ON THE PHONETICS OF RETROFLEXION IN THE (WESTERN) CRETAN DIALECT

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Abstract

This study examined the allophonic realization of the lateral approximant /l/ as a rhotic sound, specifically a retroflex approximant [ɻ] in the western Cretan dialect. Conversational speech data were collected from five villages. The results confirmed that the retroflex allophone occurred before back vowels, usually in non-prominent prosodic positions, i.e. more frequently in unstressed syllables than stressed ones and less frequently in word-initial syllable position than word-medial/-final one. The retroflex allophone differed from the standard one in terms of duration and F1 and F3. Our results add to the existing evidence that laterals and rhotics are closely related.

Keywords: retroflexion, liquids, Western Crete

1. Introduction

To date there has been limited research on the phonetics and phonology of the dialect of Crete (e.g. Kontossopoulos 1969, Newton 1972, Trudgill 2003, Kappa 2001, Kappa & Vergis 2011). Early dialectal work used impressionistic descriptions of dialectal data which unavoidably relies on the researcher's judgment. Only more recent work has started taking advantage of technological innovations such as acoustic analysis programs that ensure an objective analysis of dialectal material (e.g. Trudgill 2009).

This study is part of a large project investigating the consonantal system of the western Cretan dialect at the phonological and phonetic levels with focus on major features of the dialect such as (extreme) palatalization and affrication of velars, prenasalization of stops and retroflexion of rhotics and lateral approximants. Here we focus on the allophonic realization of the lateral approximant /l/ as a rhotic, specifically a retroflex approximant [ɻ] in the dialect. The retroflex approximant is a sound quite rare among European languages (e.g. Irish English). Greek has a rhotic phoneme in its inventory which is mostly realized as a tap [ɾ] and occasionally as an approximant [ɹ] with a varying place of articulation from front alveolar to post-alveoral depending on context, prosodic position and speaker (Arvaniti 2007, Baltazani 2005, Baltazani & Nicolaidis 2012, 2013, Nicolaidis 2001 Nicolaidis & Baltazani 2011, 2013). The phenomenon of delateralization which results in the realization of /l/ as the rhotic [ɾ] is found in most Greek dialects including Standard Modern Greek but it only operates in Coda position (e.g. [a.ðel.'fos] ~ [a.ðeɾ.'fos] 'brother', ['il.θa] ~ ['iɾ.θa] '(I) came') (see e.g. Newton 1972).

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Previous research reports that the retroflex approximant is found in central and Western Crete with the villages of Anogeia and Sfakia being most frequently cited in the literature and being known to the public as having the retroflex approximant in their systems (Pangalos 1955, Kontossopoulos 1972, Newton 1972, Trudgill & Mansfield 1994, Kappa & Vergis 2011, Vergis 2012).

Based on data from one speaker from Anogeia, Kappa & Vergis (2011) documented the realization of the retroflex approximant in the context of [+back] Vowel in all prosodic conditions (stressed and unstressed syllables, word-initially and word-medially) and in both single and complex onsets as shown in examples (1-4):

			SMG	W. Cretan	Gloss
(1)	/'la.ði/	→	['la.ði]	['ɻa.ði]	oil
(2)	/'te.los/	→	['te.los]	['te.ɻos]	end
(3)	/pla.sti.'ko/	→	[pla.sti.'ko]	[pɻa.sti.'ko]	plastic
(4)	/e.'ɣla.ko.na/	→	[e.'ɣla.ko.na]	[e.'ɣɻa.ko.na]	(I) was running

The goal of this paper is (a) to replicate the results in Kappa & Vergis (2011) in terms of the distribution of the retroflex allophone in the dialect by eliciting data from more speakers from a variety of villages in western Crete and (b) to offer quantitative data on the phenomenon of retroflexion by examining the fine-grained phonetic details of its realization as well as the similarities and differences between the acoustics of /ɾ/, /l/, and [ɻ] in the dialect using acoustic measurements (duration and F1-F3 formant frequencies). Of interest are the environments that favor the application of the phenomenon, specifically following vowel, syllable position within the word and stressed vs. unstressed syllable position.

2. Method

2.1 Informants

Eight speakers of the western Cretan dialect were recorded, five male and three female. In this paper we present a detailed acoustic analysis of the male speakers (some interesting data from the female speakers are briefly discussed in Section 3). Our informants had a mean age of 66 years (range = 45-78 years) from the villages of Anogeia, Asi Gonia, Kouroutes, Agios Georgios and Episkopi. None of the informants had spent a period of more than six months away from his village.

2.2 Elicitation of speech materials

Dialectal data were drawn from natural conversations (semi-directed interviews) between each informant and a native speaker of the western Cretan dialect. Each conversation revolved around informants' hobbies, work, family and village and lasted approximately twenty minutes. Informants were recorded directly onto a laptop hard disk via a Blue Yeti microphone at a sampling rate of 44.1 kHz.

2.3 Acoustic analysis

Acoustic analysis was performed using the PRAAT speech analysis software (Boersma & Weenink, 2008). We measured the duration of [l], [ɻ] (in cases where /l/ or /ɾ/ were realized as a retroflex by western Cretan speakers) and [ɾ] (duration of closure). Duration was measured from spectrograms, from the onset to the offset of periodic energy in F2. First (F1), second (F2) and third (F3) formant frequencies were measured at the centre of [l] and [ɻ] (again in cases where /l/ or /ɾ/ were realized as a retroflex by western Cretan speakers).

2. Results

2.1 Descriptives

The number of underlying /l/ and /ɾ/ instances identified for each western Cretan informant in the corpus are shown in Table 1. Table 2 displays the realizations of underlying /l/ and /ɾ/ by each informant. In order to present a complete picture of the allophonic realizations of /l/, apart from the standard [l] and the dialectal [ɻ] realizations, the palatal lateral approximant [ʎ][1] and the retroflex lateral approximant [ɭ] realizations are also given although not further analyzed. Underlying /l/ was realized 137 times as [l] and 60 times as [ɻ]. There were also 5 [ɭ] realizations all produced by informant 3. Underlying /ɾ/ was realized 190 times as [ɾ] and 20 times as [ɻ] (again all [ɻ] realizations were produced by informant 3). With the exception of informant 3, who used extensive retroflexion in his speech, western Cretan speakers

Table 1: Number of /l/ and /ɾ/ instances identified per informant in the corpus.

Informant	**Underlying /l/ and /ɾ/**
1	69
2	99
3	130
4	72
5	80
Total	**450**

Table 2: Number of realizations of underlying /l/ and /ɾ/ analyzed per informant in the corpus.

	Underlying /l/				**Underlying /ɾ/**	
Inform.	Alveolar lateral approx. [l]	Palatal lateral approx. [ʎ]	Retroflex lateral approx. [ɭ]	Retroflex approx. [ɻ]	Alveolar tap [ɾ]	Retroflex approx. [ɻ]
1	15	4	0	21	29	0
2	41	10	0	5	43	0
3	43	6	5	21	35	20

[1] Palatal [ʎ] is an allophone of /l/ when the latter is followed by /i/ and a back vowel in the same syllable (e.g. Arvaniti, 2007) and is found in all Greek dialects including Standard Modern Greek.

4	24	3	0	9	36	0
5	14	15	0	8	43	0
Total	**137**	**38**	**5**	**60**	**190**	**20**

Table 3: Number of realizations of underlying /l/ and /ɾ/ as a function of the following vowel.

	Underlying /l/				**Underlying /ɾ/**	
Context	Alveolar lateral approx. [l]	Palatal lateral approx. [ʎ]	Retroflex lateral approx. [ɭ]	Retroflex approx. [ɻ]	Alveolar tap [ɾ]	Retroflex approx. [ɻ]
_i	36	17	2	0	48	2
_e	57	4	1	0	27	5
_a	32	12	1	36	71	11
_o	8	5	1	19	40	2
_u	4	0	0	5	4	0
Total	**137**	**38**	**5**	**60**	**190**	**20**

therefore did not use the retroflex approximant [ɭ] realization as an allophone of /l/ or the retroflex approximant [ɻ] realization as an allophone of /ɾ/.

The degree of the use of retroflexion by western Cretan speakers can be better visualized when looking at Table 3 showing the realizations of /l/ and /ɾ/ (pooled over informants) as a function of the following vowel. The standard [l] realization was mainly used by the informants before front vowels (/i, e/) as shown in (5) but not exlusively since there were also [l] realizations before back vowels (/a, o, u/) as shown in (6). On the ther other hand, as expected the dialectal [ɻ] allophone of underlying /l/ occured only before back vowels as shown in examples (7-8). Both the dialectal retroflex approximant [ɻ] and the standard lateral approximant [l] realization were therefore used by western Cretan speakers in front of back vowels with a slight preference for the dialectal one; the dialectal realization was used 60 times and the standard realization 44 times pooled over back vowels (36 vs. 32 times respectively before /a/, 19 vs. 8 times respectively before /o/ and 4 times each before /u/). One final point to be made concerns the use of retroflexion by informant 3. The extensive use of retroflexion in his speech discussed in the previous paragraph was confirmed by the fact that not only did he use the retroflex realization as an allophone of underlying /ɾ/ (he produced all 20 retroflex approximant [ɻ] instances shown in the last column of Table 4) as shown in (9) but he did so in all contexts (i.e., including the use of the retroflex realization before the front vowels /i, e/) as shown in (10).

			SMG	W. Cretan	Gloss
(5)	/'po.le.mo/	→	['po.le.mo]	['po.le.mo]	war
(6)	/ði.la.'ði/	→	[ði.la.'ði]	[ði.la.'ði]	that is
(7)	/'θa.la.sa/	→	['θa.la.sa]	['θa.ɻa.sa]	sea
(8)	/'te.los/	→	['te.los]	['te.ɻos]	end
(9)	/'te.se.ɾa/	→	['te.se.ɾa]	['te.se.ɻa]	four
(10)	/'ko.ɾes/	→	['ko.ɾes]	['ko.ɻes]	daughters

Table 4: Number of realizations of the standard [l] and the dialectal [ɻ] realizations of /l/ in word-initial, medial and final position before back vowels /a, o, u/.

Syllable position	**Realization of underlying /l/**	
	Alveolar lateral approx. [l]	Retroflex approx. [ɻ]
Word-initial	4	1
Word-medial	14	23
Word-final	26	36

Table 4 displays the frequencies of the standard [l] and the dialectal [ɻ] realization before back vowels (pooled over informants) as a function of syllable position within the word. In word-initial syllable position, there were 4 vs. 1 realization for the standard and the dialectal realization respectively (i.e., 20% of the times the latter realization was preferred); in word-medial syllable position, there were 14 vs. 23 realizations for the standard and the dialectal realization respectively (i.e., 62% of the times the latter realization was preferred); and in word-final syllable position there were 26 vs. 36 realizations for the standard and the dialectal realization respectively (i.e., 58% of the times the latter realization was preferred) (see examples below for syllables in word-initial (11-12), word-medial (13-14) and word-final position (15-16). Given that across syllable position (Table 3) there were 44 vs. 60 realizations for the standard and the dialectal realization respectively (i.e., 58% of the times the latter realization was preferred), the dialectal realization was much less preferred in word-initial position (but note that there were only 5 instances in total in our corpus in this position) compared to the other two positions (the dialectal realization in those positions was preferred approximately as commonly as it did when looking the data across syllable position).

			SMG	W. Cretan	Gloss
(11)	/'la.ɾi.sa/	→	['la.ɾi.sa]	['la.ɾi.sa]	Larissa
(12)	/'lo.ɣo/	→	['lo.ɣo]	['ɻo.ɣo]	reason
(13)	/ði.la.'ði/	→	[ði.la.'ði]	[ði.la.'ði]	that is
(14)	/'a.lo.ɣo/	→	['a.lo.ɣo]	['a.ɻo.ɣo]	horse
(15)	/'e.va.la/	→	['e.va.la]	['e.va.la]	(I) put
(16)	/'i.θe.la/	→	['i.θe.la]	['i.θe.ɻa]	(I) wanted

Table 5 displays the frequencies of the standard [l] and the dialectal [ɻ] realization before back vowels (pooled over informants) as a function of stress. In stressed position, there were 19 vs. 18 realizations for the standard and the dialectal realization respectively (i.e., 49% of the times the latter realization was preferred) (examples 17-18); in unstressed position, there were 25 vs. 42 realizations for the standard and the dialectal realization respectively (i.e., 63% of the times the latter realization was preferred) (examples 19-20); Given that across stress position (see Table 3) there were 44 vs. 60 realizations for the standard and the dialectal realization respectively (i.e., 62% of the times the latter realization was preferred), the dialectal realization was more preferred than the standard one in ustressed position when compared to what happens when looking the data across stress condition.

Table 5: Number of realizations of the standard [l] and the dialectal [ɻ] realizations of /l/ in stressed and unstressed syllable position before back vowels /a, o, u/.

Stress	**Surface realization of underlying /l/**	
	Alveolar lateral approx. [l]	Retroflex approx. [ɻ]
Yes	19	18
No	25	42

			SMG	W. Cretan	Gloss
(17)	/po.'la/	→	[po.'la]	[po.'la]	many
(18)	/a.'la/	→	[a.'la]	[a.'ɻa]	but
(19)	/'i.le.ɣa/	→	['i.le.ɣa]	['i.le.ɣa]	(I) was saying
(20)	/'a.la/	→	['a.la]	['a.ɻa]	other

2.2 Acoustic analysis

Figure 1 shows mean duration (sec) for the standard [l] and the dialectal [ɻ] realization of /l/. Mean duration of [ɾ] is also given for comparison reasons. Mean duration did not differ for [l] and [ɻ] (0.060 sec vs. 0.056 sec respectively, $p > 0.05$) and both [l] and [ɻ] had a significantly longer duration than [ɾ] (0.30 sec) $p < 0.01$.

Figure 1. Mean duration (sec) of /l/, /ɾ/ and /ɻ/ in the western Cretan dialect.

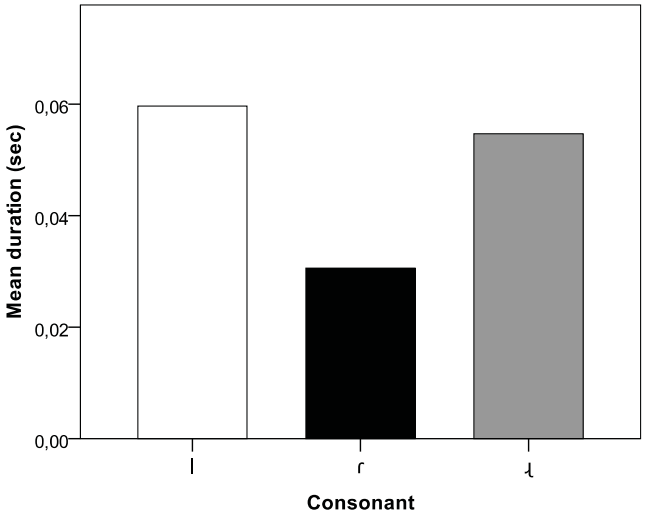


Figure 2 shows mean F1 (Hz) for the standard [l] and the dialectal [ɻ] realization of /l/ by western Cretan speakers. The dialectal realization had a higher F2 than the standard realization (496 Hz vs. 417 Hz respectively), $p < 0.01$. Figure 3 shows mean F2 (Hz) for the standard [l] and the dialectal [ɻ] realization of /l/. The two realizations did not differ significantly (1469 Hz vs. 1401 Hz respectively), $p > 0.05$. Finally, figure 4 shows mean F3 (Hz) for the standard [l] and the dialectal [ɻ] realization of /l/ by western Cretan speakers. It can be seen that the dialectal realization had a higher F3 than the standard realization (2576 Hz vs. 1979 Hz respectively), $p < 0.01$.

Figure 2: Mean F1 (Hz) of /l/ and /ʎ/ in the western Cretan dialect.

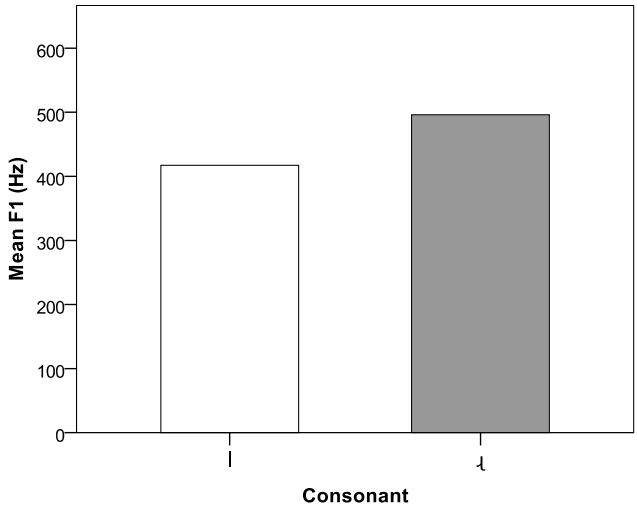


Figure 3: Mean F2 (Hz) of /l/ and /ʎ/ in the western Cretan dialect.

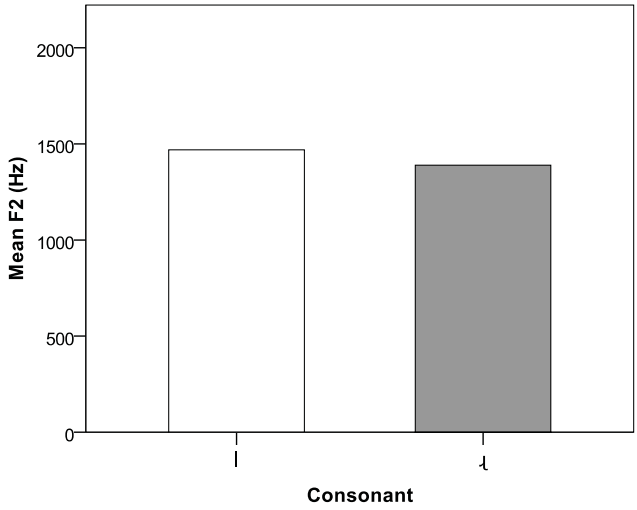
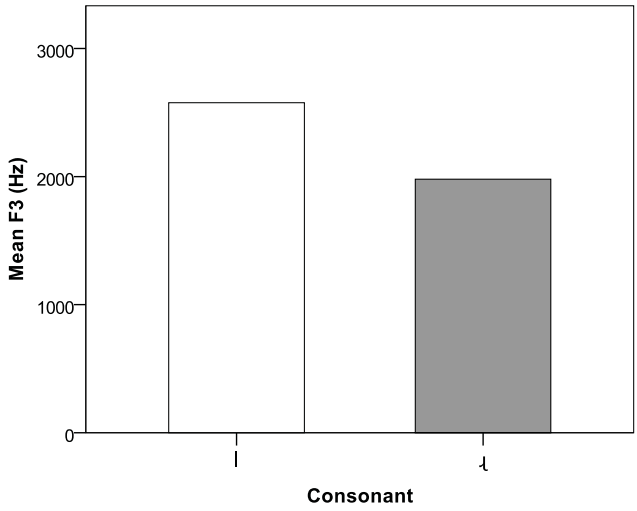


Figure 4: Mean F3 (Hz) of /l/ and /ʎ/ in the western Cretan dialect.



3. Discussion

This paper examined the delateralization and retroflexion of /l/ before back vowels /a/, /o/ and /u/ in the western Cretan dialect. The materials were drawn from conversations between the participants and a native speaker of the dialect. We investigated the distribution of retroflexion as a function of stress and syllable position within the domain of word (i.e., whether the syllable is domain initial, medial or final) in the dialect as well as the acoustic realization of retroflexion by measuring (a) the duration of [l], [ɻ] and [ɾ]; (b) F1-F3 formant frequencies of [l] and [ɻ].

The results showed that all our western Cretan informants use both the standard alveolar [l] and the dialectal retroflex [ɻ] realization before back vowels. The phenomenon of retroflexion is therefore documented in several villages in western Crete and its occurrence is not restricted in Anogeia and Sfakia. Our informants showed a preference for the dialectal retroflex [ɻ] allophone compared to the standard alveolar [l] allophone before back vowels (44 vs. 60 instances respectively pooled over speakers). The use of retroflex [ɻ] as an allophone of /l/ was thus not obligatory; the same speaker may use/not use it in the same environment and it is interesting to note that we found instances of the same word spoken by the same informant with and without retroflexion. From our discussions with the informants it became apparent that they are aware of the use of [ɻ] in their speech. Our results also showed that one of the speakers of the dialect that we recorded used extensive retroflexion in his speech; he used the retroflex lateral approximant [ɭ] as an allophone of underlying /l/ and also the retroflex [ɻ] as an allophone of underlying /ɾ/. In order to conclude whether this was an idiosyncratic use of retroflexion or a phenomenon more widespread in western Crete, we would need recordings and analyses of more speakers of the dialect.

The acoustic analysis showed that the standard [l] and the dialectal [ɻ] realization differ significantly in terms of duration, F1 and F3 frequencies. The dialectal [ɻ] realization had a longer duration, a higher F1 and lower F3 than the standard, providing acoustic evidence for retroflexion in the western Cretan dialect.

An examination of the frequency of retroflexion as a function of syllable position within the word showed that it was less preferred in word-initial position (i.e., speakers used more often the standard [l] instead of the dialectal realization [ɻ]) but these results should be treated with caution because they refer to a small number of instances. Regarding the effect of stress, it was found that speakers used the dialectal realization more frequently in unstressed position than in stressed position compared to the use of retroflexion pooled over stress position. The above findings show (a) that retroflexion is usually preferred in perceptually non-prominent positions, such as unstressed syllables and non-word initial ones and (b) that the underlying /l/ is realized faithfully in salient/prominent positions, such as stressed and word-initial ones.

The examination of our data also revealed cases of leftward retroflex harmony attested by the speaker that showed extensive retroflexion in his speech, e.g. /leˈɾono/ > [ɻeˈɻono] ‘make dirty’, thus confirming the findings of Kappa & Vergis (2011). Retroflex harmony seems to be sensitive to sociolinguistic factors, as far as the direction of retroflex harmony concerns; there were some interesting data, attested in the speech of the female speakers of the dialect, showing a rightward retroflex

harmony, e.g. /kava'laɾis/ > [kava'ɻaɻis] 'horseman', /psilo'ɾiti/ > [psiɻo'ɻiti] 'mountain name'. The acoustic analysis of the speech of our female informants is still in progress and is expected to provide answers to questions related to the application of retroflex harmony in the dialect, differences on the use of retroflexion between male and female speakers (cf. Vergis 2012), the spreading of retroflexion across word-boundaries etc.

To summarize, our results provide experimental evidence on the application of retroflexion in a number of villages in western Crete and add to existing evidence that laterals and rhotics are closely related forming the natural class of liquids (e.g. Walsh Dickey, 1997).

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