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# Rhoticisation and lambdacisation as perceptual confusion

... in Greek

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- Listener-driven sound change model (Ohala 1993)
- In languages with two phonemic liquids (one lateral, one rhotic)





# Which factors enable or inhibit the confusion?

• Stress turned out non-significant in earlier experiments (Müller 2010, 2012)

 $\rightarrow$  Properties of the liquids?



# 1 Syllable position:

Most lateral rhoticisation occurs in preconsonantal (coda) position.

## Why?

In this position, release cues of the lateral are masked by the silent period preceding the release of a voiceless stop. Taps are better perceived because of their svarabhakti vowel.

 $\rightarrow$  Stimuli containing liquids in all syllable positions.



## STIMULI

# Syllable positions

Onset cluster	Coda cluster	Intervocalic	Word-initial	Word-final
/pLaka/	/kaLpa/	/kaLa/	/Laka/	/kataL/
	/kaLta/			
/kLaka/	/kaLka/			

L = rhotic or lateral

uttered by a male native speaker of Greek



# 2 Lateral degree of darkness:

Darker laterals are more prone to rhoticisation than are clearer laterals.

from the observation that dialect areas with lateral rhoticisation are adjacent or surrounded by areas with darker laterals.

## Why?

In darker laterals, the tongue body gesture is more similar to that of a tapped or trilled rhotic.

 $\rightarrow$  Stimuli containing laterals with a degree of darkness continuum.



## STIMULI

## Lateral degree of darkness

	verydark	dark	medium	clear	veryclear
F1 (in Hz)	602	564	533	513	504
F2 (in Hz)	966	1076	1194	1322	1462
F3 (in Hz)	2376	2426	2478	2531	2584

 $\Delta$ F2-F1 increases by 1.14 Bark for every step on the continuum (values based on a large cross-linguistic study by Recasens 2012)



# 3 Duration of laterals:

The shorter a lateral's duration, the easier it will be confused with a rhotic (tap).

## Why?

A tap is a short reduction in intensity. A lateral is a long reduction in intensity.

 $\rightarrow$  Stimuli containing both shortened and (normally) long laterals.



## STIMULI

# Lateral duration

- "Long" laterals = 60ms (average duration in spontaneous speech, Müller 2011)
- "short" laterals = 30ms (closer to the tap's closure duration (20ms))

 $\rightarrow$  for every syllable position, there are 10 different lateral stimuli (duration (2 levels) x darkness (5 levels))



a. Approximants are more easily confused with laterals.

### Why?

Like laterals, they lack a svarabhakti vowel

and are of longer duration than the tap.

 $\rightarrow$  Stimuli containing approximant rhotics (45ms).



"Approximant" is used for a rhotic without any trace of a closure+svarabhakti sequence.



b. Taps need the presence of svarabhakti vowel in order to be perceived as a rhotic.

#### Why?

The svarabhakti vowel allows for a contrast between the short reduction in intensity (here: 20ms) and the surrounding vocalic carrier.

 $\rightarrow$  Stimuli containing taps with and without svarabhakti vowels.





c. Trills and taps that have a clear closure are not perceived as laterals.

## Why?

- They have a very distinct acoustic pattern from laterals.
- $\rightarrow$  Stimuli containing taps and two-closure trills.







## TEST

# Multiple-forced choice test

(in order to avoid a range effect bias, cf. Benders & Escudero 2010).



Depending on syllable position, the number of available choices ranged between five and eight.



# TEST

Test locations:

- University of Cyprus (59 participants)
- Aristoteles-University Thessaloniki (233 participants)
   (mean age: 20.9 years (sd 3.6 years))

Test duration:

5-10 minutes, 111 stimuli (one repetition)



LIND SPRACHVERA

Phonetics Lab, University of Cyprus



# 1 Lateral degree of darkness:

Darker laterals are more prone to rhoticisation than are clearer laterals.

	very dark	dark	medium	clear	very clear
short lateral	59	53	56	51	58
long lateral	49	37	42	34	38

Factor Darkness:  $\chi^{2}[4]=3.9254$ , p=0.42



# 2 Syllable position:

Most perceptual lateral rhoticisation occurs in preconsonantal (coda) position.

Tukey Post-hoc-tests: Intervocalic/Final/Coda(t)/Coda(p)/Coda(k) > ComplexOnset(p)/ComplexOnset(k)/Initial → Less lateral rhoticisation in

syllable-initial positions.

Factor SyllablePosition:  $\chi^2$ [7]=136.1913, p<0.000





# 3 Duration in laterals:

The shorter the duration in a lateral, the easier it will be confused with a rhotic (tap).

 $\rightarrow$  supported by data

LateralDuration:  $\chi^{2}[1]=12.7850$ , p=0.0003494 SyllablePosition:LateralDuration:  $\chi^{2}[7]=25.0663$ , p=0.0007385





- a. Approximants are more easily confused with laterals.
- **b.** Taps need the presence of svarabhakti vowel in order to be perceived as a rhotic.
  - $\rightarrow$  48.5% of taps were perceived as a rhotic (29.0% as a lateral, remaining %s: no consonant perceived)
- c. Trills and taps are not perceived as laterals.



Rhotic lambdacisation







# 4 Rhotics variants and syllable position



Approximant:

ComplexOnset(p)/ComplexOnset(k) > Intervoc/Coda(t)/Final/Coda(p)/Coda(k) /Initial

 $\rightarrow$  mirrors lateral rhoticisation

Trill: no difference between syllable positions

SyllablePosition:  $\chi^{2}[6]=215.95$ , p<0.000 RhoticQuality:  $\chi^{2}[3]=1228.44$ , p<0.000 SyllablePosition:RhoticQuality:  $\chi^{2}[18]=183.54$ , p<0.000









Tap: ComplexOnset(p) >
ComplexOnset(k)/Intervocalic/Initial/Fin
al/Coda(t)/Coda(p)/Coda(k)
→ lexical effect? stimulus /plaka/ is a
meaningful word in Greek, whereas
/praka/ is not.

Tap without svarabhakti: ComplexOnset(p)/Coda(p) > Initial > ComplexOnset(k) > Coda(k) > Coda(t) > Final





- The position of a liquid within the syllable contributes to its perceptual confusion with other liquids.
- Shortening (articulatory, prosodic?) is a prerequisite for lateral rhoticisation.
- Contrary to expectations, darkness in laterals did not prove to be a factor in lateral rhoticisation.
- The presence of a svarabhakti vowel is an important feature for the perception of a rhotic (tap or trill).



# THANK YOU!

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