

# PHONETIC VARIATION IN STANDARD SCOTTISH ENGLISH: RHOTICS IN DUNDEE

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## ABSTRACT

Research on Scottish English /r/ mainly focused on the urban centres of Glasgow and Edinburgh, while the phonetic variation of this sound remains largely unknown in other cities. This paper aims at providing new data to characterize Standard Scottish English and one of its prominent features by analyzing the variation of both prevocalic and non-prevocalic /r/ in Dundee. Though age and gender have some influence on /r/ production, the most significant factors are phonetic and phonological environments. Variants include not only taps and approximants, but also fricatives, affricates, and vocalic realizations, though the speakers remain essentially rhotic.

**Keywords:** Rhotics, Rhoticity, Scottish English, Sound change, Sociophonetics.

## 1. INTRODUCTION

In many languages, including English, the phoneme /r/ is particularly variable and exhibits several phonetic realizations [11]. Contemporary Scottish English (SE) is a variety of English that presents two interesting features regarding rhotics : their realization and their distribution, two phenomena that appear to be phonetically linked. Reports on SE phonology, such as [14] or [15], indicate that rhotics in this accent are usually coronal taps [ɾ] and approximants [ɹ], and that this variety is rhotic, in other words that it exhibits an articulated /r/ in coda position. The phonetic variation of /r/ is said to be structured by internal as well as social factors, such as phonological environment [15], age and gender (see [6], [8], [15]). Recent findings of studies, mostly conducted in the Central Belt area of Scotland, indicate that /r/ is extremely variable, and that in coda position it is being vocalized by some groups of speakers. This process, shown in [3], [5], [6], [8], [12] or [13], is often referred to as derhoticisation. This loss of a consonantal /r/ non-prevocalically seems to primarily affect working-class speakers, while the middle-class (MC) remains essentially rhotic (see [4], [10], [13]).

In Scotland, research mainly focused on the two greatest urban centres of Glasgow ([12], [13],

[12]) and Edinburgh ([3], [8]), and on close towns such as Ayr [6] and Livingston [8]. Towns further away, Gretna and Eyemouth, are small and spatially marginal as they are located along the national border with England [5]. Little is known about the distribution and realization of /r/ in Standard Scottish English in urban centres other than Glasgow and Edinburgh. Dundee, the fourth city in Scotland (about 150,000 inhabitants), is located outside the immediate influence of these cities, and offers an opportunity for the study of variation and possibly change in rhotic use in contemporary urban Scotland. The aim of this study is to check the hypothesis that /r/ patterns in Dundee similarly to other places, both in terms of distribution and realization, and to test whether internal (*phonological environment*) and social (*age and gender*) factors play a significant role in the variation and change of this sound in Standard Scottish English.

## 2. METHODOLOGY

This is a sociophonetic study using acoustic measurements of a corpus composed of 18 MC speakers (Table 1), who were recorded in 2012 reading a word list in Dundee. All speakers are born and have always lived in Dundee. The list contains 130 randomized words with /r/ in various phonetic and phonological contexts (plus 32 distractors without /r/). This study focuses on those words that have /r/ in a stressed syllable (119 words). The vowels /ɛ, e, i, u, o, ɔ, ʌ, a/ were tested in the different environments. For CrV and VrC environments, the consonants /p, b, t, d, k, g/ were tested, as well as /f, θ/ for CrV and /s, θ/ for VrC.

**Table 1.** Number of speakers in age and gender groups

	Young (18 years old)	Old (42 to 55 years old)
Female	5	5
Male	5	3

Recordings were made in a quiet room using a Marantz Professional® PMD661 digital recorder and an Audio-Technica® AT831R cardioid microphone placed at the top of the chest of the

speaker, at approximately 20 cm from the mouth. Recordings were then imported and analysed into the PRAAT [2] phonetic software. Tokens which presented acoustic background noise or other signal problems were excluded from analysis (Table 2). The /r/ sound was manually segmented, and coded according to typical phonetic characteristics of speech sounds, particularly of rhotics (such as F3 trajectory and F3-F2 distance, the presence of trilling cycles, frication), based on spectrum and waveform inspection. Statistical significance was evaluated using  $\chi^2$  tests.

**Table 2.** Sample sizes and phonological environments tested

Environment	#rV	CrV	VrV	Vr#	VrC
$N (= /r/s)$	190	329	216	544	749
Example words	<i>run, rack</i>	<i>great, tree</i>	<i>very, sorry</i>	<i>car, store</i>	<i>park, short</i>

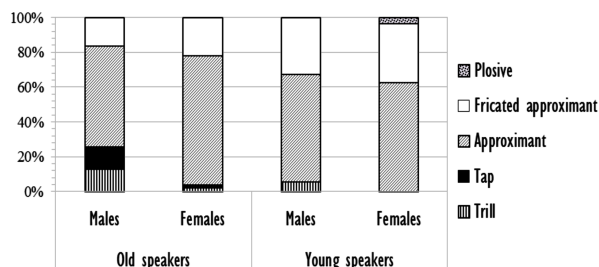
### 3. RESULTS

As expected, /r/ is extremely variable in this accent, both in prevocalic and non-prevocalic positions. The phonetic realizations of this phoneme range from coronal trills and taps to central post-alveolar approximants, post-alveolar and glottal fricatives, and even vocalic realizations, including monophthongs. The results are presented by phonological environment, as this is the most significant factor in /r/ variation.

#### 3.1. Prevocalic /r/

In prevocalic position, the most common variants of /r/ are coronal taps and central approximants, and may be voiced or voiceless. Three sub-environments have been tested: word-initial, post-consonantal, and intervocalic.

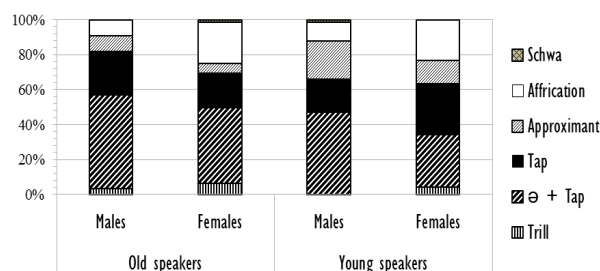
**Figure 1.** Realization of /r/ in word-initial position (e.g. *red*) by age and gender



In word-initial (/#rV/) position (Figure 1), the most common rhotic type is a central approximant (64.7%). A partially fricativised approximant is another frequent realization (27.4%), and exhibits, in addition to a low F3, noise frequencies. Taps and trills are rare but present (2.6 and 4.2%

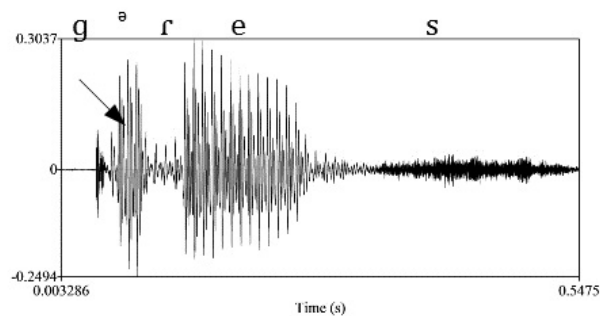
respectively), and age and gender are significant factors in this respect, these variants being more common for older men compared to other speaker groups.

**Figure 2.** Realization of /r/ in postconsonantal position (e.g. *great, three*) by age and gender



In postconsonantal (/CrV/) position (Figure 2), /r/ is most frequently realized as a tap (65.0%), which usually comprises a short vocalic, schwa-like segment following the consonant and preceding the closure (Figure 3). The appearance of such vocalic elements has been reported and studied for various languages, including Greek [1], Catalan [7], or Romanian [9]. Voiceless taps, without any such vocalic element, are yet not rare (22.8%) and found after voiceless consonants. Another realization of /r/ is an approximant (12.8%), with characteristics similar to that in word-initial position. In certain phonetic contexts, the approximant forms an affricate (17.6%), in the post-alveolar region, with preceding alveolar plosives (e.g. *tree*). Coarticulation thus leads to much variation, depending on the place of articulation and voicing of the preceding consonant. Trills are rare but present (4.0%).

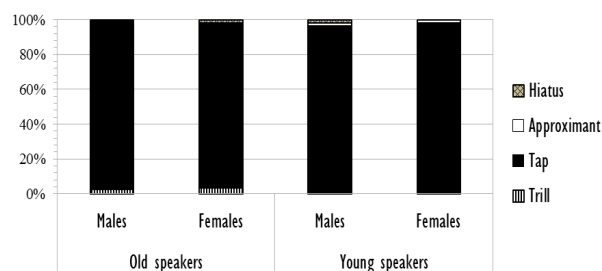
**Figure 3.** Vocalic element preceding the closure of a coronal tap realization of /r/ in *grace*



In addition to phonological environment, phonetic context is thus a significant factor that influences the production of rhotics with (taps and trills) or without (approximants, affricates, vocalizations) contact ( $\chi^2(16, 329) = 104.874, p < .0001$ ), as well as, for taps only, the presence or absence of a pre-closure vocalic element ( $\chi^2(4, 329) = 24.244, p < .0001$ ). Neither gender or age are significant

factors in the use of either taps or approximants in this context.

**Figure 4.** Realization of /r/ in intervocalic position (e.g. *sorry*) by age and gender

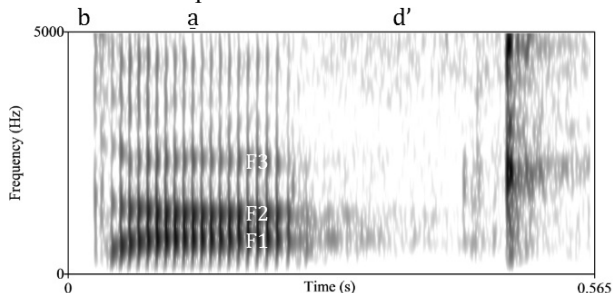


Finally, in intervocalic (/rV/) position (Figure 4), /r/ is less variable than in other positions, as it is almost categorically (more than 97% of productions) realized as a coronal tap with a brief closure for all speaker groups. There is thus no significant difference in that respect based on either gender ( $\chi^2(1, 216) = 0.004, n.s.$ ) or age ( $\chi^2(1, 216) = 0.438, n.s.$ ), though the rare approximants are only produced by young speakers.

### 3.2. Non-prevocalic /r/

Non-prevocalically, i.e. in preconsonantal (/rC/) and word-final (/r#/) position, /r/ is even more variable than prevocalically, because in addition to coronal consonantal realizations, it may be vocalized, particularly before a consonant.

**Figure 5.** Derhoticized monophthongal realization of preconsonantal /r/ in *bard*

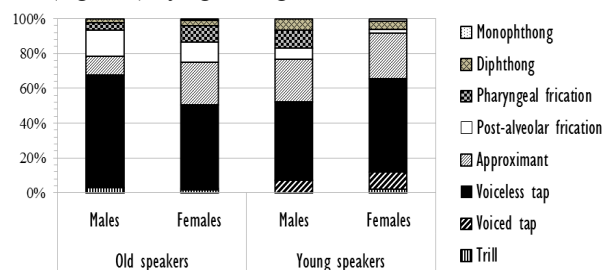


The vocalization of /r/ leads to a diphthongal vowel with changing F1 and/or F2 or even to a non-rhotic monophthong with flat formants (Figure 5). Both cases exhibit no lowering of F3, which remains far above F2 (the acoustic distance between the two is above the 3.5 Bark threshold required for rhoticity perception). These vocalized variants can be considered phonetically non-rhotic, though they might still be interpreted as phonologically rhotic.

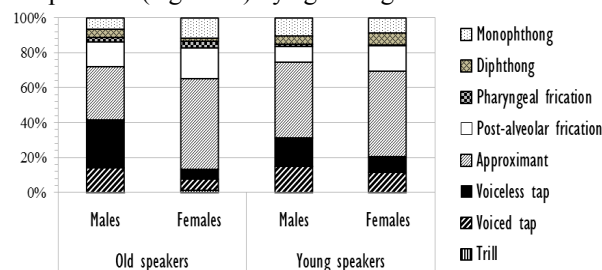
The difference between the use of taps, approximants, and other variants in the two non-prevocalic environments (/rC/ and /r#/), is highly significant ( $\chi^2(2, 1293) = 139.88, p < .0001$ ):

taps are the most frequent realizations in /r#/, while in /rC/, approximants are the most frequent variants.

**Figure 6.** Realization of /r/ in word-final position (e.g. *car*) by age and gender



**Figure 7.** Realization of /r/ in preconsonantal position (e.g. *card*) by age and gender



Taps can be voiced and voiceless: voiced taps are taps in which the closure phase is followed by a short vocalic element, whereas voiceless taps involve a closure followed by voiceless frication or burst. Taps are majoritarily voiceless in /r#/, while the proportions of voiced and voiceless taps are more balanced in /rC/. This may be due to the final devoicing that can be observed in SE, or else to a premature stopping of voicing that has been found for SE /r/ [3]. Vocalized realizations are rarer but present in both positions (5% in /r#/ and 14% in /rC/); among those monophthongs are more frequent before consonants (9.5%) than word-finally (0.6%).

In word-final position (e.g. *car*, *fear*), the differences between groups of speakers are marginal as taps, approximants, and most other variants are produced in similar proportions ( $\chi^2(6, 1293) = 12.534, n.s.$ ) across groups. Two significant differences can still be found. First, the rare monophthongs are only produced by female speakers. Second, voicelessness seems more favoured by older rather than younger speakers. Indeed, voiced taps are only found for young speakers, and voiceless post-alveolar frication, which is most probably the result of approximant devoicing, is less frequent for these speakers than for older speakers ( $\chi^2(1, 1293) = 14.315, p < .001$ ).

In preconsonantal position (e.g. *card*, *fierce*), more marked differences can be observed between speaker groups. Men produce more taps, both voiced and voiceless, than women do ( $\chi^2(1, 749) =$

35.147,  $p < .0001$ ), while, instead of taps, women produce approximants. These are the most frequent variants for all speakers (51.9 to 69.7%) except the older men (44.8%) who favour taps. Differences in the production of vocalized realizations (diphthongs or monophthongs) instead of consonantal constrictions are not significant ( $\chi^2(3, 749) = 1.46$ , *n.s.*), while pharyngeal fricatives, which are very rare, are more common for older speakers. Finally, the vocalization of /r/ is most frequent after the open vowel /a/ and before /t/ and /d/; taps are least favoured before alveolar plosives or fricatives.

#### 4. DISCUSSION

This study contributes to the characterisation of Standard Scottish English and of one of its major features, rhotics and rhoticity. It has shown that in Dundee, /r/ is extremely variable, even in a formal style and that the variation is conditioned by internal and social factors, the former being much more significant than the latter. The most significant factor is the phonological environment. In word-initial and preconsonantal environments, /r/ is most frequently realized as a central approximant, while in postconsonantal, intervocalic, and word-final environments, the most frequent realization is a coronal tap. Particularly, intervocalic /r/ is almost categorically a tap. The phonetic environment also plays a significant role, at least in some phonological environments. The social factors of age and gender are only significant for some environments, and some minority variants. Taps and trills are rarer for younger speakers, who also produce a greater proportion of voiced variants than the older speakers.

These results indicate that the variability is structured internally, and that sound change is limited for /r/ in this corpus, which may be due to the formality of speech. Though vocalized variants of /r/ are present, all speakers remain essentially rhotic, and little change is observable in apparent time, which confirms the expectation that derhoticization mainly concerns working-class speakers in Scotland. Rhotics in Standard Scottish English in Dundee vary and pattern relatively similarly to other locations in Scotland. Though the extreme variability of /r/, in English, and in Scotland more particularly (see [11]), can be used socio-indexically [12] to signal identity status (social class, but also gender or national identity), these results also suggest that this variation is, at least in formal MC speech, highly dependant upon linguistic factors.

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