

PHONETIC AND PHONOLOGICAL INVESTIGATION OF THE FIFTH LIQUID IN MALAYALAM: EVIDENCE FOR RHOTIC CHARACTERISTICS

Reenu Punnoose & Ghada Khattab

Newcastle University, UK

rpunnoose84@gmail.com; ghada.khattab@ncl.ac.uk

ABSTRACT

As part of its liquid inventory, Malayalam has two rhotics, two laterals and a fifth liquid which has been called an ‘r-sound’ by some researchers and a lateral by others. This paper presents findings on the phonetic and phonological nature of the fifth liquid in Malayalam, which has never been the subject of experimental research before. Results show that this sound has the phonetic characteristics of a clear post-alveolar central approximant, therefore suggesting that Malayalam has a third rhotic. Interestingly, however, its phonological behaviour displays patterns that are typical of other retroflex rather than of alveolar sounds in the language. An extrinsic phonetic interpretation of phonology is suggested to account for the results.

Keywords: rhotics, Malayalam, resonance

1. INTRODUCTION

Malayalam, like its sister language Tamil, has a five member liquid inventory: two rhotics (*/r/*, */r̥/*), two laterals (*/l/*, */l̥/*) and a fifth liquid (*/z/*) which has been variously referred to as a rhotic [1] and a lateral [7], and which for historical reasons is denoted by */z/* (see next paragraph). Recent work on Tamil has classified the fifth liquid as a ‘retroflex central approximant’ [10, 11]. This has important implications for Malayalam since the fifth liquid in both languages is reportedly ‘similar’ in nature [12] and occurs in shared lexical items, e.g. */paz̥am/* *banana*.

The presence of this fifth liquid in both languages can be traced back to the inventory of Proto-Dravidian, which included what was described as a retroflex fricative [6]. */z/* then evolved into a variety of other sounds in most Dravidian languages, including */ŋ/*, */d/*, */r/*, and */j/*. Only certain dialects of Tamil and Malayalam have retained */z/* in their inventory, though in most dialects of Tamil it has merged with */l/*.

Acoustically, the fifth liquid in Tamil has been reported to be most similar to */l̥/* [11], with both sounds being characterised by low F2 and F3 as is typical of retroflex sounds. */z/* was found to have a higher F4 than */l̥/* (Hz) but the main acoustic difference between the two sounds was found to be in the presence of spectral zeroes in */l̥/* but not */z/*, suggesting */z/* could be rhotic. From an articulatory perspective, the tongue-tip constriction formation and release of both */z/* and */l̥/* is described as involving a counter-clockwise movement, i.e. from back- to-front. */z/* was found to be characterised by upward raised, inward pulled anterior tongue body and a flat posterior tongue body, creating a ‘pitted tongue shape, and a correspondingly greater back-cavity volume’ (pg.1996) [11]. This is in contrast with the other liquids in Tamil, which showed either a flat or slightly concave tongue contour (in the case of rhotics) or a flat anterior and a convex posterior tongue body (in the case of laterals). Nevertheless the rhotics and */z/* were found to have a medial tongue-tip constriction in common (but no closure), an absence of lateral channels, and a concave tongue contour behind the oral constriction suggesting that */z/* is a rhotic in dialects of Tamil where it has not merged with */l̥/*.

The findings of recent studies for the fifth liquid in Tamil have important implications for its counterpart in Malayalam, and raise the question of whether the fifth liquid in Malayalam is also realized as a retroflex central approximant, how it is different from the retroflex lateral and what its auditory and acoustic characteristics are. To the best of the authors’ knowledge, there has been no previous phonetic study of the fifth liquid in Malayalam. This paper therefore aims to examine the possibility of a third rhotic in Malayalam.

2. PHONOLOGICAL FEATURES

The fifth liquid in Malayalam has the following features:

- It occurs only in intervocalic positions (unlike the other liquids in Malayalam) and does not form clusters.
- Like the two rhotics in Malayalam, it does not geminate.
- It does not occur with other retroflex consonants in the same or adjacent syllables and does not occur word-initially, like the other retroflex sounds in Malayalam. This might suggest that /z/ is phonologically retroflex and therefore cannot occur in the same or adjacent syllable with any consonant from the same ‘retroflex’ series.
- In non-compound words, the liquid that /z/ co-occurs with most frequently is /l/, e.g. /kuzal/ *flute*, /nizal/ *shadow*, /kazal/ *foot/ sole*, etc. Malayalam exhibits a general preference for a clear rhotic-dark lateral or dark¹ rhotic-clear lateral combination in non-compound lexical items, with very few exceptions, e.g. /kaɻari/ *form of martial art*, /kallara/ *tombstone*, /pɔral/ *scratch/blemish*, etc.

The first two points support the phonetic evidence for /z/ being a rhotic¹. Furthermore, the co-occurrence of /z/ with a *clear* alveolar lateral and its patterning like other retroflex consonants suggests that it is phonologically ‘dark’ and retroflex.

3. PHONETIC CHARACTERISTICS

The findings of this phonetic study are part of a larger study on the auditory and acoustic characteristics of the five liquids in Malayalam.

3.1. Method

Eight male speakers of the Central Travancore dialect of Malayalam, aged 55 to 70, were recorded reading the carrier phrase /avarodə ___ enə parajuka/ (*say ___ to them*) in which the target word contained at least one of the five liquids in Malayalam. Two repetitions of each target word were recorded. Data included words with a VCV, VVCV, and CVCV syllable structure. Auditory and acoustic analyses were carried out on the data. Acoustic measures included F1, F2, F3 values at onset, mid-point and offset for the liquids, at mid-point and offset for the preceding vowels, at onset and mid-point for the following vowels. Only mid-point values are reported in this paper.

3.2. Results

3.2.1 Auditory analysis

All speakers produced all their fifth liquid tokens as a clear post-alveolar central approximant. It sounded almost as far back as the ‘retroflex’ lateral but did not appear to involve either the *underside* of the tongue tip against the hard palate or the back-to-front tongue movement that is typical of retroflex sounds in Malayalam. Instead the auditory impression was that of raising and approximation of the tongue tip/blade against the hard palate. In general, vowels surrounding /z/ sounded fronted and raised compared to vowels surrounding the retroflex lateral in Malayalam, which sounded retracted and lowered.

3.2.2 Acoustic analysis

F1, F2 and F3 formant frequencies varied significantly depending on the type of liquid, $\lambda=0.34$, $F(30,3338)=49.78$, $p<0.001$, $\omega \approx 0.65$. /z/ was found to have similar F1, F2 and F3 values to the lamino-alveolar tap, /ɾ/, in Malayalam and similar F2 values but higher F1 and lower F3 than the alveolar lateral /l/ ($p<0.001$). /z/ had significantly lower F1 and higher F2 values than the trill ($p<0.001$). Compared to the retroflex lateral /ɻ/, /z/ had a lower F1, a higher F2 ($p<0.001$) and a lack of energy above F4 (fig. 1) and was most similar acoustically to the lamino-alveolar tap /ɾ/ and the lamino-alveolar lateral /l/ among the five liquids in Malayalam (Table 1). This is consistent with the auditory impressions of /z/ sounding clear versus /ɻ/ sounding dark. /z/, /ɻ/ and /ɾ/ had similar F3 measures, and /z/ had lower F3 measures than the alveolar lateral /l/, perhaps suggestive of the former’s post-alveolar place or articulation. Vowels surrounding /z/, like those surrounding /ɾ/ and /l/, showed a lower F1 and a higher F2 than those surrounding /ɻ/ and /ɻ/ ($p<0.001$) (Figs. 2 & 3 below) (only vowel space of the preceding vowels is shown here).

Table 1: Mean F1, F2, F3 mid-point values (SD in brackets) of the five liquids in Malayalam in intervocalic position.

	F1	F2	F3
ALV.LATERAL	369 (40)	1698 (253)	2556 (257)
RTF.LATERAL	436 (78)	1309 (219)	2356 (259)
TAPS	378 (50)	1727 (196)	2482 (231)
TRILLS	469 (66)	1235 (169)	2298 (243)
FIFTH LIQUID	406 (59)	1724 (200)	2417 (260)

Figure 1: Spectrogram of the word /kazi/ 'to eat' (below, left) and /kaji/ 'to play' (below, right) as produced by a native speaker of Malayalam.

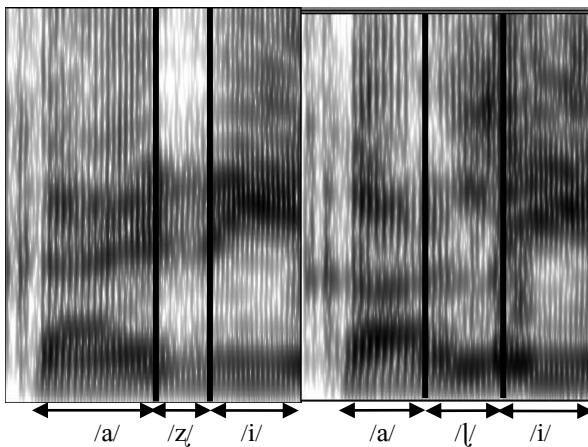


Figure 2: F1, F2 vowel space (mid-pt) of /i/, /a/, /u/ preceding the fifth liquid versus the rhotics in Malayalam.

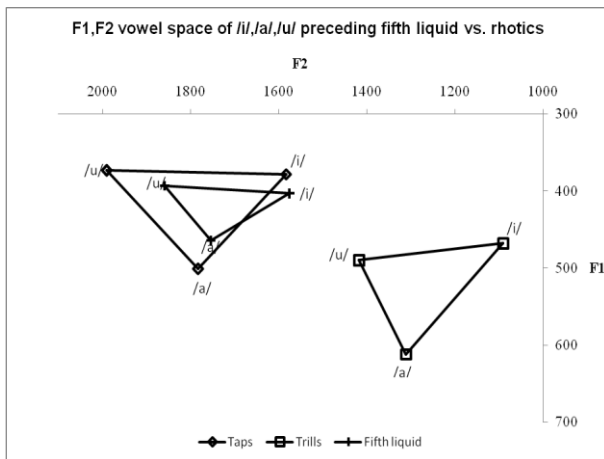
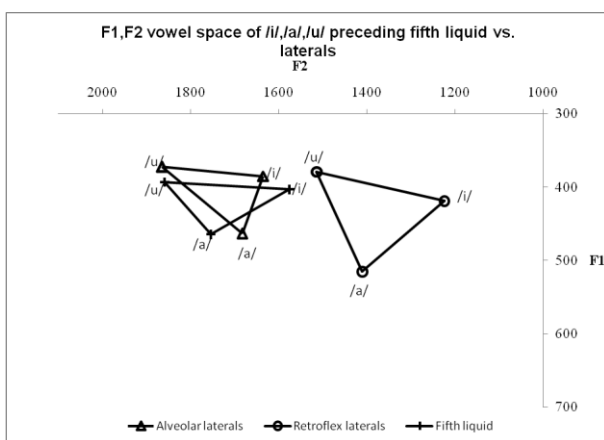


Figure 3: F1, F2 vowel space at mid-point for /i/, /a/, /u/ preceding the fifth liquid versus laterals in Malayalam.



4. DISCUSSION

4.1. Fifth liquid: rhotic or lateral?

The fact that /z/ mostly patterns with /l/ in non-compound lexical items and that it does not geminate (and neither do the two other rhotics in Malayalam, while laterals do) seem to suggest that /z/ is a rhotic from a phonological point of view.

Phonetically, both auditory and acoustic analyses suggest that /z/ is a clear post-alveolar approximant. Acoustically, /z/ was found to be most similar to the lamino-alveolar tap /ɾ/ in Malayalam and then to the alveolar lateral. /z/ mainly differed from the retroflex lateral in that it had higher F2 values.

Low F3, which is often claimed in the literature to be an indicator of rhoticity (mainly based on studies on English e.g. [4]), was not found to differentiate exclusively between the rhotics and the laterals in Malayalam. Instead /z/ was found to have similar F3 values to those of the retroflex lateral and both the rhotics. This may be seen as further evidence supporting recent work that suggests that F3 measures may not be a reliable indicator of rhoticity [5].

4.2. Phonetically clear but phonologically dark?

The fifth liquid in Malayalam appears to be phonetically clear but phonologically dark due to its co-occurrence with the clear alveolar lateral in non-compound lexical items. This pattern supports an extrinsic interpretation of phonology whereby phonological structure is related to but does not equate to phonetic events. These results are similar to those found in a recent study of British English liquids [2] which focused on the rhotic-lateral interaction in two rhotic dialects and two non-rhotic dialects. The phonetic realization and phonological representation of the syllable-initial dark lateral in a rhotic dialect showed opposing resonance qualities (phonetically dark but phonologically functioning as clear due to its contrast with a dark rhotic in the same system). The author used the notion of Extrinsic Phonetic Interpretation (EPI) to account for the mismatch. Such cases of phonology-phonetics mismatches are known in the literature and indicate that the relationship between phonetic realisation and phonological representation cannot only be universal and might be weak and learned language specifically.

4.3. Implications for the fifth liquid in Tamil and in Malayalam

The fifth liquid in Tamil has been described as a retroflex central approximant exhibiting similar F1, F2 and F3 values to the retroflex lateral approximant in its inventory, differing mainly in their F4 values (higher in the former) and absence versus presence of antiformants [11]. On the other hand, in the present study, the fifth liquid in Malayalam has been found to differ from the retroflex lateral in the inventory. This was mainly exhibited in the F2 values, which were higher in the fifth liquid and indicative of its clear resonance compared with the retroflex lateral's dark resonance. In Malayalam the fifth liquid appears to be at least phonologically 'retroflex' which means that there are two retroflex liquids in the inventory—the fifth liquid and the lateral. Applying the Principle of Maximal Differentiation (according to which the sounds in a system should be maximally different from each other in the phonetic space) [2] to the phonetic realisations of both of these sounds using resonance as a strategy may explain the clear resonance of the fifth liquid as opposed to the dark resonance of the retroflex lateral. The use of resonance quality as a contrast maintenance strategy has been reported previously in the literature on Malayalam, namely to distinguish the denti-alveolar contrast [3] and the singleton-geminate contrast [9].

While very few dialects of modern Tamil have retained the fifth liquid in their inventories and most have merged it with the retroflex lateral [7] all dialects of Malayalam have retained this sound. The absence of perceptually salient strategies of maximal differentiation like resonance quality might be the reason behind the loss of the fifth liquid contrast in some dialects of Tamil and all Dravidian languages except Malayalam, where it seems to be contributing to the long lasting presence and survival of the fifth liquid.

5. REFERENCES

- [1] Asher, R.E., Kumari, T.C. 1997. *Malayalam*. London: Routledge.
- [2] Carter, P. 2003. Extrinsic phonetic interpretation: Spectral variation in English liquids. In Local, J., Ogden, R., Temple, R. (eds.), *Phonetic Interpretation: Papers in Laboratory Phonology VI*. Cambridge: Cambridge University Press, 237-252.
- [3] Dart, S.N., Nihalani, P. 1991. The articulation of Malayalam coronal stops and nasals. *JIPA* 29(2), 129-142.
- [4] Delattre, P., Freeman, D. 1968. A dialect study of American r's by x-ray motion picture. *Linguistics* 44, 29-68.
- [5] Heselwood, B. 2009. Rhoticity without F3: Lowpass Filtering, F1-F2 relations and the perception of rhoticity in 'NORTH-FORCE', 'START' and 'NURSE' words. *Leeds Working Papers in Linguistics and Phonetics* 14, 49-64.
- [6] Krishnamurti, Bh. 2003. *The Dravidian Languages*. Cambridge: Cambridge University Press.
- [7] Kumari, S.B. 1972. *Malayalam Phonetic Reader*. Mysore: Central Institute of Indian Languages.
- [8] Local, J. 1995 Making sense of dynamic, non-segmental phonetics. *Proc 13th ICPhS Stockholm*, 3, 2-9.
- [9] Local, J., Simpson, A. 1999. Phonetic implementation of geminates in Malayalam nouns. *Proc 14th ICPhS San Francisco*, 1059-1062.
- [10] McDonough, J., Johnson, K. 1997. Tamil liquids: An investigation into the basis of the contrast among five liquids in a dialect of Tamil, *JIPA* 27, 1-26.
- [11] Narayanan, S., Byrd, D., Kaun, A. 1999. Geometry, kinematics, and acoustics of Tamil liquid consonants. *J. Acoust. Soc. Am.* 106(4), 1993-2007.
- [12] Zvelebil, K. 1970. *Comparative Dravidian Phonology*. The Hague: Mouton.

ⁱ Throughout the paper, 'clear' and 'dark' refer to secondary articulation involving palatalisation and velarisation respectively.