An Acoustic Analysis of Tamil Liquids

Nishant Suria

24 March 2023

1 Introduction and Background

Tamil is a Dravidian Language spoken natively by approximately 78 million people, largely concentrated in South India, but also spread across South Asia, with diaspora communities all over the world. Standard Tamil features five distinct liquid sounds. (McDonough & Johnson, 1997)

(1)

Tamil	ல்	ள்	ழ்	ற்	ர்
IPA	l	ɭ	ɻ	r	ɾ
Romanization	l	ll	zh	rr	r

Tamil is used in spoken and written communication, and features a level of diglossia between spoken Tamil which tends to vary by region and socioeconomic factors, and a formal or 'literary' variety that tends to uphold standards set in the 13th century by Tamil grammarian Pavanandi (Keane, 2004). As this relates to liquids, the following differences between spoken Tamil and literary Tamil have been described:

a. Distinction between /r/ and /ɾ/ has been lost entirely in most dialects outside of Kanyakumari, allowing these to be pronounced in free variation, most commonly as [ɾ].

b. /ɻ/ and /l/ are largely merged in many dialects in and around the city of Chennai[1], merging them to [l]. This merge in particular may be conscious to speakers, as [ɻ] is often regarded as a distinctively Tamil sound, and affords a level of prestige among speakers. It is often taught prescriptively in schools.

2 Purpose

The purpose of this analysis is to examine /ɻ/ in the Tamil language, specifically in contrast with the other four liquids, and attempt to find the auditory clues that are used to distinguish /ɻ/, specifically focusing on formants.

[1] Chennai is the capital and largest city of Tamil Nadu, India.

3 Methods

Due to several circumstances, the conditions of data collection were far less than ideal. However, where possible, care was taken to observe diligent elicitation practices.

Target words containing each Tamil liquid were elicited from the speakers using naturalistic carry sentences, in random order. Additionally, three words with no testing significance were also added.

(2)

Tamil	IPA	Gloss	Target
வலி	ʋəli	'pain'	l
விலை	ʋiləi	'price'	l
புலி	puli	'tiger'	l
களி	kəɭi	'porridge'	ɭ
வெள்ளை	ʋeɭːəi	'white'	ɭ
புளி	puɭi	'tamarind'	ɭ
கறி	kəri	'curry'	r
புறா	pura	'dove'	r
கரி	kəɾi	'charcoal'	ɾ
வழி	ʋəɻi	'way'	ɻ
பழி	pəɻi	'blame'	ɻ
பழம்	pəɻəm	'fruit'	ɻ
விழா	ʋiɻa	'ceremony'	ɻ
கடி	kədi	'bite'	-
பக்கம்	pəkːəm	'page'	-
கத்தி	kətːi	'knife'	-

Speakers were asked to read carry sentences containing each word. Instructions were to speak naturally and loudly, and speakers were not informed what particular sounds were being studied. However, is because native Tamil orthography features written distinction between the five liquids, it is natural for some speakers to be coaxed into speaking with distinctions they may not ordinarily make. Data was elicited from seven speakers:

(3)

Speaker ID	DP	EB	KM	PP	PS	RM	VD
Chennai Tamil Native	-	+	+	+	+	-	+
Tamil Medium Education	+	+	+	-	-	-	+

As noted before, Chennai Tamil speakers will often merge /ɻ/ and /ɭ/, and those educated in Tamil will often fortify this distinction due to prescriptive schooling. Speakers were asked to self-record, and thus recording quality was not uniform between speakers.

Praat was used to analyze each liquid articulation, measuring formants 1 to 4. Due to recording quality, the formants were occasionally not clear, wildly variable, or incomplete. For this reason, data was elected to be measured from a representative moment of the articulation rather than averaging over

the bounds, which would be a superior method under laboratory conditions.

4 Results

4.1 Researcher Observations

By ear, the distinction between [+lateral] and [-lateral] approximants can be quite salient. Both the researcher (a native English speaker) and a correspondent[2] (a native Tamil speaker, and not one of the speakers used in the analysis) evaluated some speakers to have audible /ɻ/-/l/ distinctions in the recording, whom are noted here.

(4)

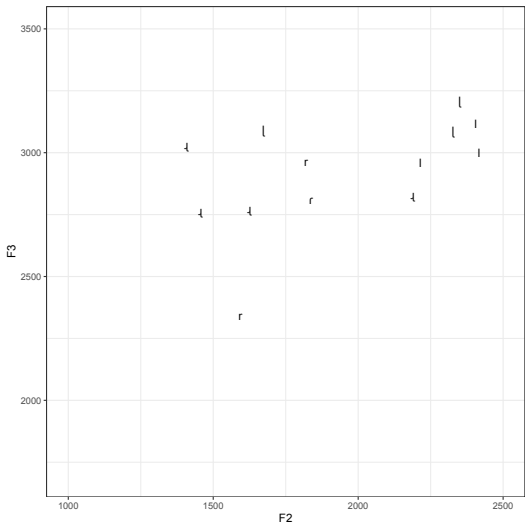
Speaker ID	DP	EB	KM	PP	PS	RM	VD
Salient /ɻ/-/l/ Distinction	+	+	-	-	+	-	+

It was also observed during the debrief phase that no speaker consistently produced /ɻ/ as distinctly [-lateral] in casual speech (Speakers were debriefed in Tamil by the correspondent).

4.2 Preliminary Formant Analysis

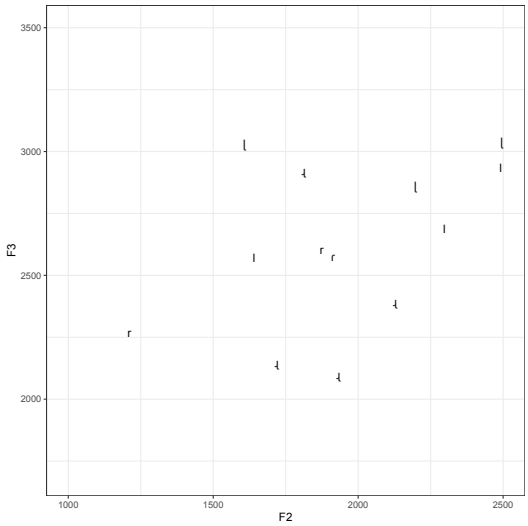
The strongest distinctions were found using F2 and F3, and thus analysis will start with those formants. F4 readings were often highly variable and indistinct, due to test conditions, so they will not be considered. For each Speaker, F2 and F3 are plotted against each other.

(5) F2 and F3 of liquids in Speaker DP (Hz)

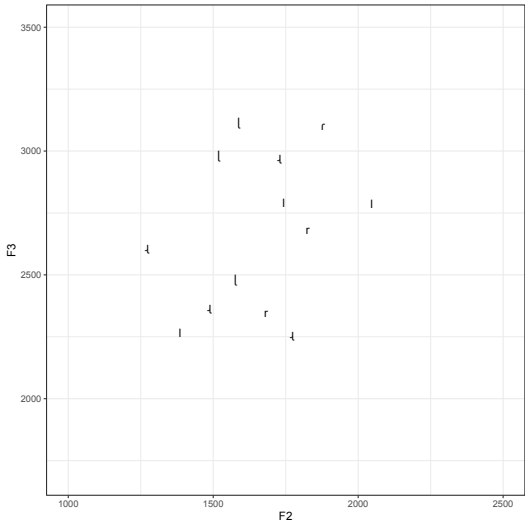


[2]My dad.

(6) F2 and F3 of liquids in Speaker EB (Hz)[3]

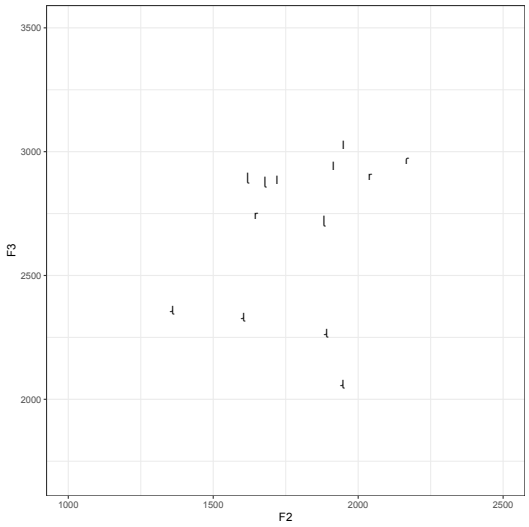


(7) F2 and F3 of liquids in Speaker KM (Hz)

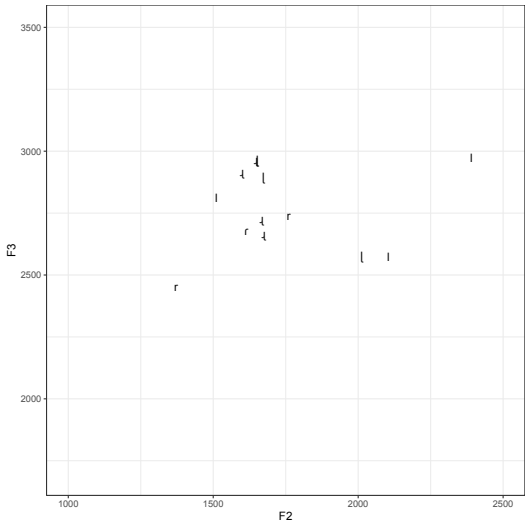


(8) F2 and F3 of liquids in Speaker PP (Hz)

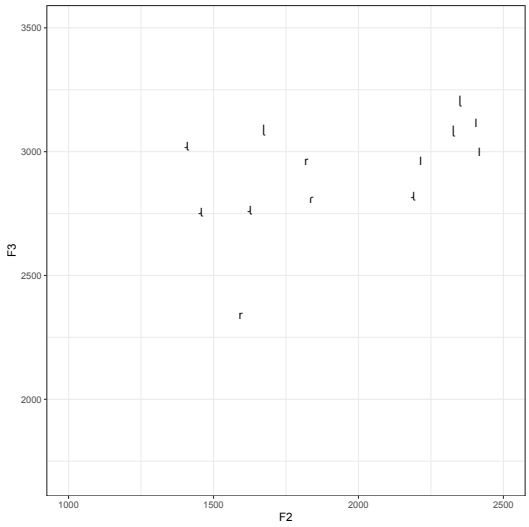
[3]Speaker EB pronounced one /ɬ/ containing word with a perceived [+lateral] sound, and all others with a clear [-lateral] sound



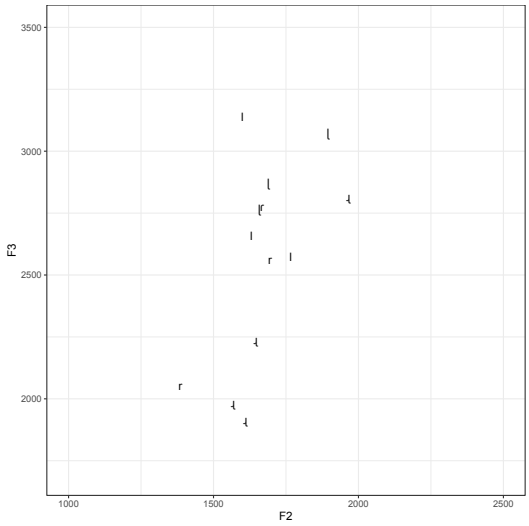
(9) F2 and F3 of liquids in Speaker PS (Hz)



(10) F2 and F3 of liquids in Speaker RM (Hz)



(11) F2 and F3 of liquids in Speaker VD (Hz)



Concentrating on data collected from speakers with observed audible distinctions first, it seems that there is a correlation between F3 and rhoticity of the liquid. In Speaker DP, for example, somewhere around 3000 Hz, a difference in F3 determines the boundary between a [+lateral] and a [-lateral] liquid. However, this distinction also seems to be somewhat two-dimensional, where the dividing line of F3 seems to lower as F2 increases, something seen in Speakers EB and VD. Speaker PP seems to have a different pattern, but a similar 'cloud' of [+lateral] and [-lateral] liquids can be drawn in 2D space.

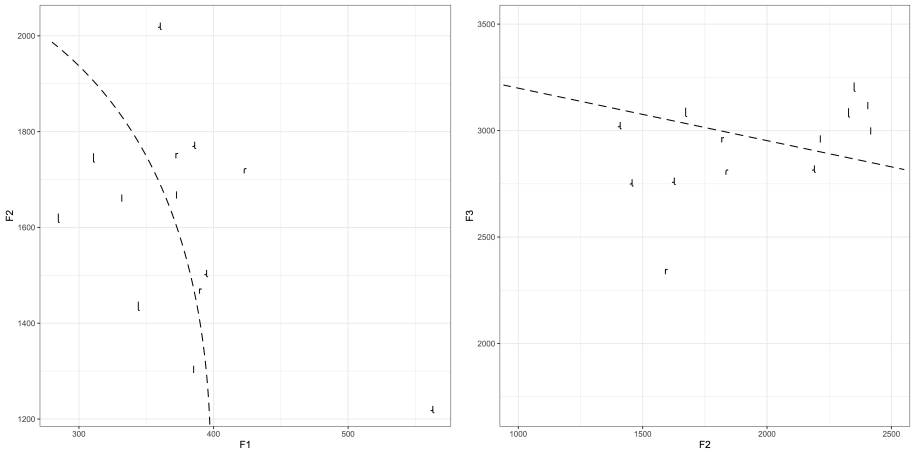
An interesting observation with Speaker RM is that the data also seems to suggest a patterning of /ɻ/ with the [-lateral] sounds, with a lower F3, despite

the fact that this wasn't an audible distinction to the researchers

4.3 F1 vs. F2 vs. F3

In order to get a fuller picture for how /ɻ/ is distinguished from [+lateral], F1 is also examined here. For this analysis, Speaker DP is shown as the exemplar.

(12) Formant Comparison in Speaker DP (Hz)



For both graphs, an approximate 'boundary line' can be drawn between [-lateral] and [+lateral] liquids.

From the data shown, it seems that lower F1 as well as lower F3 can be said to be correlated with rhotic sounds. In both cases, however, this distinction is dependant on F2. It stands to reason then, that the Tamil liquids are distinguished not only by one particular formant but rather their relationship to one another.

5 Conclusion

Ultimately, the conclusion of this analysis is largely unclear. However, the following can be gleaned.

a. The formant values of [+lateral] liquids and [-lateral] liquids tend to pattern together, respectively, despite a difference of manner of articulation.

b. Unlike with English /ɹ/, which tends to show a clear drop in F3 when compared to English /l/, distinguishing Tamil /ɻ/ seems to involve at least F3 and F2, if not F1 as well.

It may be possible to argue that Tamil speakers use F2 with the difference F3-F2 to decide what they are hearing, but more data would be needed to support

this. With better recording apparatus and test conditions, it is probable that the data would have higher fidelity and show a stronger correlation.

Additional study will also be necessary to determine the formant values of /ɻ/ in casual speech, given the observation that none of the speakers actually had a salient /ɻ/-sounding during casual speech. It is to be seen whether these speakers truly merge the liquids, as with Speaker PS, or if they still have some observable formant distinction, as with Speaker RM. Furthermore, it would be important in such an analysis to attempt to locate speakers who produce this distinction in all speech.

6 References

1. Keane, E. (2004). Tamil. Journal of the International Phonetic Association, 34(1), 111-116. doi:10.1017/S0025100304001549

2. McDonough, J., & Johnson, K. (1997). Tamil liquids: An investigation into the basis of the contrast among five liquids in a dialect of Tamil. Journal of the International Phonetic Association, 27(1-2), 1-26. doi:10.1017/S0025100300005387