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The Effects of Orthographies, Stress and Consonantal Manners on Syllabification and Acoustic Durations of Intervocalic Consonants with Singleton and Geminate Graphemes by Thai L2 Speakers of English

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ABSTRACT

This research investigates how orthographies, stress, and consonantal manners influence syllabification and acoustic durations of intervocalic consonants by Thai L2 English speakers, who were classified into three CEFR English proficiency levels: A1, A2 and B1 and participated in two tasks. The first task aims to examine syllabification, known as a word-part identification task, wherein the participants were instructed to identify the first part of a word in one question item and the second part of the same word in another. The findings reveal dynamic changes in syllabification preferences as L2 proficiency increases. The initial stages of acquisition display a strong reliance on orthographic forms for syllabification. An increase in proficiency is associated with a growing awareness of the interaction of stress with syllabification but a declining reliance on orthography. The second task aims to investigate the production, referred to as a read-aloud task where the participants were asked to read aloud target words in carrier sentences. The durations of intervocalic consonants were analyzed using Praat software (Boersma & Weenink, 2021) based on waveforms and spectrograms. The results indicate that participants at all levels produced intervocalic consonants orthographically represented as geminates significantly longer in duration than those represented as singletons. The durational ratio of orthographic singletons to geminates is overall greater for intervocalic consonants in pre-stress positions than for those in post-stress positions. This ratio steadily decreases from A1 to native English speakers. The findings from both tasks consistently show that higher English proficiency correlates with native-like syllabification and acoustic duration.

Keywords: orthographies; stress; consonantal manners; syllabification; durational ratio

INTRODUCTION

The acquisition of second language (L2) phonology is interfered with by the phonology of a first language (L1) (Bada, 2001; Li, 2016; Major, 2008), as evidenced in learners' alteration to L2 syllabic structure according to their mental representation of L1 syllabic structure (Gut, 2009; Ishikawa, 2002). Orthographic forms also affect the production of L2 speech sounds, especially in the initial stages of acquisition, resulting in non-nativelike pronunciation (Bassetti, 2008).

This current study draws upon psycholinguistic and acoustic approaches to examine how Thai L2 speakers of English syllabify and produce intervocalic consonants, orthographically alternating between singleton and geminate graphemes[1] in di- to trisyllabic words with alternating iambic and trochaic stress.

[1] More generally known as *doubled letters* or *homogeneous digraphs*

Intervocalic consonants, whether orthographically represented as singletons or geminates, are underlyingly construed as a single phoneme within the mental grammar of native English speakers (NES). Irrespective of orthography, English syllabification is influenced by stress. *The Maximal Onset Principle* (MOP), advocated by scholars such as Clements and Keyser (1983), Kahn (1976) and Pulgram (1970), suggests syllabifying a word such as *a letter* as [ˈlɛ.tər], whereas the *Weight-to-Stress Principle* (WSP), proposed in various forms by phonologists, e.g., Selkirk (1982), Murray and Vennemann (1983), Kager (1989), Prince (1990), Hammond (1999), and Duanmu (2000), syllabicates it as [ˈlɛt.ər].

Thai learners of English, whose L1 stress operates only at the prosodic level without lexical stress, are presumed to base syllabification upon orthographies and their native Thai syllabic structures. Upon seeing geminate graphemes, Thai learners of English, especially in the early stages of acquisition, usually mistake the consonant in question as underlying /cc/. We have empirically observed a pattern where English majors often syllabify words with double graphemes as geminates, as shown in their phonemic transcriptions of words like 'happy', 'letter', and 'announce', which are phonemically transcribed as /hæppi/, /lɛttər/, and /ænnaʊns/, respectively.

Thai learners' orthographic syllabification yields the production of intervocalic consonants with geminate graphemes twice as two separate phonemes across syllables. This type of syllabification, previously termed *ambisyllabicity* in studies by Ishikawa (2002), Eddington and Elzinga (2008) and Eddington et al. (2013), is referred to in this study as *heterosyllabic gemination*. In contrast, when the intervocalic /t/ is spelt with a singleton letter <t>, as in the words 'atom' /ˈætəm/ and 'atone' /əˈtoʊn/, Thai learners tend to syllabify the phoneme in question to the onset of the following syllable, yielding [ʔàʔ.tɔm] and [ʔàʔ.tʰoʊn], respectively. This sustains the orthographic effects on syllabification. The evidence for heterosyllabic gemination can also be acoustically substantiated with the relevant hypothesis that Thai English learners' production of intervocalic consonants spelt with geminate graphemes exhibits longer duration than their singleton counterparts.

Thai learners' utilization of gemination in the adaptation of English loanwords and transliterations is found in English-to-Thai dictionaries. Gemination serves as a repair strategy for monomoraic Thai syllables to fulfil the requirement for the bimoraicity of Thai syllables (Petkla, 2020; Ruangjaroon, 2020).

The extent to which Thai learners rely on orthographies for the syllabification of intervocalic consonants is presumed to vary with their English proficiency. To this end, Thai speakers of English were classified into three English proficiency levels based on *the Common European Framework of Reference* (CEFR) levels: A1, A2 and B1. According to CEFR descriptors for overall phonological control under the heading of linguistic competence (Council of Europe, 2018), learners of English at level A1 are expected to exhibit prosodic features of a limited repertoire of simple words and phrases learnt despite a very strong influence on stress, intonation and rhythm from speakers' mother tongue; those who are placed at level A2 are expected to use the prosodic features, e.g. word stress, of familiar everyday words and phrases but yet with a strong influence on stress, intonation and rhythm from speakers' mother tongue; and those who are at level B1 are expected to approximate intonation and stress at both utterance and word levels. Therefore, learners with increased proficiency are hypothesized to demonstrate syllabifications and produce durational ratios of intervocalic consonants orthographically represented as singletons to those as geminates that align more closely with those of NESs. The evidence from a word-part identification task suggests that Thai participants at lower levels tend to rely more on orthographic representation, segmenting geminates as two letters. Conversely, as participants reach higher levels, their reliance on gemination for syllabification decreases, showing a stronger adherence to the WSP, where stress plays a significant role in syllabification.

The following subsections proceed to delve into the effects of syllabic structures and orthographies on English syllabification, followed by a review of relevant English syllabification principles and previous studies. The section concludes with a discussion about representations of *ambisyllabicity* and *gemination* through *skeletal* and *moraic* models.

EFFECTS OF SYLLABIC STRUCTURES AND ORTHOGRAPHIES ON ENGLISH SYLLABICATION

English and Thai syllabic structures differ in complexity. The maximal Thai monosyllable can be represented with a template of C(C)V(V)(C), whereas that of English may have a more complex template of (C)(C)(C)V(V)(C)(C)(C) (Ruangjaroon, 2020). The underlying CV syllable is supposed to exist in Thai speakers' phonology, albeit it surfaces as an ill-formed syllable, as demonstrated in (1).

(1)	a. [pák]	'to sew'	CVC
	b. [páːk]	'mouth'	CVVC
	c. [paː]	'to throw'	CVV
	d. *[pá]	'to patch'	*CV

All Thai CV syllables, as constrained by bimoraicity, surface as heavy syllables to conform to monosyllabic words uttered in isolation. To avoid violating this constraint, epenthesis of syllable-final glottal stop for native Thai words, as exemplified in (2), and gemination and vowel lengthening for English loanwords, as in (3) and (4), are employed as repair strategies (Kenstowicz & Suchato, 2006).

(2)	a. 'country'	/pratheːt/	[pràʔ.thêːt̚]
	b. 'rubbish'	/khaja/	[khàʔ.jàʔ]
	c. 'watch'	/naːlikaː/	[naː.líʔ.kaː]

(Bennett, 1995; Petkla, 2020, p. 19)

(3)	a. 'happy'	/ˈhæpɪ/	[hɛ́p.pîː]
	b. 'dinner'	/ˈdɪnər/	[dɪn.nɤ̂ː]
	c. 'tennis'	/ˈtɛnɪs/	[tʰen.nít̚]

(Petkla, 2020, p. 77)

(4)	a. 'column'	/ˈkɒləm/	[kʰɔː.lâm]
	b. 'credit'	/ˈkrɛdɪt/	[kʰreː.dìt̚]
	c. 'fashion'	/ˈfæʃən/	[fɛː.tɕʰân]

(Petkla, 2020, p. 77)

In Thai, geminate graphemes are mapped onto two separate phonemes across syllables, as exhibited in (5).

(5)	a. สัมมนา	/săm.má.naː/	‘seminar’
	b. บุคคล	/bùk.kʰon/	‘person’
	c. ปากกา	/pàːk.kaː/	‘pen’

Intervocalic consonants in some certain Thai words, albeit orthographically represented as singletons, are also geminated, as seen in (6).

(6)	a. บุคลิก	/bùk.kʰà.lík/	'personality'
	b. บุพบท	/bùp.pʰà.bòt/	'preposition'
	c. อัปมงคล	/ʔàp.pà.moŋ.kʰon/	‘bad luck’

Orthographic influence also manifests in transliteration by English-to-Thai dictionaries, such as *Sor Sethabut* and *Oxford-River Books*, where geminate graphemes are transliterated into a sequence of two identical Thai letters, as demonstrated in (7). Furthermore, it is common for one language to borrow words from other languages to compensate for lexical deficiencies. Foreign words borrowed into a language occasionally contain sounds and syllable patterns deemed illicit in the target language. As these loanwords are integrated into the target language, they undergo some phonological alternations (Abdulrazzaq & Al-Ubaidy, 2023). English loanwords borrowed into Thai with intervocalic geminate graphemes are similarly transliterated, as in (8).

		Sor Sethabut	Oxford River Books
(7)	a. ‘pepper’ /ˈpɛpər/	เพ**พ**-เ**พ**อะ [pɛp-pə]	ˊเพ็**พ**เ**พ**อะ(ร) [ˈpɛppə(r)]
	b. ‘rubber’ /ˈrʌbər/	รั**บ**-เ**บ**อะ [rʌb-bə]	ˊรั**บ**เ**บ**อะ(ร) [ˈrʌbbə(r)]
	c. ‘letter’ /ˈlɛtər/	เล**ท**-เ**ท**อะ [lɛt-tə]	ˊเล็**ท**เ**ท**อะ(ร) [ˈlɛttə(r)]

		Loanwords
(8)	a. ‘tennis’ /ˈtɛnɪs/	เท**นนิ**ส [tɛnnɪs]
	b. ‘message’ /ˈmɛsɪdʒ/	เม**ส**เ**ส**จ [mɛsseɪdʒ]
	c. ‘dollar’ /ˈdɑlər/	ดอ**ลล**าร์ [dɔllɑr]

Thai learners of English, heavily relying on transliteration, tend to syllabify intervocalic consonants spelt with doubled letters as *heterosyllabic geminates*. According to Thirakunkovit (2019), as geminate graphemes are produced twice across syllables, Thai learners of English produced geminate-spelt intervocalic consonants with longer durations than singleton counterparts and also longer than those of NESs.

ENGLISH SYLLABIFICATION PRINCIPLES AND PREVIOUS STUDIES

SYLLABIFICATION PRINCIPLES

English syllabification has drawn substantial attention due to blurry syllabic boundaries without consensus among reputable dictionaries. Cambridge Dictionary syllabifies ‘balance’ as /bæl.əns/, whereas Merriam-Webster syllabicates it as /ˈba-lən(t)s/. The word ‘bury’ is syllabified as /ˈbɛr.ɪ/ in the Cambridge Dictionary but as /ˈbe-rē/ in Merriam-Webster (Eddington et al., 2013). Marchand et al. (2009) reported a 25% syllabification discrepancy in entries between the two dictionaries.

In English syllabification, several key principles play integral roles, i.e., the *Sonority Sequencing Principle* (SSP), adhered to by e.g. Clements and Keyser (1983), Murray and Vennemann (1983) and Vennemann (1972), the MOP, the WSP, *ambisyllabification* (Kahn, 1976), and *resyllabification* (Borowsky, 1986; Selkirk, 1982).

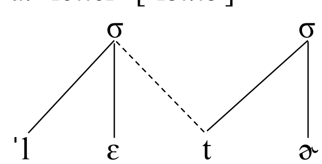
The SSP posits that consonantal sonority increases towards the syllabic peak and decreases towards the margin, applying both polysyllabic and monosyllabic words. However, exceptions occur, such as when the more sonorous fricative /s/ precedes the voiceless stops /t/, /p/, and /k/ with lower sonority, as in words like *start*, *speak* and *ski,* or follows them as in*box* and *ads* (Lin, 2011).

The MOP is a persistent principle to which additional syllabifications must adhere (Duanmu, 2008; Gussenhoven & Jacobs, 2017; Hayes, 2009), stipulating that intervocalic consonants should optimally be part of the onset, while adhering to a language's phonotactic constraints. Nonetheless, the principle provides inconsistent syllabifications for the medial consonantal cluster /mp/ in *empty* and *comprise* with [ˈɛmp.ti] and [kəmˈpraɪz].

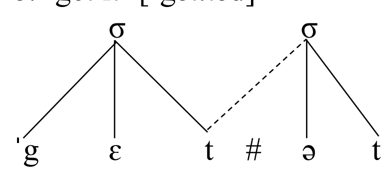
Complementary to the above are ambisyllabification and resyllabification, both of which take stress into account for syllabification. Ambisyllabification permits an intervocalic consonant to be simultaneously part of both the coda of a preceding syllable and the onset of the subsequent one. The intervocalic /t/ in *the letter* is initially syllabified as an onset to satisfy MOP; nevertheless, a syllable concluding with a stressed lax vowel is deemed ill-formed. Every individual syllable of a polysyllabic word is expected to pattern a legitimate monosyllable, postulated to be stressed, and never concluding with a lax vowel.

Hayes (2009) proposed two types of ambisyllabicity, the first of which applies the word internally when the following vowel is stressless, as illustrated in (9a), while the other applies across word boundaries, as in (9b).

(9) a. ‘letter’ [ˈlɛt.tɚ]



b. ‘get it’ [ˈgɛt.təd]



It is noteworthy that there is no conventional transcription for ambisyllabic consonants. Duanmu (2008) and Durvasula and Huang (2017) transcribed an ambisyllabic consonant by underlying it as in [ˈlɛt̲ɚ] ‘letter’, while Eddington and Elzinga (2008), Eddington et al. (2013) and Ishikawa (2002) doubled the phoneme across syllables to indicate the segment, as in [ˈlɛt.tər]. Nonetheless, ambisyllabic consonants are, albeit doubly affiliated to two syllables; they are treated as a *single* phoneme. As such, they should not be transcribed using two separate phonemes.

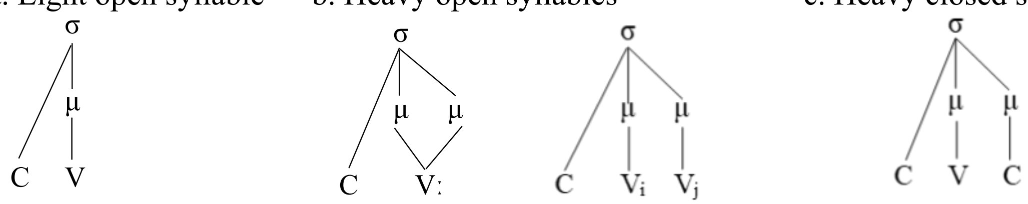
Selkirk's resyllabification further adapts ambisyllabification by reassigning an intervocalic consonant to the coda of the preceding stressed syllable, as in the analysis of syllabification for *after*, with which Kahn's analysis encounters a problem. A comparative illustration of Kahn's ambisyllabification (1976) and Selkirk's resyllabification (1982) is provided in (10).

(10) a. Ambisyllabification b. resyllabification

(Suh, 2001)

The WSP was grounded on the *Theory of Weight* (Gordon, 2006), where syllables may be categorized as *heavy* or *light*, with measures of weight indicated by 'mora' (μ). Moraicity is confined to the segments within the rhyme constituent where short vowels and coda consonants are each assigned one mora, while long vowels and diphthongs are assigned two morae. Bimoraicity is ascribed to heavy syllables, whereas light syllables are monomoraic. The WSP specifies that stress exclusively falls on heavy syllables; light syllables are precluded from bearing stress.

(11) a. Light open syllable b. Heavy open syllables c. Heavy closed syllable



(Zec, 2007)

PREVIOUS STUDIES

Numerous studies have examined English syllabification, manipulating a range of psychological experimental tasks. Derwing (1992) utilized *a pause-break task*, instructing participants to insert a pause between syllables of disyllabic words. The response *lem-PAUSE-mon*, with the intervocalic /m/ pronounced twice, was counted as ambisyllabic. Treiman and Danis (1988) employed *syllable reversal task*, in which participants were directed to interchange the first with the second syllable, yielding responses like *monlem*, *monle* and *onlem*. The response with /m/ occurring twice was considered ambisyllabic. Furthermore, Fallow (1981) used a syllable doubling task, asking participants to repeat the first or the second syllable of a disyllabic word twice, resulting in responses such as *le-lemon* or *lem-lemon*, or *lemon-mon* or *lemon-on*. His study revealed that ambisyllabicity accounted for approximately 22% of the responses.

Ishikawa (2002) incorporated both oral and written tasks to investigate Japanese learners of English' syllabification of disyllables and nonwords with single intervocalic consonants. The findings revealed a preference for CV.CVC syllabification over CVC.VC and CVC.CVC. Moreover, Elzinga and Eddington (2014) conducted a word-division experiment using an online questionnaire, where respondents were prompted to identify the first part of a disyllabic word in one item and the second part in another. The findings indicated that only 16.7% of the responses were ambisyllabic.

AMBISYLLABICITY AND GEMINATION

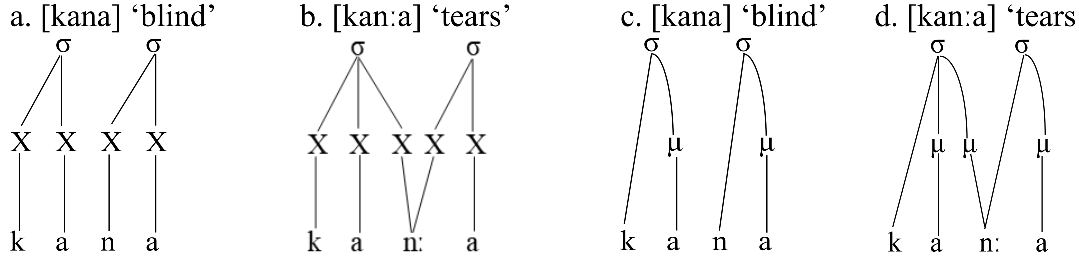
Geminates, also known as *long consonants*, exhibit a phonological contrast with singletons or short consonants. The phonetic opposition between the two manifests as a durational distinction, where geminates are produced with greater acoustic length than their singleton counterparts (Dmitrieva, 2012, p. 7). Ladefoged and Maddieson (1996) reported that geminates are 1.5 to 3 times longer in duration than singletons in careful speech. The durational ratio of singletons to geminates ranges from 1 to 1.4 in English and from 1 to 2.29 in Turkish (Delattre, 1971; Ham, 2001).

Geminates, as involving the orthographic convention of employing two identical consonantal graphemes to indicate consonantal lengthening, may be referred to as *double consonants* (Dmitrieva, 2012, p. 7).

The transcription for a geminate has been an enduring subject of debate, with opposing perspectives revolving around whether a geminate is conceived as a single long consonant /C:/ or a doubled consonant /CC/. In terms of syllabic structure, geminate may be heterosyllabic /C.C/ or (initial or final) tautosyllabic /C:/ (Di Benedetto et al., 2021).

The skeletal models, including the CV-slot (Levin, 1985), the X-slot (Clements & Keyser, 1983), and the moraic model (Hayes, 1989; Hyman, 1985), are commonly adopted to illustrate geminate representation. The skeletal X-slot model encodes segmental length or quantity through timing slots on the X-tier, where singletons are associated with one X slot and geminates with two X slots, as depicted in (12a) and (12b). Conversely, the moraic model designates singletons as non-moraic and geminates as monomoraic (Gordon, 2006; Gussenhoven & Jacobs, 2017; Kotzor et al., 2017), as in (12c) and (12d).

(12) a. [kana] 'blind' b. [kanːa] 'tears' c. [kana] 'blind' d. [kanːa] 'tears'



(Kotzor et al., 2017)

Geminates are classified as *true* or *fake geminates*. *Lexical* or *underlying geminates*, which are inherently long and included as part of the phonemic inventories of languages like *Finnish*, *Hungarian*, *Estonian*, *Japanese*, *Russian*, *Arabic*, *Italian* and *Polish*, are instances of true geminates. Lexical geminates can be identified using a minimal pair where substitution of a singleton with a geminate in certain words causes a change in meaning. *Assimilated geminates*, resulting from total assimilation in which one consonant adopts the identity of its neighbouring segments within the same word at a morpheme juncture, are also categorized as true geminates. In contrast, fake geminates stem from the accidental concatenation of two identical consonants across morpheme or word boundaries, also known as *concatenated geminates* (Dmitrieva, 2012, p. 8; McCarthy, 1986; Oh, 2017; Oh, 2020). Three types of geminates evidenced in Bengali include:

(13)	a. Underlying:	/pat̪t̪a/	[pat̪t̪a] "whereabouts"
	b. Concatenated:	/pat̪+t̪e/	[pat̪t̪e] "spread out" infinitive
	c. Assimilated:	/kor+t̪e/	[kot̪t̪e] "do" infinitive

(Lahiri & Hankamer, 1988)

True lexical geminates in very few languages bear phoneme-grapheme correspondence, as in (14) to (16), where minimal pairs of singletons and geminates from *Italian*, *Polish* and *Finnish* are instantiated.

(14)	a.	sette	/sette/	'seven'
	b.	sete	/sete/	'thirst'

Italian

(15)	a.	saki	/saki/	'sacks' or 'bags'
	b.	ssaki	/sːaki/	'mammals'

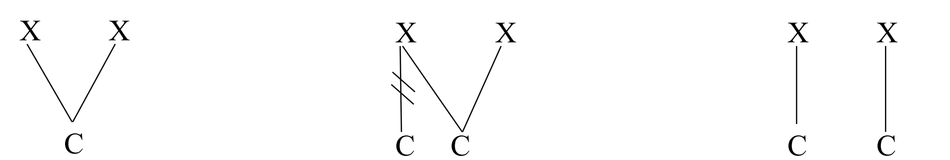
Polish

(16)	a.	takka	/ˈtɑkkɑ/	'fireplace'
	b.	taka	/tɑkɑ/	'back'

Finnish

In autosegmental phonology, true geminates are represented as a single bundle of features linked to two timing slots, whereas fake geminates are represented as two separate feature bundles with each affiliated to its own slot (McCarthy, 1986; Oh & Redford, 2012), as illustrated in (17).

(17) a. Lexical b. Assimilated c. Concatenated



(Zirak & Skaer, 2013)

In English, lengthened consonants are never underlying geminates in that they are not phonemic, and consonantal length never serves as a distinctive feature contrasting singletons with geminates. Therefore, the assertion is made that instances of English geminates are all fake, contrary to Thirakunkovit (2021), who claimed the existence of three types of geminates: underlying, concatenated and assimilated, in English.

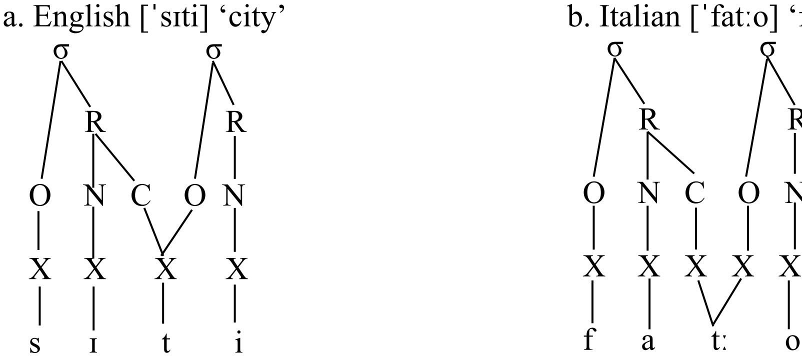
As cited in Gussenhoven and Jacobs (2017, p. 143), van der Hulst posited that languages do not distinguish ambisyllabicity from gemination in terms of weight. Furthermore, ambisyllabicity could be construed as a special case of gemination (Borowsky et al., 1984). Reverting to moraicity, short vowels and coda consonants are each assigned one mora; long vowels and diphthongs are assigned two. Hence, ambisyllabic /t/ as in English ‘city’ and geminate /tː/ as in Italian [ˈfatːo] ‘fact’ may be identical in moraic representation, as in (18).

(18) a. English [ˈsɪti] ‘city’ b. Italian [ˈfatːo] ‘fact’

(Gussenhoven, 1986, p. 143)

Bird (2002, p. 283), however, emphasized distinctions between geminate and ambisyllabic consonants, mentioning four dimensions. Firstly, geminates exhibit phonetic elongation in duration (Borowsky et al., 1984; Jensen, 2000), while ambisyllabic consonants are treated the same length as singletons. Secondly, geminates are moraically associated (Hayes, 1989), while ambisyllabic consonants are non-moraic. Thirdly, ambisyllabicity is prosodically triggered by *stress*; gemination is not prosodically initiated. Finally, geminates and their singleton counterparts are contrastive, whereas ambisyllabic and non-ambisyllabic consonants are not. On this account, McCully (2009), Yavas (2011) and Lee and Seo (2019) illustrated the temporal length of an ambisyllabic segment utilizing the skeletal-slot model. A comparison between geminate and ambisyllabic consonants through skeletal X-slot representation is presented in (19).

(19) a. English [ˈsɪti] ‘city’ b. Italian [ˈfatːo] ‘fact’



(Lee & Seo, 2019; McCully, 2009, p. 104)

SYLLABIFICATION TASK

The word-part identification task, replicated from a prior study by Elzinga and Eddington (2014), aimed to examine whether participants at lower English proficiency levels more strongly rely on orthographies for syllabification than those at higher levels.

METHODS

PARTICIPANTS

Sixty native Thai undergraduates majoring in *English for Communication* at the Faculty of Liberal Arts in a state-run Thai university were recruited as experimental participants. Regardless of whether the participants were English majors or not, the results would not be affected if the criterion for placing participants into different proficiency levels was based on CEFR. Prior to the data collection, the *Oxford Placement Test* was administered to the target population to assess their English proficiency, and they were also asked to read and agree to an informed consent form to ensure that undue influence was eliminated. Twenty participants placed at CEFR English proficiency levels A1, A2 and B1 were each purposively selected to constitute one of the experimental groups. They were compensated for their participation. Additionally, two male and two female native American English speakers, aged between 40 and 50, were personally invited to voluntarily participate as a control group.

STIMULI

The stimuli comprised 32 authentic disyllabic English words, each incorporating one of the eight target intervocalic consonants, which include four obstruents: /p/, /k/, /f/, /s/ and four sonorants: /m/, /n/, /l/, /r/. The stimuli were dichotomized by two orthographic forms and two stress-related contexts, constituting four distinct contexts where the same target consonant orthographically alternate singleton and geminate graphemes, and phonetically alternate their occurrence in post-stress with pre-stress positions as follows:

(20) a. $V_{[+stress]}CV_{[-stress]}$: orthographic singleton in post-stress position
b. $V_{[+stress]}CCV_{[-stress]}$: orthographic geminate in post-stress position
c. $V_{[-stress]}CV_{[+stress]}$: orthographic singleton in pre-stress position
d. $V_{[-stress]}CCV_{[+stress]}$: orthographic geminate in pre-stress position

Table 1 displays a list of 32 English words selected for the word-part identification task.

TABLE 1. List of words used for word-part identification task

Target Consonants	Post-stress		Pre-stress	
	<C>	<CC>	<C>	<CC>
/p/	léper	pépper	propóse	applý
/k/	récord	híccup	akín	occúr
/s/	príson	fóssil	resúme	assígn
/f/	déafen	éffort	refér	efféct
/m/	lémon	hámmer	camél	commít
/n/	mány	cánnon	canál	connóte
/l/	mélon	féllow	alóud	allót
/r/	párent	párrot	aróund	arrést

DATA COLLECTION

The questionnaire was conducted online using Google Forms, and the data collection took place at a language laboratory in the Faculty of Liberal Arts building. Participants were seated at computers and instructed to complete the questionnaire comprising 64 multiple-choice questions by identifying the first part of a word in one question item and the second part of the same word in another. Both question and response items were randomly shuffled. Prior to data collection, participants were asked to agree to an informed consent form to avoid any undue influence on participation. Question items and their corresponding multiple options are exemplified in (21) to (24).

(21) a. What is the first part of the word 'leper'?
- le-
- lep-

b. What is the last part of 'leper'?
- -er
- -per

(22) a. What is the first part of the word 'pepper'?
- pe-
- pep-

b. What is the last part of 'pepper'?
- -er
- -per

(23) a. What is the first part of the word 'propose'?
- pro-
- prop-

b. What is the last part of 'propose'?
- -ose
- -pose

(24) a. What is the first part of the word 'apply'?
- a-
- ap-

b. What is the last part of 'apply'?
- -ly
- -ply

DATA ANALYSIS

Counted as one response is the first part of a word identified in one question item and the second part of the same word in another. A total of 2,048 syllabification tokens obtained from 32 responses by 64 participants were classified as [V.CV], [VC.V] or [VC.CV], corresponding to MOP, WSP and heterosyllabic gemination, respectively. Syllabification tokens were computed as percentages for each type. Linear Logistic Regression was utilized to determine whether and to what extent the independent variables (orthographies and stress) influence the dependent variable (syllabification).

RESULTS

AVERAGE FREQUENCIES OF EACH SYLLABIFICATION TYPE

The A1-CEFR-level participants showed a preference for MOP or [V.CV] when stimuli were orthographically represented as singletons. Table 2 presents their syllabification patterns, indicating that stimuli with singleton graphemes in post-stress positions were syllabified as onsets of the subsequent syllables with a mean frequency of 75% and those in pre-stress positions with up to 90.05%. However, when presented with orthographic geminates, participants favoured syllabifying the stimuli as heterosyllabic geminates or [VC.CV] at a 53% rate when preceded by stressed lax vowels and at a 60.05% rate when followed by stressed vowels.

TABLE 2. Frequencies of each syllabification type by A1-CEFR-level participants

Syll.	<V́CV>	<V́CCV>	<VCV́>	<VCCV́>
[V.CV]	75.00	32.50	90.05	32.50
[VC.V]	7.50	13.80	4.40	7.55
[VC.CV]	17.50	53.80	5.65	60.05

Among the A2 group, as shown in Table 3, [V.CV] responses for orthographic singletons averaged 67.5% in post-stress positions and reached 88.75% in pre-stress positions. They predominantly favoured orthographic syllabification, with heterosyllabic gemination responses at an average frequency of 55.05% in pre-stress positions and 51.25% in post-stress positions.

TABLE 3. Frequencies of each syllabification type by A2-CEFR-level participant

Syll.	<V́CV>	<V́CCV>	<VCV́>	<VCCV́>
[V.CV]	67.50	23.75	88.75	35.00
[VC.V]	13.75	25.00	5.05	10.05
[VC.CV]	18.75	51.25	6.30	55.05

In Table 4, B1 participants reduced reliance on orthographic cues, with the average frequency of [VC.CV] responses below 23%, contrasting with higher rates in earlier groups. Simultaneously, there was an increased reliance on WSP, with [VC.V] responses exceeding 26% for both post-stress stimuli with orthographic singletons and geminates.

TABLE 4. Frequencies of each syllabification type by B1-CEFR-level participants

Syll.	<V́CV>	<V́CCV>	<VCV́>	<VCCV́>
[V.CV]	55.00	60.65	96.90	77.50
[VC.V]	30.05	26.90	0.00	0.00
[VC.CV]	15.00	12.55	3.15	22.50

The B1 participant group's syllabication, especially for post-stress intervocalic consonants, is more congruent with the NES group than other experimental groups. This trend indicates a growing awareness of the influence of stress on syllabification, regardless of orthographies. Table 5 further details the average frequencies for each syllabification type by the NES group.

TABLE 5. Frequencies of each syllabification type by NES group

Syll.	<V́CV>	<V́CCV>	<VCV́>	<VCCV́>
[V.CV]	53.15	46.90	100.00	100.00
[VC.V]	43.75	43.75	0.00	0.00
[VC.CV]	3.15	9.40	0.00	0.00

EFFECTS OF ORTHOGRAPHIES AND STRESS ON SYLLABIFICATION

The influences of orthographies and stress on syllabification are analyzed utilizing Linear Logistic Regression, with results detailed in Table 8. Consonantal manners are, however, excluded from the analysis as less relevant to the hypothesis formulated.

TABLE 6. Linear Logistic Regression analysis for the effects of independent variables on syllabification

DV	IV	A1			A2			B1			NES		
		β	Exp(β)	Sig.	β	Exp(β)	Sig.	β	Exp(β)	Sig.	β	Exp(β)	Sig.
[V.CV]	Orthographies	-2.106	.122	<.001	-2.468	.085	<.001	-.389	.678	.040	-.250	.779	.617
	Stress	.650	1.916	<.001	.764	2.147	<.001	1.614	5.021	<.001	20.571	858778236.626	.
[VC.V]	Orthographies	.180	1.197	.504	.741	2.098	.005	-.154	.858	.536	.000	1.000	1.000
	Stress	-.927	.396	<.001	-1.102	.332	<.001	-19.120	4.968E-9	.	-20.421	1.353E-9	.
[VC.CV]	Orthographies	2.247	9.455	<.001	2.276	9.737	<.001	.756	2.129	.002	1.165	3.207	.325
	Stress	-.252	.777	.185	-.162	.850	.395	-.083	.912	.725	-18.672	7.7752E-9	.

The A1 group demonstrates significant influences of stress (p<.001) and orthographies on [V.CV] syllabification (p<.001). A positive coefficient for stress suggests that pre-stress stimuli tend to be syllabicated as onsets; an exponentiated coefficient exceeding 1 indicates that the likelihood of pre-stress stimuli being syllabified as onsets is approximately twice as high as that of stimuli in post-stress positions. A negative coefficient for orthographies indicates that orthographic singletons, compared to geminates, are prone to be syllabified as onsets. The exponentiated coefficient of less than 1 suggests that the likelihood decreases by 12.2% for stimuli orthographically represented as geminates.

The [VC.V] syllabification is significantly influenced by stress (p<.001), with its negative coefficient and exponentiated coefficient indicating that stimuli in post-stress positions are more likely to be syllabicated as codas, while for stimuli in pre-stress positions, the probability of being syllabicated as codas decreases by 39.6%. The impact of orthographies on this syllabification type is insignificant (p=.504).

The [VC.CV] syllabification is significantly affected by orthographies (p<.001). Stimuli orthographically represented as geminates exhibit a 9.5 times higher likelihood of undergoing heterosyllabic gemination than those represented as singletons do. The influence of stress on heterosyllabic gemination is insignificant (p<.185).

Regarding the A2 group, stress and orthographies significantly impact [V.CV] syllabification (p<.001). Pre-stress intervocalic consonants are twice as likely to be syllabified as onsets. The intervocalic consonants orthographically represented as singletons are inclined to be onsets, with the odds reduced by 8.5% when orthographically represented as geminates.

The influence of stress on [VC.V] syllabification is statistically significant (p<.001), with the corresponding coefficient and exponentiated coefficient indicating a 33.2% decline in coda syllabification likelihood for pre-stress stimuli. Orthographies, while having a minor impact (p=.005), suggest that stimuli with geminate graphemes are inclined to be assigned to codas, with a probability approximately twice as high as singletons.

The findings from the A2 cohort highlight a substantial influence of orthographies on heterosyllabic gemination. Geminate graphemes, as opposed to singleton, are almost ten times more likely to undergo gemination (p<.001).

Among the B1 group, only stress significantly affects [V.CV] syllabification (p<.001). Pre-stress stimuli exhibit a four times greater likelihood of being syllabicated as onsets than post-stress stimuli do.

The [VC.V] syllabification is also solely influenced by stress, with a highly negative coefficient and exponentiated coefficient indicating a strong inclination for post-stress intervocalic consonants to be syllabified as codas, while pre-stress stimuli have much lower odds of syllabification as codas.

The influence of orthographies on heterosyllabic gemination almost reaches statistical significance (p=.002). Stimuli with geminate graphemes are twice as liable to undergo heterosyllabic gemination than those with singleton graphemes.

The [V.CV] syllabification by the NES cohort is strongly influenced by stress, as indicated by the vast coefficient and exponentiated coefficient, suggesting that pre-stress stimuli are approximately 850 million times more prone to be syllabified as onsets. This substantial influence aligns with the 100% average frequencies of [V.CV] syllabification for the pre-stress stimuli, as earlier seen in Table 5.

Similarly, the [VC.V] syllabification is strongly affected by stress, as indicated by highly negative coefficient and exponentiated coefficient values, signifying that post-stress stimuli exhibit a pronounced tendency to be syllabified as codas. This pattern closely corresponds to findings in the B1 group as hypothesized.

Heterosyllabic geminates produced by the NES group are more inclined to occur when preceded by stressed lax vowels, as indicated by a high negative coefficient value. The exponentiated coefficient value suggests a 0.00000077752% decrease in the likelihood of heterosyllabic gemination for pre-stress stimuli. Thus far, it can be inferred that stress is the primary factor influencing NESs' syllabification.

PRODUCTION TASK

The reading-aloud task aimed to investigate how Thai participants acoustically produce intervocalic consonants with alternating singleton and geminate graphemes, and whether the durational ratios of stimuli with orthographic singletons to those with geminates produced by higher proficient Thai participants more closely align with those by the NES group than lower proficient Thai participants.

METHODS

PARTICIPANTS

The same 60 native Thai participants, placed into CEFR levels A1, A2 and B1, along with the four native American English speakers who took part in the syllabification task, were also involved in this task. The durational ratios produced by the NES group were utilized as a benchmark.

STIMULI

Additional 32 di- to trisyllabic words, each containing either one of the 8 target consonants from the first task were constructed with two orthographic alternations: singleton and geminate graphemes, alternating in post-stress and pre-stress positions. The stimuli are listed in Table 7.

TABLE 7. List of words used for reading-aloud task

Consonant Types	Post-stress		Pre-stress	
	<C>	<CC>	<C>	<CC>
/p/	wéapon	ápple	apártment	appéar
/k/	dócument	óccupy	recórd	accóunt
/s/	clóset	lésson	recéipt	assúme
/f/	réference	óffer	proféssion	affáir
/m/	cámera	hámmer	amóunt	ammónia
/n/	ténor	chánnel	banána	connéction
/l/	Álan	yéllow	alóne	illúsion
/r/	dúring	mírror	aróma	corréct

The primary stress of the target words was indicated by an acute accent to prevent potential confusion among participants regarding noun and verb homographs, e.g. *récord* [ˈrɛk.ərd] and *recórd* [rɪˈkɔrd].

DATA COLLECTION

Participants were presented with a printed list of the target words, arranged in the same sequence for every participant. They were instructed to read aloud each stimulus three times at a normal speech rate in the carrier sentence: "What does the word _________ mean?" where the target words carried the tonic stress in the intonational unit. Thirty-two target words were produced three times by 64 participants, yielding a total of 6,144 audio tokens.

The recording was performed by each of the participants individually on Praat by Boersma and Weenink (2021) through an Oker-G328 headset-mounted microphone in a quiet, well-lit lecture room in the Faculty of Liberal Arts building.

Prior to the recording, fifteen minutes were allocated for silent reading to ensure that participants familiarize themselves with the target words. The three repetitions of pronunciation were averaged for a mean duration.

ANALYSIS

The acoustic durations of target consonants were measured by analyzing waveforms with reference to spectrograms utilizing Praat (Boersma & Weenink, 2021). The duration of stops was measured from the onset of stop closure, marked by a silent portion until the end of the aperiodic burst portion. The fricative duration was measured from the aperiodic frication portion, extending to the point at which the periodic signal of the subsequent vowel resumed. Nasal duration was determined by the portion with abrupt reduction in F1 intensity, waveform alternations and the emergence of antiformants corresponding to the opposing white bands. The liquid duration was computed based on the segment with a decreased signal intensity, waveform alternations, and a diminished formant structure (without the presence of anti-formants), spanning to the point where the formants stabilized in the following vowel. Any silent intervals between the conclusion of the preceding vowel and the onset of the following were included in the measurement.

The durational ratios of intervocalic consonants with orthographic singletons to geminates were computed by dividing the geminate duration by that of the singleton. Moreover, the extent to which the independent variables can explain the variance in the dependent variable was examined using the linear mixed model.

RESULTS

DURATIONAL RATIOS OF POST-STRESS INTERVOCALIC CONSONANTS WITH ORTHOGRAPHIC SINGLETONS TO GEMINATES

As shown in Table 8, participants across proficiency levels consistently produced intervocalic consonants with geminate graphemes longer in duration than their singleton counterparts. The singleton-geminate durational ratios slightly increased from the A1 to the A2-CEFR-level group and then steadily decreased from A2, B1 to the NES group. All Thai participant groups produced singleton-geminate durational ratios greater for sonorants than for obstruents, whereas the NES group produced obstruents with greater durational ratios.

TABLE 8. Durational ratios of intervocalic consonants with singleton to geminate graphemes in post-stress positions

	A1			A2			B1			NES		
	<V́CV>	<V́CCV>	Ratio	<V́CV>	<V́CCV>	Ratio	<V́CV>	<V́CCV>	Ratio	<V́CV>	<V́CCV>	Ratio
stop	179.31	185.78	1.04	165.35	174.44	1.05	144.06	145.63	1.01	119.00	119.67	1.01
fricative	124.82	138.38	1.11	131.56	141.81	1.08	119.94	135.11	1.13	108.50	124.54	1.15
nasal	87.22	108.39	1.24	81.68	103.96	1.27	86.17	95.19	1.10	72.42	62.21	0.86
liquid	98.75	118.85	1.20	89.61	115.72	1.29	85.89	100.37	1.17	82.92	82.33	0.99
Avg.	122.52	137.85	1.13	117.05	133.98	1.14	109.01	119.07	1.09	95.71	97.19	1.02

In the A1 group, intervocalic consonants displayed increasing average lengths from nasals, liquids, and fricatives to stops, with the greatest durational ratios observed for nasals (1.24), followed by liquids (1.20), fricatives (1.11) and stops (1.04). Similarly, the A2 group exhibited increased lengths from nasals, liquids, and fricatives to stops, with durational ratios ranging from 1.05 for stops to 1.29 for liquids. In contrast, B1 participants, despite producing intervocalic consonants with increased lengths from nasals, liquids, and fricatives to stops, exhibited a reverse order of lengths for nasal and liquid singletons. Their durational ratios ranged from 1.01 for stops to 1.17 for liquids. Hypothetically, the durational ratios obtained from B1 participants align more with those from the NES group for all consonantal categories. However, the A2 group's ratios are less congruent with those of the NES group than the A1 group.

DURATIONAL RATIOS OF PRE-STRESS INTERVOCALIC CONSONANTS WITH ORTHOGRAPHIC SINGLETONS TO GEMINATES

All Thai participant groups consistently produced pre-stress intervocalic consonants with geminate graphemes for longer durations than those with singleton graphemes. The average durational ratios decreased from the A1 to the NES group and increased from obstruents to sonorants across all groups, as detailed in Table 9.

TABLE 9. Durational ratios of intervocalic consonants with singleton to geminate graphemes in pre-stress positions

	A1			A2			B1			NES		
	<VCV́>	<VCCV́>	Ratio	<VCV́>	<VCCV́>	Ratio	<VCV́>	<VCCV́>	Ratio	<VCV́>	<VCCV́>	Ratio
stop	76.61	159.33	2.08	72.33	131.28	1.81	76.20	116.33	1.53	70.83	90.08	1.27
fricative	93.31	153.06	1.64	98.53	148.56	1.51	104.89	155.35	1.43	129.25	160.29	1.24
nasal	93.63	115.67	1.24	105.06	126.58	1.20	96.36	109.08	1.13	95.33	100.58	1.06
liquid	105.39	105.76	1.00	108.99	87.06	0.80	108.65	98.97	0.91	103.67	95.88	0.92
Avg.	92.23	133.45	1.45	96.23	123.37	1.28	96.53	119.93	1.24	99.77	111.71	1.12

The intervocalic consonants with singleton graphemes produced by the A1 group varied in lengths from least to most vowel-like, whereas those with geminate graphemes are inversely ranked in lengths. Moreover, the singleton-geminate durational ratio was found to be greatest at 2.08 for stops, followed by 1.64 for fricatives, 1.24 for nasals, and 1.00 for liquids.

Regarding the A1 group, lengths of intervocalic consonants with singleton graphemes ranked from least to most vowel-like. In contrast, those with geminate graphemes displayed an inverse ranking in lengths. The singleton-geminate durational ratio was highest at 2.08 for stops, followed by 1.64 for fricatives, 1.24 for nasals, and 1.00 for liquids.

The A2 group similarly produced increasing lengths of intervocalic consonants from the least to the most vowel-like for orthographic singletons and partially vice versa for orthographic geminates. The highest durational ratio in this group was 1.81 for stops, followed by 1.51 for fricatives, 1.20 for nasals, and 0.80 for liquids.

The B1 group exhibited a range of lengths for intervocalic consonants orthographically represented as singletons from stops, nasals, fricatives to liquids, and from liquids, nasals, stops to fricatives for those represented as geminates. Durational ratios varied from 0.91 for liquids, 1.13 for nasals, 1.43 for fricatives, to 1.53 for stops.

Participants at higher English proficiency levels demonstrated durational ratios between two orthographic forms across all consonantal categories that more closely aligned with the NES participants. The NES group's ratios ranged from 0.92 for liquids, 1.06 for nasals, 1.24 for fricatives, to 1.27 for stops.

EFFECTS OF ORTHOGRAPHIES, CONSONANTAL MANNERS AND STRESS ON ACOUSTIC DURATIONS

The strength of stress, orthographies and consonantal manners in explaining or predicting the variance in the acoustic durations of intervocalic consonants was investigated, manipulating the Linear Mixed Model, as detailed in Table 10.

TABLE 10. Linear Mixed Model analysis of independent variables influencing durations of intervocalic consonants

IV	A1		A2		B1		NES	
	F	Sig.	F	Sig.	F	Sig.	F	Sig.
Stress	29.155	<.001	95.899	<.001	6.985	.008	3.020	.085
Orthographies	70.627	<.001	11.071	<.001	72.557	<.001	.892	.347
Consonantal Types	137.351	<.001	94.163	<.001	78.944	<.001	25.367	<.001

Within the A1 and A2-CEFR-level cohorts, all three independent variables were found to be significant factors. In the former group, consonantal manners were strongest in predicting the variance in acoustic durations, followed by orthographies and stress, whereas stress was the most influential factor among the latter group, followed by consonantal types and orthographies. Nonetheless, within the B1 participant group, only consonantal manners and orthographies significantly predicted acoustic duration variance. With respect to the NES group, only consonantal manners were significant predicting factors.

Furthermore, the analysis through One-Way ANOVA revealed that the A1 and the A2 groups pronounced the intervocalic consonants orthographically represented as geminates significantly longer in duration than those represented as singletons, the post-stress consonants longer than the pre-stress ones, and the intervocalic obstruents longer than the sonorants.

The B1 group produced the consonants with orthographic geminates significantly longer than those with orthographic singletons and the intervocalic obstruents longer than the sonorants, but the post-stress consonants insignificantly longer than the pre-stress ones.

Among the NES group, only the intervocalic obstruents were found to differ significantly in length from the sonorant counterparts, whereas the intervocalic consonants alternating singletons and geminates and pre-stress and post-stress positions were not.

DISCUSSION & CONCLUSION

The result of this study unveils a dynamic and evolving pattern of syllabification preferences among Thai L2 English speakers at different proficiency levels influenced by stress and orthographies. These preferences evolve as participants proceed through stages of L2 acquisition towards nativelikeness.

At the initial stage, participants heavily rely on orthographies, with a pronounced predilection for [V.CV], based on the MOP, when the stimuli are orthographically represented as singletons. However, they exhibit a preference for heterosyllabic gemination [VC.CV] when the stimuli are represented as geminates.

The A2 participants' syllabification of stimuli with singleton graphemes remains predominantly aligned with the MOP. Nonetheless, their syllabification shows a slight decrease in reliance on orthographies but a slight increase in reliance on the WSP.

Syllabication by participants at the B1 level demonstrates a substantial decline in their preference for heterosyllabic gemination, with a growing inclination towards syllabification in line with the WSP, suggesting the increased awareness of the interaction of stress placement with syllabification.

Hypothetically, the syllabification preferences of participants with higher English proficiency more closely align with those of the NES, reflecting a maturation of linguistic competence in terms of syllabification through stages of L2 acquisition. Gemination among Thai participants serves as compelling evidence that L1 orthography and phonology interfere with the L2 acquisition, and this interference weakens as they advance in their acquisition.

The current findings replicate those of earlier studies conducted by Eddington et al. (2013), Elzinga and Eddington (2014) and Ishikawa (2002) revealing that intervocalic consonants preceded by stress are more liable to be syllabicated as codas than as ambisyllabic, especially by NESs and more proficient L2 English learners, while pre-stress intervocalic consonants are more inclined to be syllabified as onsets. Such findings collaborate with the notion that stressed syllables attract intervocalic consonants (Derwing, 1992; Fallow, 1981; Treiman & Zukowski, 1990).

Non-native English speakers like Japanese tend to prefer syllabification as an onset following MOP, regardless of stress placement (Ishikawa, 2002); similarly, Thai participants in this study displayed a preference for syllabification as an onset when intervocalic consonants are orthographically represented as singletons and as heterosyllabic geminates, or known as *ambisyllabic consonants* in other studies, when the consonants are orthographically represented as geminates. Both studies confirm the interference in L2 phonology acquisition with that of the L1.

Furthermore, the influence of orthographies on syllabification has also been consistently substantiated by prior studies of Treiman and Danis (1988), Derwing (1992) and Treiman et al. (2002). Nonetheless, the sonorants were not found to be more likely to be attracted to the coda of the preceding syllable than the obstruents, as suggested by Derwing and Neary (1991) and Treiman et al. (1992).

The NESs in previous studies were reported to ambisyllabify, referred to in this study as ‘to hetero-syllabically geminate’, intervocalic consonants more frequently than the NESs in the present study. Elzinga and Eddington (2014) and Ishikawa (2002) found that a relatively large number of responses from the NESs were associated with ambisyllabicity.

The findings regarding acoustic durations of intervocalic consonants shed light on the relationship between phonological and acoustic analyses. Participants at all levels consistently produced intervocalic consonants orthographically represented as geminates in both post-stress and pre-stress positions for longer durations than those represented as singletons. The durational ratios of orthographic singletons to geminates in post-stress positions slightly increased from CEFR level A1 to A2 and steadily decreased from A2 to B1, approaching NESs’ patterns. The durational ratios between the two orthographic forms in pre-stress positions exhibited a decrease from A1 to NES participant groups.

Consistent with Thirakunkovit (2019), the acoustic duration of intervocalic consonants is influenced by orthographic representations. In this study, the consonants with geminate graphemes, which were produced as heterosyllabic geminates by Thai participants, are, on average, acoustically longer than those produced by NESs. The durational ratio of orthographic singletons to geminates, especially in post-stress positions, obtained from the NES group, which is close to 1, suggests that intervocalic consonants, whether orthographically surfacing as singleton graphemes or as geminate graphemes, are produced at roughly equal lengths. This reflects NESs’ mental representation of syllabification in which stress interacts with syllabification rather than orthographies, and consonants preceded by stressed lax vowels are presumed to be ambisyllabic consonants, albeit with their length being the same as that of non-ambisyllabic singleton consonants.

Conversely, heterosyllabic gemination reflects Thai speakers of English’ mental representation of syllabification, where geminate graphemes are syllabified as two separate phonemes across syllables. Such finding is, however, not maintained by acoustic evidence, in that the ratio of consonants with singleton graphemes to those with geminate graphemes, which roughly ranges between 1.1 and 1.5 suggests that the consonants, assumed to be heterosyllabic geminate, are shorter than true lexical geminates, found in languages such as Russian, Italian, Japanese and Bengali, which were reported to be 1.5 to 3 times longer than singleton counterparts (Ladefoged & Maddieson, 1996).

With respect to consonantal types, the results from this research are consistent with those found in the works of Dmitrieva (2012) and Dmitrieva (2017), where singleton and geminate obstruents were, on average, reported to exhibit longer durations than sonorants. This indicates a cross-linguistic similarity in which the length of consonants decreases from voiceless obstruents, voiced obstruents, and nasals to liquids.

In conclusion, the current findings demonstrate that syllabification preferences among Thai speakers of English evolve with increasing proficiency, influenced by stress and orthographies. Acoustic durations of intervocalic consonants are also affected by orthographies, stress and consonantal types. As participants' L2 acquisition progresses towards nativelikeness, their syllabification preferences and acoustic durations of intervocalic consonants exhibit greater similarity with NESs.

The study's findings imply that achieving target-like pronunciation in English for Thai speakers might be more attainable than previously thought, especially with a focus on duration awareness. By incorporating minimal pair exercises, both in perception and production, learners can be explicitly trained to discern and replicate subtle differences in syllable duration. This targeted approach could significantly enhance their pronunciation skills, bridging the gap between non-native and native-like English pronunciation.

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