# Rhoticisation and lambdacisation as 

 perceptual confusion... in Greek

|  | LUDWIG- <br> MAXIMILIANS- <br> UNIVERSITÄT <br> MÜNCHEN | CONFUSION? |
| :---: | :---: | :---: |

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


## 

- for instance, in historic sound changes NHIXNDILE

Pompei inscription, from Garrucci 1854

Which factors enable or inhibit the confusion?

- Stress turned out non-significant in earlier experiments (Müller 2010, 2012)
$\longrightarrow$ Properties of the liquids?


## Hypotheses and Stimuli

RHOTICISATION

## 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.
$\longrightarrow$ Stimuli containing liquids in all syllable positions.

## HYpOTHESES AND STIMULI

RHOTICISATION

## STIMULI

## Syllable positions

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

$\mathrm{L}=$ rhotic or lateral
uttered by a male native speaker of Greek

## Hypotheses And Stimuli

## 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.

## Hypotheses and Stimuli

RHOTICISATION

## 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)

## Hypotheses and Stimuli

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

Stimuli<br>Lateral duration

- "Long" laterals $=60 \mathrm{~ms}$ (average duration in spontaneous speech, Müller 2011)
- "short" laterals $=30 \mathrm{~ms}$ (closer to the tap's closure duration (20ms))
$\longrightarrow$ for every syllable position, there are 10 different lateral stimuli (duration (2 levels) x darkness (5 levels))


## Hypotheses And Stimuli

LAMDACISATION

## 4 Rhotics variants

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.

## Hypotheses And Stimuli

RHOTICISATION

## 4 Rhotics variants

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:
20 ms ) and the surrounding vocalic carrier.
$\longrightarrow$ Stimuli containing taps with and without svarabhakti vowels.



## Hypotheses And Stimuli

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

## Why?

They have a very distinct acoustic pattern from laterals.
$\longrightarrow$ 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:


Phonetics Lab, University of Cyprus

5-10 minutes, 111 stimuli (one repetition)

## Results

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

## Results

## 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
$\longrightarrow$ Less lateral rhoticisation in syllable-initial positions.

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


## Results

## 3 Duration in laterals:

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

## $\longrightarrow$ supported by data

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

Lateral rhoticisation


## 4 Rhotics variants

a. Approximants are more easily confused with laterals.
b. Taps need the presence of svarabhakti vowel in order to be perceived as a rhotic.
$\longrightarrow 48.5 \%$ 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.


## Results

## 4 Rhotics variants and syllable position



## Approximant:

ComplexOnset(p)/ComplexOnset(k) >
Intervoc/Coda(t)/Final/Coda(p)/Coda(k)
/Initial
$\longrightarrow$ mirrors lateral rhoticisation

Trill: no difference between syllable positions

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

## Results

4 Rhotics variants


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

## Tap without svarabhakti:

ComplexOnset(p)/Coda(p) > Initial >
ComplexOnset $(\mathrm{k})>\operatorname{Coda}(\mathrm{k})>\operatorname{Coda}(\mathrm{t})>$ Final

## Conclusion

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- 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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