Length contrast of high vowels in the Thai language of the Sukhothai period:

What do the inscriptions say?

La distinction de quantité vocalique de voyelles fermées en langue thaïe de la période Sukhothaï:

que les inscriptions disent-elles?

Abstract

In an attempt to study the length distinction of high vowels in Sukhothai Thai, this research compares the analysis of the graphemic system and spelling variations found in the Sukhothai inscriptions with the phonemes in Proto-Southwestern Tai (PSWT) and donor languages of the loanwords. The result indicates that short and long high vowels in PSWT behave differently in phonemic-graphemic mapping. Short vowels are mapped with <i> and <u> whereas long vowels with <ī>, <ī̃>, and <ū>. In addition, the existing spelling variations are limited to specific kinds of word, namely: open-syllable words, loanwords, and function words, all of which are susceptible to variation in spelling. These findings attest to the existence of length contrast in Sukhothai Thai.

Dans le but d'étudier la distinction de la quantité vocalique de voyelles fermées en la langue thaïe de Sukhothaï, cette recherche compare l'analyse du système graphématique et de variations orthographiques trouvées dans les inscriptions de Sukhothaï avec les phonèmes en Proto-Southwestern Tai (proto-tai sudoccidental) (PSWT) et les langues d'origine des emprunts. Le résultat indique que les voyelles brèves et les voyelles longues fermées en PSWT se conduisent différemment dans la graphie phonème-graphème. Les voyelles brèves sont signalées par <i> et <u> alors que les voyelles longues par <ī>,<ī̃>, et <ū>. De plus, les variations orthographiques qui existent sont limitées à certains types de mots: les mots à syllabe ouverte, les emprunts, les mots grammaticaux, tout ce qui est sensible

à la variation d'orthographes. Ces résultats confirment la présence de la distinction de la quantité vocalique en thaïe de Sukhothaï.

Keywords: vowel length, Thai, Tai, Sukhothai inscriptions.

1. **Introduction**

The Thai language of the Sukhothai period, as recorded in inscriptions dating back to the 13th-16th centuries, is one of the few attested medieval languages in the Southwestern branch of the Tai language family. Although its exact relationship to modern Tai varieties has never been clarified, many scholars, including Ittaratana (1975), Jansomwong (1987), Dhananjayananda (1993), consider the language to be a direct ancestor of Thai, which is currently spoken as the official national language of Thailand. Because Sukhothai inscriptions are the oldest original documents of a Tai language that survive today, studying the Thai language of Sukhothai period may reveal unique information about the history of Thai and the Tai language family in general.

One puzzle of crucial relevance involves the length contrast in high vowels. Because Sukhothai Thai is only attested in inscriptions, information about its phonological system must be distilled from the writing system of the available texts. As pointed out by Na Nagara and Griswold (1992), Danvivathana (1981), and Jansomwong (1987), symbols representing short and long vowels seem to be used interchangeably in Sukhothai inscriptions. With the assumption that writing represents speech sound more or less accurately, these previous studies suggest that the variation of vocalic symbols indicates a lack of phonemic length distinction in the Thai language of the Sukhothai period, especially among high vowels (Jansomwong 1987: 49). The hypothesis is at odds with the widely-accepted view that Proto-Southwestern Tai (PSWT) had length contrast in high vowels (Li 1977; Pittayaporn 2009b; Sarawit 1973). If vowel length was indeed not phonemic in Sukhothai period, a merger between short and long vowels must have occurred sometime after the proto-language. Unfortunately, the spelling variation that started the discussion on vowel length has never been investigated systematically.

This paper, therefore, studies the length distinction of high vowels in the Thai language of the Sukhothai period based on Sukhothai inscriptions, methodologically combining graphemic analysis and Comparative Tai, following the Old Mon analysis of Shorto (1965). First, a graphemic analysis is applied to analyze inscriptional data, the only primary source that represents Sukhothai-period Thai phonology, in order to access the nature of the variation of vocalic symbols reported in earlier studies. After analyzing the graphemic systems of each individual inscription, the graphemes extracted from the inscriptions are matched with its corresponding sound in PSWT or, in case of loanwords, the pronunciation in the donor language, Old Khmer. The results show that

phonological length is an important factor in the mapping between the Sukhothai graphemes and their corresponding PSWT phonemes. Moreover, the results reveal that variations found in Sukhothai inscriptions are surprisingly few and mostly explainable. Therefore, this study proposes that vowel length was contrastive for high vowels in the Thai language of the Sukhothai period.

2.   **Previous studies**

A considerable body of literature exists on both the synchronic and diachronic aspects of the Thai language of Sukhothai period, including discourse (e.g. Ittaratana 1975), semantics (e.g. Engchuan 2000), and phonology (e.g. Brown 1965; Diller 1988; Jansomwong 1987; Rod-in 1991; Suwattee and Kullavanijaya 1976). This includes a number of studies on the vowel inventories of the Thai language of Sukhothai, which have conflicting views on the existence of length contrast in high vowels.

The first group of studies maintains that vowel length contrast was contrastive in high vowels. Both Brown (1965) and Rod-in (1991) reached this conclusion by applying the Comparative Method to data from Southern Thai. Their position lies on the assumption that the Thai language of the Sukhothai period and present-day Southern Thai dialects are genetically related (Brown 1965: 145; Brown 1966: 1-2; Rod-in 1991). According to Brown (1965), approximately twenty dialects of Southern Thai, currently spoken in southern Thailand and northern Malaysia, are direct descendants of Sukhothai Thai. The reconstructed vowel systems proposed by Brown and Rod-in include a phonemic length contrast in all three pairs of high vowels, /i-iː/, /ɯ-ɯː/ and /u-uː/.

Nevertheless, this research result is far from conclusive as no convincing support for the genealogy is provided. Brown (1965) took the tonal symbols in Sukhothai inscriptions to be a reflection of the reconstructed system of Proto-Southern Thai, which he believed to have had three lexical tones. In addition, he also speculated that the classification of consonant symbols into "high," "mid," and "low" in modern Thai orthography was devised to match the three classes of consonantal phonemes he both presumed to have existed in the Sukhothai period and took as evidence for the genetic relationship between Sukhothai-period Thai and Southern Thai (Brown 1966: 2). However, no hard evidence was put forward to support the relationship of Sukhothai Thai and Southern Thai. This casts doubt on the validity of the conclusion that vowel length was contrastive in high vowels.

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Another view on the status of vowel length in the Thai language of Sukhothai is that the language lacks a vowel length contrast in high vowels. Focusing on the writing system of Sukhothai inscriptions, Danvivathana (1981) and Jansomwong (1987) attempted to posit the sound represented by each graph. These studies suggest that the length distinction in high vowels is not phonemic in the Thai language of the Sukhothai period, as the symbols representing long and short high vowels appear interchangeably. Although they rightly used epigraphic data from Sukhothai inscriptions to arrive at their suggestion, the main shortcoming is their method of analyzing the graphemic system of Sukhothai inscriptions. More specifically, they lumped graphs from different inscriptions from different ages, regions, authors, and scribes in the same pool. In other words, they did not take into account the possibility that graphic variation may have been due to other linguistic factors, such as origin of words, syllable structure, or function of words.

More seriously, the assumption that a grapheme represents one phoneme is not tenable, since there could be cases of allography or homography. A graph could represent more than one speech sound, e.g. Mon graphs *ṣ* and *s* spellings as in *kṣīw, pṣuk, kusīw, suk* infer one sound /s/. On the other hand, a speech sound could also be represented by more than one graph, e.g. Mon *cap* as an alternant of *cup, cip*, 'to arrive as', is a homograph of *cap* 'to adhere to.' Moreover, when a script developed for writing one language is applied to the writing of another, such as scripts in Sukhothai inscriptions, the resulting adaptation is likely to be neither systematic nor consistent in the matching of graphemes to phonemes (Shorto 1965: 89-90). Because this group of studies ignored these possibilities, the hypothesis that there was no length distinction among high vowels in Sukhothat needs to be considered cautiously.

In summary, both groups of studies on vowel length in Sukhothai Thai suffer serious shortcomings. In particular, those that apply the Comparative Method to dialect data are based on a doubtful assumption that Sukhothai-period Thai is a direct ancestor of Southern Thai. On the other hand, those using data from the Sukhothai inscriptions rightly take spelling variation as significant but fail to assess its nature systematically. Because inscriptions are the only primary source for the Thai language of Sukhothai period, this study follows the second group in taking spelling variation found in the Sukhothai inscriptions as crucial data. However, the importance of careful graphemic analysis as well as knowledge of PSWT should be stressed when trying to understand the nature of spelling variations.

3. Data and methodology

The Thai language of the Sukhothai period or Sukhothai Thai is a working terminology referring to a language represented by Sukhothai inscriptions. The inscriptions used in this study are the inscriptions collected and transliterated in *Prachum Charuek Phak VIII: Charuek Sukhothai* [*Collection of inscriptions, part VIII: Sukhothai inscriptions*] (2005) published by the Fine Arts Department. Of the 63 inscriptions in the volume, only those with more than one hundred legible words are used. The inscriptions used in this study were found in a variety of regions. Most of the inscriptions are found in Sukhothai, located in north central Thailand, where the Sukhothai Kingdom existed in the 13th-16th centuries. The others are found in the central regions of Thailand, such as Ayutthaya and Bangkok, and northern Thailand, such as Nan and Lamphun. They are sometimes considered as representing dialects rather than languages spoken in the Sukhothai Kingdom. Therefore, each of the thirty inscriptions selected were analyzed separately to allow for both potential variation due to the possibility of being different dialects and other extra-linguistic factors yet to be detected. The selected inscriptions include those written with Sukhothai Thai script and Sukhothai Khmer script, the two scripts that were used to record the Thai language of Sukhothai period.

The oldest attestation of the Sukhothai Thai script is generally believed to be the *Inscription 1* (1292), which dates back to the late 13th century. Modified from the Old Khmer script of the 10th–13th century Khmer inscriptions (Bradley 1912; Bradley 1917; Cœdès 1925; Phirunsarn 1981), the Sukhothai script has altogether six vocalic symbols that represent high vowels, namely *i, ī, ï, ï̄, u*, and *ū* [1] as shown in Table 1. Of the six symbols, only *i, ī, u*, and *ū* are derived from their corresponding Old Khmer symbols (Jenner 2009b; Jenner 2009c; Phirunsarn 1981). The graphs *ï* and *ï̄* were newly invented and appear only in some inscriptions. However, it is not clear whether *ï* is a separate grapheme or exists in an allographic relation with another graph (Songvitaya 1981).

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
[1] Transliteration used in this paper follows the system used by Na Nagara and Griswold in Epigraphic and Historical Studies (1967-1979) modified from Graphic System used by Cœdès (1924).

Table 1   **The Sukhothai Thai graphemes and allographs representing high vowels (modified from Songvitaya 1981)**

Time period	i	ī	ï	ï̄	u	ū
10th–13th-century Old Khmer			-	-		
late-13th Century Sukhothai			-			
eary-14th Century Sukhothai	,	,	-	-	,	,
late-14th Century Sukhothai	,				,	,
early-15th Century Sukhothai			-			

In addition to the Sukhothai Thai script, the Sukhothai Khmer script was also employed to write inscriptions during the Sukhothai period. First used to represent the Thai language in the early-15th century, the script also originated from Old Khmer script (Kaewklom 1980) and was originally used to write the Sanskrit and Khmer languages. The oldest inscription written in this script is the *Wat Pa Daeng inscription 1-3* (1406). In contrast to the Sukhothai Thai script, Sukhothai Khmer script contains only four symbols derived from Old Khmer, namely <i>, <ī>, <u>, and <ū>. The shape of each symbol is shown in Table 2.

Table 2   **The Sukhothai Khmer graphemes and allographs representing high vowels (Kaewklom 1980; Phirunsarn 1981; Songvitaya 1981)**

Time period	Position	<i>	<ī>	<u>	<ū>
10th–13th-century Old Khmer	Word-initial	(glyph)	(glyph)	(glyph)	(glyph)
	Other	(glyph)	(glyph)	(glyph)	(glyph)
Late-14th -15th Century Sukhothai	Word-initial	(glyph), (glyph), (glyph)	N/A	(glyph)	N/A
	Other	(glyph), (glyph)	(glyph), (glyph), (glyph)	(glyph)	(glyph), (glyph)

Following Shorto's (1965) methodology, the graphemic systems in Sukhothai inscriptions were extracted. For each inscription, the symbols for high vowels were first analyzed using graphemic analysis. As an analogy of phonemic analysis, graphemic analysis is a linguistic study involving a writing system. It aims to describe orthographic units in the system and graphotactics that make each element in the writing system connected systematically (Bussmann 2006; Coulmas 1999). As an analog to phoneme, a grapheme is the smallest unit in the writing system that can distinguish the meanings of words. For example, <k> and <p> are two separate graphemes in English because they differentiate between the words <kick> and <pick>. On the other hand, two graphs are considered allographs of the same grapheme if an exchange between them does not change the meaning of the word. For example, <A> and <a> are allographs of the same grapheme in English because <Apple> and <apple> have the same meaning (Crystal 1997).

To discover their pronunciation, each word containing a high vowel grapheme was first matched with a corresponding PSWT reconstruction. The correspondence between graphemes and PSWT phonemes were then set up for further analysis extraction of the sound represented by each

grapheme. With respect to the PSWT vowel system, the majority view is that PSWT has a vowel length distinction not only in *a-*a: but also in high vowels (Li 1977; Pittayaporn 2009b; Sarawit 1973). Although Jonsson (1991: 102-21) disagrees with this view, claiming that vowel length was only contrastive for *a-*a: from the fact that there are few minimal pairs in other vowels, she fails to provide concrete arguments in support of her position. As Pittayaporn (2009b) points out, even though there were few minimal pairs, the conditioning environment for short and long vowels could not be identified. Moreover, vowel lengths agree in most cases in modern languages. Etyma with long/short vowels are also long/short in other languages. Similarly, words with short vowels in one language will have short vowels in another language (Pittayaporn 2009b). This paper, therefore, adopts the view that PSWT has length contrast in high vowels.

Unfortunately, there are two complications in assigning the reconstructed PSWT forms to the words with high vowel graphemes found in Sukhothai inscriptions. The first is the lack of lexicon of PSWT. Li (1977); Sarawit (1973), and Pittayaporn (2009b) did not show full data of the reconstructed form of each etymon in PSWT. As this paper focuses on length distinction, a nucleus of each etymon was reconstructed mainly based on PSWT data in Gedney's wordlist (Hudak 2008). The reconstructed forms were then checked with data from Saek (Hudak 2008; Hudak 2010) and Bao Yen (Pittayaporn 2009a). These varieties are Tai languages in Northern and Central branches, respectively.

The second complication is that many words are not re-constructible in PSWT but are loanwords from Indic or Khmer. In such cases, the original forms in the donor languages are used instead. The original forms analyzed here are extracted from Jenner (2009a) for Khmer loanwords and Indic ones that are considered to have been borrowed through Khmer language (Nacaskul 1962; Varasarin 1984). This is problematic because, unlike with PSWT, the question of whether Old Khmer had a vowel length contrast or not is more controversial, cf. Ferlus (1992); Jacob (1960). Hence, even though Jenner (2009a) suggested the vowel length distinction in Old Khmer, the possibility that length distinction might not exist was also widely considered in this study.

After the correspondence of graphemes and proto-phonemes had been set up, the Sukhothai sound represented by each grapheme was extracted. Following Shorto (1965), discrepancies between the graphemic and phonological systems were also taken into account. If a grapheme corresponded with only one proto-phoneme, it was assumed to represent that particular

PSWT phoneme retained in Sukhothai-period Thai. Cases that did not show one-to-one correspondence were analyzed either as allography and homography of the grapheme or as evidence for a change in phonemic distinction depending on how they fit within the general picture.

4. Graphemic system used in Sukhothai inscriptions

Methodologically, it is important that each inscription must first be analyzed separately to allow for possible graphemic variation across inscriptions. Because graphemes representing (i) and (ɯ) and those representing (u)[2] behave differently in Sukhothai inscriptions, this section discusses the two groups separately.

4.1 Graphemes representing (i) and (ɯ)

The graphemes representing (i) and (ɯ) are different from other graphemes, since scholars claimed these graphemes as showing variation. Our analysis reveals that the 30 inscriptions were written using three graphemic systems, which differ with respect to the number of graphemes representing (i) and (ɯ) that occur in the text. The high vowel graphemes in the three systems are shown in Table 3. The analysis reveals that most of the variations that have been observed are due to differences in the number of graphemes that exist in the graphemic system of the texts.

Table 3   Graphemic systems of Sukhothai inscriptions

	<i>	<ī>	<ī̈>	Numbers of Inscriptions
System I	✓	-	-	1
System II	✓	✓	-	21
System III	✓	✓	✓	8

Among 30 inscriptions, there is only one inscription using System I with one grapheme <i> representing (i) and (ɯ). On the other hand, System II is the most recurrent graphemic system, found in 21 inscriptions. It contains modified grapheme from Old Khmer script, <i> and <ī> without any newly invented graphemes. System III having <ī̈> in addition to graphemes in System II appears in 8 inscriptions. Even though Sukhothai inscriptions vary with respect to the graphemic systems

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[2] (V) is used to represent a vowel phoneme without length indication.

used, there is no obvious effect from any specific extralinguistic factors, e.g. age, region, and content. However, the usage of Sukhothai Thai and Khmer script in each inscription seems to partially determine which graphemic system is used in that inscription. All of the inscriptions using Sukhothai Khmer script use System II. This is not surprising as the Sukhothai Khmer script originated from Old Khmer, which also has only two graphemes, <i> and <ī>. The frequency of each system is shown in Figure 1.
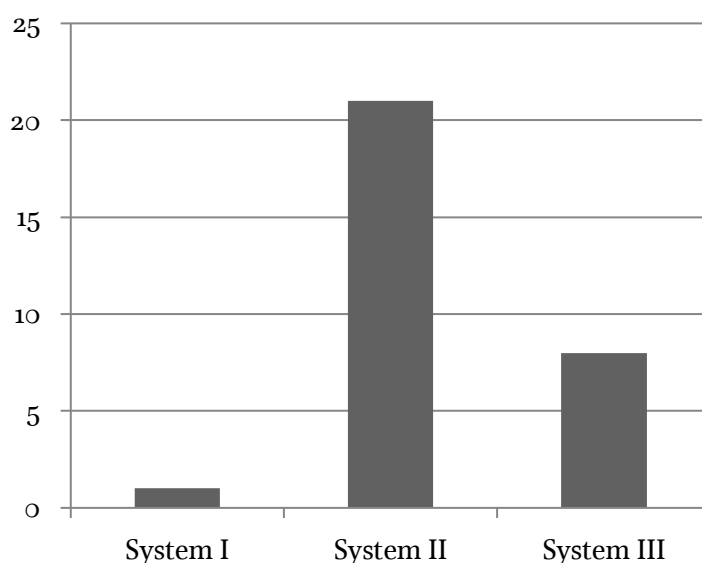
Figure 1   Number of Sukhothai inscriptions by system

4.1.1   System I

Among the three graphemic systems, System I is the least common as only one inscription uses the System I, *Inscription 107* (Wat Bang Sanuk inscription, uncertain[3]). It is the third oldest inscription found written with Thai Sukhothai script that has recorded the Thai language of Sukhothai. The grapheme <i> used in this inscription does not exhibit any variation. This grapheme is found both in syllable with and without coda grapheme, as illustrated in Table 4.

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[3] Penth (1996) suggested that the date of *Inscription 107* remains doubtful. It can be 1339, 1219, or neither.

Table 4   Distribution of grapheme representing (i) and (ʉ) in System I

Grapheme	Syllable with coda grapheme		Syllable without coda grapheme	
	Graph	Example	Graph	Example
<i>	-*i*	*ti* 'good', *mi* 'hand', *biset* 'special', sri 'honor'	-*i*-	*sip* 'ten', *tin* 'soil', *niṅ* 'one', *bim* 'press', '*inda* 'indra'

4.1.2   System II

System II is the most recurrent graphemic system in the Sukhothai inscriptions, appearing in 21 inscriptions, as shown in Table 5.

Table 5   Sukhothai inscriptions using System II

#	Name of inscription	Number	Year	Script
1.	Chedi Phihan	319	early-14th century	Sukhothai Thai
2.	Pho Khun Ramphon	285	1357	Sukhothai Thai
3.	Khao Kop	11	1359-1369	Sukhothai Thai
4.	Wat Pa Mamuang (Thai) 2	7	1362	Sukhothai Thai
5.	Wat Khao Sumanakut	8	1368	Sukhothai Thai
6.	Wat Sri Chum	2	1369	Sukhothai Thai
7.	Wat Phra Yuen	62	1371-1404	Sukhothai Thai
8.	Pa Nang Khumyia	102	1379	Sukhothai Thai
9.	Pu Khun Chit Khun Chod	45	1392	Sukhothai Thai
10.	Kham Pu Sabot	64	1392	Sukhothai Thai
11.	Pa Nang Mo	288	1392	Sukhothai Thai
12.	Wat Hin Tang	95	1400-1419	Sukhothai Thai
13.	Wat Pa Daeng 1	9/1	1406	Sukhothai Khmer
14.	Wat Pa Daeng 2	9/2	1406	Sukhothai Khmer
15.	Wat Pa Daeng 3	9/3	1406	Sukhothai Khmer

#	Name of inscription	Number	Year	Script
16.	Wat Asokaram	93	1413	Sukhothai Thai
17.	Wat Burapharam	286	1413	Sukhothai Thai
18.	Chedi Noi	40	late-14th – late-15th century	Sukhothai Thai
19.	Wat Phra Sadet	15	1525	Sukhothai Thai
20.	Nai Sriyotha Ok Buat	86	1528	Sukhothai Khmer
21.	Wat Khema	14	1536	Sukhothai Thai

This system contains 2 symbols that represent high vowels, namely <i> and <ī>. These symbols are considered as separate graphemes since minimal pairs are commonly found, as shown in Table 6.

Table 6   Minimal pairs in System II

<i>	<ī>
<phi> 'if'	<phī> 'spirit'
<mi> 'not'	<mī> 'have'
<yin> 'hear'	<yīn> or <ayīn> 'stand'
<śilā> 'stone'	<śīlā> 'precept'
<hin> 'rock'	<hīn> '?'

These two graphemes occur in syllables with and without coda grapheme. However, only <i> is found in syllable with <ḥ> coda[4]. The distribution of graphemes in System II is illustrated in Table 7.

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[4] <ḥ> is analyzed to be a coda consonant in this paper, since it co-occurs with other vowel graphemes but in the coda position. This analysis agrees with the status of <ḥ> in Old Mon (Diffloth 1984) and Old Khmer (Jenner 2009a; 2009b).

Table 7   Distribution of grapheme representing (i) and (u) in System II

Grapheme	Syllable with coda grapheme		Syllable without coda grapheme	
	Graph	Example	Graph	Example
<i>	-i	*mi* 'not', *ti* 'good', *di* 'at', *bi* 'older sibling', *ji* 'name', *bihār* 'temple', *sri* 'honor', *maiṯri* 'friendship'	-i-	*tin* 'soil', *hin* 'rock', *sip* 'ten', '*tin* 'foot', *khin* 'arise', *niṅ* 'one', *mit* 'dark', *gin* 'night', *dib* 'divine'
			-iḥ	*ṯiḥ* 'blame', *hariḥ* 'hari'[5]
<ī>	-ī	*mī* 'not', *khī* 'ride', *ñī* 'two', *mī* 'have', *jī* 'name' *jī* 'buy', *thī* 'hold', *munī* 'sage', *cetīya* 'pagoda', *sāmī* 'monk', *srī* 'honor'	-ī-	*hīn* 'rock', *īṅ* 'lean on', *ṯūn* 'foot', *khīn* 'arise', *nūṅ* 'one', *gīn* 'night', *p̱īn* 'climb', *īn* 'other', *īt* 'brick', *dīb* 'divine', *dīp* 'island', *śīl* 'precept'

Table 7 shows a few words that fluctuate between the symbols <i> and <ī>, such as 'honor' is found spelled as *sri* and *srī* or 'night' as *gin* and *gīn*. However, only 15 percent of words appearing more than once show spelling variation. The majority of the inscriptions using System II do not appear to vary. Moreover, variation is mostly limited to specific types of words, to be explained in the latter part of §4.1.

4.1.3   System III

There are 8 inscriptions using System III, as shown in Table 8.

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[5] One anonymous reviewer suggests that most of the cases of final *ḥ* shown in this paper are the retention of Khmer spelling, except *hariḥ*, a possible case of Sanskritized spelling.

Table 8　Sukhothai inscriptions using System III

#	Name of inscription	Number	Year	Script
1.	Ramkhamhaeng[6]	1	1292	Sukhothai Thai
2.	Nakon Chum	3	1357	Sukhothai Thai
3.	Wat Pa Mamuang (Thai) 1	5	1361	Sukhothai Thai
4.	Wat Chang Lom	106	1370	Sukhothai Thai
5.	Kotmai Laksana Chon	38	1397	Sukhothai Thai
6.	Wat Ta Then Khueng Nang	46	1404	Sukhothai Thai
7.	Wat Kamphaeng Ngam	291	1412-1536	Sukhothai Thai
8.	Wat Sorasak	49	1417	Sukhothai Thai

There are four symbols representing (i) and (ɯ) in System III, namely *i, ī, ï* and *ï̄*. However, applying the graphemic analysis reduces the number of graphemes to three. The symbol *ï* is not considered as a grapheme, because it appears only once in the *Inscription 106* (1370) (Songvitaya 1981). The symbol seems to be an allograph of <i>, because 'arise' appeared in two different forms, *khin* and *khïn* in Inscription 106. The other symbols are considered as separate graphemes since minimal pairs are commonly found, as shown in Table 9.

Table 9　Minimal pairs in System III

<i>	<ī>	<ï̄>
<mi> 'not'	<mī> 'have'	<mï̄> 'hand'
<tr̥i> 'think'	<tr̥ī> 'three'	-
<phi> 'if'	<phī> 'spirit'	-
<j̥i> 'a particle'	-	<j̥ï̄> 'buy'
<yin> 'hear'	-	<yï̄n> 'stand'

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[6] Although the authenticity of the *Ramkhamhaeng* inscription is still controversial, its inclusion in this study does not affect the validity of the analysis as the study examined each inscription separately to allow for possible variation across inscriptions. Interestingly, this inscription does not deviate enough from others to affect the overall conclusion.

<i>	<ī>	<ī̄>
-	<jī> 'point'	<jī̄> 'name'
-	<sī> 'four'	<sī̄> 'script'

These three graphemes distribute in both orthographically open and orthographically closed syllables, similar to those in System II. However, words with <ḥ> coda cannot be found in inscriptions using System III. Their distributions can be illustrated in Table 10 below.

Table 10 Distribution of grapheme representing (i) and (ɯ) in System III

Grapheme	Syllable with coda grapheme		Syllable without coda grapheme	
	Graph	Example	Graph	Example
<i>	-i	*mi* 'not', *si* 'four', *di* 'at', *mi* 'have', *vimal* 'pure', *tilak* 'mark', *mauli* 'topknot', *simā* 'boundary'	-i-	*kin* 'eat', *phit* 'incorrect', *hin* 'rock', *'tin* 'foot', *khin* 'arise', *niṅ* 'one', *gin* 'night', *ciṯ* 'mind', *bhiksu* 'monk'
<ī>	-ī	*mī* 'not', *tī* 'good', *thī* 'frequent', *hnī* 'flee', *jī* 'name' *jī* 'buy', *kavī* 'poet', *pīṭak* 'pitaka', *nadī* 'river', *vāsī* 'dweller'	-ī-	*sīp* 'ten', *phīt* 'incorrect', *jīn* 'hear', *ṯīn* 'foot', *pīk* 'climb', *khīn* 'arise', *nīṅ* 'one', *gīn* 'night', *jīn* 'stand', *nībbān* 'nirvana', *'īnd* 'indra', *śīl* 'precept'
<ī̄>	-ī̄	*jī̄* 'name', *thī̄* 'hold'	-ī̄-	*khī̄n* 'arise', *ṇī̄ṅ* 'one', *ī̄n* 'other', *ayī̄n* 'stand'

In Table 10, some words show spelling variations. For example, the word 'have' appears in two forms, *mi* and *mī*, and the word 'one' has three forms, *niṅ*, *nīṅ* and *ṇī̄ṅ*. However, this

phenomenon is quite rare. Although some might argue that the spelling variation may reflect a phonemic merger in progress, a close examination at individual cases indicates that this is not the case. After analyzing each variant carefully, only few words are found with variations. Moreover, most cases of variation are explainable. Figure 2 illustrates the type frequency of variant and invariant words. Counting only words that appear more than once in an inscription, the result shows that only 15 and 18 percent of words in inscriptions using System II and System III respectively appear in more than one form.
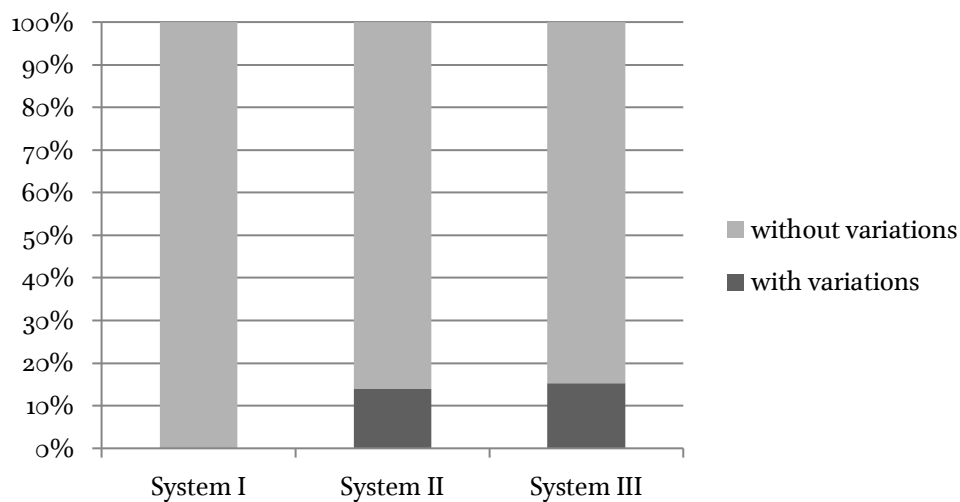
Figure 2 **Type frequency of words with a grapheme representing (i) and (u) that show variations compare to those that do not**

Of crucial relevance is the fact that the variations discussed above are limited to three classes of words. The first class is the class of graphemically open-syllable words. When the words consist of a single open syllable, the vocalic graphemes <i>, <ī>, and <ī̄> occur interchangeably without changing the meaning of the words, as shown in Table 11.

Table 11 Variation patterns of open-syllable words in Sukhothai inscriptions

PSWT vowel	Sukhothai graph	Example	
		Words	Frequency
*iː	ī	ʼpī 'year'	74 (80%)
	i	ʼpi 'year'	19 (20%)
*ɯː	ī	jī 'name'	52 (66%)
	ī̄	jī̄ 'name'	21 (26%)
	i	ji 'name'	6 (8%)

This variation of open-syllabled words seems to be related to the phonotactic restriction in PSWT that neutralizes the vowel length distinction by allowing only long vowels in open syllables (Pittayaporn 2009a). The fact that Sukhothai graphemic systems also display spelling variations only in open monosyllabic words suggests that Sukhothai Thai inherited the vowel length contrast and its neutralization in open syllables from PSWT. This pattern of variation is also reminiscent of Old Khmer and Old Mon inscriptions, in which <ī> only occurs in open-syllabled words and appears interchangeably with <i> (Jacob 1960). The case of <ī̄>, which appears interchangably with <i> and <ī>, might be a result of the fact that <ī̄> was an innovation in Sukhothai script.

The second class of variation consists of Khmer and Indic loanwords, which constitute nearly half of the cases of spelling variations. Like Tai cognates, all loanwords with spelling variations have either *i* or *ī* in the donor languages. Examples of loanwords that show spelling variation are presented with reconstructed pronunciation in Old Khmer in Table 12.

Table 12   Variation patterns of Indic loanwords in Sukhothai inscriptions and its reconstructed pronunciations in Old Khmer

Vowel in donor language	Sukhothai graph	Indic	Example	
/i/	*i*	*citta* /cit/	*cit*	'mind'
	ī		*cīt*	'mind'
	i	*inda* /ʔin/	*ind*	'Indra'
	ī		*īnd*	'Indra'
/iː/	*ī*	*dīpa* /diːp/	*dīp̣*	'island'
	i		*dip̣*	'island'
	ī	*śrī* /sriː/	*śrī*	'glory'
	i		*śri*	'glory'

As for Khmer loanwords, they show significantly less variation than their Indic counterparts. The only Khmer word with a clear etymology is *taṃḷiṅ/taṃḷiṅ* 'unit of weight', written as *taṃliṅ* or *taṃlūṅ* in *Inscription 106* (1370). Note, however, that Indic loanwords were most likely borrowed through Old Khmer (Gedney 1947; Huffman 1986). The spelling variation in Indic and Khmer loanwords could be due to two reasons. First, the variation might be a trace elucidating that Sukhothai graphemic systems were inherited from the Old Khmer writing system. In Old Khmer inscriptions, <ī> appears interchangeably with <i> (Jacob 1960). This means that the Indic loanwords in Sukhothai inscriptions might reflect how the words were spelled in Old Khmer sources. The second possible reason behind the spelling variation concerns the proficiency of the inscribers in these foreign languages. If these non-native words had not been established in the lexicon of Thai speakers in Sukhothai period, the spelling variations might in fact reflect variation in the spoken language at that time.

The last class of words in the Sukhothai inscriptions that tends to vary is the class of function words. In the Sukhothai inscriptions, function words sometimes deviate from the general trend of spelling and display variation between and within inscriptions, as shown in Table 13. Typologically speaking, function words, such as articles, pronouns, prepositions, etc., are by default unstressed at the sentential level (Kager 2007; Pittayaporn & Chulanon 2012; Selkirk 1996; Zwicky 1985). As unstressed words tend to be pronounced relatively short, it is not surprising to observe confusions between graphemes for short and long vowels for function words.

Table 13   Variation patterns of function words in Sukhothai inscriptions

PSWT vowel	Sukhothai graph	Example	
		Words	Frequency
*i	*i*	*sip* 'ten'	75 (87%)
	ī	*sīp* 'ten'	11 (13%)
*iː	*ī*	*nī* 'this'	180 (73%)
	i	*ni* 'this'	68 (27%)
*ɯ	*i*	*niṅ* 'one'	135 (85%)
	ī	*nīṅ* 'one'	23 (1%)
*ɯː	*ī*	*gī* 'to be'	9 (75%)
	ī̄	*gī̄* 'to be'	1 (8%)
	i	*gi* 'to be'	2 (17%)

However, there are also a few cases that appear not to fit into these three word classes. A closer look at the data shows that these words are both cases of variations with the same inscription and between inscriptions. Intra-inscription variations in this case are found only in three inscriptions - *Inscription 3* (1357), *Inscription 2* (1369), and *Inscription 62* (1371-1404). Since these

inscriptions were all inscribed in the 14th century, variations found might be due to a trend occurring during this period.

The distribution and variation of graphemes representing (i) and (ɯ) are also observed by Na Nagara and Griswold (1992). They suggested that the variation between <i> and <ī> might be due to the shape of the graphemes themselves. The little vertical line that distinguished those graphemes was sometimes so faintly engraved that it might have been hard correctly recognize them. This supports the fact that variations are found more extensively in graphemes representing (i) and (ɯ) than those representing (u).

In summary, Sukhothai inscriptions can be divided into three groups according to different graphemic systems representing (i) and (ɯ). Only System II and System III shows graphemic distinction. The variation in the Sukhothai inscriptions studied here indicates that even though the vocalic symbols occur interchangeably as stated in previous studies, these are only limited to specific conditions. As for the other vowels, spelling variation occurs only in open-syllable words, loanwords, and function words. As these types of words are especially amenable for spelling variation to occur, the variation found in the Sukhothai inscriptions cannot be used as evidence for the lack of vowel length distinction in Sukhothai Thai.

4.2 Graphemes representing (u)

In Sukhothai Inscriptions, grapheme representing (u) cannot divide inscriptions into classes as those representing (i) and (ɯ), since there are two (u) graphemes, <u> and <ū> distributed equally in every inscription. They are clearly two separate graphemes as shown by a few minimal pairs. Even though there are some variations between these two forms, they are very rare. Table 14 shows list of minimal pairs between <u> and <ū> found in Sukhothai Inscriptions.

Table 14   Minimal pairs of Graphemes representing (u)

<u>	<ū>
<cuṅ> 'then'	<cūṅ> 'lead someone by the hand'
<tu> 'fierce'	<tū> 'look'
<luk> 'move, stand'	<lūk> 'offspring'

<u>	<ū>
<suṅ> '?'	<sūṅ> 'tall'
<sut> 'end'	<sūt> 'pray'

These two graphemes show similar distribution. They are both found in orthographically open and closed syllables. However, only <u> is found occurring with <-ḥ> coda. Their distributions are summarized in Table 15 below.

Table 15   Distribution of grapheme representing (i) and (ɯ) in System II

Grapheme	Syllable with coda grapheme		Syllable without coda grapheme	
	Graph	Example	Graph	Example
<u>	-u	*purī* 'city', *sādhu* 'salute', *bhikṣu* 'monk', *utam* 'abound'	-u-	*khun* 'lord', *khut* 'dig', *ruṅ* 'rainbow', *un* 'warm', *pun* 'virtue', *buddha* 'buddha', *dukkha* 'sufferring', *putra* 'offspring', *sakul* 'family'
			-uḥ	*luḥ* 'attain', *parrcuḥ* 'load'
<ū>	-ū	*tū* 'look', *phū* 'male', *kū* 'I', *gū* 'couple', *pū* 'grandfather' *rū* 'know', *hū* 'ear', *grū* 'teacher', *pūrī* 'city', *mūnī* 'sage', *pūjā* 'worship'	-ū-	*lūk* 'offspring', *plūk* 'plant', *sūṅ* 'tall', *lūṅ* 'uncle', *hūṅ* 'cook', *cūṅ* 'lead someone by hand', *fūk* 'mattress', *p̱ūrūs* 'man', *sathūp̱* 'sthupa', *rūp* 'classifier of monk', *dhūp̱* 'incent'

Like grapheme representing (i) and (ɯ), these graphemes also show variations. For example, the word 'virtue' has two forms, *pun* and *pūn*. The word 'sun' is also found having two

forms, *suriya* and *sūriya.* This phenomenon is found only in two percent of the words in Sukhothai inscriptions with (u) nucleus. Moreover, it is also limited to loanwords. There might be two reasons triggering the spelling variation in Indic and Khmer loanwords, reasons similar to those representing (i) and (ɯ) as discussed previously. First, <u> and <ū> behave like <ī> and <i> in Old Khmer inscriptions. They appear interchangeably (Jacob 1960). The spelling variation found in Sukhothai inscriptions might reflect how they are spelled in Old Khmer sources. The Sukhothai inscribers' proficiency in foreign languages could be another reason behind this variation in spelling. Variations in loanwords pronunciation might then reflect in spelling variations found. Since the variation is rare and is limited to specific environments, it cannot be used as evidence against the length contrast of (u) is Sukhothai Thai.

To recapitulate, graphemes representing high vowels in Sukhothai inscriptions show orthographical distinction between each grapheme, a phenomenon that seems to supportlength distinction of vowel phonemes in Sukhothai Thai. In the next section, the distribution of each grapheme is analyzed together with the correspondences of vocalic symbols and original vowel phonemes to prove the vowel length contrast in the Thai language in Sukhothai period.

5. Length contrast of high vowels

As analyzed in previous section, there are three graphemic system found in 30 Sukhothai inscriptions. In this section, the correspondences of vowel graphemes and proto-vowel phonemes in each graphemic system are analyzed separately, as the System I-III contain a different number of graphemes and show distinct behaviors.

The graphemes representing (i) and (ɯ) are analyzed separately from the graphemes representing (u), because behave differently in each system. In System I, there is only one grapheme, <i>. All high non-rounded vowels, *i, *iː, *ɯ, and *ɯː, in PSWT available in System I are mapped into <i> with no regard for backness and length. This behavior is different from those graphemes in System II and III.

The graphemes are matched with the PSWT phonemes straightforwardly as shown in Table 16. In general, the short high unrounded vowels *i and *ɯ are both mapped with the grapheme <i>. Their long counterparts *iː and *ɯː are mapped with the grapheme <ī>.

Table 16 Correspondence of Sukhothai grapheme representing (i) and (ɯ) in System II with PSWT phonemes

Sukhothai grapheme	Syllable structure (orthographic)	PSWT phoneme	Example
\<i\>	open syllable	*i	*mi* 'not'
		*iː	*ti* 'good', *di* 'at', *bi* 'older sibling'
		*ɯː	*ji* 'name'
	closed syllable	*i	*tin* 'soil', *hin* 'stone', *sip* 'ten'
		*iː	*'tin* 'foot'
		*ɯ	*khin* 'arise', *niṅ* 'one'
		*ɯː	*mit* 'dark', *gin* 'night', *yin* 'stand'
\<ī\>	open syllable	*i	mī 'not'
		*iː	*khī* 'ride', *ñī* 'two', *mī* 'have'
		*ɯː	*jī* 'name', *zī* 'buy', *thī* 'hold'
	closed syllable	*i	*hīn* 'stone', *'īṅ* 'lean on'
		*iː	*'tīn* 'foot'
		*ɯ	*khīn* 'arise', *nīṅ* 'one'
		*ɯː	*gīn* 'night', *'pīn* 'gun', *'īn* 'other'

Not every item found corresponds with PSWT as straightforward as mentioned earlier, as shown in Table 16. There is a minority of words that do not follow this trend. Figure 3 illustrates that there are less than 35 percentages of words with *i, *iː, *ɯ, and *ɯː nucleus in PSWT that deviate from the normal cases. Moreover, if these words appear more than once in Sukhothai inscriptions, they tend to show variations both between different inscriptions and in the same inscription. For example, PSWT *mi 'not', cf. Pittayaporn et al. (2014), that should be written as *mi*, but in *Inscription 288* (1392), it is represented by *mī*. Another case is *χɯn 'arise' that mainly appear in *khin* form, but sometimes appear as *khīn* in the same inscription.
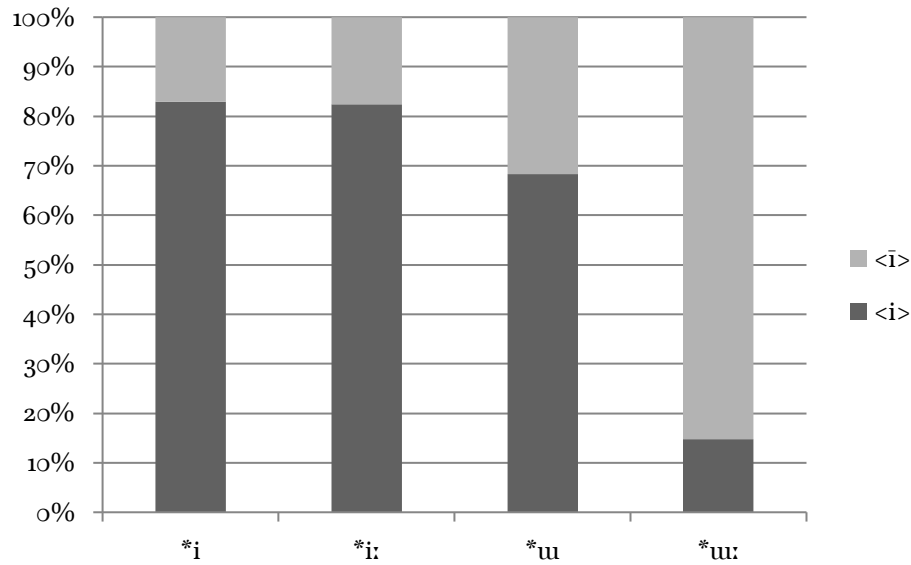
Figure 3　Frequency of correspondences of graphemes representing (i) and (ɯ) in System II and PSWT phonemes

The graphemes representing (i) and (ɯ) in System III behave similar to those in System II. The correspondence between Sukhothai graphemes and PSWT phonemes in System III are summarized in Table 17 below.

Table 17　Correspondence of Sukhothai grapheme representing (i) and (ɯ) in System III with PSWT phonemes

Sukhothai grapheme	Syllable structure (orthographic)	PSWT phoneme	Example
\<i\>	open syllable	*i	*mi* 'not'
		*iː	*si* 'four', *di* 'at', *mi* 'have'
	closed syllable	*i	*kin* 'eat', *phit* 'incorrect', *hin* 'stone'
		*iː	*ʈin* 'foot'
		*ɯ	*khin* 'arise', *niṅ* 'one'
		*ɯː	*gin* 'night'

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Sukhothai grapheme	Syllable structure (orthographic)	PSWT phoneme	Example
<ī>	open syllable	*i	*mī* 'not'
		*iː	*tī* 'good', *thī* 'frequent', *hnī* 'flee'
		*ɯː	*jī* 'name', *jī* 'buy'
	closed syllable	*i	*sīp* 'ten', *phīt* 'incorrect', *yīn* 'hear'
		*iː	*ṯīn* 'foot', *pīk* 'wing'
		*ɯ	*khīn* 'arise', *nīṅ* 'one'
		*ɯː	*gīn* 'night', *yīn* 'stand'
<ī̈>	open syllable	*ɯː	*jī̈* 'name', *thī̈* 'hold'
	closed syllable	*ɯ	*khī̈n* 'arise', *nī̈ṅ* 'one'
		*ɯː	*ʔī̈n* 'other', *ayī̈n* 'stand'

Due to the appearance of a newly invented symbol <ī̈>, the mapping of the grapheme to PSWT phonemes in System III differs from System II in one respect. Like Systems I and II, the high front vowels *i and *iː are mapped with <i> and <ī>, respectively. The difference, however, lies in the mapping of the high back unrounded vowels *ɯ and *ɯː. In System III, the long *ɯː matches the grapheme <ī> and <ī̈>, in contrast to the short *ɯ, which is mapped to either <i> or <ī̈>. Superficially, the fact that PSWT *ɯ and *ɯː are both mapped with <ī̈> might be viewed as evidence for a lack of length distinction. However, short *ɯ is also mapped with the same grapheme as short *i, while long *ɯː is mapped with the same grapheme as long *iː. The correspondences of these Sukhothai graphemes and proto-vowels show the difference in mapping of short and long proto-vowels.

Like in System II, some SWT words do not show straightforward correspondence. Figure 4 displays type frequency of correspondences between vowel graphemes and PSWT phonemes. Less than 25 percent of the words with *i, *iː, *ɯ, and *ɯː nucleus do not follow the trend of System III. All of those words vary both between different inscriptions and within the same inscriptions, if they appear more than once.
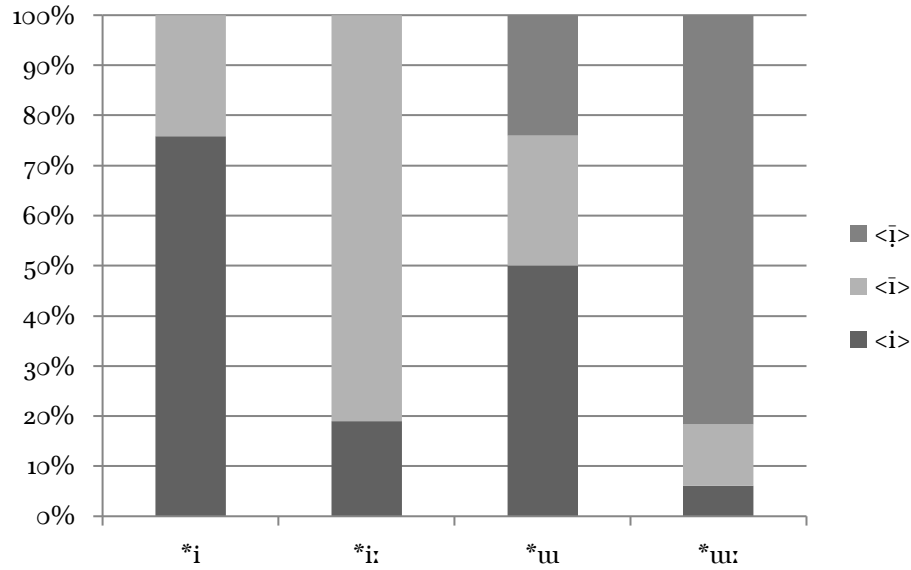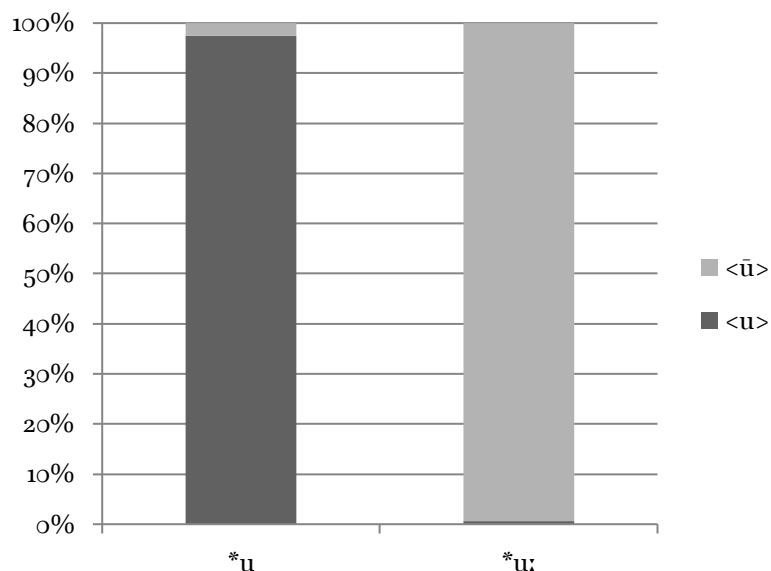
Figure 4 Frequency of correspondences of graphemes representing (i) and (ɯ) in System III and PSWT phonemes

On the other hand, graphemes representing (ɯ) behave quite differently from the other graphemes studied in this paper. Every inscription contains both <u> and <ū>, no matter which graphemic system the inscription uses. In terms of correspondence, <u> generally corresponds with short vowel *ɯ, while <ū> corresponds with *ɯ:, as shown in Table 18.

Table 18 Correspondence of Sukhothai grapheme representing (ɯ) with PSWT phonemes

Sukhothai grapheme	Syllable structure (orthographic)	PSWT phoneme	Example
<u>	closed syllable	*ɯ	*suk* 'cooked, ripe', *ruṅ* 'morning', *khun* 'lord'
		*ɯː	*ʼpluk* 'plant'
<ū>	open syllable	*ɯː	*gū* 'couple', *rū* 'know', *hū* 'ear'
	closed syllable	*ɯ	*lūṅ* 'uncle', *hūṅ* 'cook'
		*ɯː	*cūṅ* 'lead someone by hand', *fūk* 'mattress', *sūṅ* 'tall'

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Apart from the normal cases, there are also some words that do not follow this trend. Figure 5 illustrates that this phenomenon occurs in less than five percent of the words with (u) nucleus in Sukhothai inscriptions. If they appear more than once, these words show variations as mentioned earlier in §4.2.

Figure 5   Frequency of correspondences of graphemes representing (u) and PSWT phonemes

After considering the correspondence between Sukhothai graphemes and PSWT phonemes, majority of the correspondences reveal a few general trends. An important point discovered in this study concerns the behavior of words with short and long vowels in PSWT. The PSWT short vowels tend to correspond with different sets of graphemes from long vowels, despite the differences in graphemic system. This analysis does not apply to the case of loanwords in Sukhothai inscriptions. There is no general tendency that can be extracted from the correspondences of grapheme representing high vowels and Old Khmer phonemes, as illustrated in Table 19.

Table 19   Correspondence of Sukhothai grapheme representing high vowels with Old Khmer phonemes

Sukhothai grapheme	Syllable structure (orthographic)	Old Khmer phoneme	Example
<i>	open syllable	/i/	*wimal* 'pure', *tilak* 'mark'
		/iː/	*mauli* 'topknot', *simā* 'boundary'
	closed syllable	/i/	*cit* 'mind', *bhiksu* 'monk'
	closed syllable with <ḥ> coda	/i/	*t̲iḥ* 'blame'
<ī>	open syllable	/i/	*kawī* 'poet', *p̲īṭak* 'pitaka'
		/iː/	*nadī* 'river', *wāsī* 'dweller'
	closed syllable	/i/	*nībbān* 'nirvana', *īnda* 'indra'
		/iː/	*cārīk* 'inscribe', *j̲īl* 'precept'
<u>	open syllable	/u/	*bhiksu* 'monk', *utam* 'abound'
	closed syllable	/u/	*dukkh* 'suffering', *putra* 'offspring', *sakul* 'family'
	closed syllable with <ḥ> coda	/u/	*luḥ* 'attain', *duḥluḥ* 'attain'
<ū>	open syllable	/u/	*pūrī* 'city'
		/uː/	*pūjā* 'worship'
	closed syllable	/u/	*p̲ūrus* 'man'
		/uː/	*rūp* 'classifier of monk', *sathū̲p* 'stupa'

One possible reason for the unsystematic correspondences is the variation of graphemes normally found in loanwords. Since loanwords show more variations than other classes of words, the correspondences of Sukhothai graphemes and Old Khmer phonemes might not show length distinction as the correspondence with PSWT phonemes displays.

Despite the difference in the number of high vowel graphemes, the three graphemic systems used in Sukhothai inscriptions share a number of features. The PSWT *u and *u: are always matched with <u> and <ū>, respectively, with very little variation. As for the remaining phonemes, *i, *i:, *ɯ, and *ɯ: are matched with the remaining graphemes in the system. In System I, all four proto-vowels, therefore, are obviously matched with <i>, the only remaining grapheme. In System II, these four vowels are divided into two groups, which are matched with the two remaining graphemes, <i> and <ī>. The short vowels *i and *ɯ are represented by <i>, while the long *i: and *ɯ: are matched with <ī>. In System III, on the other hand, there is an additional grapheme, <ī̄>. The PSWT *ɯ: is mapped with this new grapheme and <ī>, while its short counterpart *ɯ is mapped with either <i> or <ī̄>, depending on the inscription.

The fact that short and long vowels are mapped with different graphemes in both System II and System III provides support for reconstructing a vowel length distinction in Sukhothai Thai high vowels. Although *ɯ is mapped with two different graphemes, <i> and <ī̄> in System III, the variation is explained by the lack of a special grapheme dedicated to the short back unrounded vowel. While <ī̄>, which usually represents *ɯ:, captures the backness of *ɯ, the grapheme <i>, which typically corresponds to *i, captures the length.

In contrast with other systems, System I shows an asymmetry of the graphemic system because of a lack of the counterparts of <i>. The high vowels apart from *u and *u: then map into <i>. Although this phenomenon might lead to the conclusion that there is no length contrast, it could also be the result of homography. The other inscriptions support the existence length contrast, such as *Inscription 319* (early-14th century) using System II, and *Inscription 3* (1357) using System III. If the *Inscription 107* inscribed the same languages as others and length is contrastive in this language, lack of graphemic distinction should be analyzed as homography instead of as a lack of length distinction.

To recapitulate, the general pattern of correspondence between Sukhothai graphemes and PSWT phonemes mapping the short and long proto-vowels with different graphemes shows short vowels with <i> and <u> and long vowels with <ī>, <ī̄>, and <ū>. These patterns support the existence of the length distinction. If length had not been phonemic in Sukhothai Thai, long and short high vowels in PSWT should not have been represented differently in Sukhothai inscriptions.

The unsystematic correspondences of loanwords and the spelling variations are both rare and found only in specific environments. Most variations are found in open-syllabled words, loanwords, and function words. There are very few variations that cannot be explained. These variations are not frequent enough to deny the existence of length contrast in the Thai language of Sukhothai, as proposed in other studies.

From a diachronic point of view, Sukhothai Thai is shown to have retained the PSWT length distinction of high vowels. Other vowels in the system, on the other hand, display changes in the length distinction (Maspong 2016; 2018). Recall that in PSWT only high vowels and *a - *aː are contrastive for length, while the other vowels are either long or short vowels that lack long and short counterparts respectively. (Li 1977; Pittayaporn 2009b; Sarawit 1973). Sukhothai develop length distinction for the upper mid vowels (e, ɤ, o), which used to have only short vowels. The lower mid vowels of Sukhothai (ɛ, ɔ) also have allophonic length, absent in PSWT.

6. Conclusion

This paper studies the length contrast of high vowels in the Thai language of the Sukhothai period. It applies graphemic analysis to Sukhothai inscriptions and compares the Sukhothai grapheme with correspondent phonemes in PSWT and donor languages. Instead of pooling all the inscriptions together as in previous works, this study examines each inscription separately. This methodology reveals that Sukhothai inscriptions are written using three different graphemic systems that differ in terms of the number of graphemes for high vowels. By establishing correspondences between Sukhothai graphemes and PSWT phonemes, our results also reveal that PSWT vowel phonemes of the same quantity display the same behaviors with respect to their mapping as the Sukhothai graphemes. The importance of vowel length in the phoneme-grapheme mapping means that vowel length was contrastive for high vowels in the Thai language of Sukhothai period.

This conclusion shows that the relationship of graphemes and phonemes in Sukhothai Thai involved underrepresentation, as the six phonemes retained from PSWT were mapped into three to five graphemes in the Sukhothai inscriptions. In other words, some phonemes must have been represented by the same graphemes. In particular, both /i/ and /ɯ/ were mapped with <i>. Similarly, both /iː/ and /ɯː/ were mapped with <ī>. The homography is clearly due to the fact that

Old Khmer writings only had four symbols for high vowels, which is a normal result of applying a script developed for one language to the writing of another language (Shorto 1965: 89).

Most importantly, this study is a reminder of the complexity of using written documents as primary evidence to reconstruct the phonology of medieval languages. To fully understand the language that underlies ancient inscriptions, it is necessary to understand the writing system employed to record it. It is only after combining systematic and detailed analysis of the writing system with linguistic evidence that it is possible to reconstruct the sound system of a language that is no longer spoken.

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