Phonetic Reduction Effects in Malayalam

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Abstract

The current study examines how lenition processes are affected by speech rate in Malayalam. Two native Malayalam speakers were asked to read the North Wind and Sun passage at three different speech rates, and singleton, intervocalic consonants were analyzed to see how the rate of speech impacted the surface forms observed. Additionally, the study looked at instances where the use of the enunciative vowel was optional, and how the choice to use it could be described by a function of speech rate. Speech rate was shown not to impact when and how consonant lenition occurred, but speech rate did influence the presence of the enunciative vowel, which was present more frequently in slower speech. Consonant lenition may be weakly influenced by a syllable's location in the word, depending on the place of articulation. The presence of the enunciative vowel, in addition to being influenced by speech rate, may also be tied to intonational boundaries, which shift as speech rate increases.

1 Malayalam

Malayalam is a Dravidian language spoken in the state of Kerala in Southwest India and is spoken by 35 million individuals around the world (Ethnologue, 2019). Malayalam has extensive morphology and complex phoneme inventory that have the topic of study for many, but little attention has been placed on the phonetic reality of Malayalam. The current study aims to examine how phonetic reduction influences continuous speech at three different speech rates.

2 Lenition

Phonetic reduction is commonly referred to in the literature as lenition, defined as either a decrease in resistance to airflow or a decrease in effort needed to produce an articulation (Bauer, 2008). There is a large amount of overlap betweeen these two concepts. For example, building and holding pressure in the mouth (say for a plosive stop) requires more articulatory effort than producing a vowel, which does not require the same level of pressure. The tongue gesture for vowels doesn't make sustained contact with the periphery of the mouth in the same way a plosive stop does, and as such, vowels may be considered to require less articulatory effort than plosive stops.

Figure 1 demonstrates a general heirarchy of lenition in consonants, with sounds at the top being considered most likely to become phonetically reduced, while those at the bottom are considered the most extreme forms of reduction. Geminate consonants are more likely to appear as singleton consonants if reduced, while singleton consonants are more likely to become fricatives, approximants, or glottal stops. Lenition generally occurs word-medially or word-finally, where perception is weaker (Bauer, 2008).

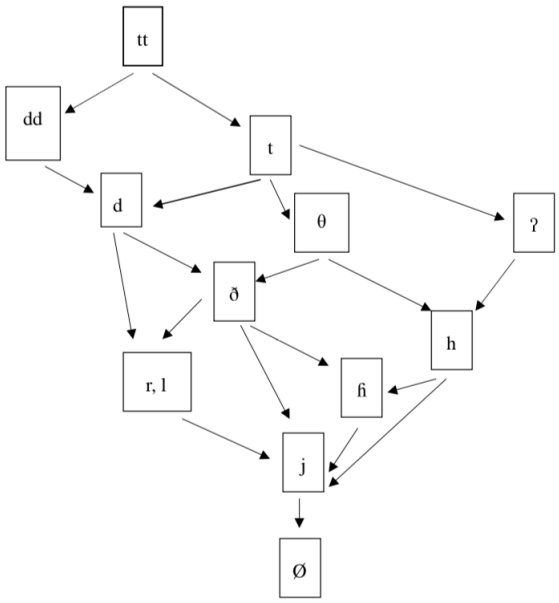

Figure 1: Bauer's (2008) figure showing the directionality of lenition processes.

3 Variable

This study examimes potential lenition occurrance in singleton, intervocalic consonants and the enunciative vowel in Malayalam.

General examples of consonant lenition include voicing of stops in intervocalic positions, reducing stops to fricatives or approximants intervocalically, debuccalization of stops word-finally, and deletion of segments. Malayalam lacks a clear voicing contrast in native words, and all stops are voiced intervocalically (Namboodiripad & Garellek, 2016). This may or may not be seen as a form of lenition, as many consonants are not fortified (in this case, devoiced) in scenarios where one might expect, such as in careful or slowed speech. While orthography has preserved intervocalic voiceless consonants, these consonants might be best described as underlyingly voiced. The current paper seeks only to observe the forms observed without commenting on whether the voiced or voiceless stops are underlying.

Asher & Kumari (1997) noted that /k/ can sometimes appear as [ɣ̞], [h], or [ɦ] on the surface, meaning the consonant becomes spirantized, or more fricative-like. This is also an instance where a consonant can be lenited by moving to the glottis, a process called *debuccalization*. As noted above, debuccalization of stops word-finally is a commonly observed form of lenition. The allophones of /k/ described by Asher & Kumari (1997) are not word-final, as Malayalam lacks word-final obstruents, but there are plenty of examples of word-final debuccalization in English. For the word *cat* /kæt/, for example, the word final /t/ is frequently pronounced as a glottal stop [ʔ], instead of [t] or [tʰ]. Malayalam,

on the other hand, protects obstruents from occurring at the end of the word through the use of an enunciative vowel, described in further detail in following sections.

Other potential examples of lenition in the Malayalam literature include Namboodiripad & Garellek's (2016) observation that voiced stops can become voiceless in casual speech. With respect to velar stops, devoicing may be a sign of lenition given that voiced velar stops [g] are more difficult, and less commonly found among the world's languages than voiced alveolar or voiced labial stops. On the other hand, devoicing for other places of articulation may indicate fortification, since it takes more articulatory effort to stop voicing during the voiceless stop, then start voicing again to produce the next sonorant. The current study did not examine voiced aspirated consonants for potential effects of lenition, as the passage used contained very few examples. However, this is an area for further research.

The second part of the current study examined the presence of the enunciative vowel in optional contexts. The enunciative vowel in Malayalam is non-phonemic and is used word-medially or word-finally (Namboodiripad & Garellek, 2016). Primarily, it protects word-final obstruents from occurring next to word-initial obstruents in a C#C environment, forming a Cə#C pattern instead. The literature commonly refers to the presence of this enunciative vowel as "Schwa Insertion" or "Enunciative Vowel Insertion," (Mohanan, 1986; Valentine, 1976; Asher & Kumari, 1997). It is not clear whether this vowel is being inserted or deleted, as its presence is mostly dependent on the phonological environment. While the enunciative vowel is required word-finally between consonants, the enunciative vowel becomes optional word-finally in a Cə#V environment. That is, [poḏapːə onːum] and [poḏapː onːum] are both grammatical.

This variability may be due to lenition processes that cause short, unstressed vowels to be deleted in Malayalam, which occurs more frequently in more casual and faster speech (Asher & Kumari, 1997). It is unclear if the enunciative vowel, which is non-phonemic, is covered by Asher & Kumari's (1997) observations, but there may be some overlap between their findings and a rule Valentine (1976) proposed, which stated that the enunciative vowel was required before a pause in speech. If faster speech contains fewer pauses, then fewer enunciative vowels will occur as a result. The current study focuses on word-medial consonant lenition and enunciative vowel deletion, and how either of these may be affected by changes in speech rate.

4 Methods

Two native Malayalam speakers were asked to read the North Wind and Sun story (from Namboodiripad & Garellek 2016) at three uncontrolled, subjective speeds: slow enough for a non-speaker to able to parse the words from the flow of speech, a medium speed, and as quickly as possible. Another recording of the story, from (Namboodiripad & Garellek, 2016), was read at an unspecified pace and the data was analyzed as read at a medium pace. While the two speakers who read at all three rates were not primed with a metronome or given explicit instructions as to what "fast" or "slow" speech meant, the two speakers

were consistent in their pacing. Table 4 below demonstrates how quickly the speaker finished each reading when pauses between phrases or sentences were removed.

	Slow	Medium	Fast
Speaker One	45 s	35 s	27 s
Speaker Two	46 s	36 s	28 s
Average	45.5 s	35.5. s	27.5 s

Table 1: Speech Rates by Speaker

Intervocalic stop reduction and enunciative vowel deletion were analyzed for rate of occurance. Consonants were coded visually according to a set of rules. Stops are largely defined by preceding silence and considered voiceless if no voicebar preceded the burst. Taps were defined by single burst and no preceding silence. Fricatives required noise in upper formants, and approximants had to cause formant changes between vowels.[1] If none of these occurred and the consonant is not heard, the consonant was considered deleted and ambiguous tokens were not considered.

I hypothesized that consonants would show more reduced forms as speech rate increased, and that some consonants would show more signs of reduction than others, based on the place of articulation. I also hypothesized that as the speech rate increased, the enunciative vowel would be used less frequently in optional contexts.

5 Results and Discussion

5.1 Consonants

Speed was determined to have no effect on consonant lenition, as there were no obvious differences in the rates of occurrance between allophones.

My hypothesis that place of articulation would impact which forms of lenition were observed was not fully supported, as there were very few instances of intervocalic labial and velar stops. However, in comparing the dental and retroflex stops, there was a greater variety of reduced surface forms used for the dental stops, whereas the retroflex stops only appeared as voiced stops [d̻] or taps [ɾ̻]. Figure 2 visualizes the relationship between place of articulation and type of phonetic variant.

However, Figure 2 assumes that all consonants are equal within a word. That is, consonants are no more likely to be lenited in the first syllable than the last. Again, there was limited data for labial and velar consonants, but Table 5.1 below outlines variants observed in different types of syllables, if CV is assumed.

[1] Approximants have been labeled lowered fricatives (for example, [ɣ̞]) so as not to confused lenited consonants with phonemic approximants.

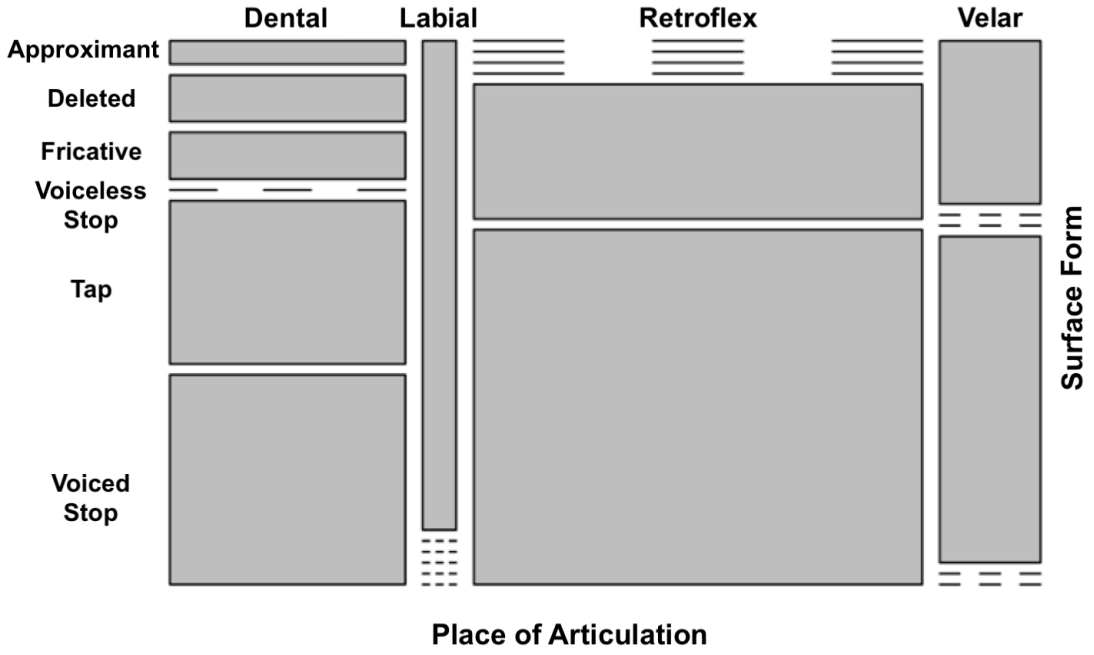

Figure 2: Place of Articulation Effect on Surface Form

Note that there are no instances of labial or velar stops in the second syllable in the North Wind and Sun story, leaving a gap in the data. The third syllable contains the widest variety of allophones, but the manner of these allophones depend on the place of articulation. For labials, only the lowered fricative [β̞] is observed, but dentals show the greatest range of possible allophones, including the dental tap [ɾ̪], the fricative [ð], the lowered fricative [ð̞]. The dental stops were also the only type of segement to be deleted in the third syllable. Retroflex stops showed little variation between the second and third syllables, and the velar stops were either voiceless in the third syllable [k], or lenited to the lowered velar fricative [ɣ̞]. The voiced velar stop [g] is missing from the data, and it is unclear whether [g] would appear with more data, or if [g] is simply not a possible lenited

First Syllable	Second Syllable	Third Syllable
p		β̞
t̪	d̪ / ɾ̪	ɾ̪ / ð / ð̞ / NULL
ʈ	ɖ / ɽ	ɖ / ɽ
k		k / ɣ̞

Table 2: Stop Allophones by Syllable Number

form of [k].

5.2 Enunciative Vowel

The enunciative vowel [ə] is deleted most frequently in "fast" speech and deleted least frequently in "slow" speech. Figure 3 demonstrates that [ə] is deleted more frequently as speed increases, or perhaps inserted more frequently as speed decreases. In these optional contexts, the use of the enunciative vowel isn't required by phonological rule, and so the speech rate plays a part in determining whether this vowel is used or not.

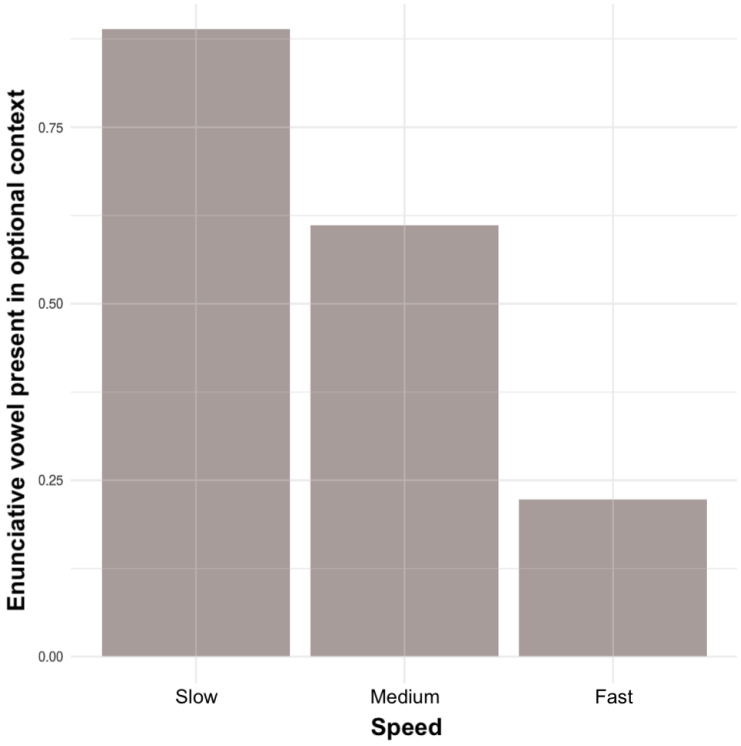

Figure 3: Effect of speed on enunciative vowel presence

It is possible that reduction occurs to the extent allowable by contrast in fast speech, and [ə] is non-contrastive, and so is not necessary for comprehending fast speech. It is also possible that slow speech contains more pauses, confirming Valentine's (1976) hypothesis that the enunciative vowel is always present at the end of a word when a pause follows. Speaker One had 23 pauses when speaking at the slowest rate, 18 when speaking at a normal pace, and 8 when speaking as quickly as possible.

Per Valentine's 1976 rule, as the number of pauses decreases, so does the use of the enunciative vowel. However, this rule may not capture the full picture of what is happening in these instances. In Figures 4, 5, and 6 below, there is always an enunciative vowel after the word /poḏapː/ [poḏapːə] 'cloak.' Figure 4 demonstrates "slow" speech,

Figure 5 “medium” speech, and Figure 6 “fast” speech. Comparing Figure 6 to the others, there are fewer pauses during the “fast” speech, given that there are no stretches of silence within the selected portion. Figure 4, on the other hand, shows two pauses, one after /poḏapː/ [poḏapːə] ‘cloak,’ and one after /maːtːaːmpatːa/ ‘to be able to change.’ As all three instances of /poḏapː/ contain the enunciative vowel, but as there is no following pause at the fastest speech rate, Valentine’s 1976 theory may be incomplete.[2]

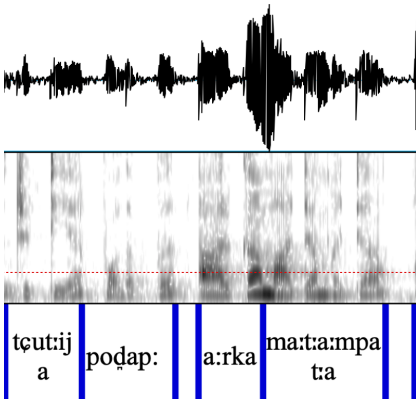

Figure 4: “Whichever one of us can remove that cloak wrapped…” read at the slowest speed.

Figure 7 shows the pitch contour of the same phrase at the fastest pace. There is a rise in pitch at the end of /poḏapː/, and a fall in pitch at the beginning of /aːrka/ ‘who.’ This pattern is common to other South Asian languages such as Tamil (Keane, 2006, 2014) or Bengali (Khan, 2014), where a rise in pitch marks the end of a prosodic unit, or phrase. There are also glottal striations at the end of /poḏapː/, another common indicator of a phrase boundary. It is possible, then, that the presence of the enunciative vowel in an optional context is another way speakers signal the end of a phrase. In this case, Valentine’s (1976) rule may be incomplete, as intonational boundaries are often, but not necessarily, accompanied by pauses. As Figure 6 demonstrates, the pause may be ommitted, but other signals that indicate a phrase boundary are present, and the enunciative vowel may be one such signal.

6 Conclusion

For consonants, speech rate had little to no effect on how and when lenition occurred. Across all three speeds, the most variation in the types of forms observed occurred in dental stops, where the syllable may have loosely predicted the manner of the allophone observed. The retroflex stops showed only two surface forms that did not vary based on

[2]Translations for Figures 4, 5, 6, and 7 were taken from Namboodiripad & Garellek (2016). The translation may not accurately reflect the section of speech demonstrated in the spectrogram, as the section selected is found within the middle of a sentence.

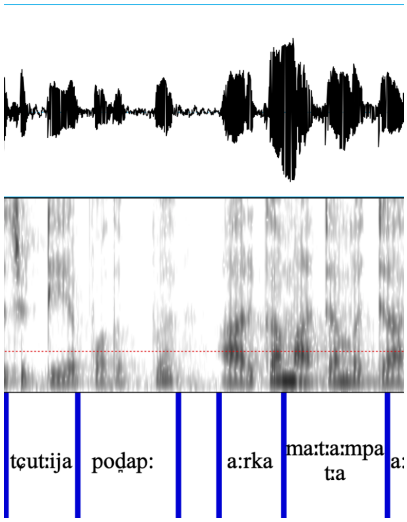

Figure 5: "Whichever one of us can remove that cloak wrapped…" read at a medium speed.

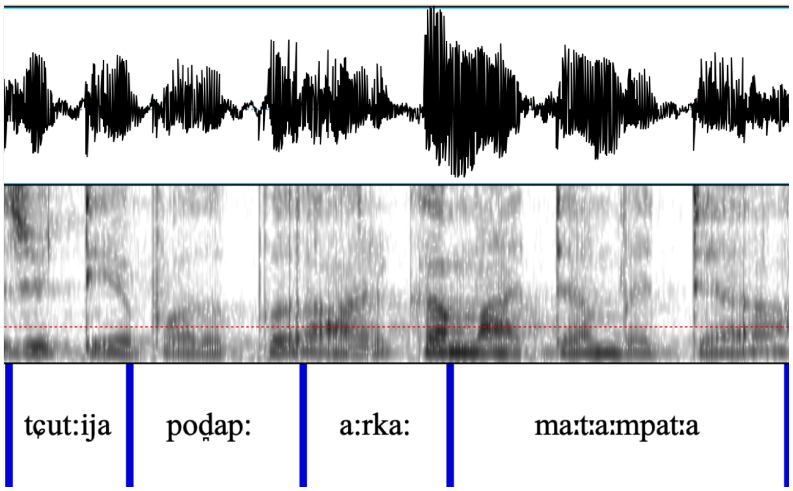

Figure 6: "Whichever one of us can remove that wrapped…" read at the fastest speed.

where the stop was located in the word. The least variation was observed in the labial and velar stops, though this is also likely because there were few examples of these stops intervocalically in the passage selected. More data will need to be collected to determine how the number of syllables may determine where in the word certain allophones are found, as lenition often increases as the distance from the stressed syllable increases Keating (2006).

Mohanan (1986) proposed a rule that stress is always found on the first syllable except in the event that the first syllable contains a short vowel while the second vowel contains a long vowel. Some descriptions of the intonational phonology of Tamil and Malayalam

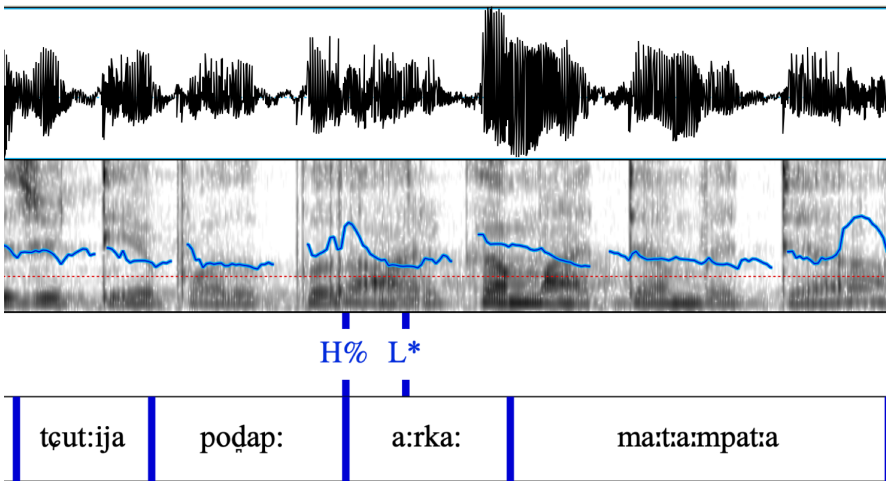

Figure 7: "Whichever one of us can remove that cloak wrapped..." read at the fastest speed with pitch tracking demonstrating intonational boundaries.

have different findings Keane (2006, 2014), as stress is usually marked by an intonational landmark such as a drop or peak in pitch. In Tamil (Keane, 2006, 2014), this low landmark is consistently found on the first syllable of a word. I also observed similar effects in the Malayalam data studied here, though a more formal analysis will have to be conducted to make any claims about this phenomenon.

Intonational phonology may also help explain why the enunciative vowel was not always deleted in optional contexts, even when speaking very quickly. If the final word in a very large prosodic phrase ends in an obstruent, the enunciative vowel may help to mark that final boundary, even if the following word begins with a vowel. As such, adjustments to rules that determine when and where the enunciative vowel arises may have to take prosody into account, though it is unclear to what extent. That is, how large does the prosodic unit have to be to warrant the presence of the enunciative vowel to help indicate a boundary?

By manipulating prosody through speech rate, the evidence presented here supports the idea that the presence of the enunciative vowel may one of several cues for an intonational break. The evidence also supports the idea that the type of lenition observed is also tied to prosody through a consonant's location within a word, not by speech rate. However, more data is necessary to make any substantial claims about the variety of lenited consonants in Malayalam, and how intonational phonology is correlated to the presence of the enunciative vowel.

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