italian but for [z] in English (e.g., in the word *zero* 'zero'). Finally, Milenova (2014) has argued that the effects of similarity among sounds (and also between sounds and graphemes) could explain imperfect learning patterns of new sounds in LS production. Obviously, all these aspects could be considered in further studies specifically devoted to analyzing one of these variables. However, these preliminary findings are in line with previous literature on the acquisition of new sounds in LS speech (e.g., Milenova, 2014), and they help cast a new light on the phonetic cues in the production of complex sounds in LS speech.

6. Conclusions

Our data have shown that Italian dental affricates as produced by Irish English learners are not frequently reduced to the corresponding fricatives sounds, as has been previously claimed by other studies. However, FL productions still show some peculiarities as to both voicing distribution and, most of all, length variability of the affricate and its parts. Future studies should be aimed at widening the corpus by recording more subjects at different proficiency levels in Italian as a FL. A perception experiment has already been designed that aims to analyze whether our learners are able to discriminate voiced and voiceless dental affricates, even in the case of partial devoicing

(Meluzzi, 2020), and whether they attribute socio-indexical values to the different pronunciation. A second perception test will be run with L1 speakers, who will be asked to tell whether different realizations of the dental affricates sound more or less “foreign”. Furthermore, we aim to test whether a specific phonetic training could help our learners in acquiring dental affricates as a phonemic unity.

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ABOUT THE AUTHORS

Chiara Meluzzi is Researcher in Linguistics at University of Milan, where she teaches General Linguistics. After completing her PhD in Linguistics at University of Pavia in January 2014, she worked as research assistant and Post-Doc Fellow at Free University of Bolzano/Bozen, Scuola Normale Superiore di Pisa, and University of Pavia, where she has also taught courses in Sociolinguistics and Phonetics. Her main research interests concern language variation and change, with a specialization in sociophonetics and forensic applications of linguistics. Her publication list includes a monography dedicated of Italian dental affricates (Franco Angeli, Open Access). Address: University of Milan, via Festa del Perdono 7, 20122 Milan, Italy, 0250312872, chiara.meluzzi@unimi.it

Francesca Nicora is currently a teaching assistant in Italian at the National University of Ireland, Galway (NUIG) and PI for the MISTRAL project. She holds a MA in Theoretical and Applied Linguistics (Università degli Studi di Pisa) and another MA in E-Learning and E-Teaching Italian to Foreigners (Università per Stranieri di Siena). In 2020, she completed her Structured-PhD degree in Italian Studies from the NUIG with the thesis “Prosodic training in foreign language: a study with Hiberno-English learners of Italian“, winner of the Irish Association for Applied Linguistics postgraduate award. Her research interests include second language prosody acquisition, phonetics and phonology, audiovisual translation practices and technologies in language teaching. Address: National University of Ireland, University Road, Galway, Ireland, H91TK33, 35391524411, francesca.nicora@nuigalway.ie

Lucia Sbacco is now a PhD student in Speech and Language Sciences at Newcastle University. She graduated at University of Pavia in Linguistics with a thesis on dental affricates’ realization in the Marche regional variety of Italian. Her research interests span from sociophonetics, to second language acquisition and dialectology. She is currently conducting research on the phonetic patterns of pre-adolescent English speakers' production of Italian as a Heritage language. Address: Newcastle University, School of ECLS, King George VI Building, Newcastle upon Tyne, NE17RU, United Kingdom, l.sbacco2@newcastle.ac.uk

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