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An acoustic analysis of metaphony in the dialects of the Lausberg Area (Southern Italy)

This acoustic analysis focuses on metaphony - a type of regressive vowel harmony - in a restricted dialectal area in Southern Italy, across the border between Basilicata and Calabria, the so-called "Lausberg Area" (Lausberg, 1939). The first aim is to relate synchronically metaphony to V_1CV_2 coarticulation, in which V_2 influences V_1 and can lead to associated sound changes. Secondly, we want to determine if metaphony varies between younger and older speakers and between males and females. Overall, the results showed an influence mainly of suffix vowel height on mid stem vowels in both age groups. The generally weaker metaphonic influence in younger speakers – especially in young men – suggests their tendency to converge to Standard Italian as regards stem vowel quality.

Keywords: dialects, metaphony, coarticulation, sociophonetics, sound change.

1. *Introduction*

The present study is a phonetic analysis of metaphony - a type of regressive vowel harmony typical of many Romance languages - in a restricted dialectal area in Southern Italy, across the border between Basilicata and Calabria, called the Lausberg area (Lausberg, 1939) after the author who first described it. In particular, the dialects in this area have undergone far fewer phonological changes from Latin compared to other Southern Italian dialects. The vowel systems in the Lausberg area are particularly interesting, since we find the coexistence, and very often also mixing, of more than one vowel system in a relatively restricted territory. Basically, most dialects in the Lausberg area share the so-called Sardinian vowel system, keeping the Latin vowel qualities but neutralising vowel length. In particular, the *Mittelzone* in the east is thought to be the sub-area characterized by the uniform spreading of the Sardinian vowel system (Lausberg, 1939; Martino, 1991). Along the transition area between the Lausberg area and the *Südzone* (as defined by Lausberg, 1939) we often find traces of the Sicilian vowel system, merging the Latin /i/, /iː/ and /eː/ into short /i/, and /u/ and /oː/ into short /u/ (Martino, 1991: 46). There is a more complex area in the north-west, the so-called *Zwischenzone*, where a mixed vocalic system occurs, taking elements of the Sardinian and the Sicilian vowel system. In this sub-area, we can distinguish two phonologically contrasting degrees of aperture for mid vowels: /e/-/ɛ/ and /o/-/ɔ/ (as in the Neapolitan vowel chart).

Figure 1 - *Geographical localisation of the Lausberg area (between the two borders highlighted in red) and of its sub-areas (adapted from Pellegrini, 1977 and Martino, 1991). The* Zwischenzone *corresponds to the striped area on the left, while the remaining area left blank represents the* Mittelzone*. The area just below the southern red border represents the transition territory to the* Südzone *(below the black southern border)*

The map of the Lausberg area has been reviewed more than once (Rensch, 1964; Falcone, 1976; Trumper, Maddalon, 1988; Martino, 1991), but we lack recent studies completely mapping the status of the dialects in this area today. Literature on the dialects of the Lausberg area is unfortunately limited. Some systematic studies, apart from the very first ones that first detected and described this linguistic area (Lausberg, 1939; Rensch, 1964), were carried out by Trumper (1979, 1997), Martino (1991), Romito (Romito et al., 2006), Conte (as concerns the Basilicata territory, 2014).

Metaphony is pervasive in most Romance and Italian dialects, especially southern ones, and is triggered by a still existing or previously existing high vowel in the unstressed suffix, influencing the quality of the stressed root vowel, or less typically also the pre-tonic vowel in trisyllabic words. These suffixes may indicate a variety of morpho-syntactic categories, mainly gender and number in nouns and person, and number and tense in verbs. The numerous studies on metaphony and associated sound changes for Italian dialects (Lausberg, 1939; Rensch, 1964; Rohlfs, 1966; and many others) have been mostly auditorily based without any quantitative analysis (more recent studies are also Maiden 1991; Gaglia, 2011; Savoia, 2015; the volume on metaphony by Torres-Tamarit et al., 2016). Only very recently, some first acoustic analyses of metaphony in Southern Italian dialects have also appeared (see Grimaldi, 2003; Grimaldi et al., 2016; Grimaldi, Calabrese, 2018; Romito et al., 2006; Romito, Gagliardi, 2009; Romito et al., 2011).

Metaphony can result not only into vowel shifting (typically raising), but also diphthongization. In particular:

– Vowel raising usually affects mid-low vowels, less frequently mid-high ones and more rarely the low central vowel: ɛ → e/_i, u; ɔ → o/ _ i, u; e → i/_ i, u; o → u/_i, u; a → ɛ/_i, u.

(1) Mormanno, Calabria: [ˈvɛcca] – [ˈveccu] (‘old woman, old man’) (Savoia, 2015: 209)
(2) Papasidero, Calabria: [ˈmɔru] - [ˈmurisi] (‘I die, you die’) (Trumper, 1997: 362)

– Diphthongisation usually involves mid-low and more rarely low vowels: /a, ɛ/ → /jɛ, je, iːə/; /ɔ/→ /wɔ, wo, uːo/. Diphthongs are typical of – but not exclusive to – the *Zwischenzone* (though not shared by all varieties) and in the northern part of the *Mittelzone*.

(3) Trebisacce, Calabria: [ˈbɛllə] – [ˈbiəllə] (‘beautiful’, fem. sg. vs. masc. sg.) (IPA-adapted from Rensch, 1964: 25)
(4) Papasidero, Calabria: [ˈlɔrda] - [ˈluordu] (‘dirty’, fem.sg. vs masc.sg.) (IPA-adapted from Rensch, 1964: 46)

Curiously, however, diphthongising areas seem not to be geographically compact (Martino, 1991: 45). As far as the southern part of the *Mittelzone* is concerned (broadly coinciding with the High Ionic Calabrian coast), monophthongisation follows diphthongisation historically (Martino, 1991: 14; Trumper, 1997: 361) and is typically also accompanied by compensatory lengthening: /je, ie/ →/ iː/, /wo/ → /uː/. Consequently, the following changes are possible within the relatively geographically restricted Lausberg area.

(5) *[ˈbɛllu] > *[ˈbiɛllu] > [ˈbiːllə] (‘beautiful’, masc. sing.) (Romito et al., 2006: 4)
(6) *[ˈkoktu] > *[ˈkuottu] > [ˈkuːttu] (‘cooked’, masc. sing.) (Trumper, 1997: 361)

Metaphonic effects have been shown to be confined principally to the influence of vowel height on the mid vowels /e, o/ (Lausberg, 1939; Rensch, 1964; Rohlfs, 1966), which in the Sardinian vowel system can be also phonetically realised as [ɛ, ɔ]. We expect most metaphonic effects in mid vowels not only because this is suggested by the literature (Lausberg, 1939; Rensch, 1964; Rohlfs, 1966), but also because in the Sardinian vowel system the opposition between tonic mid-high and mid-low vowels – in non-metaphonic contexts – is not phonologically relevant, but rather conditioned by the phonological environment. More specifically, a mid target stem vowel is probably more open in words where the trigger is /e, a/, but should get higher to a certain degree (thus undergoing metaphony) when the trigger is high. Fronting or backing effects are expected principally when both trigger (i.e. the suffix) and the target (i.e. the metaphonising stem vowel) are either both front or back (that is, we do not expect a categorical shift in frontness or backness, but basically only in vowel height, see also Maiden, 1991; Savoia, 2015).

It is currently unclear whether metaphony in the Lausberg area still exists or whether it is waning under the influence of Standard Italian in which there are no categorical metaphonic effects. For this purpose, an apparent-time analysis (Bailey, Wikle, Tillery & Sand, 1991; Weinreich, Labov, Herzog, 1968) was carried out, in which younger and older speakers were compared acoustically in order to assess the

metaphonic influence of suffix vowel on stem vowels. Given that certain kinds of sound changes in progress are known to be influenced by sex and sometimes led by women (e.g. Eckert, 1989; Labov, 1990; Maclagan et al., 1999), coupled with some suggestions that women might be less inclined to make use of broad dialect features than men in the Lausberg area (Trumper, 1979), a further test was made on whether any such weakening of metaphony towards the standard was different for women and for men.

In summary, the main aim of the study was to test whether metaphony occurs in the Lausberg area. Assuming metaphony does occur, the further questions that were considered were the following:

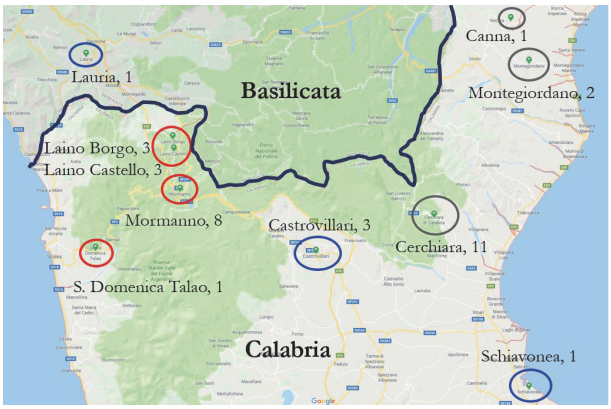
1. Is the metaphonic influence of the suffix vowel strongest for mid (as opposed to high or open) vowels?
2. Is metaphony principally due to a change in height rather than fronting?
3. Are metaphonic effects weaker for younger than older speaker and, if so, does this weakening interact with speaker sex?

2. *Method*

2.1 Speakers and villages

34 participants (18 females) from 10 villages in the Lausberg area were recorded in quiet conditions at their homes. The speakers were recruited either from personal contacts of the first author (who is herself a native speaker of this region), or through contacts given by previous participants, or by broadcasting the research activity on social media. All participants were paid a small amount of money for their participation. Before carrying out the recordings, all participants were invited to answer some questions related to their age, degree of education, and use of dialect in everyday life. Only participants who declared to be able to speak the local variety of the village they are from and to use the dialect at least relatively often were involved in the recordings. The speakers include 18 older (41-92 years) and 16 younger (13-32 years) speakers. Fig. 2 shows the villages and the number of speakers per village from which recordings were made. Unfortunately, Basilicata was underrepresented (Lauria), since most of the villages from which recordings were made are in Calabria, in the Province of Cosenza. Nevertheless, as Fig. 2 also shows, the whole Lausberg-Calabrian area has been broadly covered, taking both *Zwischenzone* and *Mittelzone* into account and also including some villages at the border between the Lausberg area and the transition zone to the *Südzone* (cf. § 1). The further details are as follows: Laino Borgo and Laino Castello, Mormanno and S. Domenica Talao belong to the *Zwischenzone*; Lauria is on the northern border between *Zwischenzone* and *Mittelzone*; Canna, Montegiordano and Cerchiara belong to the *Mittelzone*, while Castrovillari and Schiavonea are both at the southern border of the Lausberg area (Trumper, Maddalon, 1988). A further summary of some of the speaker attributes is shown in Table 1 in the *Appendix*, including village of origin, sex and age.

Figure 2 - *The geographical distribution of the villages represented in the data. The border between the two regions Basilicata and Calabria is highlighted in dark blue. The villages belonging to the* Zwischenzone *are circled in red, those belonging to the* Mittelzone *are circled in dark grey, while those on the borders of the area are circled in blue. The number of speakers for each village is also indicated. URL: maps.google.com*



While most of the dialects belonging to the Lausberg area should share the Sardinian vowel system (see references in § 1), Castrovillari and Schiavonea might indeed show a greater influence of the Sicilian vowel system (Martino, 1991: 12). However, the vowels of the *Zwischenzone* might also be influenced by the *Südzone*, characterized by the Sicilian vowel system, at least in some lexical items (Lausberg, 1939; Martino, 1991). Finally, the exact borders of the Lausberg area are not easy to trace, especially considering that these might have changed in the many decades since the first studies were undertaken. For instance, a closer contact between villages, possibly due to slightly improved infrastructure and mobility linked to study and work, might be contributing to dialect levelling (Trumper, 1979; Trumper, Maddalon, 1988). These are some of the reasons why recordings were made from a wide selection of villages in each zone.

2.2 Lexical items and vowel tokens

The lexical items in this study were elicited through a picture-naming task in order to avoid the use of Standard Italian and to encourage the participants to talk directly in the dialect. Also, all interactions between the investigator and each participant were carried out in the dialect, as far as this was possible. Each speaker produced a total of 102 inflected words (51 stem types) including inflected nouns, adjectives and verbs, in randomised order and in two repetitions. In order to elicit inflected lexical items just by using pictures, a slightly different strategy was adopted for each lexical category, as visible in Figs. 7 to 9 in the *Appendix*. In particular, while nouns could be elicited on their own, inflected adjectives had to be elicited in combination with a noun (e.g. ['puma '**rus:a**], 'red apple', where ['rus:a] is the target word, see Fig. 8 in the *Appendix*) and inflected verbs had to be elicited within sentences which

were graphically "suggested" by the picture and thus different for each verb (see Fig. 9 in the *Appendix*). In order to make sure that the participants had understood the task, a training phase, consisting in observing the pictures and clarifying their meaning in case of ambiguities, preceded the recording phase. The speakers repeated each word twice, first in isolation and then embedded in a carrier sentence ("I say __ two times", in the dialect [jɛ 'diku __ dui 'votə] as regards nouns and adjectives, while verbs could not be elicited in isolation, so that the same sentence containing the target verb had to be repeated twice.

The mostly bisyllabic words were composed of a stem and either front vowel suffixes (henceforth: V_{front} = /i, e/, e.g. /ˈkani/ - /ˈkane/, 'dogs' - 'dog'), or back vowel suffixes (V_{back} = /u, a/, e.g. /ˈvec:u/ - /ˈvec:a/, 'old man' - 'old woman'). 25 and 26 stem types preceded V_{front} and V_{back} suffixes respectively. The stem vowel (Vstem) varied over /i, e, a, o, u/ (e.g. in /kani/ - /kane/, 'dogs' - dog', the Vstem is /a/). Following the removal of those words that had been misarticulated or produced in Standard Italian, 2444 stem vowels preceding V_{front} suffixes and 2535 stem vowels preceding V_{back} suffixes remained for analysis.

The lexical items considered in the analysis are listed in Italian in Table 2 in the *Appendix*. The expected pronunciation of the items in the dialect is also indicated. As anticipated, these words that vary in stem and suffix vowels include all lexical categories that could be affected by metaphony, i.e. nouns, adjectives and inflected verbs (first, second and third person singular of the present indicative). In particular, the high vowel suffixes /i, u/ are the ones expected to trigger metaphony (§ 1). Table 2 also shows that the lexical items are organised into pairs, where the stem is shared and there are two competing suffixes. From a morphological point of view, the /i/ marks either (a) the plural counterpart for nouns with the/e/suffix in the singular (e.g. /ˈverme, 'vermi/, 'worms' - 'worm'), or (b) the second person singular for some verbs vs. the third person singular ending with /e/, e.g. /ˈtenisi, 'tene/, '(I) have' - '(you) have'. The suffix /u/ marks in verbs the first person singular vs. the third person singular, e.g. /ˈtrovu, 'trova/, or it represents in nouns and adjectives gender, e.g. /ˈbona, 'bonu/ ('good', feminine vs masculine).

2.3 Instrumentation and software

The speakers were recorded at their homes using a laptop and a headset with integrated microphone (*Sennheiser SC 60*). The words were elicited in a picture-naming task using *SpeechRecorder 3.28.0* (Draxler, Jänsch, 2004). The raw speech data were then semi-automatically segmented and labelled using MAuS (*Munich Automatic Segmentation System*) (Kisler et al., 2017), which is integrated in the *emuR* package (version 1.1.2) (Winkelmann et al., 2017) in the R software environment (version 3.5.3). Even though the segmentation process used for the data was based on the phonological set for Italian, a phonological transcription in the dialect for each word of the dataset was given to the system. This is why the segmentation of dialectal data could be possible even by using a language-dependent segmentation system. Any obviously misplaced segment boundaries were manually corrected.

2.4 Formant analysis

The first two formant frequencies were calculated with the *Praat* formant tracker (using the *PraatR* package in R) (Albin, 2014) between the acoustic onset and offset of the stem vowel using a 25 ms window and a 5 ms frame shift. Visibly mis-tracked formants were manually corrected. They were then linearly time normalised into 11 equidistant time points. The strength of metaphonic effects was assessed separately in the context of front vowel (V_{front}) and back vowel suffixes (V_{back}) and separately for F1 and F2.

2.5 Statistical analysis

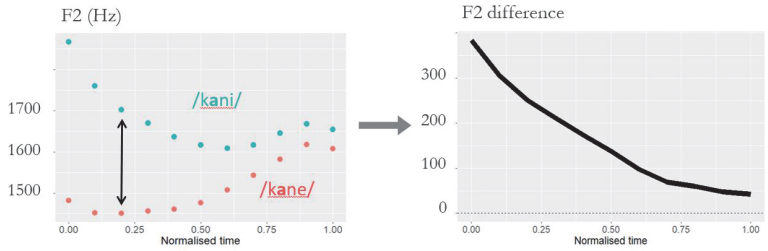
Linear mixed effects (LME) models were applied to the data by using the *lmerTest* package (version 3.1-0) on R. The dependent variable was the formant value extracted at time-normalised point 0.1, with fixed factors stem (five levels: one of the stem vowels /i, e, a, o, u/), suffix (two levels: one of the suffix vowels /i, u/), age group (two levels: young, old), sex, and with the speaker and stem (e.g. 'mes' for 'mese/mesi') as the random factors. The random factors included intercepts and all possible slopes to measure the interaction between the fixed and random factors; these were dropped if they were non-significant. Four mixed models were applied: one for each of the two formants separately, and one for each of the front, /i, e/, and back, /u, a/, suffix pairs. The motivation for basing the dependent variable on time-normalised point 0.1 was that this was the time point in which metaphonic effects were most marked (see § 3.1). After applying the LME models to the data, estimated marginal means (EMMs) post-hoc tests between different factor combinations were computed by using the *emmeans* package (version 1.4.5) in R.

3. *Results*

3.1 Does metaphony occur in the Lausberg area?

An initial analysis of metaphony was made by subtracting separately by speaker and stem the formant values at each time point in the non-metaphonic context from those in the metaphonic context. For example, the mean F2-trajectory in the stem vowel of /'kane/ (non-metaphonising) was subtracted from the mean F2 of the stem vowel /'kani/ (metaphonising) for a given speaker (Fig. 3). If the result of the subtraction is zero, then the suffix/i, e/ has no influence on the target, i.e. there is no metaphony.

Figure 3 - *An example of application of formant difference plotting of F2 for a particular stem and speaker*



Formant difference plots (Fig. 4 and Fig. 5) were obtained by subtracting formants in the stem vowel in the context of the two front or back vowel suffixes separately for each speaker, and then by grouping the differences according to target type and aggregating them across speakers and items. The plots for V_{front} (Fig. 4) suffixes were separated from those with V_{back} suffixes (Fig. 5). Thus, the upper plots in Fig. 4 are based on subtracting F2 of e.g. /a/ in /'kane/ from F2 of /a/ in /'kani/; and the upper plots in Fig. 5 subtracting F2 of e.g. /e/ in /'vec:a/ from F2 of /e/ in /'vec:u/. The plots in the lower rows are based on similar calculations but for F1. If the suffix influences the stem vowel, then the F2 difference plot should be positive regarding a stem in the context of a V_{front} suffix (given that F2 /i/ > F2 /e/) (Fig. 4) and negative in a V_{back} context (since F2 /u/ < F2 /a/) (Fig. 5). Similarly, the F1 difference plot should be negative for stems before V_{front} suffix (F1 /i/ < F2 /e/) (Fig. 4) and negative in a V_{back} context (F1 /u/ < F1 /a/) (Fig. 5). Trajectories further away from zero indicate a greater influence of the suffix on the stem vowel.

In summary, Figs. 4 and 5 provide clear evidence for metaphony. They also show that formant differences are more marked at the vowel onset.

Figure 4 - *F2 and F1 differences in V_{front} contexts for all stem types, aggregated across speakers and items, also including the confidence interval of the mean difference values plotted*

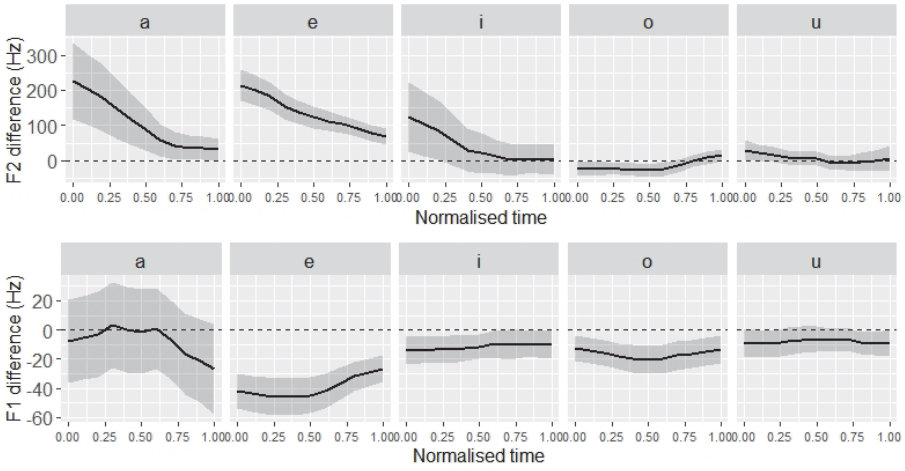
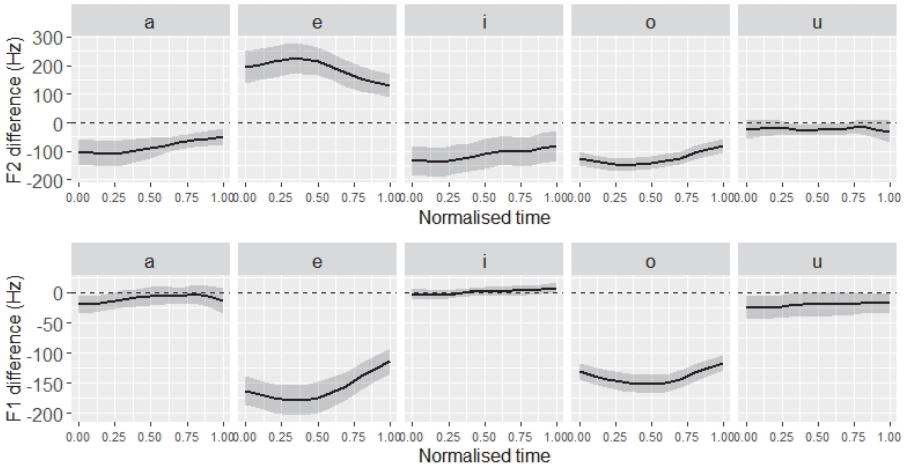


Figure 5 - *F2 and F1 differences in V_{back} contexts for all stem types, aggregated across speakers and items, also including the confidence interval of the mean difference values plotted*



3.2 Are metaphonic effects stronger in mid-vowels?

Figs. 4 and 5 clearly show that the metaphonic influences are greatest on mid vowel stems /e, o/. In addition, there is a weaker metaphonic influence on /a/ vowel stems, especially in F2. This suggests that /a/ might be slightly fronted due to the influence of the /i/ suffix. Also, a slight tensing of /i/as regards V_{front} contexts (since F2 and F1 get more distant), and a small retraction as regards V_{back} (noticeable because of the F2 lowering), are visible from the figures.

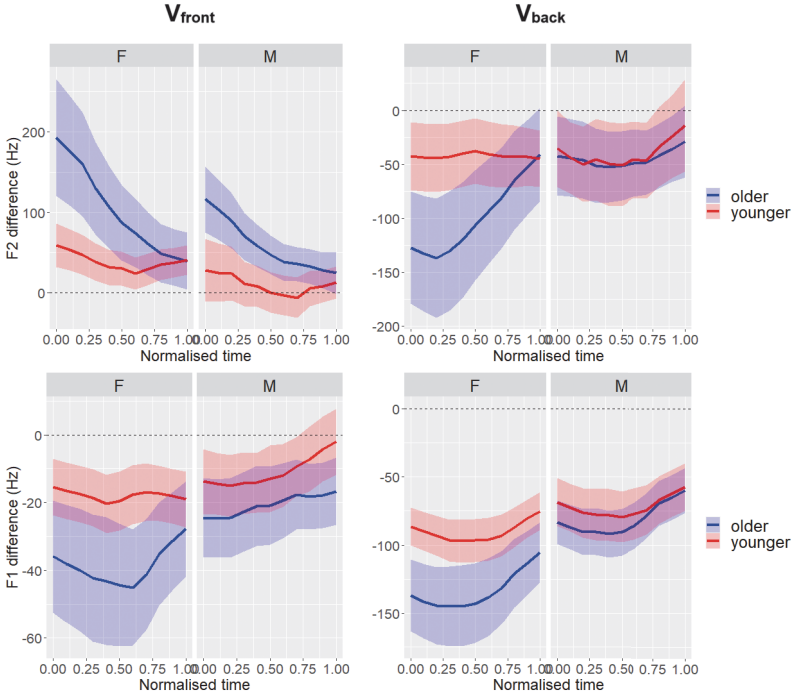
3.3 Does metaphony have a greater influence on height than fronting?

Figs. 4 and 5 show that the influence of the suffix vowel on the stem vowel was stronger in F1 than in F2, thereby also confirming that metaphony affects vowel height to a greater extent than vowel fronting. The most marked F2 effects were an F2 lowering of stem-/o/ in the context of suffix-/u/ and F2 raising of stem-/e/ in the context of suffix-/i/.

3.4 Are there age and sex influences on metaphony?

Following the reasoning in Fig. 3, if metaphony is present, then F2 difference plots (indicating fronting) should be positive for the V_{front} = /i, e/ suffixes and negative for the V_{back} = /a, u/ suffixes; and F1 difference plots (indicating raising) should be negative in both V_{front} and V_{back} contexts. Based on these difference plots, the results in Fig. 6 show that metaphony was stronger in older (blue lines) than in younger (red lines) speakers and that this age effect was more marked for females and especially for V_{front} suffixes.

Figure 6 - *F2 and F1 differences for stems preceding V_{front} = /i, e/ and stems preceding V_{back} = /u, a/, grouped by age and sex and aggregated across items and speakers, also including the confidence interval of the mean difference values plotted. "F" stands for females, "M" for males, while age groups are distinguished by the blue (= old) and red (= young) colours respectively*



3.5 Statistical analysis

Since there were in all cases four-way interactions between the fixed (independent) factors, the results are discussed in terms of post-hoc tests (cf. § 2.5).

Turning firstly to the mid-vowel targets /e, o/ where the major effects of metaphony were expected, the results – listed in detail in Table 3 in the *Appendix* – show the following. The /a, u/ suffix pair (V_{back}) had a significant influence on /e/ and /o/ stems in both F1 and F2 for all speaker (age, sex) groups with the exception of F2 in /o/ for younger men. The /e, i/ suffix pair (V_{front}) only influenced /e/ in both F1 and F2 in women and in older men.

The metaphonic effects for other vowel stems were generally not significant, with the following two exceptions: F2 in /i/ stems was significantly lower preceding an /u/ vs. /a/ suffix and to a greater extent in older ($p < .001$) than in younger women ($p < .05$); and F2 in /a/ stems was significantly ($p < .001$) raised preceding an /i/ vs /e/ suffix in older women.

4. *Discussion*

The study has provided acoustic data from over 30 speakers to show that metaphony occurs in the dialects of the Lausberg area, as also attested in most Southern Italian varieties and to a certain extent also in Northern Italy (Rohlfs, 1966; Savoia, Maiden, 1997; Grimaldi, 2003; Grimaldi, Calabrese, 2018; and Walker, 2005 and Delucchi, 2012 as regards some northern Italian dialects). Consistently with earlier studies (Martino, 1991; Romito et al., 2006; Savoia, 2015), the suffix vowel had the greatest influence on stem mid vowels /e, o/. There was also clear evidence that the influence of the suffix on the stem vowel was stronger in F1 than in F2, thereby also confirming that metaphony affects vowel height to a greater extent than vowel fronting. Nevertheless, F2 effects emerged visibly for /e/ stems in V_{front} contexts and /o/ stems in V_{back} contexts: /e/ was more front (as shown by a raised F2) in the metaphonising /i/suffix context, and /o/ was more back (as shown by a lowered F2) in the metaphonising /u/ suffix context.

This aspect makes metaphony different from other kinds of phonologised coarticulation processes, like e.g. Umlaut in German, where we systematically have vowel fronting (e.g. "grün" [gryːn] from Old High German "gruoni"). In the dialects of the Lausberg area, and consistently with most southern dialects having metaphony (Rohlfs, 1966; Savoia, 2015), we have hardly any significant effect on frontness or backness of the stem vowel, when stem vowel and suffix are not both either back or front. At the same time, our data show some minor (but significant) fronting or backing effects, also when the stem and the suffix do not agree in [±back] or [±front]. This shows that the metaphonic phenomenon is actually coarticulatorily complex and cannot be reduced to a "simple" vowel raising.

The study also shows that there were some more minor influences of age on metaphony in men. More specifically, stem-/o/ was retracted due the following suffix-/u/ and stem-/e/ was raised and fronted due to the following suffix-/i/ in older but not younger men. By contrast, there were no such significant age differences in women. These results suggest a potentially greater influence of Standard Italian (and hence waning of the dialect) in men than in women. The reason why women continue to make greater use of dialect could be that they have less contact with speakers of Standard Italian. Trumper (1979) suggested that this difference in the use of dialect between men and women could come about because women tended not to have occupations and hence very limited contact with other villages or big social networks. Whether this remains the case today needs to be demonstrated; but irrespective of the cause, our results do point to an influence of Standard Italian on the dialects of the Lausberg area that seems to be more advanced in men than in women. Analysis is currently in progress on a larger number of speakers in order to investigate whether the findings demonstrated in this study vary by sub-region and by village.

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Appendix

Table 1 - *The recorded speakers grouped by age and sex. The first two letters of the speakers' code refer to the village they come from: CA = Canna, CC = Cerchiara, CV = Castrovillari, LA = Lauria, LI = Laino, MG = Montegiordano, MM = Mormanno, SD = S. Domenica Talao, SH = Schiavonea. The last letter of the speakers' code refers to their sex. The column "Age" indicates the biological age of each speaker when recorded*

Age group	Sex	Speaker	Age
older	F	CA01F	44
		CC01F	65
		CC03F	44
		CC04F	51
		CC05F	81
		CC08F	44
	M	CC02M	47
		CC03M	46
		LI01M	82
		LI02M	80
		LI03M	90
		LI04M	92
		LI05M	67
		LI06M	85
		MG01M	45
		MG02M	67
		MM09M	73
		SH01M	41
younger	F	CC02F	13
		CC06F	14
		CC07F	19
		CV01F	32
		CV02F	24
		CV03F	22
		LA01F	31
		MM02F	25
		MM03F	28
		MM04F	26
		MM05F	25
		SD01F	27
	M	CC01M	27
		MM03M	26
		MM04M	25
		MM05M	22

Table 2 - *List of elicited lexical items used for this study, listed in alphabetical order. The expected metaphonic changes are highlighted in bold type. In bisyllabic words, the stressed syllable is always the first one*

Target word	Expected pronunciation	Target word	Expected pronunciation	Target word	Expected pronunciation
NOUNS and ADJECTIVES					
bella	bɛlla	lunga	lɔŋga	uova	ɔva
bello	b**e**llu, b**i**llu	lungo	l**o**ŋgu, l**u**ŋgu	uovo	**o**vu, **u**vu
braccia	vrattsa	mese	m**ɛ**se	vecchia	v**ɛ**cca
braccio	vrættsu	mesi	m**e**si, m**i**si	vecchio	v**e**ccu, v**i**ccu
buona	bɔna	morta	m**ɔ**rta	verde	v**ɛ**rde
buono	b**o**nu, b**u**nu	morto	m**o**rtu, m**u**rtu	verdi	v**e**rdi, v**i**rdi
cane	kane	nera	ˈni(v)ura	verme	v**ɛ**rme
cani	k**æ**ni	nero	ˈni(v)uru	vermi	v**e**rmi, v**i**rmi
capretta	kraˈp**ɛ**tta	nipote	nip**ɔ**te	volpe	vurpe
capretto	kraˈp**e**ttu, krap**i**ttu	nipoti	nip**o**ti, nip**u**ti	volpi	vurpi
corna	k**ɔ**rna	noce	nutʃe	zoppa	ts**ɔ**ppa
corno	k**o**rnu, k**u**rnu	noci	nutʃi	zoppo	ts**o**ppu, ts**u**ppu
corta	kurta	nuova	n**ɔ**va		
corto	kurtu	nuovo	n**o**vu, n**u**vu	**VERBS**	
cotta	k**ɔ**tta	ossa	**ɔ**ssa		
cotto	k**o**ttu, k**u**ttu	osso	**o**ssu, **u**ssu	tieni	ˈt**e**nisi
croce	krutʃe	pettine	ˈp**ɛ**ttine	tiene	t**ɛ**ne
croci	krutʃi	pettini	ˈp**e**ttini, p**i**ttini	dormi	ˈd**o**rmisi
cuore	k**ɔ**re	pezza	p**ɛ**ttsa	dorme	d**ɔ**rme
cuori	k**o**ri, k**wo**ri	pezzo	p**e**ttsu, p**i**ttsu	penso	p**e**nzu
dente	d**ɛ**nte	piede	p**ɛ**de	pensa	p**ɛ**nza
denti	d**e**nti, d**i**nti	piedi	p**e**di, p**i**di	trovo	tr**o**vu
dita	ˈjidita, jita	ponte	p**ɔ**nte	trova	trova
dito	ˈjiditu, jitu	ponti	p**o**nti, p**u**nti	corri	ˈkurrisi

Target word	Expected pronunciation	Target word	Expected pronunciation	Target word	Expected pronunciation
dolce	durtʃe	prete	ˈprɛvete	corre	kurre
dolci	durtʃi	preti	ˈpreviti, priviti	esci	ˈjessisi
fiore	fjɔre	rossa	russa	esce	jesse
fiori	fjori, fjuri	rosso	russu	apri	ˈ(j)aprisi
fredda	fridda	santa	santa	apre	(j)apre
freddo	friddu	santo	sæntu	bevi	ˈvivisi
ginocchia	jiˈnucca(i)	sposa	spɔsa	beve	vive
ginocchio	jiˈnuccu	sposo	sposu		
grossa	grɔssa	topi	ˈsoritʃi, suritʃi		
grosso	grossu, grussu	topo	ˈsɔritʃe		
legna	linna	uomo	ˈommini		
legno	linnu	uomini	ˈɔmmine		

Table 3 - *Post-hoc tests that were significant in the stem vowels /e, o/. The columns show (from left to right) the suffix vowel pair, the stem vowel, age group, sex, the dependent variable (dV), t-ratio (t), degrees of freedom (df), and probability of significance (p-value). For example, row 1 means that the suffix vowel /a/ vs. /u/ had a significant influence on F2 of the stem vowel /e/ in older women*

dV	Suffix pair	Stem	Age group	Sex	t	df	p-value
F2	a, u	e	older	F	5.0	77.0	$p < .001$
			younger	F	5.1	35.0	$p < .001$
			older	M	3.5	56.0	$p < .001$
F1	a, u	e	older	F	7.7	34.5	$p < .001$
			younger	F	5.6	23.3	$p < .001$
			older	M	4.3	29.1	$p < .001$
			younger	M	3.2	45.4	$p < .01$
F2	a, u	o	older	F	6.4	75.8	$p < .001$
			younger	F	5.2	32.7	$p < .001$
			older	M	4.0	58.0	$p < .001$
			younger	M	2.1	110.3	$p < .05$
F1	a, u	o	older	F	10.9	34.5	$p < .001$
			younger	F	22.5	6.9	$p < .001$
			older	M	5.7	30.0	$p < .001$
			younger	M	4.4	42.6	$p < .001$

dV	Suffix pair	Stem	Age group	Sex	t	df	p-value
F2	e, i	e	older	F	6.6	50.5	$p < .001$
			younger	F	3.0	29.0	$p < .01$
			older	M	4.8	42.3	$p < .001$
F1	e, i	e	older	F	4.2	71.3	$p < .001$
			younger	F	2.4	34.0	$p < .05$
			older	M	4.1	56.1	$p < .001$

Figures 7, 8 and 9 - *The following figures show some examples of visual stimuli used for the picture-naming task described in the Method (§ 2.2). In particular, Fig. 7 is an example of how inflected nouns were elicited; Fig. 8 shows an example of how inflected adjectives were elicited; Fig. 9 shows an example of how conjugated verbs were elicited*

Figure 7 - *Picture stimulus used to elicit the word 'egg' (in the dialect* ['ovu, 'uvu]*) on the left, vs. picture stimulus to elicit the word 'eggs' (in the dialect* ['ɔva]*), on the right*

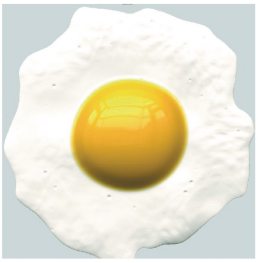

Figure 8 - *Picture stimulus used to elicit the word 'red', masc. sing. (in the dialect* ['rusːu]*), on the left, vs. picture stimulus to elicit the word 'red', fem. sg. (in the dialect* ['rusːa]*), on the right. In the picture on the right, the red apple is circled in order to lead the speaker to specify its colour, i.e. the participants tended to say 'red apple', in the dialect* ['puma 'rusːa]*, and not just the isolated target word*

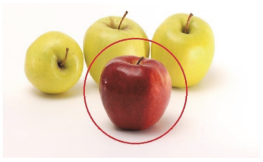

Figure 9 - *Picture stimulus used to elicit the word '(I) think' (in the dialect* [ˈpenzu]*), on the left, vs. picture stimulus used to elicit the word '(he/she) thinks' (in the dialect* [ˈpɛnza]*), on the right. In the picture on the left, the man pointing at himself graphically represents the subject of the sentence to be uttered by the speaker, in this case 1st person singular. In the picture on the right, the man pointing in the direction of the drawing graphically suggests to the speaker that the subject of the sentence to be pronounced is the 3rd person singular*