

Comparative Analysis of Chinese and Indonesian Vowel Systems

Analisis Komparatif Sistem Vokal dalam Bahasa Mandarin dan Bahasa Indonesia

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Abstract

In Chinese and Indonesian languages, a syllable is composed of consonants and vowels. Many researchers have focused on studying consonants and paid less attention to vowels. However, vowels play an essential role in a syllable, which is in fact the most pronounced part of a syllable. It is because of vowels that people can perceive language and communicate with each other. This article takes the Chinese and Indonesian vowels as the research object and makes a comparative analysis of the Chinese and Indonesian vowel systems to reveal the similarities and differences between the two at the level of monophthongs, compound vowels, and allophones. Hopefully, it can make contributions to the development of the Chinese-Indonesian comparative phonology discipline. This paper mainly adopts qualitative research method, that is, combining literature integration method, description method, contrast method and analysis method. It reaches several conclusions: First, the Chinese monophthongs, compound vowels, and allophones are more developed than those of Indonesian; Second, there is contrast between rounded and unrounded lip sounds in the Chinese monophthong system, which does not exist in the Indonesian system; Third, there exists some cases in Chinese compound vowels system that the spelling is inconsistent with the actual pronunciation, but this is not the case in Indonesian. Fourth, Chinese vowels' allophones are mainly caused by the different positions of vowel in the syllables, while in Indonesian they are mainly affected by the different natures of the syllables. The results of this research can provide some insights for other Chinese and Indonesian language researchers.

Keywords: *monophthongs, compound vowel, allophone, comparative analysis*

Abstrak

Dalam bahasa Mandarin dan bahasa Indonesia, sebuah suku kata terbentuk dari gabungan konsonan dan vokal. Banyak peneliti lebih fokus pada penelitian di bidang konsonan dan mengabaikan bidang vokal. Kenyataannya, peran vokal dalam sebuah suku kata sangat esensial, karena vokal merupakan bagian yang diucapkan paling nyaring dalam sebuah suku kata. Dengan adanya vokal, orang-orang baru dapat saling memahami dan berinteraksi satu sama lainnya. Artikel ini mengangkat topik vokal dalam bahasa Mandarin dan Indonesia sebagai objek penelitian. Analisis komparatif terhadap sistem vokal dalam bahasa Mandarin dan bahasa Indonesia dilakukan untuk menemukan

persamaan dan perbedaan yang terdapat dalam jenjang monoftong, gugus vokal dan alofon, di mana diharapkan dapat memberikan sumbang asih pada perkembangan disiplin keilmuan perbandingan fonologi antar bahasa Mandarin dan bahasa Indonesia. Artikel ini menggunakan metode penelitian kualitatif, yaitu gabungan dari metode integrasi literatur, metode deskriptif, metode komparatif dan metode analisis, yang pada akhirnya menghasilkan beberapa kesimpulan: Pertama, monoftong, gugus vokal dan alofon dalam bahasa Mandarin jauh lebih berkembang dibandingkan dengan bahasa Indonesia. Kedua, terdapat kontras antara bunyi bibir membulat dan tidak membulat dalam sistem monoftong Bahasa Mandarin, yang tidak terdapat dalam bahasa Indonesia. Ketiga, terdapat beberapa ejaan yang berbeda antara cara pengucapan dan penulisannya dalam sistem gugus vokal bahasa Mandarin, yang tidak terdapat dalam bahasa Indonesia. Keempat, alofon vokal dalam bahasa Mandarin disebabkan oleh perbedaan posisi vokal dalam sebuah suku kata, sedangkan dalam bahasa Indonesia disebabkan oleh perbedaan karakter suku kata. Temuan dalam penelitian ini dapat menjadi masukan bagi peneliti-peneliti lainnya di bidang bahasa Mandarin dan bahasa Indonesia.

Kata kunci: *monoftong, gugus vokal, alofon, analisis komparatif*

Introduction

Language is a tool for exchanging ideas among people, and speech is the main means for transmitting information among them. Without speech, humans cannot achieve the purpose of mutual communication. Traditional linguistics believes that speech is one of the three major elements of a language and is the material shell of any language. Since people rely on speech for communication purposes, which exists in society and is used in society, speech is social. It is ubiquitous in people's daily life. Speech is inseparable from people's lives, therefore it is necessary to study the speech system of any language, which will help us preserve and inherit human intangible cultural heritage.

Every language has its own speech system, and any speech system has its own characteristics. When researching the speech system of one language or comparing the speech systems of two or more languages, what must have done is reveal their characteristics. For example, a syllable in Chinese is composed of an initial, a final and a tone, while a syllable in Indonesian is only composed of an initial and a final. Obviously, tone is one of the unique characteristics of Chinese speech system, which distinguishes it from the Indonesian speech system. What people say is a stream of meaningful speech. However, when people make sounds through sneezing, coughing, yawning, snoring, those sounds do not contain meaning, which therefore cannot be regarded as speech. A string of meaningful speech streams sounded by people is undoubtedly "syllables". Huang & Liao (2017) pointed out that "syllables" are phonetic segments composed of phonemes and are the smallest units of speech that people naturally feel when they listen to other people talking. Although syllables can be combined to form a word, a larger linguistic unit, words belong to lexical category and are beyond the scope of phonetic research. It can be seen that a "syllable", the smallest phonetic unit that people can perceive when listening, take a dominant position in the field of phonetics. It is actually the core component of phonetic research and has been the research object of phonetic scholars for a long time.

In phonology, syllables are composed of smaller phonetic units, which are called "phonemes". Jiang (2013) pointed out that "phonemes" are the smallest phonetic units

divided from the perspective of timbre, such as “爸 (*bà*) daddy” in Chinese can be divided into two different phonemes “*b[p]*” and “*a[A]*”. The phoneme located at the beginning of a syllable is called the initial, whereas the one located at the back of the syllable is called the final. As in the above example, “*b[p]*” is the initial and “*a[A]*” is the final. However, in addition to initials and finals, phonetics also includes the concept of consonants and vowels. There are differences between initials and consonants, which will not be discussed here. The same is for finals and vowels, which are both related and different in some way. Many people cannot distinguish the differences between finals and vowels, and treat them as equal, which has affected the scientificity of phonetics research. In fact, the finals and vowels are two different concepts. “Vowels are phonemes formed by the airflow that vibrate vocal cords, which pass through the mouth and throat without obstruction, such as a, o, e, i, u, etc.” (Huang & Liao, 2017: 20) The difference between finals and vowels is that, finals are not only composed of vowels, but also combination of vowels and consonants. For example, in the word “瞎 (*xiā*) blind”, the final is only composed of a vowel; but in the word “甘 (*gān*) sweet”, the final is composed of vowel “*a[a]*” and consonant “*n[n]*”. In short, the concept of finals and vowels must be distinguished, so that phonetics research can be conducted properly.

Nowadays, there are many scholars have made deeper studies of the Chinese-Indonesian phonetic (speech) system, and related research results have been achieved. However, most have carried out research for teaching needs, and their research focuses are different. Tang (2012), Lin (2006), Liang (2014), and Anggreani (2014) have conducted comprehensive research on Chinese-Indonesian phonetic units. Nevertheless, Tang, Lin, Liang, and Anggreani's research have their weaknesses. For example, none of the four researchers paid attention to the phenomenon of vowel allophones. In actual communication, due to the influence of speech flow, phonemes produced by people will produce allophones, which is ignored by the four researchers. In addition, Lin and Liang's exposition of Chinese and Indonesian compound vowels is less of perfection; Anggreani's research does not make a detailed comparison of Chinese and Indonesian phonemes (2014); Tang's research is more complete, but there is no distinction between the concept of finals and vowels (2012). Instead, he confused these two concepts, which has led to the bias of his research.

Other scholars have investigated the Chinese-Indonesian phonetic system from one or more other perspectives, such as Lin (2010), Gao (2005), Ji & Cai (2013), Wang (2011), Wang & Sun (2007), and Wikarti, Renata & Moira (2019). Ji & Cai and Wikarti, Renata & Moira mainly conducted their investigation from consonant, vowel and tone level. However, their studies are lack of discussions about Chinese and Indonesian compound vowels, nor do they mention the phenomenon of allophones. Lin and Gao mainly investigated the consonant and vowel levels. Similarly, their research was imperfect at the level of compound vowels and allophones; Wang, Wang & Sun mainly investigated from the vowel level only, who made detailed discussion on Chinese vowels. However, they did not make any discussion on Indonesian vowels.

Although the current research on the comparative analysis of the Chinese-Indonesian phonetic system covers a wide range of objects, including consonants, vowels, tones and syllables, there are still several shortcomings: First, many studies have not discussed and explained the phenomenon of allophones; Second, there are fewer studies of vowels, and more rarely are studies related to compound vowels; Third, many studies have been conducted solely based on the needs of teaching. The conclusions

drawn tend to be practical and do not make significant academic contributions. The research scope of this article involves monophthongs, compound vowels, and phenomenon of allophones, which can supply findings to fulfill the shortcomings of the previous studies, and also promote the development of Chinese-Indonesian comparative phonology, which can be seen as the novelty and academic values of this article.

Thus, the studies related to the comparative analysis of Chinese and Indonesian consonants are relatively more common than those related to the comparative analysis of vowels. Many scholars do not pay much attention to the problem of vowels. This is possibly because the position of vowels in one syllable are not so easy to attract people's attention, and also because the numbers of vowels are not as many as consonants. However, the importance of vowels in a syllable must not be ignored. A series of syllables can only be perceived by listeners if they emit loud vowels. Consonants alone cannot convey information. Based on the understanding of the importance of vowels, their existence that cannot be ignored, and the current existing studies in which many scholars do not pay much attention to vowels aspect, this article takes the Chinese and Indonesian vowel systems as the research object, compares and analyzes the two systems to find out the similarities and differences between them, so that the deficiencies in previous studies can be resolved. People's understanding on Chinese and Indonesian phonetic system is also getting deeper, thereby error speech in language use can be avoided or reduced. Furthermore, the research results on this paper can also being used to promote the development of comparative phonology discipline, which proves the importance of this research.

Method

The research scope of linguistics is extremely extensive, involving the fields of applied linguistics and theoretical linguistics. Theoretical linguistics can be divided into two branches: general linguistics and monolingual linguistics (Wang & Xie, 1998: 241). This article focuses on the characteristics of synchronic Chinese and Indonesian vowel systems. This study used a qualitative research method. It used a literature integration method to find and collect data and uses a descriptive method to sort out and summarize data. In order to reveal the characteristics of the Chinese and Indonesian vowel systems, a comparison method and an analysis method were used. Therefore, this article can be described as a combination of literature integration, description, comparison, and analysis method. In other words, various methods were used for this research.

The research process used in this article were as follow: First, previous research results and several linguistics monographs were consulted. For Chinese references, "*Modern Chinese*" edited by Huang & Liao (2017), and "*Teaching Chinese Phonetic as a Foreign Language*" edited by Mao (2008) were used as mainly data source. For Indonesian reference, "*Tata Bahasa Baku Bahasa Indonesia*" edited by Alwi, Dardjowidjojo, Lapoliwa & Moeliono (2010) and "*Fonologi Bahasa Indonesia*" edited by Chaer (2013) were consulted. Besides that, data were also collected from internet, books and academic journals, therefore, literature integration method was used in this stage; Second, sorting out and summarizing data. On the process, detail description of Chinese and Indonesian vowel systems, covering monophthongs, compound vowel, and phenomenon of allophones had been made. This stage involves the descriptive method. Finally, the last stage was revealing the characteristics of Chinese and Indonesian vowel

systems, and also to find out the similarities and differences between them. In this stage comparative analysis method was used.

Result and Discussion

Characteristics of Chinese Vowel System

Chinese is an ideographic language. However, the pronunciation of Chinese characters is marked by Chinese pinyin (Latin letters). Therefore, like many languages in the world, Chinese syllables consist of consonants and vowels. Chinese monophthongs include 7 linguistic vowels, 2 apical vowels, and 1 tongue rolling vowel. These 7 linguistic vowels in Chinese are a[A], o[o], e[e], ê[ɛ], i[i], u[u], and ü[y]. Mao (2008) pointed out that vowels are generally classified from three dimensions, which are the height of the tongue, the front and back of the tongue, and the roundness of the lip. From the perspective of the height of the tongue, there are high vowels (i, u, ü), semi-high vowels (e, o), semi-low vowels (ê), and low vowels (a); from the perspective of the front and back of the tongue, there are front vowels (i, ü), central vowels (e[ə]), and post vowels (u, o); and from the perspective of roundness of the lip, there are round lip vowels (ü, u, o) and non-round lip vowels (i, a). The pronunciation of Chinese linguistic vowels is shown below.

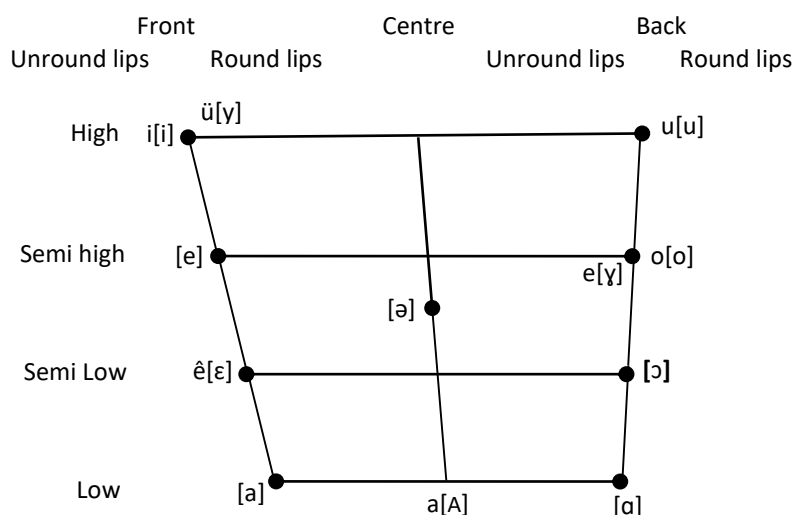


Figure 1. Mandarin Chinese Linguistic Vowels Tongue Map

Two apical vowels in Chinese are -i[ɿ] and -i[ʅ]. Apical vowel -i[ɿ] is front, high, and unrounded lip vowels, while apical vowel -i[ʅ] is post, high, and unrounded lip vowels. These two apical vowels in Chinese do not form an independent sound. While apical vowel -i[ɿ] appears only after the consonants z, c, and s, apical vowel -i[ʅ] appears only after the consonants zh, ch, sh, r. They are different from the appearance of the linguistic vowel i[i] which never appears after z, c, s and zh, ch, sh, r. Therefore, although "Scheme of Chinese Phonetic Alphabet" uses "i" to mean i[i], -i[ɿ], -i[ʅ], it does not cause confusion.

The only tongue rolling vowel in Chinese is er[ər]. The vowel er[ər] is a roll, central, middle, and unrounded lip vowels. When pronounce er[ər], the tongue tip needs to curl up. "Er" is marked with two letters. However, the following r does not represent a phoneme, which is only a symbol for tongue rolling. In addition, it is worth mentioning that aside from ê[ɛ], -i[ɿ], and -i[ʅ], other Chinese monophthongs can independently form

phonetic sounds (independent words). For example, "衣(yī) clothes" "屋(wū) house" and "耳(ěr) ear" all can form phonetic sounds. The linguistic vowel ê[ɛ] however, must be matched with i or ü to form words, such as "夜(yè) night" "月(yuè) moon" etc. The pronunciation of the 10 monophthongs in Chinese is shown in the table below.

Table 1. Monophthong List of Mandarin Chinese

Tongue position	Linguistic					Apical		Tongue Rolling
	Front		Centre	Back		Front	Back	Centre
	Unround lips	Round lips	Unround lips	Unround lips	Round lips	Unround lips	Unround lips	Unround lips
High	i[i]	ü[y]			u[u]	-i[ɿ]	-i[ɿ]	
Semi high				e[y]	o[o]			
Centre								er[ər]
Semi low	ê[ɛ]							
Low			a[A]					

"Scheme of Chinese Phonetic Alphabet" specifies the spelling rules of Chinese characters, which states that each monophthong represents a vowel phoneme in Mandarin Chinese vowels, such as a/A/, o/o/, e/y/, i/i/, u/u/, etc. In simple terms, phonemes are the smallest distinctive units of speech divided by the social attributes of speech. For example, "沙(shā) sand, 书(shū) book, and 奢(shē) luxurious" all have the same consonants and tones. However, since their vowels [A, u, y] are different, the meanings they convey are different. The role of meaning must be summarized into three different vowel phonemes. However, in different environments, or in actual communication, each phoneme may have its own allophones. The vowel allophones that can be observed in Mandarin Chinese are shown in the table below.

Table 2. Allophones of Mandarin Chinese

Phonemes	Allophone	Appearing conditions	Example
/a/	[a]	Before [-i] or [-n]	爱[ai]、按[an]
	[A]	Syllable without rhyme	压[iA]、蛙[uA]
	[ɑ]	Before [-u] or [-ŋ]	熬[au]、昂[ɑŋ]
	[ɛ]	Between the rhyme [-i] and the rhyme [-n]	烟[iɛn]
/o/	[o]	Unconditional	波[po]、说[ʃuo]
/ə/	[y]	In a single final	哥[ky]、特[tʰy]
	[ə]	In the nasal vowel, Light syllable rhyme	门[mən]、横[xəŋ]的[tə]
/e/	[e]	In front of rhyme [-i]	被[pei]、危[wei]
	[ɛ]	After the rhyme [-i] or [-y]	街[tɕiɛ]、绝[tɕyɛ]
/i/	[i]	Rhyming belly	基[tɕi]、今[tɕin]
	[l]	Rhyme	开[kʰal]、黑[xel]
	[j]	Rhyme head (zero initials)	叶[jɛ]、要[jaʊ]
/u/	[u]	Rhyming belly	故[ku]、父[fu]
	[ʊ]	Rhyme	好[xaʊ]、后[xoʊ]
	[w]	Rhyme head (zero initials)	完[wan]、为[weɪ]
/y/	[y]	Rhyming belly	去[tɕʰy]、裙[tɕʰyn]
	[y]	Rhyme head (zero initials)	月[yɛ]、圆[yɑn]

/ɿ/	[ɿ]	Be the finals after [ts, tsh, s]	资[tʂɿ]、私[sɿ]
/ʅ/	[ʅ]	Be the finals after [tʂ, tʂh, ʂ, ʐ]	知[tʂʅ]、日[ʐʅ]
/əɾ/	[əɾ]	Raising tone and falling-rising tone syllable	儿[əɾ ³⁵]、尔[əɾ ²¹⁴]
	[er]	Falling tone syllable	二[er ⁵¹]、贰[er ⁵¹]

Although there are only 7 Chinese monophthongs in the spelling form, namely a, o, e, i, u, ü, and er, these 7 letters represent more complicated phoneme allophones (see Table 2). There are 3 monophthongs (ê[ɛ], -i[ɿ], -i[ʅ]) which are not found in the spelling form, but they represent 3 different phonemes. Among Chinese monophthongs, only o[o], -i[ɿ], and -i[ʅ] have no allophones. However, the other monophthongs have at least two or more allophones, such as /a/ has 4 allophones, /u/ has 3 allophones, etc. It can be seen that Chinese allophones are quite developed. In order to understand the difference between them, their distribution conditions must be clear.

There are 13 compound vowels in Mandarin Chinese. According to the loudness of the vowels, the Chinese compound vowels can be divided into 4 front-voiced compound vowels, 4 middle-voiced compound vowels, and 5 back-voiced compound vowels. The Chinese compound vowel is not a simple addition of two or three vowel phonemes. There is no pause in the middle. The pronunciation of the compound vowel is quickly slid from the A vowel to the B vowel, or from the B vowel to the C vowel. Therefore, a compound vowel is a complex of multiple vowels and can be viewed as a whole.

The four Chinese front-voiced compound vowels are ai[ai], ei[ei], ao[au], ou[ou]. When pronounced, the front head sound is more open and gradually slides toward the back head sound, which is less open. The pronunciation of front head sound should be clear and loud; The four middle-voiced compound vowels in Chinese are iao[iau], iou[iou], uai[uai], uei[uei], and the opening degree changes from small to large and then to small. The vowels in the front are light and short, the vowels in the middle are clear and loud, and the vowels in the back are more vague; The five back-voiced compound vowels in Chinese are ia[iA], ie[iɛ], ua[uA], uo[uo], üe[yɛ]. When pronounced, the front head sound is smaller and gradually slides toward the rear head sound with a larger opening degree. The pronunciation of the back head sound should be clear and loud (see Table 3). There are 16 other nasal vowels in Chinese. Since they are composed of vowels and nasal consonants, which are beyond the research scope of the vowel level, this article does not discuss them.

It is worth noting that there are several phonetic spellings of Chinese compound vowels that are not exactly the same as the actual pronunciation, such as “ao” and “iao”. The actual pronunciation of “ao” is [au], the “o” in the latter part is to be pronounced as “u”, so is the “iao” pronunciation, the “o” in it is to be pronounced as “u”. In addition, “iou” and “uei” must be written as “-iu” and “-ui” when they are paired with a consonant. The “o” and “e” that are loud in the middle do not need to be written, even though the actual pronunciation has not changed. These several phonetic spellings are special in Chinese compound vowels system, thus deserving attention.

Table 3. Mandarin Chinese Compound Vowels Structure

Diphthong	Diphthong structure		
	Front sound (rhyme)	Major vowels (rhyme)	Rear sound (rhyme)
ai[ai]		a[a]	i[i]
ei[ei]		e[e]	i[i]

ao[au]		a[a]	o[u]
ou[ou]		o[o]	u[u]
iao[iau]	i[i]	a[a]	o[u]
iou[iou]	i[i]	o[o]	u[u]
uai[uai]	u[u]	a[a]	i[i]
uei[uei]	u[u]	e[e]	i[i]
ia[iA]	i[i]	a[A]	
ie[iɛ]	i[i]	e[ɛ]	
ua[uA]	u[u]	a[A]	
uo[uo]	u[u]	o[o]	
üe[yɛ]	ü[y]	e[ɛ]	

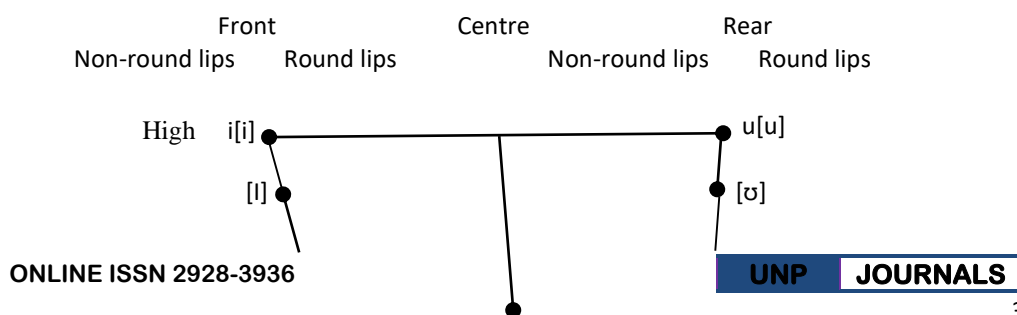
Charateristics of Indonesian Vowel System

Indonesian is a phonetic script, which uses 26 Latin letters as the national standard writing symbol like many other languages in the world. Each letter represents a phoneme, and each phoneme can match with others to form a syllable. A syllable in Indonesian is composed of consonants and vowels. Indonesian vowels can be divided into two types: monophthongs and diphthongs. There are six Indonesian monophthongs, all of which are linguistic vowels, including a[A], i[i], u[u], é[e], e[ə], and o[o]. The Indonesian monophthongs can lie in the front, in the middle and rear section of a syllable, as shown in the following table.

Table 4. The Position of the Indonesian Monophthong in the Syllable

Monophthong	Location of the unit		
	Front	Middle	Back
/a/	api (fire)	kantor (office)	kuda (horse)
/i/	ikan (fish)	pintu (door)	laci (drawer)
/u/	ukir (carve)	pundak (shoulder)	baru (new)
/e/	ekor (tail)	besok (tomorrow)	sore (noon)
/ə/	emas (gold)	keras (hard)	tante (auntie)
/o/	obat (medicine)	kota (city)	radio (radio)

Chaer (2013) pointed out that the Indonesian monophthongs can be classified according to the height of the tongue, the front and back of the tongue, and the roundness of the lip. From the perspective of the tongue, the monophthongs can be divided into high vowels (i, u), semi-high vowels (é[e], [o]), middle vowels (e[ə]), semi-low vowels ([ɛ], o[o]), and low vowels (a[A]); From the perspective of the front and back of the tongue, Indonesian monophthongs can be divided into front vowels (i, é[e], [ɛ]), central vowels (e[ə]), and rear vowels (u, o[o]); And from the perspective of lip roundness, Indonesian monophthongs can be divided into round vowels (u, o[o]) and non-round vowels (i, é[e], [ɛ], etc.). The pronunciation of Indonesian monophthongs (linguistic vowel) are shown below.



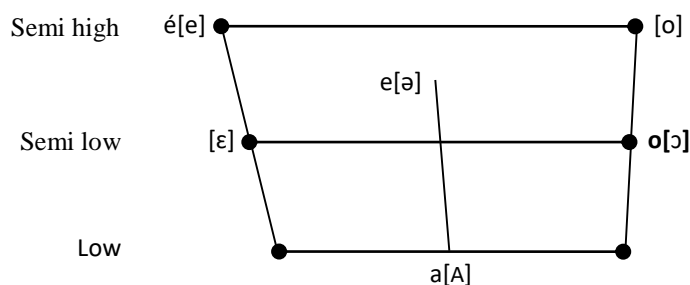


Figure 2. Standard Indonesian Linguistic Vowels Tongue Map

Regarding the distribution of the Indonesian monophthongs, it is worth noting that except e[ə], there are no fixed positions for other monophthongs in Indonesian. They can appear in the front, middle and back of the syllable (see Table 4 for details). However, the distribution of e[ə] is relatively special. Generally, e[ə] appears in the front and centre of a syllable, and basically does not appear in the back section, such as “*elang* (*eagle*), *ker*a (*monkey*), etc”. If e[ə] appears at the end of the syllable, most of the words formed by it come from foreign words. For example, “*kode*”, “*mode*” and “*parade*” are derived from the English words: “*code*”, “*mode*” and “*parade*”. The pronunciation of the six linguistic monophthongs in Indonesian can be seen in the table below.

Table 5. Standard Indonesian Monophthongs

Tongue position	Linguistic				
	Front		Centre	Back	
	Non-round lips	Round lips	Non-round lips	Non-round lips	Round lips
High	i[i]				u[u]
Semi high	é[e]				
Centre			e[ə]		
Semi low					o[o]
Low			a[A]		

Like Chinese, Indonesian phonemes undergo phonetic variants due to the influence of language flow in actual communication. Chaer (2013) pointed out the difference between phonemes, who believes that phonemes are a collection of phonemes with similar pronunciation. The biggest feature of phonemes different from other phonemes is that some phonemes have a distinguishing effect, but other phonemes do not. For example, the phoneme /u/ is pronounced [u] in the word “*aku* (*me*)” and is pronounced [ɔ] in the word “*akur* (*harmony*)”. [u] and [ɔ] can be seen as two different phonemes, but they both belong to the same phoneme /u/. When pronouncing “*aku* [Aku]” as “*aku* [Akɔ]”, it does not affect the meaning despite the awkward pronunciation. [u] and [ɔ] can be regarded as allophones of /u/. The allophones in standard Indonesian are shown in the following table.

Table 6. Allophones of Standard Indonesian Monophthongs

Phoneme	Allophones	Appearing conditions	Example
/a/	[A]	Unconditional	e-nam[ənAm], du-a[duA]

/o/	[o]	Located in a non-occlusive syllable, Other syllables do not contain phonemes [ɔ]	to-ko[toko], bak-so[bAkso]
	[ɔ]	Located in the closed syllable, Other syllables contain phonemes [ɔ]	to-koh[tɔkɔh], ro- kok[rɔkɔʔ]
/ə/	[ə]	In the front or middle section of a syllable, Few are located at the back section of a syllable (loanword)	ke-ra[kəɾA], e- rat[əɾAt], ru-te[rutə]
/e/	[e]	Located in a non-occlusive syllable, Other syllables do not contain phonemes [ɛ]	sa-te[sAte], be-sok[besɔʔ]
	[ɛ]	Located in the closed syllable, Other syllables contain phonemes [ɛ]	ka-ret[kAɾɛt], em- ber[ɛmber]
/i/	[i]	Located in a non-occlusive syllable, Occluded syllables with stress intonation	gi-gi[gigi], ta-li[tAli], ping-gul[pingɔl]
	[ɪ]	Located in the closed syllable, Other syllables contain phonemes [ɪ]	pa-rit[pAɾɪt], irit[ɪɾɪt]
/u/	[u]	Located in a non-occlusive syllable, Occluded syllables with stress intonation	u-pah[upAh], rum-put[rumpɔt]
	[ʊ]	Located in the closed syllable, Other syllables contain phonemes [ʊ]	wa-rung[wAɾʊŋ], u-tuh[ʊtʊh]

There are a few things to be noted regarding the allophones of Indonesian vowels. First of all, the distribution of the phonemes [ɛ] and [ə] is overlap. It is noticeable that [ə] generally appears in the front or middle section of the syllable. This situation is similar to the distribution of [ɛ], which can appear in the front occluded syllables. There are still no theories guiding how to separate the two clearly; Second, the phenomenon of “vowel harmony” plays a pivotal role in Indonesian vowel allophones. The so-called “vowel harmony” phenomenon refers to a phenomenon in which the pronunciation of vowels in closed syllables affects the pronunciation of vowels in non-occluded syllables, such as “*lirik* [lɪɾɪʔ] (*lyrics*)”, “*efek* [ɛfɛʔ] (*effect*)”, “*rokok* [rɔkɔʔ] (*cigarette*)” and any other words. Since the vowels in the back section of occluded syllables are read as [ɪ], [ɛ], [ɔ], the vowels in the front of the syllables are also read as [i], [e], [o], which is special in Indonesian vowel allophones and deserves attention.

There are six monophthongs in Indonesian, but they are only represented by 5 letters (a, i, u, e, o). Among them, “e” represents 2 phonemes—[ə] and [e], while the rest of them each represent a phoneme. The allophones of the Indonesian monophthongs are relatively simple. There are at most 2 allophones per phoneme, and a[A] and e[ə] have no allophones. In addition, [ə] is not found in written form, but actually represents a phoneme. The phoneme of the Indonesian monophthongs is changed mainly due to the different nature of the syllables (see Table 6 for details). This can be regarded as an unique phenomenon in the allophones of the Indonesian monophthongs.

There are four diphthongs in Indonesian, namely ai[Aj], au[Aw], oi[oj], ei[ej], “where ei[ej] is a diphthong added due to the impact from foreign words.” (Alwi et al., 2010: 63), Indonesian diphthongs are composed of only two vowels, so they are also called compound vowel. Indonesian diphthongs are generally located in the middle or back of the syllable. Only au[Aw] has a relatively free distribution, which can be located in the

front, middle and back of the syllable. The distribution of Indonesian diphthongs is shown in the table below.

Table 7. The Distribution of Diphthongs in Indonesian

Diphthongs	Position of diphthong		
	Front	Middle	Back
/Aj/	-	balairung (hall)	pandai (diligent)
/Aw/	audisi (audition)	tauge (sprouts)	pulau (island)
/oj/	-	boikot (boycott)	koboi (cowboy)
/ej/	-	geiser (geyser)	survei (survey)

Indonesian diphthongs are not a simple addition of two vowels. They must be pronounced without pauses, which is very different from the pronunciation methods of other vowel combinations. When other vowel combinations are pronounced, there is a slight pause in the middle, and each sound should be pronounced loud with the same stress, such as *iu*, *ua*, *eo*, etc. It can be seen that other Indonesian vowel combinations each belong to a different syllable, even if they are all composed of two phonemes. For example, "*ti-up (blowing)*, *lu-ar (outside)*, *be-o (parrot)*" are composed of two syllables. In a nutshell, there is no other diphthongs in Indonesian in addition to "*ai*", "*au*", "*oi*" and "*ei*". The vowel combinations in Indonesian language that have been investigated so far are "*aa*, *ai*, *ao*, *ua*, *ue*, *ui*, *ia*, *iu*, *io*, *oa*, *oi*, and *eo*", where as "*ii*, *uu*, and *oo*" are only used for minority names. (Chaer, 2013: 84)

Comparative Analysis of Chinese and Indonesian Vowel Systems

After a detailed description of the Chinese and Indonesian vowel systems, the next stage is to reveal the similarities and differences between them from three perspectives, namely, monophthongs, diphthongs and allophones.

From the perspective of monophthongs, there are several findings. First of all, Chinese monophthongs are obviously more developed than Indonesian monophthongs. Chinese has 10 monophthongs, which are divided into linguistic vowels, apical vowels and tongue rolling vowel. In Indonesian, there are only 6 monophthongs, all of which are linguistic vowels; Second, there are contrast between rounded and unrounded lip sounds in Chinese linguistic vowels, such as *i*[i] and *ü*[y], and also *e*[ɤ] and *o*[o]. Although Indonesian linguistic vowels also have rounded and unrounded lip sounds, they do not form contrast; Third, except of a few specific vowels in Chinese monophthongs, other vowels can form words independently, but Indonesian monophthongs cannot; Finally, both Chinese and Indonesian monophthongs can be flexibly located in the front, middle and back of syllables. For example, Chinese words such as "*安 (ān) safe*, *搬 (bān) to move*, and *八 (bā) eight*" as well as Indonesian words, such as "*api (fire)*, *kantor (office)* and *kuda (horse)*".

From the perspective of vowel allophones, there are several findings. First, the allophones of Chinese monophthongs are more complicated than the Indonesian ones. The Chinese monophthongs have two or more allophones except of "*o*[o], *-i* [ɿ], and *-i* [ɿ]". In contrast, Indonesian "*a*[A]" and "*e*[ə]" have no allophones and other monophthongs have only two allophones; Second, allophones of Chinese monophthongs are mainly generated because they lies in different positions in syllables, such as the four allophones of "*a*[A]". However, Indonesian monophthongs have allophones mainly due to the different nature of the syllables, such as [e], [i], [u], etc;

Finally, there is the phenomenon of "vowel harmony" in the allophones of Indonesian monophthongs, that is, the pronunciation of the vowel phoneme in a syllable affects the pronunciation of the vowel phoneme in another syllable. However, the so-called "vowel harmony" phenomenon does not exist in the allophones of the Chinese monophthongs.

In order to refine the findings of this research, the authors believe that it is necessary to conduct a detailed comparative analysis of the phonemes and their allophones of the Chinese and Indonesian monophthongs to reveal the similarities and differences between them. The details are shown in the table below.

Table 8. List of Chinese and Indonesian Monophthongs and Their Allophones

Latin alphabet	Vowel phoneme	Allophone	Chinese vowel system	Indonesian vowel system
a	/a/	[a]	Available	Not available
		[A]	Available	Available
		[ɑ]	Available	Not available
		[ɛ]	Available	Available
o	/o/	[o]	Available	Available
		[ɔ]	Not available	Available
e	/ə/	[ɤ]	Available	Not available
		[ə]	Available	Available
	/e/	[e]	Available	Available
		[ɛ]	Available	Available
i	/i/	[i]	Available	Available
		[I]	Available	Available
		[j]	Available	Available (Appears in compound vowels)
u	/u/	[u]	Available	Available
		[ʊ]	Available	Available
		[w]	Available	Available (Appears in compound vowels)
ü	/y/	[y]	Available	Not available
		[ɥ]	Available	Not available
-i	/ɿ/	[ɿ]	Available	Not available
-i	/ʅ/	[ʅ]	Available	Not available
er	/ər/	[ər]	Available	Not available
		[er]	Available	Not available

(Note: Those in boldface type are the differences between the Chinese and Indonesian monophonic systems.)

Based on the above comparative analysis, the similarities and differences between Chinese and Indonesian monophthongs system are as follow.

1. Almost all of the Indonesian monophthongs and their allophones can find their corresponding phonemes in the Chinese monophthong system, and only [ɔ] in Indonesian does not have a Chinese corresponding phoneme.
2. In the Chinese monophthong system, "a" has two allophones, namely [a] and [ɑ], which cannot be found in the Indonesian monophthong system.
3. It is clear that Chinese monophthongs e[y], ü[y], -i[ɿ], -i[ʅ], and er[ər] and allophones produced by ü[y] and er[ər] don't exist in the Indonesian monophthong system.
4. In Chinese and Indonesian monophthong systems, only a[A], i[i], and u[u] share the same phonemes and writing forms.

5. The Chinese monophthong “e” is pronounced [ɤ] in most cases, while the Indonesian “e” is pronounced [e] in most cases.

From the perspective of compound vowels, there are several findings. First of all, Chinese compound vowels are more developed than Indonesian ones. There are 13 compound vowels in Chinese, among which there are triphthongs (iao, iou, uai, uei). In contrast, there are only 4 compound vowels in Indonesian, all of which are diphthongs; Second, as for the internal structure of compound vowels, Chinese compound vowels are composed of anterior vowels, major vowels, and posterior vowels, while Indonesian compound vowels are composed of only major vowels and posterior vowels; Furthermore, in Chinese compound vowels, there is a phenomenon that the writing form is inconsistent with the actual pronunciation, such as “ao, iao, -iu, -ui”, which does not exist in the Indonesian diphthongs; Finally, in Indonesian, there are other vowel combinations in addition to diphthongs, which are not included in the compound vowels system. Meanwhile, in Chinese, there are no other vowel combinations except for front-voiced, middle-voiced and back-voiced compound vowels.

Discussion

This article finds that the Chinese monophthongs are significantly more developed than the Indonesian monophthongs. There is confrontation between rounded and unrounded lip sounds in the Chinese monophthong system, which doesn't exist in the Indonesian system. The Chinese and Indonesian monophthongs “a”, “i” and “u” share the same writing form and pronunciation. In addition, both Chinese and Indonesian monophthongs can be located in the front, middle or back of the syllable.

From the perspective of allophones, the allophones of Chinese monophthongs are more complicated than those of Indonesian. Basically, each Chinese monophthong has two or more allophones, while Indonesian ones has only two allophones for each. In addition, almost all phonemes and their allophones in Indonesian can be found in Chinese with the exception of o[ɔ], but only some Chinese phonemes and their allophones can be found in Indonesian. From the perspective of the occurrence of allophones, in Chinese they are mainly caused by the different positions in which a vowel lies in a syllable. Zhang (2012) pointed out that a vowel phoneme representing a vowel in Standard Chinese has different allophones in different circumstances. For example, the “e” in Chinese has four allophones, which is pronounced as [ɤ] alone, [ə] in *en*, [e] in *ei*, and [ɛ] in *ie*. (Zhang, 2012: 7) The “different circumstances” said by Zhang actually refer to different positions of vowels in a syllable. Shao (2010) clearly held that the Chinese pinyin letter “a” actually represents different phonemes when being in different positions. However, people are always used to seeing all of the allophones as *a* since they have no distinctive function in Mandarin. (Shao, 2010: 51) It can be seen that the opinions of Zhang and Shao are consistent with the findings of this study, that is, the allophones of the Chinese monophthong occur mainly due to the different positions a phoneme lies in the syllables; The reason for the occurrence of Chinese allophones is obviously different from Indonesian. The allophones in Indonesian language are mainly caused by the different natures of the syllables. Chaer (2013) has long discussed this point. He argued that Indonesian “i” has two allophones, which have different distributions. For example, “i[i]” appears in non-occlusive syllables such as “*ini [ini] (this)*” and “*isi [isi] (content)*”. On the contrary, “i[l]” appears in occluded (closed) syllables, such as “*benih [bənɪh] (seed)*” and “*batik [bAtɪk] (Indonesian traditional clothes)*”. (Chaer,

2013: 65) In addition, Chaer (2012) identified the complementary relationship of the monophthong “o”, who clearly pointed out that “o” in non-occluded syllables must be voiced as o[o], such as “*toko* [toko] (*shop*)” and “*loyo* [lojo] (*sluggish*)”, and “o” in the occluded syllable should be pronounced as o[ɔ], such as “*tokoh* [tɔkɔh] (*figure*)” and “*bodoh* [bɔdɔh] (*stupid*)”. (Chaer, 2012: 128)

From the perspective of compound vowels, Chinese compound vowels are more developed than those of Indonesian. Chinese has triphthongs, while Indonesian has only diphthongs. In addition, in Chinese compound vowels system there are some cases that the spelling is inconsistent with the actual pronunciation, which does not exist in Indonesian. As mentioned earlier, “*ao*, *iao*, *iou*, and *uei*” are special in Chinese complex vowels as their spelling forms are different from the actual pronunciation. When “*ao*” and “*iao*” are voiced, the “*o*” must be pronounced as [u]. If “*iou*” and “*uei*” are after initials, “*o*” and “*e*” in the middle should be deleted and written as *-iu* and *-ui* when we spell them, but the pronunciation remains unchanged. Many scholars have discussed this point. For example, Wang & Sun (2007) pointed out that, according to the rules of Chinese pinyin, “*iou*” and “*uei*” should remain unchanged in written forms when they form syllables independently. However, they need to be reduced as *iu* and *ui* when they are after initial consonants. (Wang, Sun, 2007: 94) Shao (2010) clearly proposed using the international phonetic alphabet to indicate the actual pronunciation of Chinese “*ao*” and “*iao*” when talking about compound vowels, “*ao*” being [au] and “*iao*” being [iau]. Their opinions are enough to prove that this special phenomenon of Chinese is worthy of attention. In addition, looking at the previous comparative study of Chinese and Indonesian phonetic systems, we can find that most scholars carry out research to solve the problem of cross-language phonetic teaching, thus leading to insufficient research on the Chinese-Indonesian phonetic system. The purpose of these studies is only to find out the basic similarities and differences in Chinese and Indonesian phonetic systems, and then explore more effective teaching methods based on research results. Their research purpose is not to deeply dig into the similarities and differences in the phonetic system, which is very different from the purpose of this study. In contrast, this study aims to fill the gap in previous studies to help improve this discipline. Therefore, it conducts a comprehensive comparative study of Chinese and Indonesian vowel systems from the level of monophthongs, compound vowels, and allophones. Hopefully, it is conducive to promoting the development of Chinese-Indonesian comparative phonetics and as well as the improvement of general phonetics discipline.

Throughout the previous research relating to vowels, many studies have focused on the analysis of monophthongs, a few involving compound vowels, and almost none involving allophones. Alwi (2010) and Chaer (2013) are the few scholars who have discussed allophones in their works. However, their research only covers the monolingual level and does not make comparison with Chinese monophones and corresponding allophones. While many scholars have focused on the comparative study of Chinese and Indonesian phonetics such as Lin (2006), Lin (2010), Liang (2014), etc., their research purpose is mainly to solve teaching problems, leading to the lack of comprehensive analysis of the Chinese and Indonesian phonetics system, especially research on the comparison of Chinese and Indonesian vowels system. This study is done in different way and serves different purpose. In the comparative analysis of the Chinese and Indonesian vowel systems, neither the monophthong level nor the teaching needs were the center. Therefore, the research conclusions drawn are relatively complete and

in-depth, involves three major aspects of Chinese and Indonesian vowels system, which distinguishes this research from other related studies.

Conclusion

This article makes a detailed comparative analysis of the Chinese and Indonesian vowel systems. First, the authors discuss the characteristics of the vowel systems of the two languages, covering the perspectives of the monophthongs, compound vowels and allophones, and then reveals the similarities and differences between the vowel systems of the two languages through comparative analysis. The results can be used to fill the gap of the previous studies. This study is not limited to the monophthong level but involves the level of compound vowels and allophones. Furthermore, the results of this research are conducive to promoting the development of Chinese-Indonesian comparative phonology discipline and the improvement of general phonetics discipline. It also can provide some insights for other scholars to study the similarities and differences of the Chinese and Indonesian vowel systems.

The scope of this study does not involve finals level, which can be regarded as a limitation of this study. In fact, vowels and finals are both different from and related to each other. To make a complete study, finals level should be taken into account. However, due to various considerations, this article is limited to the study of vowel system. At present, the comparative analysis involving the level of finals in Chinese and Indonesian phonetic systems has not attracted too much attention, and needs further exploration. Moreover, the research on the components of the Indonesian finals itself is very few. Until now, there are no clear statistics on the number of Indonesian finals which are composed by vowel and consonant, such as “*ab, as, ik, il, un, etc*”. In addition, the research results of the Chinese and Indonesian supersegment levels are still rare. For example, the research on the comparative analysis of the Chinese and Indonesian speech intonations, and variation in speech flows have not attracted too much attention yet, which can be chosen as the object of future research.

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