A PHONETIC INVESTIGATION OF IRISH ECLIPSIS: PRELIMINARY RESULTS AND CHALLENGES

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ABSTRACT

The acoustic correlates of Irish eclipsed and base consonants were examined (e.g. [g] in (*leis an*) *gcasúr* [gasu:r] '(with the) hammer' vs. *gasúr* 'child' [gasu:r]). A clear difference in duration was observed only for one of four speakers. Spectral moments and intensity analyses showed very few significant differences. Either there are no robust differences between these two consonant types (unlike similar phenomena in French and German) or these differences are task-dependent. Additional recordings of semi-spontaneous speech suggest that the production of eclipsis and other initial mutations may be style- or register dependent.

Keywords: eclipsis, initial mutations, neutralization processes, Irish, Celtic languages

1. INTRODUCTION

One of the most striking aspects of the Irish language is that a given word can start with a different sound depending on the context (e.g. *casúr* [kasu:r] 'hammer', *mo chasúr* [xasu:r] 'my hammer', *leis an gcasúr* [gasu:r] 'with the hammer'). These *initial mutations* are pervasive, affecting about 18% of words (in a 1.7 million word corpus of written Irish, Kevin Scannell, p.c.), are triggered by over a dozen contexts, and affect not only nouns, but also verbs and adjectives. The phonological structure of the initial mutations, the most common of which are lenition (*seimhiú*) and eclipsis (*urú*),[1] has been analysed in a number of theoretical frameworks [10] and references therein. But there have been very few experimental studies, and we therefore know very little about the acoustic properties of mutated consonants.

In this pilot study, we examine the acoustic correlates of eclipsed consonants and their corresponding base forms (e.g. the /g/ of *gasúr* [gasu:r] 'child' vs. the /g/ of *(leis an) gcasúr* [gasu:r] '(with the) hammer').

We were guided by previous work on other languages that has shown evidence for incomplete neutralization. For example, French vowel-initial words gain an onset consonant in liaison, enchaînement, and elision contexts (e.g., *avion* 'airplane': *un [n]avion* 'an airplane', *des [z]avions* 'airplanes', *petit [t]avion* 'little airplane', *l'avion* 'the airplane'). A number of studies have shown systematic differences between these "resyllabified" consonants and corresponding base consonants (e.g. between the [t] of *petit tamis* 'little sieve' /pəti.tami/ and the [t] of *petit ami* 'boyfriend' /pəti t ami/) [4, 5, 14, 15]. Similarly, studies of word-final obstruent devoicing in German and Dutch have shown subtle phonetic differences between phonemically voiced consonants and their phonemically voiceless counterparts (e.g. the final stops of *Bund* 'group' /bund/ [bunt] and *bunt* 'colorful' /bunt/ [bunt], both realized [t]) [13].

The current study focuses on the Irish spoken in Connemara, Co. Galway in the west of Ireland. Irish is a minority language spoken today as a community language in a number of mostly rural areas predominantly along the west coast. The Connemara Gaeltacht is one of the stronger official Irish-speaking districts, but as in all the Gaeltachtaí (see Figure 1), the language is under increasing pressure from English. All present-day adult speakers of Irish also speak English, although the reverse is not true, even in the Gaeltacht.

Figure 1: Map of Ireland with the official Irish-speaking regions (Gaeltachtaí) shaded.

2. METHODS

2.1. Participants

Four native speakers of Connemara Irish participated in the experiment. All participants

were in mid to late 20s, had been raised in the Connemara Gaeltacht, grew up speaking Irish at home, and completed their primary and secondary education in Irish-medium schools. They were currently living in Dublin. Speakers received €15 for their participation, which lasted about one hour.

2.2. Initial mutations

In the process of lenition, the initial consonant is weakened (e.g. stops like /g/ become fricatives or glides, e.g. *gasúr* [gasuːr] → *mo ghasúr* [ɣasuːr] 'my child' and /f/ is deleted). In eclipsis, voiceless stops become voiced, voiced stops become nasals (e.g. *gasúr* [gasuːr] → *úr ngasúr* [ŋasuːr] 'our child'), and /n/ is prefixed to vowels (e.g. *úll* [uːl] → *úr n-ull* [nuːl]). The precise details vary with dialect, so we limit our initial study to Connemara Irish. Table 1 summarizes the initial mutation patterns of this dialect, with columns showing the base consonant, its lenited and its eclipsed forms.[2] Consonants that occur word-initially only as a result of mutation or in a few loan words or past tense forms (e.g. /h/, *hata* 'hat', *thóg* [hoːg] 'took') are enclosed in parentheses. This is the case for almost all lenited consonants. We chose therefore to compare base consonants with their eclipsed counterparts, focusing on the six pairs of consonants in the bold, shaded cells of Table 1 (e.g. base [b] vs. [b] arising through eclipsis).[3]

Table 1: The initial consonant mutations of Connemara Irish.

base		**lenited**		**eclipsed**	
p	pʼ	f	fʼ	**b**	**bʼ**
t	tʼ	(h	hʼ)	d	dʼ
k	kʼ	(x	ç)	**g**	**gʼ**
b	**bʼ**	(w	v)	**m**	**mʼ**
d	dʼ	(ɣ	j)	n	nʼ
g	**gʼ**	(ɣ	j)	(ŋ	ŋʼ)
m	**mʼ**	(w	v)	--	--
s	sʼ	(h	hʼ)		
f	fʼ	∅	∅	w	v

2.3. Materials

We designed a set of 36 minimal (or near minimal) pairs of words, searching an electronic dictionary to identify items with the required characteristics [11]. Each pair consisted of 1. a word in its base form (as produced in isolation) and 2. a word whose initial consonant could be eclipsed, rendering the two words segmentally identical (e.g. *(an) gasúr, (leis an) gcasúr:* both [gasuːr]). These words were inserted into two types of carrier contexts, as shown in (1): a. a non-triggering context appropriate to the base form and b. a context triggering mutation (eclipsis).

(1) a. base (C_B): word + article + #C_{voiced}
b. mutation (C_M): prep^M + article + #$C_{voiceless}$

In the context shown in (1b), a word-initial consonant is eclipsed after the definite article in the dative singular when preceded by one of a closed class of 11 common prepositions (*ag* 'at', *ar* 'on', *as* 'out of', *le(is)* 'with', etc.).

The carrier contexts were controlled so that the word immediately preceding the target word (usually the definite article *an*) was identical across members of a pair. This controlled for potential effects of coarticulation. These phrases were in turn inserted into a variety of pragmatically neutral carrier sentences. An example is given in (2).

(2)

a. C_B: Scriostar "gan an gasúr" ón taifead. [no mutation]
' "Without the child" is deleted from the recording.'

b. C_M: Bainfear "leis an gcasúr" as an abairt. [eclipsis]
' "With the hammer" will be removed from the sentence'.

2.3.1. Procedures

Sentences were presented one-by-one on a computer screen, and participants read the sentences at a self-selected, untimed pace. Each participant was recorded individually in a quiet room. Recording were done using a Shure SM10A headworn microphone and a Marantz PMD 660 digital recorder at a sampling rate of 48 kHz.

All labelling and acoustic analyses were performed in Praat [2], with label positions determined by hand and scripts used to semi-automate the process. For all items, segment boundaries in the critical region were labeled. For oral stops, the onset of the closure and the onset of the release burst were labelled.

It was often impossible to reliably label the boundary between the final [n] of the definite article *an* and a following [m], as in (3).

(3) Chuala mé "leis an mbata" Dé Mâirt.
'I heard "with the stick" on Tuesday.'

This /n/ is not always pronounced, particularly in casual speech, and it was often difficult to be sure if it had been realized. We therefore excluded [m]-initial items (e.g. *mbata*) from the analyses.

For the remaining items (all oral stop-initial) we measured: consonant duration, closure duration, release duration, voice onset time (VOT), relative intensity of burst, and spectral moments (center of gravity, standard deviation, skewness, and kurtosis). We then performed paired comparisons between base (C_B) and eclipsed (C_M) consonants.

3. RESULTS AND DISCUSSION

The results of the duration analyses are given in Table 2. For Speaker 1, we observed a clear difference in duration: for the four types of consonants examined, mutated (eclipsed) consonants (C_M) were longer than base consonants (C_B), due to a difference in closure duration (rather than VOT). This difference may reflect that these eclipsed consonants are underlyingly voiceless, since all other things being equal, voiceless consonants are longer than voiced consonants. For Speaker 2, however, we observed the reverse pattern: for two consonant types, C_M was shorter than C_B. We observed the same pattern for Speaker 4, but only for one consonant type. For Speaker 3, C_M was longer than C_B for one consonant type.

Table 2: Duration results (* $p < 0.05$, ns not significant).

S	C (n)	C dur	Clos dur	VOT
1	b (16)	$C_B < C_M$*	$C_B < C_M$*	ns
1	b' (3)	–	–	–
1	g (16)	$C_B < C_M$*	$C_B < C_M$*	ns
1	g' (12)	$C_B < C_M$*	$C_B < C_M$*	ns
2	b (29)	ns	ns	ns
2	b' (6)	–	–	–
2	g (27)	$C_B > C_M$*	$C_B > C_M$*	ns
2	g' (18)	$C_B > C_M$*	$C_B > C_M$*	ns
3	b (18)	ns	ns	ns
3	b' (1)	–	–	–
3	g (22)	ns	ns	ns
3	g' (11)	ns	ns	ns
4	b (25)	ns	ns	ns
4	b' (6)	–	–	–
4	g (24)	$C_B > C_M$*	$C_B > C_M$*	
4	g' (14)	ns	ns	$C_B > C_M$*

The spectral moment analyses revealed very few significant differences and a great deal of inter-speaker variability, and the burst intensity analyses revealed no significant differences.

Speaker 1 systematically deleted the /n/ of the definite article *an* in the mutation condition (1b), although not in the base condition (1a), which may be relevant to the vowel duration difference.

The variability observed suggests that any differences between the base consonants and eclipsed consonants of Irish are not as robust as those found in French between base consonants and the resyllabified consonants. Yet within a given speaker, we do find a certain coherence: for the duration measures, any significant differences were always in the same direction (Table 2). This pattern of variability may be due to the fragility of the language. Discussing obsolescent languages, Babel [1] writes "[I]ncreased subphonemic variation without neutralizing phonological contrasts is a symptom of language atrophy".

The results may also be task-dependent. Two of the four speakers had difficulty with the reading task, possibly because they may have had little experience in reading Irish in the years since leaving (Irish-medium) secondary school. Independent of the issue of reading fluency, work on French has shown that differences between base and resyllabified consonants may not be present in all contexts [8, 9]. For German, the maintainance of contrast between devoiced and underlyingly voiceless consonants has also been shown to be task- [13] and speaker-dependent [12].

It is also possible that the durational differences we did find are due to an effect of orthography, since Irish consonant mutations are always represented with a digraph (e.g., <gc> ~ [g] in *leis an gcasúr* [gasu:r]. In their study of Dutch, Warner, et al. [16] report an influence of orthography on the production of homophones.

There are a number of alternate explanations for the lack of clear and consistent differences between base and eclipsed consonants. First, in the context tested (and indeed in most, though not all, mutation contexts), the mutation is completely predictable from the context and conveys no semantic information. Second, eclipsis is relatively rare, affecting only about 3% of words (lenition is much more common). But the "low functional load" and the "rarity" arguments should also apply to French resyllabification processes; these processes do not convey semantic meaning, and Fougeron & Delais [6] have shown that while the

process of encha ĥement is quite rare, speakers maintain a contrast between base and encha ĥement consonants.

We have recently recorded additional speakers, students at a Irish-medium university campus in the Connemara Gaeltacht. Participants completed not only the reading task, but also an interactive card game task, intended to minimize the potential effect of orthography and to elicit relatively spontaneous speech with many examples of the target words in the different conditions (base, eclipsed, and a control). Analysis of these new data is underway. Preliminary observations, however, reveal great variability in the realization of the initial mutations; in the card game task, many speakers did not produce the mutations expected by the traditional grammar, although at least some initial mutations are clearly present in their speech. We expected that these speakers would have no attrition in their Irish-language literacy skills, since they have had continuous, (typically) uninterrupted education in Irish, and indeed, all speakers read the written materials without difficulty. Interestingly, they also had no problem in reading words with initial mutations, although they do not produce these mutations consistently in spontaneous speech, at least in this context. This suggests that the realization of initial mutations may be style- or register-dependent, similar to that of French liaison and encha ĥement [3].

Although the observed variability complicates the analysis, it is unsurprising given observations on variability in the Irish initial mutation system and similar variability (or even collapse) in the initial mutation systems of other Celtic languages [7] and references therein. It motivates a pressing need for the development of a corpus of spontaneous, spoken Irish to identify contexts in which initial mutations are robustly produced.

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[1] We use the traditional term *eclipsis* since we know of no other term that adequately describes this process.

[2] Columns contain pairs of consonants, reflecting the phonological contrast between so-called *broad* and *slender* consonants (conventionally marked by a prime).

[3] Dentals are not eclipsed in the context we chose.