

# CHANGE IN THE IRISH PALATALISATION-VELARISATION SECONDARY CONTRAST

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## ABSTRACT

This proposed study attempts to provide an articulatory description of the changing strength in the contrastive secondary palatalisation and velarisation of modern Irish consonants. This includes the first ultrasound imaging of Irish sonorants. Older and younger groups of fluent speakers will be compared using lingual mid-sagittal ultrasound imaging of word-initial consonants. Much of the current literature suggests the contrast is changing, however, a recent study of the closely related Scottish Gaelic [7] may even imply otherwise. The change in production of such a unique feature will provide insights into the future of Irish, the impact of the majority English language, and the study of endangered languages as a whole.

**Keywords:** Palatalisation, Velarisation, Sound Change, Ultrasound, Irish.

## 1. INTRODUCTION

### 1.1 Social Context of Irish

Irish (*Gaeilge*) is a Celtic language native to the island of Ireland. Although it holds official language status in the Republic of Ireland (*Poblacht na hEireann*), English is the dominant language throughout the country. There are no adult monolingual speakers of Irish [15]. Irish is categorised by UNESCO as Definitely Endangered [14]. Indeed, in the 2022 census, just 71,968 people (a paltry 1.4% of the Irish population) said that they use the language outside of school [3]. Still, at least 26% of people in every age group could speak the language “well” or “very well.” Given its endangerment, any opportunity to further our understanding of this ancient and culturally

significant language should be considered of great linguistic importance.

The transition of speakers in Ireland from Irish to English is a common type of language endangerment called *language obsolescence* [11]. In these situations, naturally occurring phonetic changes are often accelerated. It is also common for the endangered language to take on characteristics of the majority language.



**Figure 1.** Donegal County, Galway City and Galway County — regions with over 15% of the population speaking Irish “very well” [3].

### 1.2 Palatalisation and Velarisation

One of the most unique features of Irish phonology is that every consonant has two phonemes: a palatalised (broad) or velarised (slender) secondary articulation. This has been confirmed by the existence of minimal pairs throughout the language [13]. A palatalised consonant in Irish is a secondary articulation at the hard palate — that is to say, a consonant with a main point of constriction at that consonant's place of articulation, and a second, lesser constriction between the tongue and the hard palate. Tongue position during such a sound is frequently compared to that of a high front

vowel [1, 13]. Likewise, a velarised consonant has a secondary articulation at the velum, with a tongue position comparable to a high back vowel. See Table 1 for the Irish consonant inventory.

As a Goidelic Celtic language, the closest continuously living relative of Irish is nearby Scottish Gaelic [14]. Scottish Gaelic also has a pervasive phonemic secondary articulation contrast, with some sounds adding an alveolarised phoneme for a three-way contrast [7, 8]. Contrastive palatalisation exists outside of the Goidelic languages as well, such as in some Slavic languages; but, it is nevertheless considered typologically unusual [5].

## 2. RESEARCH QUESTIONS

### 2.1 Motivation

It is well-documented that rare contrasts can be lost in endangered languages, perhaps due to a lack of that feature in the dominant language [11]. In English, palatalisation and velarisation are not phonemic or nearly as pervasive. It has already been hypothesised that the Irish contrast is waning in younger speakers [10, 13]. However, a formal articulatory study of the language that separates older and younger speakers has not been seen. One study in Scottish Gaelic [7] even claims that it is possible to maintain a contrast despite the omnipresent influence of a majority language. This proposed experiment will help us understand if the contrast is actually disappearing and how it is evolving. This will be important diagnostic research into the health of the Irish language, and will provide insights into the study of endangered languages as a whole.

### 2.2 Research Questions

I plan to investigate the secondary palatalisation-velarisation contrast in Irish to understand how speaker age in an obsolescing language affects rare contrasts. I will answer three closely related research questions:

- I. Is the contrast realised differently in older and younger speakers?

- II. Are the sounds more distinct in the older speaker group, indicating a weakening contrast?
- III. If so, do younger speakers produce both secondary articulations as the same phoneme or do they use other articulation strategies?

## 3. LITERATURE REVIEW

### 3.1 Review of Studies of Irish

The most well-known articulatory study comparing velarised and palatalised consonants in modern Irish was carried out by Bennett et al., [1]. They performed ultrasound imaging of five radio broadcasters from Connemara who spoke the Connacht dialect of Irish both in and out of work. These are well-spoken and perhaps “traditional” speakers, ranging in age from 35 to 60. Bennett et al. presented measurements of both palatalised and velarised versions of the stops /p/ or /b/, /t/ and /k/ and the fricatives /f/, /s/ and /x/ in word-initial syllables before both vowels /i/ and /u/. Differences in tongue backness, height and tongue root advancement/retraction were studied in order to make three key conclusions. First, the position of the tongue body (especially in the dorsal region) sufficiently distinguishes velarised consonants from their palatalised counterparts. Second, coronals are weaker than labials with respect to tongue body backness, but not tongue root backness. Third, vowel context has only a minor effect on tongue body positioning.

These researchers have since published new ultrasound data on stops in all three major dialects of Irish: Connacht, Munster and Ulster Irish [2], although they did not attempt to draw conclusions on dialectal differences. Just one of their speakers is below the age of 34 and none are older than 56. They analysed the effects of syllable position on the contrast, and determined that it was stronger in onset position than coda position.

Two acoustic studies of Irish, Gabriele [4] and Sutton [13], found that some speakers pronounce palatalised consonants as consonant-[j] clusters. This shows the need for articulatory measurements to further understand speakers’ pronunciation strategies. The former

work used second-language speakers in the United States (under the assumption that effects of contact with English would be augmented in these speakers). The latter used just a single Irish speaker and recordings from instructional tapes on pronunciation.

### 3.2 Review of Studies of Scottish

Nance and Kirkham [7] have performed an ultrasound study of the three-way Scottish Gaelic contrast. They looked at sonorants in speakers from 23 to 80 years old, a wide range of ages. Interestingly, they found maintenance, articulatorily, of a contrast — in conflict with other results. They suggested this could be due to “educated and linguistically aware” speakers.

Earlier work by Nance [8] views the change in the three-way Scottish Gaelic contrast by differentiating speakers by age. She compared the contrast in alveolar lateral approximants across four groups: two groups of teenagers, a group of middle-aged speakers and a group of older speakers. Such a study separating speakers by age groups is missing for Irish. Based on the acoustic data collected, Nance was able to determine that a contrast existed in all groups of speakers; but, younger speakers’ contrasts were less phonetically distinct. An interesting finding was that some young speakers maintained palatality but not laterality, while the opposite was true for other young speakers.

### 3.3 Review of Studies of Palatalisation Change

A palatalisation contrast has also been reviewed diachronically by Iskarous & Kavitskaya [5], who studied changes over a long period of time to 12 Slavic languages. Articulatory descriptions of this contrast are similar to those for Irish, except that the Slavic non-palatalised sound is plain (having no secondary point of stricture), rather than velarised. Although Proto-Slavic had a contrast in many sounds, modern Slavic languages — most of which have strong speaker bases — have evolved in a variety of ways. Russian preserves the contrast in all of the same phonemes, while Slovenian has lost the contrast in almost all of the same phonemes. Across the languages surveyed, phonological mergers

occurred more frequently in some consonant pairs than others. It is worthwhile to note the range of possibilities, given that change in obsolescing languages can mimic that of non-endangered ones [11].

## 4. METHODOLOGY

### 4.1 Speakers

I will compare older and younger speakers in order to make generalisations about the direction the Irish contrast is headed. These groups will be defined as younger than 34 and older than 60, respectively. This is outside the age ranges used by Bennett et al. [1, 2], excluding that one 24-year-old participated in the latter study. I will take any Connacht Irish speakers that use the language outside of school and self-describe as competent, regardless of their competence in English. This means that the young group represent the future of the language, and will provide the most insightful information about the direction it is headed. Ideally, there will be at least six speakers in the younger age group and six in the older age group, in order to establish statistically significant observations about each group in general, and avoid bias from the natural variation of each speaker.

### 4.2 Stimuli

Twenty-two stimulus words have been compiled (Table 2) to target both the palatalised (C<sup>y</sup>) and velarised (C<sup>v</sup>) counterparts of the plosives /p/ or /b/<sup>1</sup>, /t/ and /k/, the fricatives /f/, /s/ and /x/, the rhotic /r/, the lateral /l/, and the nasals /m/, /n/, and /ŋ/. Of all consonants in the Irish inventory, I omit only the glottal fricatives due to their restricted distribution [1]. All target consonants except for /l/ and /r/<sup>2</sup> are word-initial, in a CV syllable where the following vowel is /i/. Vowel

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<sup>1</sup> Bennett et al. [1] compare the voiceless p<sup>i</sup> to the voiced b<sup>y</sup> due to limited occurrence of p<sup>y</sup> word-initially. Voicing of obstruents is unlikely to affect the tongue contour.

<sup>2</sup> /l/ and /r/ are given in different front vowel contexts, and /r/ is given syllable-initially, not word-initially. This is how they are given in the original source [9], and may be because these sounds occur in limited distribution.

context has been found to have little effect on tongue positioning [1]. So, I restrict the stimuli to one word pair per target consonant to minimize the overall number of repetitions required of the speakers.

### 4.3 Procedure

I will use lingual mid-sagittal ultrasound imaging to gather data. This is the method used to study a palatalised-non-palatalised contrast in recent studies of Irish [1, 2], Scottish Gaelic [7], Russian [6] and Romanian [12]. Ultrasound provides clear video imaging of the tongue, with higher spatial coverage than X-Ray Microbeam (XRMB) or Electromagnetic Midsagittal Articulometry (EMA). Ultrasound is also portable, and will allow easy collection of data from a large number of speakers in each age category, in the rural Irish counties where they may live. The ultrasound transducer will be placed under the chin and stabilized with a headset. Acoustic data will be simultaneously recorded with a microphone.

I will use the procedure outlined by Bennett et al., [1]. They directed participants to read the selected words aloud from a list in a carrier phrase, *Scairt Aoife \_\_\_\_\_ Dé Céadaoin* [sʲkʲartʲ i:fvə \_\_\_\_\_ dʲe: kʲe:dʲi:nʲ], with approximately six repetitions per word. Carrier phrases encourage more natural speech, but they were also used to align the ultrasound and audio recording. With 22 stimulus words, this means each speaker will have 132 total required sentences. The stimuli will be given to speakers in the native Irish orthography, which reflects the palatalisation or velarisation of consonants [4, 13].

### 4.4 Data Analysis

I will employ smoothed tongue splines (Analysis I), a common method of analysing ultrasound data [1, 2, 7]. A tongue spline shows height as a function of backness — essentially, the shape of the tongue — at key times. See Figure 2. To answer research Questions I and II, I must draw generalisations about the strength of the contrast in each speaker group as a whole, despite natural variation in tongue size and pronunciation among individuals. Bennett et al. [2] account for

this by *normalising* each speaker's tongue height and frontness. They then compute the Root Mean Sum of Squared Distances (RMSSD) between each individual speaker's C<sub>v</sub> and C<sub>i</sub> to quantify the difference in their tongue shapes. A higher RMSSD means that the tongue positioning for that pair of consonants is more distinct (ie. the contrast is stronger, articulatorily). An example of RMSSD used to quantify the difference in tongue contours is given in Figure 4.

Nance & Kirkham [7] employ a second analysis (Analysis II): tongue height as a function of time. See Figure 3. This analysis measures the tongue's position on three vectors, one for each secondary articulation. The independent variable, tongue height, can also be *normalised* and a difference in height for an individual's C<sub>v</sub> and C<sub>i</sub> can be calculated, which also quantifies the relative strength of the contrast in that speaker, as compared with others.

If the contrast is indeed being lost, then I must answer Question III. To do so, the tongue contours (Analysis I) will again be key. Using the continuous ultrasound recordings, I will pay attention to the gestural score of the primary<sup>3</sup> articulator as compared with the secondary articulators (the tongue root and body at the secondary point of stricture). These will determine whether the sounds have merged, or another articulatory strategy is being employed. Alternate analyses can be applied once the data is collected.

## 5. PREDICTIONS & POSSIBLE OUTCOMES

### 5.1 The Contrast is Maintained

The results of research Questions I and II offer a chance to settle the debate surrounding the Irish contrast by understanding *if* and *how fast* any change in its realisation is happening<sup>4</sup>. If the older and younger groups exhibit equivalent distances in tongue positioning between C<sub>v</sub> and

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<sup>3</sup> Note that the timing of the primary articulation may have to be inferred from the auditory data.

<sup>4</sup> It should be noted that different results may occur for different sounds.

Cj, it would indicate that the contrast — and perhaps, the whole language — is more stable, going against a majority of the literature, but supporting the findings of Nance & Kirkham [7] for Scottish Gaelic. They suggested the influence of linguistic awareness — especially amongst speakers that choose to learn a minority language. If this were the case, Irish speakers could be overemphasizing this feature of their language because they are aware of its importance, being careful to articulate it clearly and contrastively.

## 5.2 The Contrast is Weakening

The opposite result — in which younger speakers show very minimal contrast while older speakers maintain much more distinct secondary palatalisation and velarisation — would allow us to infer that the contrast is weakening. This would support several existing predictions made for Irish [10, 13] and for Scottish Gaelic [8]. One potential explanation, in this case, is the lack of this feature in the dominant language, English, which may make it difficult for young speakers who hear English frequently to perceive and produce the contrast. Any weakening observed in this study would have occurred in a relatively short period, implying that the Irish language is experiencing extreme instability.

## 5.3 Possible Realisations of a Weakening Contrast

There are multiple ways a diminished contrast could be articulated. Understanding these is the goal of Question III. If the gesture of the tongue body or root moving towards the point of secondary articulation (the soft palate or the velum) does not occur, and the tongue splines for C<sup>v</sup> and C<sup>j</sup> are identical at almost all points in time, then a merger of these sounds has occurred. Mergers of typologically rare phonological contrasts have been documented in many obsolescing languages [11], as well as in stable languages with the contrast [5].

On the other hand, if a gesture towards the palate or velum occurs, but only after the main articulation, a consonant-glide clustering is occurring (consonant-[j] and consonant-[w], respectively). Essentially, the articulations are

being separated. This indicates a changing way that younger people maintain the contrast. Consonant-glide clusters have been found in Irish by Sutton [13] and Gabriele [4]. This could be due to modern Irish speakers who are aware — through education or other means — that the contrast is important, but are unable to learn to produce simultaneous articulations due to the complexity of such a task.

# 6. IMPLICATIONS

## 6.1 Descriptive Importance

This study will enhance our understanding of tongue positioning during contrastive secondary articulations with data for almost all Irish consonant phonemes. No ultrasound study has yet looked at Irish nasals, rhotics or liquids. Bennett et al. [1, 2] investigated only obstruents. So, this work will have descriptive importance in addition to answering the research questions about change in the contrast.

## 6.2 Implications for Language Change

This study compares a unique phonetic phenomenon across generations. As such, it is of special importance in diachronic phonetics. The results (whether the Irish contrast is maintained or lost) will allow us to better understand the factors behind each possibility, whether they be sociolinguistic, phonetic or otherwise. We will be able to compare the evolution of the contrast in Irish to that in stable languages and to phonetic changes in other endangered languages. This is an exciting opportunity to see if change in obsolescing languages does mimic that which occurs naturally, as suggested by Palosaari and Campbell [11].

## 6.3 Societal Implications

Beyond this, the Irish language is a source of pride for the Irish people. The results will give the Irish people a method of understanding the state and health of their national language. Learning what articulation strategies modern young Irish speakers are using could inform revitalization policies and teaching strategies to help bolster the strength of the language while

properly preserving a feature that makes its sound system unique.

As an endangered language, opportunities to study this language should be taken sooner than later. The ultrasound recordings taken would preserve a part of the Irish language for the scientific community forever, allowing it to be studied from other perspectives in the future.

## 6.4 Limitations

This is a study of an endangered language where all participants may also have a strong knowledge of English. As such, the level of English competency and its effects on the articulation of the contrast are unfortunately outside the scope of this research.

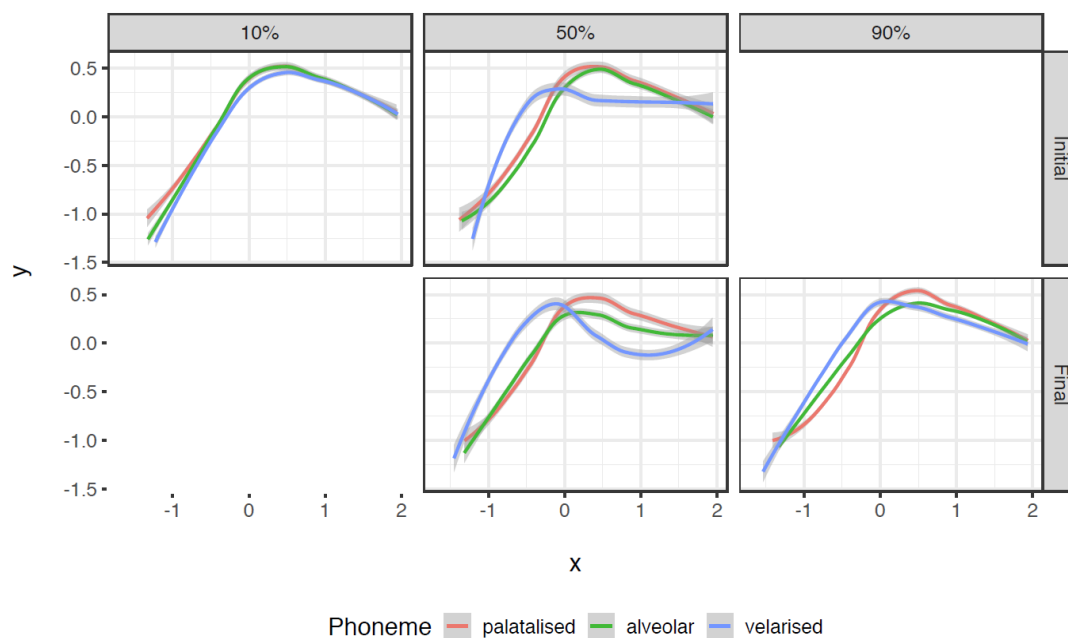
## 7. ACKNOWLEDGEMENTS

Thank you to Professor Suzy Ahn and TA Mariana Cortes Kandler for their helpful suggestions on this work. A big thank-you to Meghan, for learning Irish on Duolingo with me.

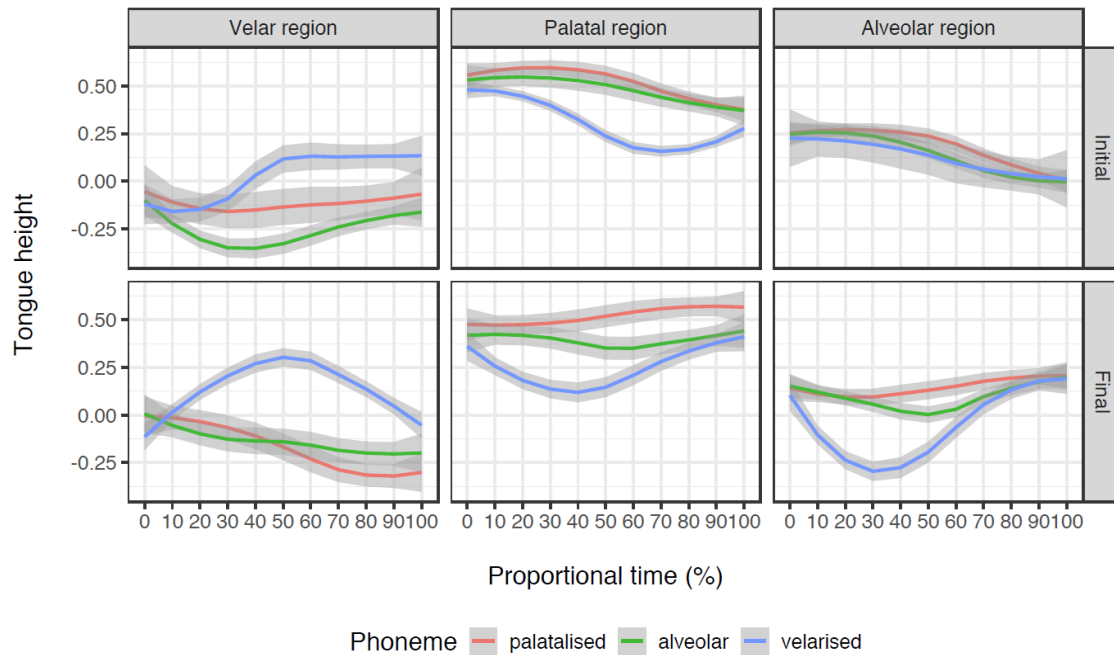
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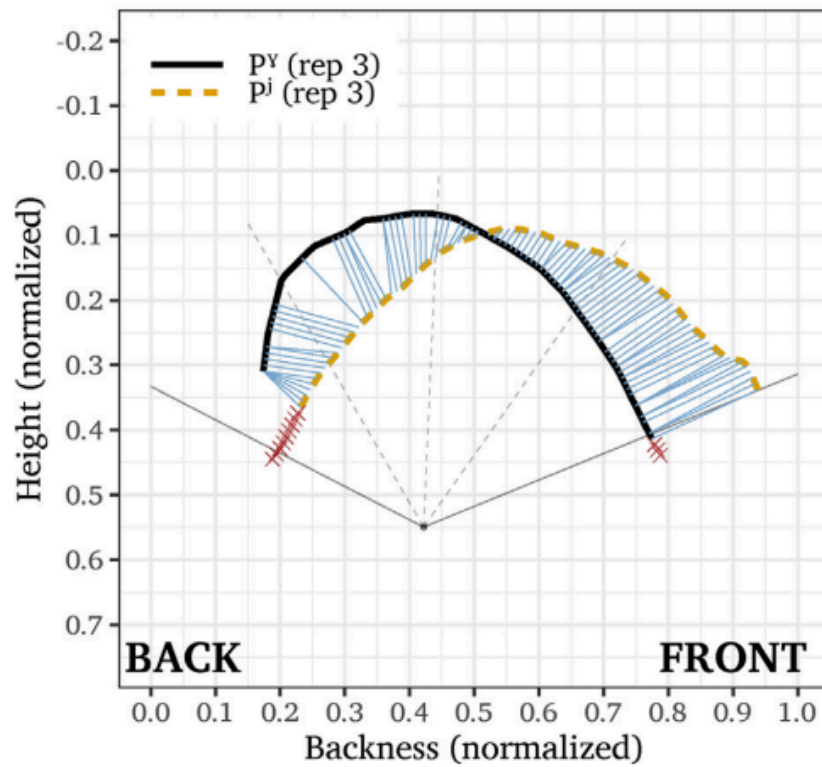
## 9. APPENDIX OF TABLES & FIGURES



**Figure 2.** Example tongue measurements using Analysis I [7].



**Figure 3.** Example tongue measurements using Analysis II [7].



**Figure 4.** RMSSD used to quantify the difference in tongue shape between  $p^v$  and  $p^j$  [2].



	Labial	Coronal	Dorsal	Glottal
Stop	pʲ pɪ bʲ bɪ	tʲ tɪ dʲ dɪ	kʲ kɪ gʲ gɪ	
Fricative	fʲ fɪ vʲ vɪ	sʲ sɪ	xʲ xɪ ɣʲ ɣɪ	hʲ hɪ
Nasal	mʲ mɪ	nʲ nɪ	ŋʲ ŋɪ	
Lateral		lʲ lɪ		
Rhotic		rʲ rɪ		

**Table 1.** Irish phonemic consonant inventory [1].

	Target	Transcription	Orthography	Gloss
Stop	pɪ	/pʲinɪ/	píghin	penny
	bʲ	/pʲirʲah/	buí	yellow
	tɪ	/tʲi/	tí	house
	tʲ	/tʲi/	tuí	straw
Fricative	kɪ	/kʲirʲ/	cíor	comb
	kʲ	/kʲi/	caoi	way
	fɪ	/fʲisɪ/	fís	vision
	fʲ	/fʲi/	faoi	about
Nasal	sɪ	/sʲisʲ/	síos	downward
	sʲ	/sʲi/	suí	sitting
	xɪ	/xʲirʲ/	chíor	combed
	xʲ	/xʲinɪ/	chaoín	cried
Rhotic	mɪ	/mʲi/	mí	month
	mʲ	/mʲi/	maoigh	boast
	nɪ	/nʲih/	nigh	wash
	nʲ	/nʲi/	naoi	nine
Lateral	ŋɪ	/ŋʲialʲ/	ngiall	hostage
	ŋʲ	/ŋʲilʲ/	ngaol	relative
Lateral	rɪ	/kærʲah/	cáireach	dirty
	rʲ	/mʲærʲah/	márach	tomorrow
Lateral	lɪ	/lʲej/	leigh	read
	lʲ	/lʲe/	lae	day

**Table 2.** Full list of stimuli. Sonorants adapted from Ní Chasaide [9]. Obstruents adapted from Bennett et al. [1]. I omit vowel lengthening.