

Three or tree? Dental fricatives in the speech of educated Singaporeans

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Introduction

It is commonly agreed by researchers that one of the most distinctive features of Singapore English (SgE) pronunciation is the avoidance of the dental fricatives /θ/ and /ð/. Sometimes these are replaced by the corresponding alveolar plosives /t/ and /d/ (Tongue 1979:27, Platt & Weber 1980:52, Deterding & Hvitfeldt 1994) or maybe by dental plosives (Brown 1991:121), and sometimes, in final position, by a labiodental fricative, /f/ or /v/ (Bao 1998:154, Deterding & Poedjosoedarmo 1998:157). All of these studies depend on the phonetic experience and impressionistic judgements of the researchers.

One investigation that has attempted numerical analysis of the use of dental fricatives in SgE is that of Tan (1989), who found that Singaporeans replace voiceless dental fricatives with plosives in 35.19% of instances during formal speech and 80.00% of the time during informal speech.

The current paper, the data for which are derived from Moorthy (1997), seeks to combine detailed auditory and spectrographic analysis of a set of data to investigate further the degree to which Singaporean speakers do indeed replace their dental fricatives with alveolar plosives.

Replacement of dental fricatives

Replacement of dental fricatives is quite common in different varieties of English. In Irish English, for example, dental plosives are often used where dental fricatives would be found in BrE, while in some varieties of Irish English, the distinction between dental fricatives and alveolar plosives is not maintained, with dental plosives used throughout (Trudgill & Hannah 1982:93), and in other varieties, particularly urban areas such as Cork and Dublin, the use of alveolar plosives throughout is common (Wells 1982:428).

In varieties of English as a second language, speakers whose first language has no dental fricatives may use different replacement strategies, and these strategies are not necessarily predictable from a contrastive analysis consideration of the first language. For example, speakers of English in Taiwan tend to use /s/ and /l/, while those from Singapore are more likely to use /t/ and /d/, even though Hokkien is the most common substratum language in both places (Peust 1996).

Speakers

For the present study, a total of eight students were recorded, five female and three male, from a range of ethnic groups. All were undergraduate university students at NIE. A summary of the students is shown in Table 1.

	Female	Male
Chinese	2	2
Malay	1	1
Indian	1	0
Eurasian	1	0
Total	5	3

Table 1. Summary of the ethnic group and gender of the subjects

The purpose of including students from different ethnic groups was to attempt to reflect the ethnic make-up of Singapore. No attempt will be made to differentiate the behaviour of the different ethnic groups in the present study, as conclusions based on a single student would not be reliable.

All the speakers could be regarded as reasonably well-educated, with a high proficiency of English that nevertheless in all cases retained a distinctive Singaporean accent even in the most formal situations, and their proficiency in English should enable these speakers to have access to a wide range of styles in speaking English (Pakir 1995, Deterding & Poedjosoedarmo 1998: 151).

Recording conditions

The speakers were recorded in the NIE Phonetics Laboratory having two separate conversations, one with the first author of this paper, a Singaporean fellow student who knew all of the students reasonably well, and the other with the second author, a British university lecturer who had taught some of the students but who did not know any of them closely.

In the first conversation, attempts were made to talk about things the subjects were passionate about, to encourage them to use a fairly informal style of speech (Labov 1972:93). Some of the students found the situation somewhat unnatural, especially the microphone placed in front of them and the unfamiliar setting of the Phonetics Laboratory. To overcome this, the conversation continued for some time, and all the students did relax after a while.

In the second conversation, the topic was mostly about the courses the students were taking at university and how they were coping. As this was with a member of the university lecturing staff, the conversation was more formal.

The data therefore consist of two styles of speech: one informal, and the other rather more formal. One purpose of this paper is to consider how the use of dental fricatives varies between these two different styles of speech.

Data for analysis

It was decided only to analyse potential instances of the voiceless dental fricative /θ/. The voiced counterpart /ð/ was excluded from the analysis because it most often occurs at the start of function words such as *the* and *that* which, as they are generally unstressed, are usually spoken quickly, which means that it is extremely difficult to determine the exact nature of the initial sound. In fact, even in BrE, /ð/ often has so little of the noise characteristic of a fricative that it is questionable whether it should really be classified as a fricative (Roach 1991:54).

A total of 550 instances of potential use of /θ/ were identified, 334 from the informal context, and 216 from the formal context, and the phrases containing these words were extracted from the tape and input to the computer for analysis using CSL software from Kay. All of these words were ones where Singaporean speakers might use /t/ instead of /θ/, so instances of words such as *both* (where a syllable-final labiodental fricative often occurs) were avoided. These data were then analysed both acoustically and auditorily.

Acoustic analysis

An aspirated plosive is characterised by a period of silence that is likely to be between 50 and 100 ms in duration (Kent & Read 1992:106) followed by a burst of aspiration that, for /t/ (in BrE), is likely to have a duration of 40 to 80 ms (Docherty 1992:25). The aspiration for the alveolar plosive /t/ is generally at a high frequency (Ladefoged 1993:201), with most of the energy above 3000 Hz.

A nonstrident fricative such as /θ/ tends to have little overall energy, and the energy it does have is generally diffuse across the spectrum (Kent & Read 1992:127).

An ideal spectrogram illustrating the acoustic difference between /t/ and /θ/ is shown in Figure 1. In this utterance, a British male speaker is saying 'The tins are thin.' In this utterance, the plosive /t/ is characterised by silence of about 98 ms followed by aspiration of about 74 ms. (Both of these values are at the higher end of the ranges indicated above, perhaps because of the deliberate style of this recording.) The aspiration is characterised by a sharp, high-frequency onset (indicated by the arrow). In contrast, the dental fricative /θ/ is characterised by relatively non-intense, diffuse energy lasting for about 188 ms.

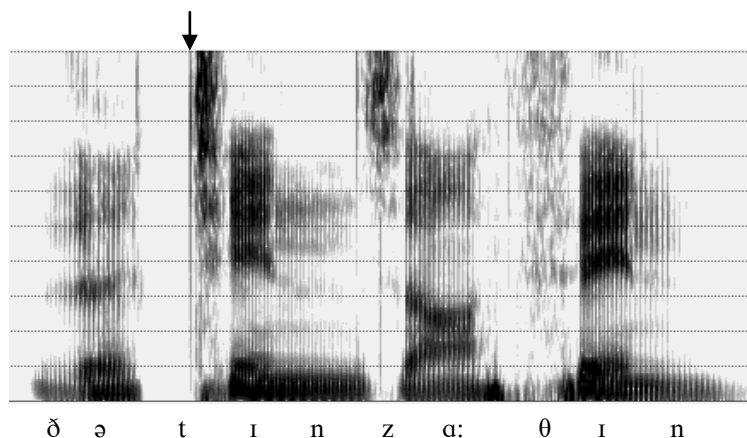


Figure 1. A spectrogram of a careful, deliberate reading of ‘The tins are thin’ by a male British speaker. The sharp onset of the aspiration for /t/ is indicated by the arrow.

The sentence for the spectrogram in Figure 1 was read directly into the computer, and this represents an ideal condition for three reasons: First, the direct input ensures the highest quality of recording, which cannot be matched with the data recorded on to audio tapes and then transferred on to a computer. Second, in this case, both the /t/ and /θ/ were preceded and followed by a vowel. If they had been preceded by another consonant or followed by an approximant, many of the features that serve to distinguish them would be less distinct. Third, the sentence shown above was spoken carefully and deliberately, to emphasise and contrast the acoustic nature of the two sounds. Conversational data are not generally characterised by such careful, deliberate enunciation.

In real, conversational data, /t/ and /θ/ are often difficult to separate. /θ/ may have the lowest relative intensity of all the sounds of English (Fry 1979:127), so it is not surprising that this sound is rather hard to identify reliably from spectrograms, as it is particularly difficult to determine whether a stretch of low intensity energy represents the background noise during the closure of a plosive such as /t/ or the weak energy of a /θ/.

For these data, the most salient acoustic cue for the presence of an alveolar plosive was found to be the presence of a high-frequency peak in energy after the release of the plosive (at the beginning of the aspiration). The data were therefore high-pass filtered to eliminate all energy below 3000 Hz, the energy

was summed over a window of 5 ms, and the magnitude of any peak in summed energy at the release of the plosive was measured.

Even this acoustic cue, the magnitude of a high-frequency energy spike, was found to be far from reliable in identifying the existence of a plosive. However, it was found to be useful in supplementing the purely auditory judgements in the analysis of spectrograms.

Auditory judgements

It is often the case that sounds which cannot easily be differentiated acoustically may also not be clearly distinct auditorily, and the problems with the attempted acoustic analysis discussed above suggest that clear auditory categorisation of a sound as a fricative or as a plosive may not always be easy.

In order to investigate this further, phrases that included 35 potential instances of /θ/ were extracted and presented to four phoneticians, all expatriate lecturers in linguistics at NIE. In each case, the phoneticians listened to the phrase three times and were asked to judge whether the sound was a plosive, a fricative, or neither. In these 35 cases, all four phoneticians agreed in only 16 cases. Even more surprisingly, in four of the cases where the phoneticians agreed unanimously that a phrase contained a dental fricative, the first author of this paper (a Singaporean) was convinced there was a plosive. And finally, when both authors of this paper took the test twice, we both were inconsistent in our own judgements. These findings indicate that in many instances a sound may be indeterminate between a fricative and a plosive, that it is very hard to be sure exactly what sound has occurred, and that Singaporean listeners may be sensitive to different cues than expatriate (American and British) listeners.

To test whether Singaporean listeners might be sensitive to different cues from expatriates, the four phrases where the expatriate phoneticians all heard a fricative while the Singaporean researcher heard a plosive were presented to a group of nine Singaporean students, all of whom were currently enrolled on a course in experimental phonetics and had studied phonetics before. The results of this test are shown in Table 2.

Phrase no.	Plosive	Fricative	Others	Don't know
1	4	4	0	1
2	0	6	3	0
3	1	7	0	1
4	7	1	0	1

Table 2. Judgements of nine Singaporean listeners on the identity of a potential dental fricative

These results confirm that the identity of many instances of potential /θ/ sounds is hard to determine, and that, if Singaporeans do use different cues than expatriates, their judgements are still variable.

In all the following results, the first author of this paper relied on her own judgements, on the basis of repeated listening using the playback facility of the computer software, together with examination of spectrograms with overlaid high-pass-filtered energy plots to indicate the existence of a high-energy spike. It should be remembered that all of these judgements can be regarded as subjective, and another researcher would certainly have made other decisions in some cases.

Results and discussion

The overall results of the use of dental fricatives for formal and informal situations are shown in Table 3. The instances where the perceived sound was either something other than /θ/ or /t/ or its nature was impossible to determine are collapsed under the label 'other'.

	/θ/	/t/	Other
formal	53	27	20
informal	40	49	11

Table 3. Percentage of dental fricatives and alveolar/dental plosives in formal and informal situations

These results clearly show that Singaporean speakers tend to use more dental fricatives in formal situations, but that this is just a tendency not an absolute situation. All the speakers used dental fricatives at times and plosives at others, but the percentage of the more prestigious form (the fricative) was greater for the formal situation.

The degree to which speakers used more dental fricatives in the formal situation varied, and there was in fact one student, a PE student, who actually used slightly fewer dental fricatives in the formal situation. It is possible that PE students feel more relaxed about the use of standard forms when speaking to their lecturers. The results for the individual speakers are listed in the Appendix.

These tendencies match those reported by Tan (1989), though given the subjectivity of many of the judgements, it seems hard to defend an accuracy level such as 35.19% that is reported there. However, the difference in the results between the formal and informal data is less extreme than that reported by Tan (1989).

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Appendix Results for individual speakers.

	Speaker	/θ/	/t/	Other
Female	F1	59	25	16
	F2	41	35	24
	F3	78	8	14
	F4	52	29	19
	F5	50	33	17
Male	M1	79	16	5
	M2	46	18	36
	M3	0	58	42

Table 4. Percentages of voiceless dental fricatives that were realised as dental fricatives, plosives, and other sounds, for individual speakers in the formal recording situation

	Speaker	/θ/	/t/	Other
Female	F1	40	45	15
	F2	29	54	17
	F3	60	21	19
	F4	33	57	10
	F5	39	54	7
Male	M1	70	23	7
	M2	6	85	9
	M3	5	78	17

Table 5. Percentages of voiceless dental fricatives that were realised as dental fricatives, plosives, and other sounds, for individual speakers in the informal recording situation

(Note: the average for each column does not tally exactly with the overall results listed in Table 3, because different numbers of tokens were selected from each speaker.)