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Anna Anastaseni, Antonio Romano

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Anna Anastaseni[1,2] & Antonio Romano[1]

[1]LFSAG, Laboratorio di Fonetica Sperimentale "Arturo Genre", Univ. degli Studi di Torino
[2]GIPSA-lab, CNRS/Université Grenoble Alpes

ABSTRACT

Due to the articulatory proximity, Italian /ʎ/ and /j/ are confused by some speakers. The neutralisation of the /ʎ/-/j/ contrast lets prevail [j]-like sounds; /lj/ and /llj/ are sometime realised with a [ʎ]-like sounds.

Two classification tasks were proposed to a sample of 113 native Italian listeners to assess the incidence of the duration factor in distinguishing intervocalic segments [ʎ], [j] and [lj], manipulating the duration of the sounds within the same contexts.

It emerged that participants were always able to tell apart [lj]-like stimuli, while they showed more variation in the classification of /ʎ/ and /j/ categories. The duration plays a significant role in the identification of /ʎ/ and /j/: with less than 140-160 ms, the perceived stimulus originated from a [ʎ]-sound is generally classified as /j/, whereas stimuli with increasing durations of an original [j]-sound need an upper threshold (~200 ms) to be mostly attributed to /ʎ/.

Keywords: Auditory phonetics, identification task, palatal lateral, palatal approximant, duration.

1. INTRODUCTION

The phonological inventory of Italian distinguishes between the lateral palatal /ʎ(ʎ)/ and the approximant palatal /j/; however, this distinction has low-functional load. In neutral pronunciation the palatal /ʎ/ is always geminate in postvocalic position [1]. The alternation as short and long is governed by position: is not phonemic. Its duration exceeds 100 ms in standard Italian and in several regional varieties [2], but it does not reach the length of the corresponding non-palatal lexical geminate [lː] and, apparently, it does not induce the preceding vowel to shorten [3]. On the other hand [j] can be considered as inherently short.

The lateral one has a complex articulatory mechanism ([1], [4], [5]). It appears late in the phonological inventory of Italian-speaking children [6] and it is often simplified ([7], [8]). The phoneme /ʎ/ is rare in majority of the world's languages; it is present in only 20 of the 451 languages considered in UPSID (*UCLA Phonological Segment Inventory Database*). Moreover, it occurs in only 16 languages whose inventory also includes the palatal approximant /j/ (by contrast, in 378 languages in the database).

The [ʎ]-sound and [j]-sound can be defined as approximants: they have a periodic structure, but a reduced intensity of about 10 dB compared to vowels [9]. The neutralisation of the opposition between /ʎ/ and /j/ is widespread and is favoured by acoustic similarity, as shown by the evolution of phonological systems in other romance languages ([8], [10], [11]). In Italy, the delateralisation of /ʎ/ (/ʎ/ → [j]) is a widespread phenomenon in the Centre-South (with considerable micro-areal variation, [12]–[14]), with the exception of Tuscany and Sardinia [1]. The neutralisation of the /ʎ/ - /j/ contrast allows [j]-like sounds to prevail. On the other hand, in the same regions a lengthening of /j/ in intervocalic position is observed ([1], [14]). Furthermore, the phonological status of /ʎ/, mainly in Northern regions, has to be assessed taking into account the extension of [ʎ]-like sounds to the realisation of /lj/ and /llj/ [1], [15], [16].

Moreover, in pronunciation, among speakers of younger generations especially in the North, regional features are weak and often phonetic features coming from different regional Italian varieties are co-present [17]. As the three corpora ParlaTO, KIP and CLIPS show, in the variety of Italian spoken in Turin, [ʎj] and [jː] are also attested, not only the expected variants [ʎ] and [lj] [18].

Within the community we have been observing in the last two years by means of acoustical analysis, the loss of the lateral feature seems not to give rise to a real neutralisation between /ʎ/ and /j/ since their common realisations are respectively [jː] and [j] and a length contrast is often preserved.

A perceptual experiment has been set up in order to verify the hypothesis that a duration feature is sufficient to avoid a full merger. It is important to check the ability of Italian speakers to classify different phonemes. In this pilot study, we have prepared two identification tasks.

Firstly, stimuli with /ʎ/, /j/, /lj/ and /llj/ were presented to the listeners. The results showed that participants had more difficulty distinguishing the palatal lateral and palatal approximant. For this reason, we decided to focus our attention on /ʎ/ and /j/, with an exploratory reanalysis of the first experiment.

2. METHOD

In both experiments, an identification task was proposed to a group of Italian speakers.

Participants had to listen to a list of pseudo-words and had to associate each pseudo-word heard to an orthographic transcription within a closed list of possible labels. The orthographic labels were spelled with ‹gl›, which in Italian is usually associated with /ʎ/, ‹i›, associated with /j/, ‹li›, associated with /lj/, and ‹lli› associated with /llj/ in the first experiment; and in the second experiment with ‹gl› and ‹i›.

The tasks were disseminated online via the Folerpa platform [19], an online tool developed at the Instituto da Lingua Galega (ILGA) of the University of Santiago de Compostela (Galicia, Spain).

In the first task 32 pseudo-words were presented to each participant, in the second task 40; each item was tested twice (total stimuli: 64 for the first test; 80 for the second). To avoid list effects the stimuli were presented at each replay in random order. In the middle of the task there was a pause.

The response times were calculated in milliseconds, between the end of the repetition of each stimulus and the listener's response.

2.1. Participants

The first task was proposed to 67 university students. Age ranged from 18 years to 29 years (mean: 21.20; SD: 2.52), all the participants were Italian native speakers. 62% of the subjects indicated Piedmont as their region of origin.

On the other hand, the second experiment was carried out with 46 students of the University of Turin aged between 21 and 31 (mean 23.93; SD: 2.07). 57% of the participants indicated Piedmont as their region of origin.

Participants were asked to indicate all the languages in which they have active and passive competence. The mother tongue and the L2, in fact, can modify the performance of identity task. Comparative studies conducted on Catalan and Spanish show that Catalan speakers have better performance in distinguishing [ʎː] and [j] than Castilian speakers [20], [21].

All participants had no hearing problems, nor had they ever suspected hearing loss.

Finally, it was controlled that no subject had given more than 85% of identical answers and that there weren’t any technical problems.

Each student was asked to complete the Vinegrad Plus Questionnaire [23], according to the modified version of Montesano and Valenti [23]. This test requests answers to a variety of questions designed to identify common traits of dyslexia. 33% of the participants were in the risk range, while 28% said they suspected to be dyslexic. These data are particularly important because phonological deficits are linked with dyslexia. In fact, many studies have shown the presence of phonological difficulties even in dyslexic adults, especially in phonological tasks that require access to phonology from visual inputs [24-26].

This fact is relevant since the identification task in the proposed modalities has an important visual component. Participants, in fact, had to make an effort of grapho-phonematic conversion to associate the heard stimuli with the proposed orthographic labels ([27]–[30]).

2.2. Stimuli

The stimuli consisted of four groups of pseudo-words with [ʎː], [j] [lj] and [lːj] (Table 1).

All stimuli had the same phonotactic structure. They were disyllabic and paroxytone pseudo-words, with the target sound in intervocalic position. The vowels preceding it were stressed.

Pseudo-words were chosen to avoid the influence of lexical variables of existing words on the identification test.

	Task 1, 2		*Task 1*	
	/ʎ/ ‹gl›	/j/ ‹i›	/lj/ ‹li›	/llj/ ‹lli›
[ˈa]_[a]	/ˈtʃaʎa/ ‹ciaglia›	/ˈtʃaja/ ‹ciaia›	/ˈtʃalja/ ‹cialia›	/ˈtʃallja/ ‹ciallia›
[ˈa]_[o]	/ˈnaʎo/ ‹naglio›	/ˈnajo/ ‹naio›	/ˈnaljo/ ‹nalio›	/ˈnalljo/ ‹nallio›
[ˈɔ]_[o]	/ˈrɔʎo/ ‹roglio›	/ˈrɔjo/ ‹roio›	/ˈrɔljo/ ‹rolio›	/ˈrɔlljo/ ‹rollio›
[ˈɔ]_[a]	/ˈtɔʎa/ ‹toglia›	/ˈtɔja/ ‹toia›	/ˈtɔlja/ ‹tolia›	/ˈtɔllja/ ‹tollia›

Table 1: Selected stimuli for the identification tasks (task 1 and 2).

Once the pseudo-words had been selected for the test, a professional speaker was recorded in a silent room, he repeated the stimuli in isolation.

Afterwards, the durations of the vowels preceding the target phonics [ʎː], [lːj], on the one hand, and [j], [lj], on the other hand, were equalised to 145 ms (± 5ms) and 160 (± 5 ms) using GoldWave audio editing software.

The mean of the duration of [ʎː] in the four pseudo-words (*ciaglia, naglio, roglio, toglia*) was 158 ms. All stimuli were standardised to this value (± 2 ms), and then, keeping the previous vowel identical, the duration of the target sound was varied by reducing it by 40 ms each time and creating four new

stimuli with [ʎ] durations of 220 ms, 180 ms, 140 ms and 100 ms.

During the first task, all stimuli were used, whereas for the second task, only stimuli with [ʎ:] and [j] were used.

Due to the impact of the duration factor for the classification of [ʎ] (§2.3.1), on the second task we focused on the rule of duration on [ʎ]-[j] distinction. The same manipulation was done with the stimuli presenting [j]-sound, in the original audio of 180 ms duration, manipulated to reproduce the same *continuum* as [ʎ] (260 ms, 220 ms, 180 ms, 140 ms, 100 ms).

2.3. Data Analysis

2.3.1. Accuracy of participants' responses in the dyslexia risk range

As mentioned, the Vinegrad Plus Questionnaire was administered to the participants of the two experiments in order to check whether there was a percentage of people in the sample who were in the dyslexia risk group.

It emerged that 33% were actually in this group. Given the possible correlation between dyslexia and the outcome of the tasks, the data on the accuracy of the answers were cross-referenced with the presence or absence of dyslexia risk.

To verify this hypothesis, the Chi Square test was applied and the χ^2 value and Cramer's V were calculated. This analysis did not yield significant results ($\chi^2 = 0.626$; V = 0.013). This fact suggests that difficulties in the classification of /ʎ/ and /j/ are not characteristic only of those with specific difficulties, but more widespread in the population.

Because of dyslexia is not affecting the results of the tasks we proposed, we did not delete the data of any participant for analysis.

2.3.2. Experiment 1

The first task showed that the participants were able to correctly associate /lj/ and /llj/ to the corresponding orthographic label ‹li› and ‹lli› (see Table 2).

	‹gl›	**‹i›**	**‹li›**	**‹lli›**
/ʎ/*	69%	22%	6%	4%
/j/	23%	70%	3%	4%
/lj/	2%	1%	91%	7%
/llj/	3%	1%	5%	92%

Table 2: Summary of identification task's results. Experiment 1. Classification of /ʎ/, /j/, /lj/, /llj/.

* Here are the reported results of stimuli with a [ʎ] duration of 180 ms, the average value among those tested. By entering the duration values of [ʎ] =180 ms here, [ʎ] and [j] with the same duration are compared.

The data were processed statistically with SPSS for Analytics (by IBM), v. 28. As we were working with categorical data, crosstabs were used to check the relationship between two variables (type of stimulus and listener categorisation). We conducted Chi-square test and Cramer V. The significance value was set at 0.05 (α=0.5).

As a result, the degree of association of /lj/ and /llj/ with the respective graphic labels ‹li› and ‹lli› is significantly higher (χ^2= 606.696; V=0.871) than for /ʎ/ and /j/ (χ^2= 191.701; V= 0.490).

In addition, we assessed the participants' sensitivity to the duration of [ʎ] by evaluating whether it affects classification. As discussed, in fact, duration is one of the variables of the realisation of these phonemes. For this reason, each pseudo-word was proposed with the target sound [ʎ] having durations of 260 ms, 220 ms, 180 ms, 140 ms and 100 ms.

It was found that the duration factor played a significant role in the correct recognition of the sound (Pearson's r=0.947**, p=0.01). As the duration of [ʎ] decreased, the number of target responses ‹gl› dropped from 87% at 260 ms to just 9% at 100 ms (Figure 1).

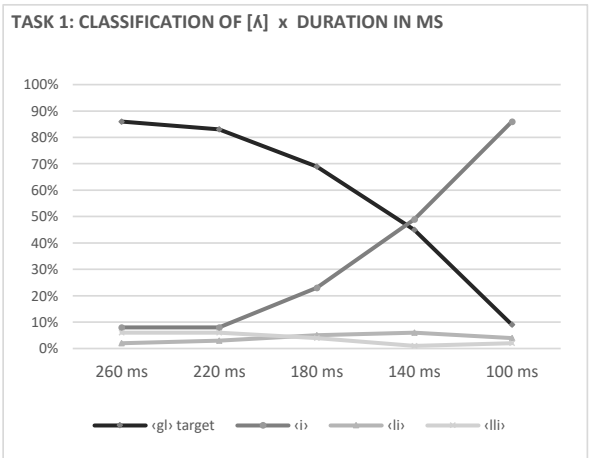

Figure 1*:* Classification of *[ʎ]* as a function of sound duration (in ms). Experiment 1.

Given these initial results, it was decided to investigate this further by proposing a task in which not only the length of [ʎ] but also that of [j] was manipulated (Experiment 2).

2.3.3. Experiment 2

Our results of the first experiment demonstrate that the duration of [ʎ] is decisive in the subjects' choices

in the identification task. The data collected in the first task was then confirmed by the second experiment and are presented below.

In this experiment, listeners had to associate manipulated stimuli with /ʎ/ and /j/ (100-260 ms) and orthographic labels with ‹gl› and ‹i›.

The results show that in more than 90% of the responses the sound [ʎ]≥220 ms it is solidly associated with the target transcription ‹gl› and the stimuli with [j] at 100 ms is associated with ‹i›.

There is a directly proportional relationship between the duration of [ʎ] and the target association ‹gl› (Pearson's r = 0.935**; p = 0.02): the longer the duration of the sound, the better its recognition.

Whereas, surprisingly, an inversely proportional relationship appears in the recognition of [j] (Pearson's r = -0.988; p = 0.002; Figure 22). The [ʎ]-sound below the 180 ms threshold is no longer identified with certainty. On the other hand, [j] is almost unambiguously associated with ‹i› when it has durations of 100 ms and 140 ms. Significantly, however, the curves describing the classification of [ʎ] and [j] as ‹gl› and ‹i› according to duration do not show an entirely symmetrical profile.

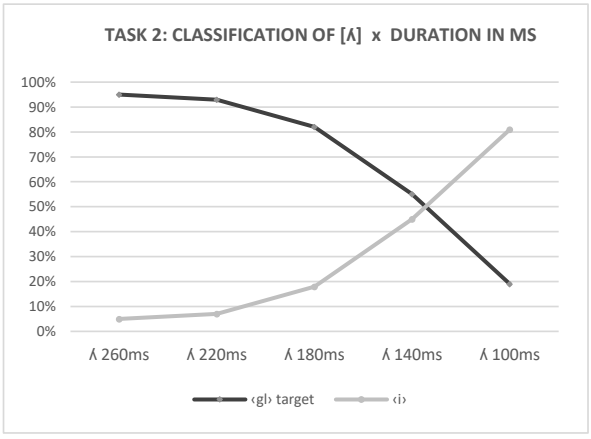

Figure 2: Experiment 2. Classification of [ʎ] and [j] as a function of duration (in ms).

The most significant finding concerns pseudo-words with [j] of longer duration, which are alternately associated with ‹gl› and ‹i›.

It appears that different parameters come into conflict: the quality of the sound and its duration. It follows that [j] of duration superior than 180 ms is clearly classifiable neither as /ʎ/ nor as /j/.

This finding suggests that the duration feature is regarded as a significant index by the listeners.

Indeed, in Italian, duration characterises and distinguishes the two phonemes.

3. CONCLUSIONS AND PERSPECTIVES

Two perceptual identification tasks were submitted to a total of 113 Italian-speaking university students.

The results of these tasks showed that participants were always able to tell apart [lj]-like stimuli, while they showed more variation in the way they classified the stimuli in the /ʎ/ and /j/ categories. In this case, it is confirmed that the duration plays a significant role in the identification of /ʎ/: with less than 140-160 ms. The perceived stimulus originated from a [ʎ]-sound is generally classified as /j/, whereas stimuli with increasing durations of an original [j]-sound need an upper threshold (around 200 ms) to be mostly attributed to /ʎ/.

The [ʎ]-sound is associated with longer duration than [j]. What has been observed has important consequences for spelling. Indeed, it must be taken into account that if at a perceptual level the distinction between phonemes is not clear, in writing the indirect route cannot be used or in any case, it has an increased chance of not being reliable.

Moreover, it is necessary to complete further research in order to reach more solid conclusions. It would therefore be necessary to verify the discrimination and identification capacity of the two phonemes in different age groups, as well as to extend the research geographically.

This is the reason why we decided to collect data from a more controlled sample. Therefore, it was decided to propose a reading task, a pseudo-words dictation task and an auditory discrimination task to 60 Piedmontese speakers, divided into age groups (15-20](20-25](25-30). All data were collected in person. Data analysis is still in progress.

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