‘O LO/R/D, OPEN THOU OU/R/ LIPS’: RHOTICITY IN CHORAL SINGING FROM GLASGOW AND CAMBRIDGE

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ABSTRACT

Front vowel phonology and realization in British choral singing is thought to be based on the non-regional standard accent SSBE. Is choral singing affected by regional variation in speech? Scottish Standard English is rhotic; SSBE is non-rhotic. Do Scottish choirs produce postvocalic /r/ in choral singing? This study compares the realization of postvocalic /r/ in choirs from Glasgow and Cambridge (1925-2017). 5016 tokens were auditory coded for rhoticity (presence/absence of /r/) and analyzed with Bayesian binomial mixed models. The predicted probability of producing /r/ was 0.68 for Glasgow and 0.10 for Cambridge. Furthermore, Glasgow produced linking /r/ categorically whereas Cambridge was variable ($\sim$ 60%). The difference between the choirs decreased over time perhaps reflecting a change in the spoken accent of the Glasgow choir director. British choral singing may be partly based on SSBE, but may also be influenced by regional features.

Keywords: rhotics, phonology, singing, sociophonetic, standard accent, SSBE

1. INTRODUCTION

Previous sociolinguistic work has found that the front vowels of choral singing have lowered over time [1] following a well-evidenced pattern of change observed in Received Pronunciation [2]. This supports the notion that choral singing is based on a standard form of the language as suggested by musicologists [3–5]. In [1], for example, choirs from different regions showed shared front vowel phonology, suggesting a generalized non-regional singing style. The question remains, are there any phonological differences between these choirs that *are* affected by dialect area? In this paper, I investigate whether choirs produce postvocalic /r/ in choral singing in a non-rhotic dialect area, Cambridge, and a rhotic dialect area, Glasgow (c.f. [2]).

For postvocalic /r/ in English (e.g. *car*, *card*), both the type of realization and whether /r/ is produced at all can vary between speakers and speaker groups making it the ideal variable for exploring variation by dialect area. In speech there is a strong effect of phonetic context on whether postvocalic /r/ is produced or not. Articulated /r/ is most likely pre-vocalically (e.g. *car and*), then pre-consonantally (e.g. *car could*), and least likely pre-pausally (e.g. *car#*) [6].

Scottish Standard English (SSE) is considered a rhotic variety [2, 7, 8] meaning that postvocalic /r/ is usually articulated in Scottish varieties of English [6], though there is some evidence that the frequency and strength of the variants produced is reducing over time [9]. In SSE, /r/ in words like *car* would be articulated e.g. /kar/, and could be phonetically realized as a post-alveolar approximant [ɹ], retroflex approximant [ɻ] (tip-up), or bunched [10], as a tap [ɾ], or as a trill [r] [11]. In SSE, historically we would expect a higher frequency of trills and taps compared to SSBE where we would expect more approximants [2].

In contrast, Standard Southern British English (SSBE) is a non-rhotic variety of English meaning that postvocalic /r/ is usually *not* produced apart from pre-vocalically [2].In other words, in SSBE the /r/ in the word *car* would not be produced at all e.g. /kɑ:/, apart from when followed by a vowel (e.g. *car and*, which could be realized as [kɑɹand]), known as linking /r/.

Here I present an empirical phonological analysis: is choral singing rhotic or non-rhotic? If the choral accents in the Glasgow and Cambridge singer groups relate to the spoken accent in each region, we would predict articulated postvocalic /r/ in Scotland but not in Southern England. If the choral accents are not related to the spoken accent of each region, we would expect both groups to produce postvocalic /r/ in linking /r/ contexts (e.g. *car and*)

1.1. Previous linguistic studies of /r/ in singing

Previous sociolinguistic analyses of singing have focused on auditory coding of consonant realizations in solo singing [12–15] using a variationist Labovian approach [16]. In the first

sociolinguistic study of singing, investigating multiple variables including postvocalic /r/ in recordings of British rock/pop bands [12] found that 'words such as *girl, more* tend to be pronounced with an /r/ even by those English English speakers (the majority) who do not have non-prevocalic /r/ in their speech' (pg. 142). Trudgill suggested the insertion of /r/ in words where they would not be found in speech was a form of hypercorrection, arguing that this was a form of accommodation towards an imagined American audience.

[17] moved away from thinking about variation in singing in a purely linguistic or conversational model, towards incorporating the notion of performance. Morrissey argued that certain features had become enregistered as appropriate for the performance of a certain genre, and that deviating from those features would essentially be considered unstylistic by listeners. These overarching styles [17] calls 'reference styles'.

More recently, in the first study of singing in Scotland, [14] investigated postvocalic /r/ in indie artists from Glasgow. They find that 'overall, there is a high rate of the variants at the weakly, rather than the strongly rhotic end of our continuum. This is despite postvocalic /r/ being a classic stereotype of Scots.' [14] (pg. 228). The authors attributed this surprising finding to the reduction of postvocalic /r/ in working class speech in the Central Belt [9].

In all studies of postvocalic /r/ in singing to date, the style of music investigated has principally been popular forms such as pop, rock, heavy metal, and indie. What we know about realization of postvocalic /r/ in classical singing is limited to classical singing pronunciation guides e.g. [18]. Previous studies have all investigated genres of singing which fall under the same popular 'reference style'. What are the constraints on the realization of postvocalic /r/ within the classical reference style?

1.2. Research questions

Evidence from front vowels suggests that British choral singing is based on a non-regional standard accent like SSBE [1]. However, *is choral singing affected by regional variation in speech?* In order to answer this broader question, this study asks; *do Scottish choirs produce postvocalic /r/ in choral singing? Is there evidence of change over time in their production of postvocalic /r/?*

2. METHODOLOGY

In order to answer these research questions two electronic time-aligned corpora were constructed in LaBB-CAT [19]. The Glasgow corpus consists of commercially released recordings of the Glasgow Orpheus (1906-1951) and Glasgow Phoenix (1951-present) choirs with audio recordings from 1925 to present day. The King's corpus consists of commercially released recordings and public broadcasts of the choir of King's College, Cambridge, with audio recordings from 1945 to 2019. Audio recordings and texts were aligned in LaBB-CAT [20] using Praat [21] and all tokens of /r/ in the corpus (8407 tokens) were auditorily coded for realization. This yielded 5016 tokens of postvocalic /r/. As the realizations were vastly dominated by approximants ($\sim$ 95% of the realized tokens of postvocalic /r/), I collapsed the levels to a binary factor (Realized vs No realization). The data were analysed with Bayesian binomial mixed models using `brms` [22] [version 2.18.0] in R [23] [version 4.1.2]. Tables were produced with `xtable` [24] [version 1.8-4] and `BayesPostEst` [25] [version 0.3.2].

2.1. Linguistic context

There are four main contexts for postvocalic /r/ as shown in Table 1.

Table 1: postvocalic /r/ contexts

coding	example	name
'r.V'	*car and*	pre-vocalic (linking /r/)
'r'	*car#*	pre-pausal
'r.C'	*car could*	pre-consonantal word boundary
'rC'	*card*	pre-consonantal within word

The four contexts are listed in the order of most likelihood of rhoticity to least likelihood [9]. i.e. /r/ is most likely to be produced in *car and* (linking /r/ context) in all varieties of English, including SSE and SSBE, whereas /r/ in *card* is least likely to be produced. In Table 2, rhoticity is broken down by Corpus and Context.

Table 2: Rhoticity by Corpus and Context

Corpus	Context	/r/	No /r/	/r/(%)
Glasgow	r	102	89	53%
-	r.C	329	282	54%
-	r.V	176	13	93%
-	rC	247	459	35%
Cambridge	r	6	273	2%
-	r.C	126	1046	11%
-	r.V	219	158	58%
-	rC	130	1361	9%

2.2. Modelling, priors, and convergence criteria

The data were modelled using Bayesian binomial mixed models. The model structures were:

```
  Combined_rhoticity ~ Corpus + Context
+ Corpus:Context + (1|Album) + (1|Song)
+ (1|Corpus:Word)

  Glasgow_rhoticity ~ Time/Director
+ Context + Time/Director:Context +
(1|Album) + (1|Song) + (1|Director:Word)
```

The dependent variable of both models is Rhoticity (Realization/Non Realization of postvocalic /r/). The predictor variables for the Combined model were the factors Corpus (Cambridge, Glasgow) and Context (r.V, r, r.C, rC). For the Glasgow only model, Context is the same, but instead of Corpus we have Time/Director which is a three-level factor: 'HSR' = Hugh S. Roberton (1925-1951), 'PM' = Peter Mooney (1959-1975), 'MJS' = Marilyn J. Smith (1987-2016).

Following recommendations by [26], I used weakly-informative regularising priors using Cauchy distributions centred on 0 with a scale factor of 2.5 for all fixed and varying effects and a cauchy distribution centred on 0 with a scale factor of 10 for the intercept. Cauchy distributions were used as opposed to normal distributions as they have more weight in the tails and therefore allocate more probability space to values further from zero while still giving values closer to zero greater probability [27]. Model chains were visually inspected for convergence, Rhat was 1 for all coefficients and the minimum effective sample size for all coefficients was greater than 100 times the number of chains. I was satisfied that the models converged successfully and that the posterior summaries are amenable to interpretation. All factors are sum coded for ease of interpretation.

3. COMBINED (SYNCHRONIC) RESULTS

As seen in Table 3, the combined rhoticity model revealed a main effect of Corpus; the predicted probability of producing postvocalic /r/ was 0.10 for Cambridge and 0.68 for Glasgow (logit difference: 1.47, 95% CI [1.22, 1.73]). The model supports an interaction of Corpus by Context. As articulated /r/ is least likely pre-pausally, there is a positive adjustment for pre-pausal tokens in the Glasgow corpus (logit difference 0.62, CI [0.25; 1.03]). As the likelihood of articulated /r/ is so high for Glasgow overall, there is a negative adjustment for pre-consonantal contexts (logit difference −0.42, CI [−0.67; −0.18]). The predicted probability for articulating postvocalic /r/ in pre-pausal context *car#* (context_r) was 0.025 for Cambridge and 0.47 for Glasgow. The predicted probability of articulating postvocalic /r/ in pre-consonantal context across word boundary *car could* (context_r.C) was 0.09 for Cambridge and 0.59 for Glasgow (interaction visualized in Fig. 1).

Table 3: Combined rhoticity model summary

	Estimate	l-95% CI	u-95% CI
Intercept	**−0.70**	**−0.95**	**−0.45**
CorpusGlasgow	**1.47**	**1.22**	**1.73**
Context_r	**−1.51**	**−1.92**	**−1.14**
Context_r.C	−0.20	−0.41	0.01
Context_rC	**−0.99**	**−1.24**	**−0.74**
CorpusGlasgow:Context_r	**0.62**	**0.25**	**1.03**
CorpusGlasgow:Context_r.C	−0.19	−0.40	0.02
CorpusGlasgow:Context_rC	**−0.42**	**−0.67**	**−0.18**

Point estimate displayed: median
Results are given on the log odds ratio (not the response) scale.
Bold font indicates 0 outside 95% credible interval.

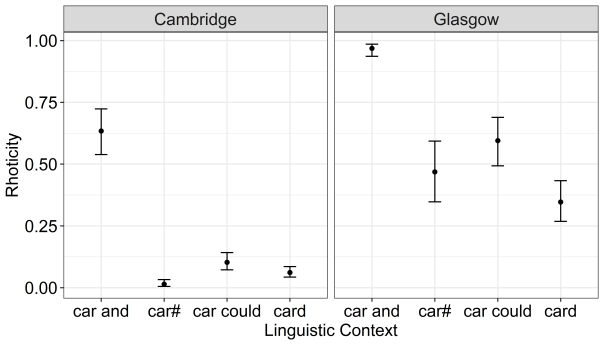

Figure 1: Combined rhoticity model: Corpus by Context interaction. y-axis: estimated proportion of rhoticity

4. GLASGOW (DIACHRONIC) RESULTS

Both King's and Glasgow data were modelled separately to investigate change over time. King's showed stable variation in linking /r/ *car and* contexts only; and only minimal /r/ produced in the other linguistic contexts; there was no evidence of change over time; model omitted for brevity.

In a model of the Glasgow data (as found in Table 4) there is a main effect of Time/Director. For Time/Director Peter Mooney (1959-1975), the predicted probability of producing postvocalic /r/ is 0.7. The predicted probability for postvocalic /r/ being produced for Marilyn J. Smith (1987-2016) is 0.46. The credible interval for Marilyn J. Smith

Table 4: Glasgow rhoticity model summary

	Estimate	l-95% CI	u-95% CI
Intercept	**0.73**	**0.24**	**1.24**
Director_PM (1959-1975)	0.10	−0.46	0.66
Director_MJS (1987-2016)	**−0.89**	**−1.65**	**−0.18**
Context_r	**−1.48**	**−2.18**	**−0.89**
Context_r.C	−0.12	−0.54	0.30
Context_rC	**−1.44**	**−1.89**	**−1.01**
Director_PM:Context_r	0.64	−0.02	1.38
Director_MJS:Context_r	**−1.73**	**−2.95**	**−0.75**
Director_PM:Context_r.C	−0.38	−0.85	0.09
Director_MJS:Context_r.C	0.32	−0.34	0.98
Director_PM:Context_rC	−0.15	−0.65	0.35
Director_MJS:Context_rC	0.36	−0.32	1.05

Point estimate displayed: median

Results are given on the log odds ratio (not the response) scale.

Bold font indicates 0 outside 95% credible interval.

does not include zero (logit difference −0.89, 95% CI −1.65; −0.18) meaning that it is different to the grand mean for Time/Director. As Peter Mooney (1959-1975) is not different to the grand mean but Marilyn J. Smith (1987-2016) is, there is evidence of change over time. That is, postvocalic /r/ is least likely to be produced in the later time period.

The model also supports an interaction of Time/Director by Context. The interaction is driven by Marilyn J. Smith (1987-2016) and the pre-pausal Context *car#* as shown in Fig. 2. The late time period Marilyn J. Smith (1987-2016) is much less likely to produce /r/ in pre-pausal Context than previous Time/Director pairs. The predicted probability of producing /r/ in pre-pausal context for Marilyn J. Smith was 0.03.

5. DISCUSSION

Glasgow choirs produce more rhoticity than King's in all linguistic contexts as we might expect for speakers of Standard Scottish English. It appears that the Glasgow choral singers are using their underlying SSE phonology which contains postvocalic /r/ in both linking /r/ and non-linking /r/ contexts. King's underlying phonology based on SSBE does not have postvocalic /r/, apart from in the linking /r/ context. Linking /r/ at King's is articulated approximately 60% of the time leaving a very high proportion of hiatus compared to rates in speech [28], perhaps evidence of corrected RP [2]. While evidence from vowels may indicate a homogeneous standard of British choral singing based on a non-regional accent like SSBE [1] (perhaps evidence of a classical reference style [17]), this work demonstrates that a choir's sung phonology may also be impacted by the phonology of the spoken accent of the singers and/or their choir directors.

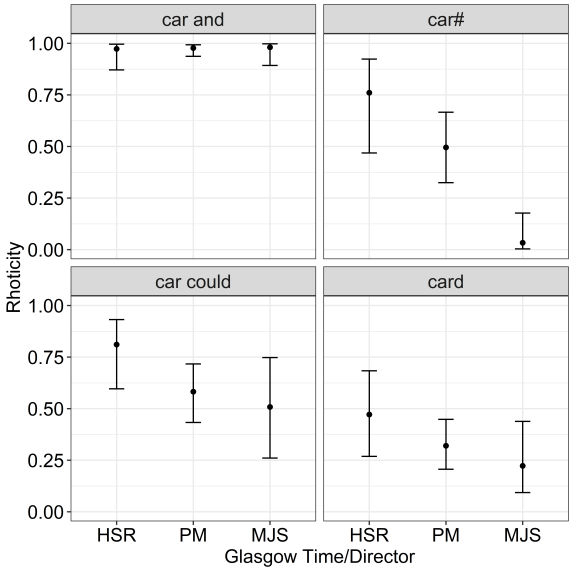

Figure 2: Glasgow rhoticity model interaction of Time/Director by Context. y-axis: estimated proportion of rhoticity. 'HSR' = Hugh S. Roberton 1925-1951; 'PM' = Peter Mooney 1959-1975; 'MJS' = Marilyn J. Smith 1987-2016

Change over time in the Glasgow data, with a reduction in production of postvocalic /r/ in pre-pausal contexts may provide evidence of levelling. One explanation is that choir's director in the later time period speaks with an SSBE accent. Whether the singers imitate the director, or their pronunciation is "corrected" in this case is unknown. The reduction of postvocalic /r/ in pre-pausal context could also be evidence of a wider pattern of levelling to a non-rhotic norm in British choral singing. The reduction of postvocalic /r/ also reflects the pattern of derhoticization in Scottish English [9] as found by [14] in indie bands in Glasgow. However, it is less likely that an ongoing change in a working-class variety has influenced the sung phonology within the classical reference style compared with indie, as channeling 'authenticity' has been recognised as integral to indie as a genre [29], perhaps suggesting it would more readily incorporate phonetic features connected with working-class identities. Future research is needed to establish whether the reduction rhoticity in pre-pausal contexts is restricted to these choirs and directors, or if it is part of a wider pattern of change in choral singing in Scotland.

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