



Bound Vowels Grapheme Representation in Balinese Script

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Abstract. The background of this research was based on the lack of adequate research results to describe bound vowel graphemes in the Balinese script writing system with all its complexities. The purpose of this research was to decipher bound vowel graphemes and their behavior in a writing system based on Balinese script. The research method applied in this research was a qualitative descriptive method. The qualitative data source was in a graphic form of dependent vocal grapheme and its representation in Balinese, which is included in the list of Balinese scripted entries in Bali-Indonesian Latin and Balinese Dictionary II Edition. The data were collected through the document analysis technique and then analyzed by describing the new meaning and appearance, determining the frequency of the occurrences, and grouping them based on grapheme definitions that apply across writing systems. The results showed that the form of the vowel graphemes in Balinese script differed in the initial and bound positions. For the vowel graphemes in the bound position, the size was smaller than the main and consonant graphemes and they were rather dependent, which were dependent on them. For example: vowels above the main consonant grapheme such as <i> for /i/ and <> for /ə/; vowel under the main consonant grapheme such as <u> for /u/, on the left of the main consonant grapheme such as <e...> for /e/, and the combination of two basic shapes that did not appear next to each other (not continua) such as <e...o> for /o/. Vowel graphemes in the Balinese script for /i/, /ə/, and /u/ did not occupy their own segmental spaces horizontally, which reflected that these graphemes were bound graphemes because they could not arise alone. Likewise, the vowel graphemes displayed on the horizontal axis for /e/ and /o/ were subsegmental graphematic and usually obligatory bound.

Keywords: Balinese script · bound grapheme · vowels

1 Introduction

Balinese script writing system as an aspect of Balinese culture has been integrated into real life (*sekala*) and noetic life (*niskala*) [1]. Currently, the Balinese script, which has become the hallmark of Balinese society, faces several internal and external challenges. Internally, it is categorized as a very complex writing system [2]. Furthermore, the

understanding and interest of primary and secondary students in integrated Balinese script in Balinese language subject is also shallow. Meanwhile, from the outer side, the system is under threat from the alphabetical writing system, which is dominant in its use.

Efforts, especially from the aspect of scientific studies, have been carried out to preserve the existence of the Balinese script and facilitate the pattern of its inheritance to the younger generation, for example, through studies related to the development of a computerized transliteration automation system for Balinese script [3–5]. However, efforts to automate the script still face various challenges, especially in terms of the accuracy of the transliteration results. Increasing the accuracy needs support from study results that can describe the system with all its complexities, so research related to this topic is significant. The findings of graphological studies that use the grapheme as a basic unit are very relevant and adequate to describe a writing system, not only for an alphabetical writing system but also for cross-world writing systems [6–8].

The Balinese script writing system has been mostly described from the orthographic aspect and phonology [9–11], while its description from a graphological perspective has never been found. The vowels, which are based on the description of the three authors, are only explained using the invariant of the *wisarga* script <h> /ha/ combined with diacritics (*pangangge suara*) <i> /i/, <v> /v/, <u> /u/, <e...> /e/, and <e...o> /o/. The vowel /a/ is represented by *wisarga* <h> without diacritic. Tinggen further stated that the vowel writing in Balinese had been replaced with *ha, hi, hu, he, ho, he (pepet)*. The letter *h* is not a vowel, but *wisarga* (glottal stop consonant) *h* is a consonant in Balinese or Latin Balinese writing.

The description of the Balinese script for vowels, according to [11], is very confusing because the use of adequate conceptual terms does not support it. For example, it is not distinguished between the visual unit material of the Balinese script as a basic shape and the relation of the visual unit to the linguistic units presented by the grapheme, which is not the same as the orthographic description. In addition, the description is also not supported by the use of symbols that can distinguish the Balinese script graphetic [...], graphemic <...>, orthographically, as well as representations at the level of linguistic units presented by graphemes, such as /.../ (phonemic), [...] (phonetically), and {...} (morphemic). Tinggen did not clearly discuss the analysis of the diacritics for the vowels as a representation of visual units related to language units and their behaviour in the Balinese script writing system.

Several researchers have conducted studies on the representation of visual units in the writing system. The study of the graphic representation in the Abugida writing system, especially in akshara-based derivatives of writing systems, presented more examples in the Brahmi script [12]; none of the analysis was done from the Balinese script. Furthermore, Meletis proposes three criteria that must be met by a writing unit to be identified as a grapheme, namely: (1) lexical distinctiveness, (2) linguistic value, and (3) minimality. The grapheme concept criteria are still tentative because their application and testing are limited to effective writing systems (Greek, Chinese, Hindi, Thai). Therefore, the application and testing of these criteria for a more straightforward writing system, in this case, the Balinese script writing system, is critical. Based on this background, a question

arises in this paper: how is the analysis of bound vowel graphemes and their behavior in a writing system based on Balinese script?

2 Balinese Script

The *aksara lagna* is the basic shape for the primary consonant with the inherent vowel /-a/ in the Balinese script writing system. There are 18 main consonants in the script, namely /ha/, /na/, /ca/, /ra/, /ka/, /da/, /ta/, /sa/, /wa/, /la/, /ma/, /ga/, /ba/, /ŋa/, /pa/, /ja/, /ya/, and /ɲa/. The vowel /-a/ attached to the *aksara lagna* will disappear if it has received diacritics or character recognition (Table 1).

One of the diacritic groups in the Balinese script writing system is *pangangge suara* especially for vowels. The diacritics for vowels using an invariant combination of the *wisarga* script < ʌ gt; /ha/ and diacritics <i> for /i/, <e...> for /e/, <> for /ə/, <u> for /u/, and <e...o> for /o/.

Table 2 shows the examples of using *Pengangge Suara* in writing Balinese words, such as <> for /ə/ in h)b)k/. *Ebek* ‘full’, <i> for /i/ in hiku;. *Ikuh* ‘tail’, <u> for /u/ in hum;. *Umah* ‘house’, <e...o> for /o/ in ehoem*o. *omong* ‘speak’, and <e...> for /e/ in ehl;. *Elah* ‘easy’.

Table 1. *Pangangge Suara*

Balinese script	Transliteration	IPA	name
ᮘᮧᮒ	i	[i]	<u>ulu</u>
ᮘᮧᮒ	e/é	[ə]	<u>pepet</u>
ᮘᮧᮒ	u	[u]	<u>suku</u>
ᮘᮧᮒ	e/é	[e]	<u>taleng</u>
ᮘᮧᮒ	o	[o]	<u>taleng tedong</u>

Table 2. Example of the use of *Pangangge Suara*

Balinese script	Transliteration	Meaning
ᮘᮧᮒᮘᮧᮒ	<u>ebek</u>	‘full’
ᮘᮧᮒᮘᮧᮒ	<u>ikuh</u>	‘tail’
ᮘᮧᮒᮘᮧᮒ	<u>umah</u>	‘house’
ᮘᮧᮒᮘᮧᮒᮘᮧᮒ	<u>omong</u>	‘speak’
ᮘᮧᮒᮘᮧᮒᮘᮧᮒ	<u>elah</u>	‘easy’
ᮘᮧᮒᮘᮧᮒ	<u>apa</u>	‘what’

Table 3. Conditions for the grapheme definition applied to units from different writing systems; graphemes are highlighted in grey

	condition (1)	condition (2)	condition (3)
German <ng>	+	+ phoneme /ŋ/	— both <n> and <g> are already graphemes
German <ch>	+	+ phoneme /ç/	+
German <sch>	+	+	— both <s> and <ch> are already graphemes
German [ç]	+ <denkt> vs. <deckt>	—	+
German [ʃ] (hasta) in <p> vs. 	+	—	+
Chinese <河> 'river'	+	+ morpheme {river}	+
Chinese [ʃ]	+	— semantic component 'water', which itself repre- sents no linguistic unit	+
Thai <น>	+	+ phoneme /n/	+
Thai <ร>	+	+ phoneme /r/	+

3 Grapheme

The minimal unit representing the unity of form or fundamental entity in the writing system is called a grapheme. Table 3 presents three criteria for defining graphemes that can be applied universally across various writing systems: 1) the lexical distinctiveness criterion (condition 1), 2) the linguistic value criterion (condition 2), and 3) the minimum criterion (condition 3) [13].









4 Research Method















This study applied a qualitative descriptive method. The qualitative data source was in a graphic form of dependent vocal grapheme and its representation in Balinese, which is included in the list of Balinese scripted entries in the Bali-Indonesian Latin and Balinese Dictionary II Edition published by *Badan Pembina Bahasa, Aksara, dan Sastra Bali Provinsi Bali* in 2016. The data were collected through document analysis technique which were then analyzed by describing the new meaning, its appearance, determining the frequency of the occurrences, and grouping them based on grapheme definitions that apply across writing systems. The initial stage of the study followed the model [14], which was to collect the basic shapes of bound vowel graphemes in the Balinese script writing system. The second stage was identifying and defining the basic sheet based on three grapheme criteria from Meletis. The third stage described the management and the behaviour of Balinese script graphemes in the Balinese script writing system by comparing them with other writing systems included in the Abugida writing system, especially derivatives of the script-based writing system.

5 Result and Analysis

The graphemes for vowels in the Abugida writing system and most akshara-based writing systems are represented differently in the bound and initial positions. Table 4 shows the

Table 4. Analysis results of Balinese script-bound vowel graphemes

Bound vowels grapheme	lexical distinctiveness	linguistic value	minimality
<  > (<i>ulu</i>)	+ <  > vs <  > <  > vs <  > 'gift' vs 'read'	+ fonem /i/	+
<  > (<i>pepet</i>)	+ <  > vs <  > <  > vs <  > 'grave' vs 'same'	+ fonem /ə/	+
<  > (<i>suku</i>)	+ <  > vs <  > <  > vs <  > 'plant' vs 'shoulder'	+ fonem /u/	+
<  > (<i>taleng</i>)	+ <  > vs <  > <  > vs <  > 'different' vs 'cage'	+ fonem /e/	+
<  > (<i>taleng tedong</i>)	+ <  > vs <  > <  > vs <  > 'greedy' vs 'profit'	+ fonem /o/	- (both  and  already graphemes)

analysis results of the Balinese vowel graphemes in the bound position based on the three criteria proposed by Meletis. Basic shapes  |  |,  |,  |,  |,  | were defined as a grapheme that met the criteria of + lexical distinctiveness, + linguistic value, and + minimality with representation of linguistic values, namely: <  > /i/, <  > /ə/, <  > /u/, <  > /e/. Meanwhile, basic shape  |,  | did not meet the criteria of minimality because  | and  | were a separate grapheme, but both combine to represent one linguistic value, namely /o/.

The vowel /a/ in the bound position was not presented by special markers because it was an inherent vowel that was already attached to the main consonant grapheme (*aksara lagna*), for example in <pc> <paca> where the vowel /a/ was already attached to the main consonant grapheme <p> /p(-a)/ and <c> /c(-a)/.

Table 5 presents the results of Balinese script for writing standard Balinese vowels at the initial position. It was presented by a constant combination of the independent invariant grapheme of *wisarga* <h> /ha/ and the dependent grapheme <i> /i/, <a> /ə/, <u> /u/, <e...> /e/, and <e...o> /o/. It produced a combination grapheme with each linguistic unit representation: such as <hi> /i/, <h> /ə/, <hu> /u/, <eh> /e/, <eho> /o/. Glottal stop consonants /h/ in vowel grapheme combinations at the initial position which were unspoken were known as the “empty consonant device” [12].

Balinese script graphemes, that horizontally occupy their own segmental spaces and are free because they appear independently without being bound by conjuncts/ligatures,

Table 5. Balinese vocal graphemes in initial position

Balinese script	Transliteration (fonemic)	Meaning
	/idup/	'life'
	/isi/	'body'
	/malah/	'good'
	/talah/	'finished'
	/uma/	'rice field'
	/usap/	'clean'
	/dewa/	'god'
	/sela/	'cassava'
	/obah/	'waver'
	/ocel/	'unsteady'

are called free graphemes; independent consonant graphemes [15, 16]. In the Balinese script writing system, all basic shapes for main consonants with inherent vowels (*/-a/*), called *aksara lagna*, were categorized as independent graphemes. Meanwhile, diacritics for bound vowels <i> /i/, <ə> /ə/, <u> /u/, <e...> /e/, and <e...o> /o/ which were clearly smaller in size than the main consonant grapheme (for example in <pi> /pi/) and could not stand alone because it they were bound to the main consonant grapheme, were called dependent graphemes.

Horizontal and vertical were two dimensions used to manage graphemes in a akshara-based writing system. There were vowel graphemes in Balinese script that had the same size as the main graphemes and occupied their own segmental spaces. Some were smaller than the consonant graphemes and bound above or below.

Bound vowel graphemes <e...> /e/ and <e...o> /o/ in the Balinese script writing system on the horizontal axis were subsegmental graphemic and usually required, as examples of word writing in Table 4 <e...> in <ebd> <beda> 'different' was a bounded subsegmental vowel grapheme that appeared to the left of the main consonant grapheme, while <e...o> was represented by a combination of two basic shapes, not continua, namely the basic shapes that did not appear next to each other. For example, the discontinuous combination of *taleng tedong* in <elob> <loba> 'greedy' appeared simultaneously on the left and right of the main consonant grapheme.

The bound vowel graphemes <i>, <ə>, and <u>, in the Balinese script writing system appeared on the vertical axis and were requisited bound. The vertical series in the examples <pic> <pica> 'gift', <(s)m> <sema> 'grave', <pul> <pula> 'planting' shared a horizontal segmental space. Vertically, the basic shapes | i|, |ə|, and | u|, which represented the vowel phonemes /i/, /ə/, and /u/ were smaller in size and put in separate spaces above and below the main consonant graphemes. The shapes that reflected the vowel phonemes /i/, /ə/, and /u/ were systematic combinations with each

main consonant grapheme or with a number of graphic variations of the main consonant graphemes (graphematic allography).

6 Conclusion

The graphemes for vowels in Abugida writing system and most akshara-based writing system are represented differently in the bound and initial positions. The Balinese script for writing standard Balinese vowels in the initial position was presented by a fixed combination of the independent grapheme <h> (as an invariant of *wisarga* /ha/ with the “empty consonant device”) with dependent graphemes <i>, <u>, <e...>, and <e...o> which produced a combined grapheme with a linguistic unit representation: <hi> /i/, <h> /ə/, <hu> /u/, <eh> /e/, <eho> /o/. For the vowel graphemes in the bound position, the size was smaller than the main consonant graphemes and they were rather dependent, which were dependent on them. For example, vowels above the main consonant grapheme such as <i> for /i/, <u> /ə/; vowels under the main consonant grapheme such as <u> for /u/, vowels on the left of the main consonant grapheme such as <e...> for /e/, and the combination of two basic shapes that did not appear next to each other (not continua) such as <e...o> for /o/. Vowel graphemes in the Balinese script for /i/, /ə/, and /u/ did not occupy their own segmental spaces horizontally, reflecting that these graphemes were bound graphemes because they could not arise alone. Likewise, the vowel graphemes displayed on the horizontal axis for /e/ and /o/ were subsegmental graphematic and usually obligatory bound.

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