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Phonological Assimilation in the English of Native and Non-native Speakers' Reading and Spontaneous Speech

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Abstract
This study examines the frequency of phonological assimilation in the speech of experienced non-native speakers (L2) of English and native speakers (L1) of British English. The study compares reading and spontaneous speech performance by both groups. Results indicate that the L1 group assimilates more than the L2 group in their speech production although the L2 participants are experienced English language instructors. In addition to studying the frequency of phonological assimilation, this study also compares the occurrences of assimilation across different task types. There is a tendency for assimilation to occur more frequently when the task requires less focus on the words.

Keywords: English pronunciation, phonological assimilation, bilingual speech, language formality

1. Introduction

A study of conversational English by Johnson (2004) identified that 25% of words have been simplified through certain phonological processes. Among these processes are elision, juncture, consonant cluster deletion and assimilation. This is not an unusual occurrence since words are often acoustically reduced compared to their citation form in everyday speech (Ernestus *et al*., 2006; Jones & Ono, 2000). Of all these phonological processes, phonological assimilation has been the focus of investigation lately especially from linguists and psycholinguists (Mitterer *et al*., 2006). Phonological assimilation has become a concern since it is a common incidence and significant in native speech and visible in both adult and children speech production (Gimson, 1989; Allerton, 2000 & Alameen, 2007).

Assimilation has been characterised as a phonological process that results from a concept of 'law of economy' (Rosa, 2002) whereby "the organ of speech tends to draw sounds together with the purpose of saving time and energy" (Clarey & Dixson, 1963, p. 12). Roach (2000) explains that words are sometimes linked together to ease the pronunciation even though mechanical speech classified words as separate units. During the process, the organ of

speech involved will naturally reduce few articulations to one articulation in order to ease the activity of sound production. According to Katamba (1989), assimilation provides advantage to the speakers and listeners in the sense of facilitating the task of speaking. The pronunciation that comes with assimilation results in smoother, more effortless and more economical transitions from one sound to another. However, it is ironic that even though assimilation is a frequent event in native speech, it happens without the knowledge of the speakers (Brown, 2006).

Assimilation has been marked as one of the native-like speech criteria (Hieke, 1987). It has been assumed to be an important feature to help speakers improve their fluency (Reed & Michaud, 2006). Therefore, it is no doubt that assimilation is a common phonological process in native speech and the tendency for native speakers to have assimilation in their natural speech production is high. However, this understanding on assimilation in native speaker speech has raised the question as to whether the non-native speaker particularly experienced non-native speaker of English assimilates like the native speaker or not. Experienced non-native speaker such as language teachers are often assumed to have similar language ability as the native speaker. Thus, a study is needed to examine whether assimilation takes place in non-native speaker speech or not. If assimilation does take place in non-native speaker speech, what is the most common type of assimilation? Does it show a similar pattern as assimilation in native speaker speech? Does the type of speaking task affect assimilation in speech production of both groups? Thus, the primary purpose of this study is to examine the frequency of phonological assimilation in speech production of native speaker and non-native speaker of English. The data gained from both groups will be compared in order to discover any major differences. The study will also try to examine the role of task type in relation to the frequency of each type of assimilation.

2. Studies on Phonological Assimilation and L1/L2 Pronunciation

Publications on phonological assimilation in particular are still very limited and research is very hard to find (Brown, 2006). For the past few years, only few notable studies on assimilation were reported such as Pater and Werle (2003), Jansen (2007), Zuraiq and Zhang (2006), and Spilkova and van Dommelen (2010).

Pater and Werle (2003) focused on the direction of place assimilation in child consonant harmony. The process takes place when consonants assimilate across intervening vowels. The study attempted to provide evidence on directionality in child language assimilation. It was found that assimilation is confined by a markedness constraint that requires a consonant before a dorsal to agree in with the dorsal. The Optimality Theory was used as the framework and the data were originally collected in a large-scale diary-style by Compton and Streeter (1977) on a child acquiring American English. This longitudinal study shows that assimilation occurs much earlier in child language development.

On the other hand, Jansen (2007) addressed aspects of regressive voicing assimilation by means of quantitative acoustic study of English obstruent clusters. In carrying out the study, he selected four native speakers of British English and they were presented with stimuli consisted of consonant clusters combining a /k, g, ŋ/ C_1 and a /t, d, s, z, r/ C_2. Results suggest that the /t/ can be characterized as voiceless aspirated while /d/ as voiceless and the contrast between /s/ and /z/ is realized as voiceless and voiced as expected. This study shed some light on the nature and modelling of regressive voicing assimilation.

Another major study on assimilation is by Zuraiq and Zhang (2006). This study has the objective of reporting patterns of phonological assimilation in consonant clusters in Urban Jordanian Arabic (UJA). In order to investigate the patterns of consonant assimilation, all possible phrases that represent C_1C_2 combinations in which $C_1 \neq C_2$ across a word boundary were created by the researchers. Their finding suggested that place assimilation in UJA is mostly regressive. It can occur across articulators and within the same articulator. UJA also shows two other types of assimilation: voicing assimilation and emphasis assimilation.

Finally, Spilkovā and van Dommelen (2010) compared the production of English function word "of" in read and spontaneous speech of L1 and L2 speakers. 10 Norwegian speakers (L2) and two British English speakers (L1) were selected to participate in data collection. The acoustic analysis generally covered word and segment durations. Their findings revealed that non-natives (L2) appeared to have longer durations than the natives (L1). However, both groups seemed to produce longer durations in read productions than spontaneous speech.

As the four studies described above are different in terms of types of assimilation and pronunciation aspect, language and participants, a comparison is not possible. This indicates an obvious gap in the literature. The lack of study on assimilation in non-native English is also apparent. Thus, the aim of the present study is to investigate assimilation in non-native English and evaluate to native production. In particular, the study examines the frequency of assimilation and compares the occurrences of assimilation across the different task types.

3. Methods

(a) Subjects

The total number of participants involved in this study was eight (N = 8); six non-native speakers and two native speakers of English. They were divided into two groups which were non-native speaker (L2) group and native speaker (L1) group. Since the target language was British English, the L1 participants were British and spoke no other languages. On the other hand, L2 participants were chosen among English teachers most of whom taught English at tertiary level. All of the non-native speakers are Malaysian. Therefore, they were considered as experienced non-native speakers of English. Besides having an in-depth knowledge of the target language, the participants were also selected based on their competency in verbal production. They were free from any speech

disorders or syndromes that can affect oral production such as stammer, stutter and resonance. However, no specific test was conducted since these speech predicaments are observable in nature.

(b) Materials

The stimuli for the experiment were 11 phrases (Task A), 8 sentences (Task B) and 5 phrases used for spontaneous speech (Task C). The stimuli consisted of sounds that can trigger phonological assimilation. The stimuli were obtained from various literatures that have employed them in investigating phonological assimilation.

(c) Procedures

Before the recording session took place, the L2 group was given a simple and short questionnaire on their English language experience. This questionnaire was used to collect data on their demographic backgrounds. While for the L1 group, no questionnaire was given but the demographic information was gained through an informal interview prior the recording process. Questions like '*how long have you been here*?', '*do you like living in Malaysia*' and '*do you plan to settle here*' were asked to also help in developing comfort.

The next step was the recording process where the oral productions of the participants were recorded. Each of the participants was recorded individually in a soundproof room where the session took place. A brief instruction was given and explained to the participants so that the participants would know what to expect.

In order to carry out the recording process, a headset with a high quality microphone attached to it (*SoniGear HS405*) was provided to the participants. The frequency response of the headset was 20 – 20,000Hz. The microphone was connected to a workstation (notebook) and Audacity 1.2.6, an audio editing and recording software used to record the participants' reading and spontaneous speech. All recordings took place for approximately 45 minutes where each session lasted around 5 to 6 minutes. The recordings were made at a 44,100Hz sampling rate.

For the first task (Task A), the participants were given 11 phrases for them to read loudly. They were asked to read each phrase once and no time was given for them to practice and examine the phrases. Only when there was a mispronunciation or hesitation, they were allowed to repeat the phrase once. In the second task (Task B), the participants were presented with 8 sentences. The participants were once more asked to read the sentences aloud in their normal reading style and no time was given for them to rehearse. For this task, they were also given one chance of reading only. Finally for the third task (Task C), the participants were asked to create a short story from the five phrases given visually using flash cards and papers. This was done to obtain the spontaneous speech data. One to two minutes were given for them to go through the phrases before they could tell the story. Once they were ready, they recited the story. They were not allowed to stop or retell the story. No particular emphasis was

given to grammar, vocabulary or sentence structure since the aim was to examine assimilation in the five phrases.

Once the recordings were completed, the data were kept in folders and each was coded based on the participants' pseudonyms. In about 45 minutes of recordings, a total of 1,341 words were produced. However, only 69 phrases were transcribed since these were the phrases where assimilation was expected to take place.

(d) Analysis

For the first research question which investigates the frequency of phonological assimilation in the speech production of native and non-native speakers, phonetic transcription was used to code the sounds made by the participants. The affected sounds were transcribed based on the International Phonetic Alphabet (IPA) by the first researcher and later the percentage of assimilation was calculated. For the second research question, the independent variable of this study was the type of task while the dependent variable was the frequency of assimilation in the speech production of the participants. A comparison between the frequencies of assimilation in the different tasks was made to see if there was a difference across task types.

4. Results and Discussion

4.1. Frequency of Phonological Assimilation

The first research question of this study is concerned with the frequency of phonological assimilation in the native and non-native speech production. Table 1 provides the comparison between L1 and L2 group in terms of the frequency of assimilation.

Table 1. Frequency of assimilation

Group	Participants' pseudonyms	Number of assimilated words/total	Percentage %	Mean Group Percentage %
L2	MNAA	3/25	12	24.7
	SRN	6/25	24	
	FHK	7/25	28	
	NHMY	8/25	32	
	AM	4/25	16	
	RMR	9/25	36	
L1	ASP	11/25	44	52
	MH	15/25	60	

It can be noted that the total number of phrases that contain assimilation sound or the stimuli for each participant is 25 (N = 25). Table 1 clearly shows that L1 assimilated sounds more than L2. The highest number of assimilation for L1 group is 15 and the lowest is 11. On the other hand, the highest number of assimilation in speech of L2 is 9 and the lowest is 3. These findings show that assimilation is more commonly found among the L1 than L2 even when the non-native speaker has extensive knowledge of the language. The finding affirms the statement from a previous study by Anderson-Hsieh *et al*. (1994)

that native speakers employ phonological process in the speech more than the non-natives.

Table 2 below shows the list of assimilated phrases and the frequency rate for each group; L1 and L2.

Table 2. Frequency and percentage of assimilated phrases

	Assimilated phrases	**Transcription of sounds**	**L1 (N=2)**	**L2 (N=8)**	**Total Frequency**
Task A	Lean bacon	/li**m** **b**eɪkən/	0 *(0%)*	1 *(16.7%)*	1
	This side	/**ðɪz** saɪd/	1 *(50%)*	0 *(0%)*	1
	Played tennis	/pleɪ**t** **t**enɪs/	1 *(50%)*	0 *(0%)*	1
	Five folders	/faɪ**f** **f**əuldəz/	2 *(100%)*	5 *(83.3%)*	7
Task B	That person	/ðə**p** **p**ɜːsn̩/	2 *(100%)*	6 *(100%)*	8
	Bright colour	/braɪ**k** **k**ʌlə/	2 *(100%)*	5 *(83.3%)*	7
	Get those	/ge**ð** **ð**əʊz/	2 *(100%)*	0 *(0%)*	2
	This side	/**ðɪz** saɪd/	1 *(50%)*	4 *(66.7%)*	5
	Read these	/ri**d** **d**iz/	2 *(100%)*	6 *(100%)*	8
	Good night	/gʊ**n** **n**aɪt/	1 *(50%)*	0 *(0%)*	1
	Dogs	/dɒ**gz**/	1 *(50%)*	0 *(0%)*	1
	Played tennis	/pleɪ**t** **t**enɪs/	2 *(100%)*	5 *(83.3%)*	7
Task C	Meat pie	/mi**p** **p**aɪ/	2 *(100%)*	0 *(0%)*	2
	Cut through	/kʌ**θ** **θ**ru/	2 *(100%)*	2 *(33.4%)*	4
	Those years	/**ðʊz** jiə**z**/	2 *(100%)*	0 *(0%)*	2
	Good girls	/gʊ**g** **g**ɜːlz/	1 *(50%)*	2 *(33.4%)*	3
	Cats and dogs	/kats æ**n** **d**ɒ**gz**/	2 *(100%)*	2 *(33.4%)*	4

Looking more closely at the finding, it can be observed that most assimilation that occurred in both native and non-native speech productions involved sounds such as alveolars /t, d/, dentals /ð, θ/ and labiodentals /f, v/. For instance, seven of all the eight participants of both groups (five L2 participants and two L1 participants) produced assimilation of sounds when they uttered "*five folders"* where the labiodental /v/ which is voiced was altered to be the voiceless labiodental /f/. The assimilation also frequently takes place when it involves alveolar /t/ and dental /ð/. For example, the phrase *cut through* which is used in third task (spontaneous speech task) where 63% of the participants (100% of L1 participants and 34% of L2 participants) switched from /kʌt θru/ to /kʌθ θru/.

One reason can be drawn to explain why natives assimilate more than the non-natives in their speech production. It seems that the factor that may have contributed to this occurrence is the pausing rate in speech production. The pausing rate employed by second language users or non-natives seems higher than the natives. When the pausing rate is higher, then the speech produced tends to isolate one sound from another. This situation could clearly be seen when they were asked to perform the second and third tasks where most of them paused for a few seconds at many places. This particular finding agrees with Anderson-Hsieh (1992) and Spilkova & van Dommelen (2010) that identified pausing as one of the prosodic variables that strongly affects non-native pronunciation.

In conclusion, the frequency of assimilation in the native speech is relatively higher than the non-native speech. The mean percentage for

assimilation in the native speech is 52% while mean percentage for non-native speech is 24.7%. However, the difference in percentage of assimilation occurrence is not great; only a difference of 27.3% (Table 1). Being experienced second language speaker may influence the small difference of percentage. Assimilation however can nevertheless be used to distinguish the speech produced by native and non-native.

4.2. Relationship between Frequency and the Type of Task

The second objective of this study is to compare the frequency of assimilation in the speech production across the different types of speaking task. This research question tries to verify Lass' (1984) findings which suggested that the less formal the language setting is; the more assimilation process will take place in the speech production. Table 3 provides the findings.

Table 3. The relationship between task type and assimilation

Task	Total stimuli (Total participant)	L1	L2	Total
Task A (phrases)	11(8)	4 (*6.3%*)	6 (*9.5%)*	10
Task B (sentences)	8(8)	13 (*20.6%*)	25 (*39.7%*)	38
Task C (story telling)	5(8)	9 (*14.3%*)	6 (*9.5%*)	15
		26	**37**	**63**

Table 3 shows that only 10 (16%) assimilated phrases were detected in Task A. A total of 38 (60%) assimilated phrases were produced by both groups of speakers in Task B and 15 (24%) assimilated phrases were produced in Task C. Both groups show a similar pattern where the highest number of assimilated sounds can be found in Task B that requires less attention to the pronunciation of individual words compared to Task A. For Task B, the total percentage of assimilated phrases for L2 group is almost 40% while the percentage for L1 group is close to 21%. Task A which does not impose other demands on the speakers other than the words had the least number of phonological assimilation. Both groups have less than 10% of assimilated phrases for Task A. In this case, the participants seem to incorporate phonological assimilation in their speech more in tasks that require less attention to articulation. However, although Task C requires even less attention to words, assimilation in Task C is less regular compared to Task B. This is probably because in Task C, participants have to create their own stories and thus, they regularly paused to think. Apart from that, the smaller number of stimuli used in Task C could also explain the finding.

4.3. General Finding

This study addresses two primary research objectives: to examine the frequency of phonological assimilation in the speech production of native and non-native and to compare the occurrences of assimilation across the different task types. The finding suggests that phonological assimilation is found more in the native speech production. The finding also seems to show that there are differences

between the different task types in terms of the frequency of assimilation. Assimilation is more frequent when the task does not focus on the words alone. It was observed that non-native speaker has the tendency to pause more in their speech. Pausing works against phonological assimilation since speakers do not assimilate over a pause. The more the speakers pause; the less likely assimilation occurs in speech. This may have contributed to the significantly smaller number of assimilation in the non-native speech. This finding is in parallel with a study by Wong (1987) where he claims that second language learners learn the target language through the eye and not through the ear. They falsely believe that words should be pronounced as what they see on the paper that is separated by blank spaces. Even though the L2 participants in this study were experienced speakers, frequent pausing rate could still be observed. The L2 participants tend to be careful in their pronunciation, grammar and choice of vocabulary. Another finding that can be highlighted is that compared to non-native, native participants are more inclined to replace voiceless /s/ with voiced /z/ when it comes after voiced fricative /ð/. For example; *those years* /**ð**oʊ**s** yɪərs/ → /**ð**oʊ**z** yɪərs/. However, both groups show a similar pattern when assimilation involves labiodentals /f/ and /v/. A clear example can be seen from the phrase *five folders*. The final /v/ of "five" becomes voiceless; *five folders* /faɪ**v** **f**oʊl dərs/ → /faɪ**f** **f**oʊl dərs/.

Finally, the study also found an incidental finding that might be useful for future research. Female participants seem to assimilate more than male participants. For example, in the L1 group, from 25 phrases, a total of 15 assimilated phrases could be identified from the speech production of a female speaker (MHMH) while only 11 assimilated phrases from the speech of a male speaker (ASP). Similar pattern can also be observed among the NNS participants. The only male speaker produced three assimilated phrases compared to the others speakers who produced more than three assimilated phrases. This finding deserves further investigation.

5. Conclusion

From this study, it can generally be concluded that the native participants used assimilation in their speech production more than non-native. However, the difference in the percentage of the assimilated sounds is relatively small. Both groups show a similar pattern of assimilation where fricatives /f/, /v/, /ð/, /θ/, /s/ and /z/ were the frequently assimilated sounds. The only difference between both groups that can be observed is that, the pausing rate in non-native speech was comparatively higher than in native's. The non-native speakers tend to be more careful before saying a word and this has triggered a conscious style that will decrease the number of assimilation in their speech.

Finally, the study found that assimilation was more frequent when the task demands less attention to the words. When the task requires more attention to the words, assimilation is less frequent.

In general, the study has provided a foundation and basis for future research that focuses on assimilation in an ESL environment. However, the number of the participants in this study is relatively small (N = 8). This is due to

the difficulty in getting full commitment from the potential participants and in addition, locating first speaker of English particularly British English speaker is difficult since the study took place at a non-native setting. Therefore, the generalisability of the findings is limited to some extent. A large number of participants and a more balanced group will give a more consistent outcome. More research is needed to scrutinise phonological processes like assimilation in the ESL setting since such studies are very limited in number and resources. The present study only reveals the differences between L1 and L2 use of assimilation. The study does not examine the effect of assimilation or perception and intelligibility. It also does not examine the proper technique in teaching assimilation in ESL pronunciation classroom and how ESL learners acquire assimilation. Since this study has called attention to the fact that assimilation is a feature of native speech, the field in general could benefit from studies that investigate all these aspects related to assimilation.

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Appendix

Task A

1. Lea*n b*acon
2. Goo*d b*oys
3. Thi*s s*ide
4. Pas*t th*em
5. Gi*ve m*e
6. Seve*n p*arts
7. I*n t*he
8. Las*t th*em
9. Playe*d t*ennis
10. Clu*b t*o meet friends
11. Fi*ve f*olders

Task B

1. I have seen tha*t p*erson many times before
2. I prefer that curtain to be in brigh*t c*olour
3. Can you please ge*t th*ose papers for me?
4. Which turn should we take? That side or thi*s s*ide?
5. Please rea*d th*ese instructions carefully
6. He always texts me goo*d n*ight before I sleep
7. Those are Mr. Samuel's do*gs* and they are quite wild
8. I have playe*d t*ennis since I started my year in this university

Task C

1. Mea*t p*ie
2. Cu*t th*rough
3. *Th*o*se y*ears
4. Goo*d g*irl
5. Ca*ts* and do*gs*

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