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AN ACOUSTIC PHONETIC ACCOUNT OF THE CONFUSION BETWEEN [l] AND [n] BY SOME CHINESE¹ SPEAKERS OF ENGLISH

ETTIEN KOFFI²

ABSTRACT

Richards (2012) and Zhang (n.d.) report that some Chinese L2 speakers of English confuse /l/ and /n/. Koffi (2019:249-50) indicates that some acoustic correlates of /l/ and /n/ produced by Mandarin 6F, 8M, 9M, and 17M mask each other. Preliminary evidence suggests that this pronunciation is confined to speakers from Hubei, Sichuan, and Shanghai. The goal of this investigation is to undertake a comprehensive study involving 27 Chinese speakers and their pronunciations of [l]s in the nouns <Stella> and <slabs> and of the [n] in the verb <need>. The first part of the investigation is a confusion study. The second deals with the F2 measurements of [l] and [n]. We focus on F2 because it is the most robust correlate for discriminating between [l] and [n] (Ladefoged 2003:1455). Thirdly, Catford's (1987) Relative Functional Load (RFL) indices are used to gauge the severity of intelligibility when [l] and [n] are confused. Finally, pedagogical implications are drawn and relevant articulatory exercises are suggested to help Chinese speakers discriminate effectively between these two problematic segments.

1.0 Introduction

A quick Google search of the phrase “*confusion between l and n by Chinese speakers*” returned 32,800,000 results in a matter of .63 seconds.³ This is proof that it is an issue that has been on the mind of many people for a while. Hilarious accounts of misunderstandings abound online. YouTube has videos that purport to teach Chinese speakers how not to confuse their [l]s and [n]s. Surprisingly, little has been written about this in serious publications, except for a handful of papers scattered here and there. The goal of this paper is to look at the confusion between these two segments from an acoustic phonetic perspective. This means analyzing various correlates of these segments and explaining why the confusion occurs. Since our ultimate goal is pedagogical, we will assess the intelligibility impact that this confusion can have when speakers who confuse their [l]s and [n]s talk with the wider body of English speakers who do not confuse them or expect them to be confused.

2.0 Confusion Data

A confusion study is carried out in order to find out the rate at which [l] was confused with [n] when 27 Chinese speakers of English read the words <Stella>, <slabs>,

¹ This paper was first presented as a poster at the 10th Annual Pronunciation Second Language Learning and Teaching conference at Iowa State University in Ames, September 6-8, 2018. I appreciate the positive feedback from many attendees. One such feedback was whether or not to say “Chinese speakers” or “Mandarin speakers,” because not all Chinese confuse [n] and [l], nor do all Mandarin speakers. After much consideration, I have decided to keep “Chinese speakers” in the title of the paper because native speakers of Mandarin do not ordinarily confuse [l] and [n].

² I enthusiastically acknowledge the contribution of two former graduate students, Paige Gibbon and Liping Ma, who helped with preliminary data collection.

³ The search was performed on August 11, 2018 at 8:48 am.

and <need> that occur in the elicitation paragraph in the Speech Accent Archive (SAA). SAA is an online repository maintained by the English Department at George Mason University (GMU). As of January 29, 2019, 2,783 people have contributed audio samples to SAA.⁴ Also, 114 Chinese/Mandarin L2 speakers of English have contributed speech samples. Trained GMU linguists have provided narrow IPA transcriptions of 27 audio samples. According to the information available at the website, 2 to 4 linguists work together to prepare each transcription. The 99-word elicitation text contains nine [l]s in word-initial positions, four words with [l]s in the coda, and one word in which [l] occurs between vowels. As for [n], it is found in 13 syllable onsets. According to the IPA transcriptions, the 27 Chinese/Mandarin speakers of English produced all the [l]s and [n]s intelligibly except when [l] occurred in <Stella> and <slabs>, as shown in the confusion table below:

Read/Spoken		Perceived					
	Words	[stɛnə]	[stɛʊə]	[snæbz]	[ni:dz]	Total	% Error
	<Stella>	3	1			23/27	14.81%
	<slabs>			1		26/27	3.70%
	<need>				0	27/27	0%
	Errors	3	1	1	0	76/81	6.17%

Table 1: Confusion Table

Three speakers produced <Stella> but their [l] was confused with [n]. A fourth [l] was misperceived as [ʊ]. In one instance, the [l] of <slabs> was misperceived as an [n]. All in all, 5 out of 81 pronunciations of [l] in <Stella> and <slabs> were confused with [n], while all the [n]s in <need> were produced and perceived accurately. The erroneous pronunciation and/or perception of [l] amounts to 6.17%. We will discuss the impact of this error on intelligibility in section 8.0. Suffice it for now to say that the acoustic phonetic analysis that follows focuses on substitution of [l] by [n] in the words <Stella> and <slabs>. Though [l] in <Stella> is pronounced once as [stɛʊə], we will not dwell on this substitution for reasons stated in the footnote.⁵ The IPA transcription indicates that all the prevocalic [n]s in the data were produced and perceived intelligibly. For the purposes of this analysis, the [n] in <need> is taken as a prototypical pronunciation by the participants. Zhang

⁴See <http://accent.gmu.edu/index.php>.

⁵ Mandarin 27M replaced the [l] in <Stella> with the approximant [ʊ]. Since this is an incidental substitution not discussed anywhere in the literature of Chinese L2 English pronunciation, we will not tarry on it. Suffice it to note that this segment is rare in world languages. Maddieson (1984:77) only found one instance of this lateral velar approximant (0.2%) in the 317 representative languages described in UPSID (the UCLA Phonological Segment Inventory Database). He was extremely suspicious about the existence of this segment. I'm also suspicious about this IPA transcription. I mention it here but do not measure it acoustically.

(n.d.:169, 170) also found that all the [n]s in <need> in his/her⁶ data were produced intelligibly.

3.0 A Closer Look at the Participants

A closer look at the five participants who substituted [l] for [n] shows that they come from specific provinces in China. Mandarin 6F is from Sichuan province, 8M from Hubei, 9M from Shanghai, 17M from Hubei, and 27M from Sichuan. These provinces are indicated on the map below:



Figure 1: Provincial Map of China⁷

4.0 A Quick Literature Review

There is a paucity of academic papers in English on the confusion between [l] and [n].⁸ In spite of my best efforts, I have come across only two such publications: Richards

⁶ My Chinese consultants told me that they could not determine from the author's name whether the person is male or female. On August 30, 2018, I wrote an email to the person using the contact information at the end of the publication, but I did not receive any response.

⁷ www.profsabroad.com/university Retrieved on August 11, 2018.

⁸ My search produced papers written in Mandarin but I could not read them. On October 10th 2015, a student in my Introduction to Linguistics course posted the following message about /l/ and /n/ in Thai: "When I was in Thailand many people had the hardest time making /l/ and /n/ sounds different. There was also an interesting thing going on with /l/ as the final consonant. In Thai /l/ never appears at the end of syllables or words. So, the older people substituted the consonant /n/ in words such as <football>. It became <footban>. My primary school students, however, had no trouble pronouncing a final /l/ - they always said <football>. I think that perhaps because the kids had heard the /l/ in the final place in <football> all through school and on the TV etc. they were more able to make that sound in the final position in foreign loanwords like <football>."

(2012) and Zhang (n.d.). Richards' paper is an impressionistic account based on her own experience as an ESL teacher of international students at Iowa State University. Zhang's study is an admixture of quantitative analysis, phonological description, and some spectrographic displays of [l]s and [n]s. The background information that he/she provides about the Sichuan dialect is very useful because two of the participants, Mandarin 6F and 27M are from the area where this dialect is spoken. According to Zhang's report, speakers from Sichuan routinely confuse [n] and [l] in their own dialect.⁹ Furthermore, he/she reports that they confuse them when speaking Mandarin and English. The fact that only 5 out of the 27 participants (18.51%) confuse these segments shows that this pronunciation is not widely spread among Chinese speakers of English; only with some speakers from the above-named provinces. This caveat should not be interpreted to mean that this issue is undeserving of scholarly or pedagogical attention; quite the contrary. Zhang indicates that Sichuan is the third largest province in China by population. This demographic information alone means that the issue is worthy of attention because, quite literally, there may be tens of millions of Chinese speakers of English who confuse their [l]s and [n]s.

5.0 An Acoustic Phonetic Methodology

An acoustic phonetic methodology is used to understand why some speakers confuse [l] and [n]. However, before going into details, we need to explain briefly what the methodology consists of. Since a picture is worth a thousand words, let's summarize the methodology by examining the spectrograph below:

English speakers have the same thing with the consonant /ŋ/. We have no problem pronouncing it in final position but in Thai it appears in the initial position and we just don't seem to be able to do it. Most people will simply insert <en> to the front of a word to approximate the sound but it doesn't really sound the same. For example, if the word should be pronounced [ŋu], they will say something like [en.gu]. English speakers really have to practice putting the consonant /ŋ/ in the initial position before they can do it well." I cannot independently verify the accuracy of the information concerning the confusion between /l/ and /n/ in Thai. But it is worth noting that younger people do not have any problem with it in borrowed English words, whereas older people substituted /n/ for /l/ at the end of words.

⁹ The term "dialect" is used throughout this paper advisedly. It does not have the same meaning as "dialect" in sociolinguistics.

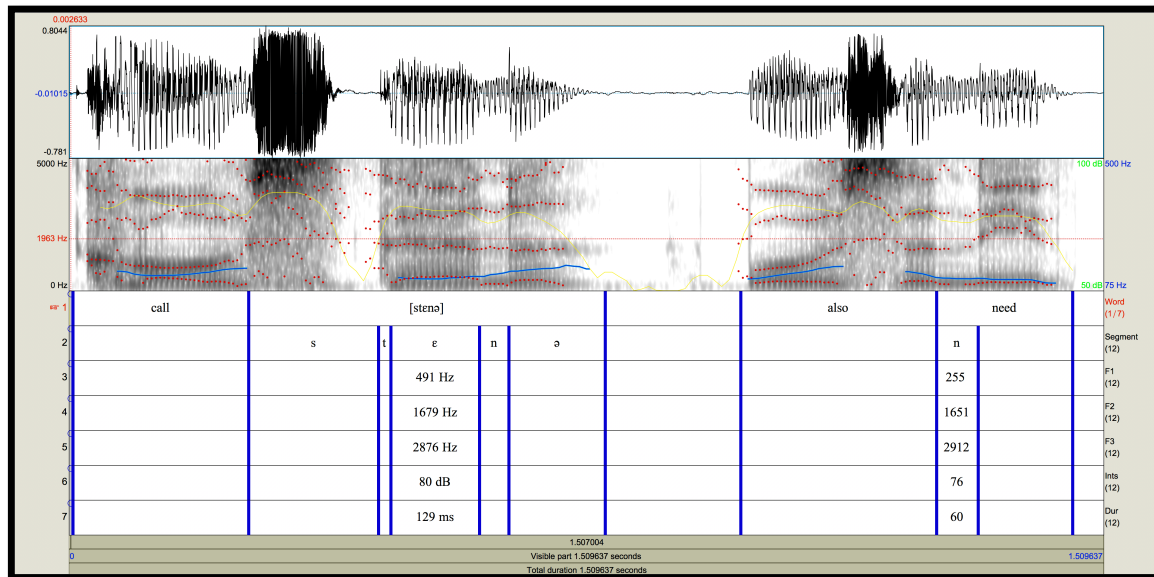


Figure 1: Annotation Procedure-Mandarin 17M

The acoustic correlates that are measured are F1, F2, F3, intensity, and duration. Spectrographs such as this one were made for all five participants. All the relevant measurements were collected and averaged among all the speakers. The acoustic phonetic discussions that follow are based on the arithmetic means, not on the correlates produced by individual speakers.

6.0 Acoustic Phonetic Accounts of the Confusion

Ladefoged (2003:145) notes that the second formant (F2) is acoustically robust for discriminate between [l] and [n]:

From an acoustic point of view, laterals are like nasals in that they have formants with lower amplitudes and with distinct locations from those in the neighboring vowels, usually producing an abrupt break in the pattern. Laterals differ from nasals in that their formants (**particularly the second formant**) more readily show distinction among them [bold fonts added for emphasis, not in original].

According to the Critical Band Theory, acoustic signals mask each other if the distance between them is < 200 Hz on the F2 frequency band. In other words, hearers are likely to confuse [l] and [n] produced by Chinese L2-speakers of English if the F2 distance between their [l]s and [n]s is less than 200 Hz. Let's see what the measurements indicate by considering the data in Table 1:

	F1		F2		F3		Intensity		Duration	
Words	Stella	Need	Stella	Need	Stella	Need	Stella	Need	Stella	Need
Segment	[l]	[n]	[l]	[n]	[l]	[n]	[l]	[n]	[l]	[n]
Mandarin6F	494	427	1566	1998	2408	3047	65	64	60	79
Mandarin8M	421	342	1734	2288	2373	2761	71	75	106	75
Mandarin9M ¹⁰	380	362	1481	1297	2623	2408	72	69	96	70
Mandarin17M	491	255	1763	1682	2967	2898	80	76	129	60
Mandarin Mean	446	346	1636	1816	2592	2778	72	71	100	71
GAE Mean	570	327	1108 ¹¹	1686	2827	2703	70	73	62	63

Table 2: Correlate Measurements

The GAE mean is based on data from Koffi (2019:217-20) of 10 native speakers of American English who read the same paragraph. From this point forward, we will not comment on any other correlates except F2 because it is the only one that plays a crucial role in the intelligibility of [l] and [n].

7.0 An Acoustic Explanation of the Confusion between [l] and [n]

Taken as a whole, the participants in this study confuse their [l]s (1636 Hz) and [n]s (1816 Hz) because the acoustic distance between them is 180 Hz, that is, below the JND of 200 Hz required for intelligibility. By contrast, the acoustic distance between the [l]s and [n]s produced by GAE is 578 Hz, that is, more than twice the required JND for optimal intelligibility. From an acoustic phonetic point of view, since the distance between the [l]s and [n]s produced by the Chinese speakers is less than 200 Hz, masking is unavoidable. This explains why a GAE hearer is very likely to confuse the [l]s and [n]s produced by the talkers in Table 2.

Now, let's turn our attention to the pronunciation of the two [l]s in <Stella> and <slabs> produced by Mandarin 9M. His pronunciation of [l] in <Stella> was perceived by the transcriptionists as an [l] but his [l] in <slabs> was perceived as [n]. The F2 of his [l] in <Stella> is 1481 Hz, while his [n] in <need> is 1297 Hz. The acoustic distance between them is 184 Hz, which is below the required JND. Why do I bring him up separately? His pronunciation is of interest to us because, even though he produced [l] accurately in <Stella>, he substituted the [l] in <slabs> with an [n]. So, his [l] in <slabs> sounds like an [n]. So, instead of <five thick slabs of blue cheese>, we hear *<five thick snabs of blue cheese>. Here, we have the same speaker alternating freely between [l] and [n] in the same paragraph. For him, the segments [l] and [n] are in free variation in syllable onsets. We note in passing that in the data, [l] was never substituted for [n], nor [n] for [l] in syllable codas. Therefore, the substitution is confined only to syllable onsets. We also see that the [l]s (1763 Hz) and [n]s (1682 Hz) produced by Mandarin 17M mask each other because the acoustic distance between them is only 81 Hz, well below the JND threshold of 200 Hz that hearers need to discriminate auditorily between [l] and [n].

¹⁰ In the case of Mandarin 9M, the measurements of [l] are those of <slabs> not of <Stella>. He produced the [l] of <Stella> intelligibly but substituted that of <slabs> with an [n].

¹¹ The F2 of [l] in GAE is considerably shorter because it was produced as a dark [l]. As Watt (2013:93) notes, "The principal distinction between these (i.e., "clear" and "dark" [l]s) is the relative spacing of F1 and F2: in the clear variant F1 is low and F2 is high, while in the dark one F1 is higher and F2 is lower than for the clear form." This means that Chinese speakers, if they produce an [l] at all, produce the clear variety.

8.0 Phonological Explanation of the Confusion

Now, let's consider the [l] (1566 Hz) and [n] (1998 Hz) produced by Mandarin 6F. The acoustic distance between them is 432 Hz. Similarly, the acoustic distance between the [l] (1734 Hz) and [n] (2288 Hz) produced by Mandarin 8M is 554 Hz. Both are well above the JND threshold of 200 Hz. Since the F2 formants are clearly distinct, why were their [l]s perceived and transcribed as [n]s? Zhang (n.d., p. 3) quotes Wang (1994:57) as saying that the Sichuan dialect has a lateral nasal approximant represented in the International Phonetic Alphabet by the symbol [ɭ̥]. This segment occurs in free variation with [n] except before [i], where it surfaces only as [n]. This explains why none of the participants in Table 2 mispronounced the [n] in <need>. Zhang also notes that the participants in his/her study never confused [l] and [n] even in Mandarin when the vowel that follows is [i]. Even though GAE hearers heard [n] in <Stella> and <slab>, Mandarin 6F and 8M actually produced a nasalized [ɭ̥]. So, why did the GAE hearers perceive [ɭ̥] as [n]?

Two explanations readily come to mind. First, a nasalized [ɭ̥] does not exist in English. The segment closest to it is [n]. So, even though to these Chinese speakers [ɭ̥] and [n] are two different segments, to a GAE hearer, they are one and the same. Secondly, we know from Miller and Nicely (1951:349) that nasality is a particularly robust feature that can be clearly perceived regardless of noise conditions:

The glaringly obvious statement that must be made ... is that voicing and nasality are much less affected by random masking noise than are the other features.

We conclude this section by noting that the lateral nasal [ɭ̥] is indeed very rare in world languages. It is so rare that it is not even mentioned in Maddieson (1984:73-78) where he discusses laterals in world languages. However, we find it mentioned in Ladefoged and Maddieson (1996:134). They list [ɭ̥] as a lateral nasal approximant that occurs in Umbundu, one of two Bantu languages spoken in Angola.

9.0 Intelligibility Issues

Here are three stories that highlight the intelligibility issues associated with the confusion between [l] and [n]. One of my former graduate students recounted this story in front of the whole acoustic phonetic class when we were discussing the unintelligibility associated with [l] and [n]. She and her boyfriend (both from China) went to a Caribou coffee shop in St. Cloud, Minnesota, USA. Her boyfriend ordered first. He wanted *<a Vanina Natte>. Confusion and pandemonium ensued. All the baristas looked at each other confused. My student stepped up and ordered what her boyfriend wanted, namely, <a Vanilla Latte>. The second story was found online post. Though I cannot vouch for its authenticity, it also underscores unintelligibility issues when [l] and [n] are confused. The story goes like this. An American was visiting Hong Kong. The Chinese host asked about how <Leighton> was doing. The American was confused and answered that he did not know anybody by that name. The host was also confused because <Leighton> was the name of the American visitor's son. The host insisted, saying: "Isn't Leighton your son's name?" The American responded, "Oh, you mean, <Nathan>!" To which the host answered, "Yes, Leighton! How old is he now?" There is a third story. A colleague told

me that in a science department at a major US university that employs many teaching assistants (TA) from China, a student jokingly replaced the sign “Drop your Projects off in this Slot” in front of the TA’s office with another sign that reads, “Drop your Projects off in this Snot.” Humor aside, the confusion between [l] and [n] is rampant among some Chinese speakers even after they have become fluent in English.

These incidents, real or imagined, underscore the fact that these substitutions play havoc on intelligibility. In our data, the confusion amounts to only 6.17%. However, as the saying goes, “Accumulated snowflakes trigger the bigger avalanches.” In the course of an oral exchange, a confusion between [l] and [n] here and there can quickly add up and become detrimental to intelligibility. In Faircloth and Faircloth (1973:57), [n] ranks first among the most commonly occurring consonants in English, and [l] ranks tenth. The two are high frequency segments. It goes without saying that confusing one with another can impair intelligibility quickly and seriously. Furthermore, according to Catford (1987:88), the relative functional load (RFL) calculations, [l] and [n] have an RFL of 61% at the beginning of words and 75% at the end of words. He defines functional load between two segments as, “the number of words in which it occurs in the lexicon, or in the case of phonemic contrast, the number of pairs of words in the lexicon that it serves to keep distinct.” These high RFLs translate into moderate and high unintelligibility. The combination of high frequency of occurrence and moderate to high RFL means that the substitution of [l] for [n] or [n] for [l] is detrimental to intelligibility.

10.0 Pedagogical Implications

As noted earlier, the substitution of [l] for [n] or [n] for [l] affects only a tiny fraction of Chinese speakers of English. In our data, it affects only 5 out of 27 participants, that is only 18.57%. Even so, Richards (2012:163) states that for those who have this problem, “Progress as regards /l/ and /n/ substitution has seemed much less assured and hard-won when it actually does occur.” A closer look at the distributional pattern of the substitution can help teachers develop a more effective intervention strategy. In our data, all the participants produced the [n] in <need> accurately. Not once was it confused with [l]. Zhang (pp, 165, 169, 170) also had the word <need> in his/her data. He/she found that [n] was never confused with [l] by the participants.

What does this tell us? It suggests that, at the very least, minimal pairs such as <lead> vs. <need>, <neat> vs. <lead> etc. can be used to sensitize learners to the fact that a distinction exists. Thereafter, other minimal pairs such as <load> vs. <node>, <lude> vs. <nude>, <lack> vs. <knack>, <low> vs. <no>/<know>, <snow> vs. <slow>, etc. can be introduced. It is important to limit the practice to word-initial or syllable onset positions because these are the most troublesome environments. Additionally, Richards (2012: 165) remarks that “It appears that /n/ is much easier for these learners to produce than /l/.” Our data confirms this observation. There was not a single instance in which [n] was mispronounced as [l]. All the substitutions had to do with [l]. However, Zhang’s data show that [n] was produced as [l] 10 out of 51 tokens (19.67%), while [l] was mispronounced as [n] only twice (3.92%). In other words, the confusion happens in both directions. Speakers can confuse [l] and [n] or they can confuse [n] and [l].

11.0 Articulatory Exercises

Our data shows that the confusion between [l] and [n] is both phonetic and phonological. It is hard to discriminate the [l]s produced by Mandarin 9M and 17M from their [n] because the F2 of their two segments are below the minimum JND threshold of 200 Hz. This means that these speakers place their tongue in more or less the same place of articulation. Mandarin 6F and 8M produced the nasalized allophone [l̃] instead of producing the plain lateral phoneme [l]. Regardless of the source of the confusion, a single articulatory exercise can be proposed to remedy the situation. But first, let's see how Ladefoged and Maddieson (1996:102) describe the articulation of nasals:

A nasal consonant is one in which the velum is lowered and there is a closure in the oral cavity somewhere in front of velic opening. Hence, air from the lungs is directed out through the nasal passage alone.

Now, contrast this with the description of the articulation of laterals in Maddieson (1984:77):

All types of laterals are predominantly dental or alveolar, and at all places the most common type of lateral is a plain voiced lateral approximant. The preference for tip or blade articulations for laterals is presumably related to their greater opportunity to provide free air passage behind the closure if the body of the tongue is not in the articulation.

What does all this mean for improving the articulation (and hence) the intelligibility of [l] and [n]? Teachers should instruct their students to place the tip of their tongue behind their front teeth, they should smile (spread their lips) and produce [l]. These two gestures automatically force the velum to rise. When this is done, a nasal sound cannot be produced. All the air molecules will flow to the area of closure. The release will produce a plain [l]. In producing [n], teachers should instruct their students to place the blade (not the tip) of the tongue right behind the alveolar area. They should not smile. The raising of the blade to the alveolar area automatically lowers the velum and makes it much easier to produce an [n] sound. Once students have been taught these articulatory mechanisms, frequent and prolonged drilling practices with minimal pairs such as those mentioned in 10.0 should help attenuate and maybe eliminate the confusion between [l] and [n].

12.0 Summary

It has been said twice already but it is worth repeating it again in closing that the issue of the confusion between [l] and [n], and vice versa, cannot and should not be generalized to all Chinese speakers of English. The problem is circumscribed to particular locations and to specific dialects in China. Even so, given the fairly high relative functional load between these two segments, confusion leads to rampant unintelligibility. For this reason, [l] and [n] deserve some priority in the L2 pronunciation curriculum. The analyses provided in this paper show that the issues with [l] and [n] are both phonetic and phonological. Yet, there is a common articulatory remedy to both. As the saying goes, “practice makes perfect.” Frequent and comprehensive practice with lexical minimal pairs can attenuate and maybe eliminate the confusion altogether.

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