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Examining Javanese Phonology Through Word-Reversal Practices

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This paper analyzes aspects of the phonology of Malangan Javanese, spoken in the city of Malang in East Java, Indonesia, through the lens of a reversed language called Basa Walikan Malangan ("Walikan"). Walikan historically functioned as a secret language, but is currently regarded as a marker of a shared local identity. It involves the total reversal of segments of Malangan Javanese and occasionally Indonesian words. Manipulation takes place on a word level and is predominantly phonemic, affecting underlying forms rather than their surface realizations. In a small number of cases, orthography appears to influence word reversal as well. We demonstrate how Walikan reversals chiefly comply with the phonology of Malangan Javanese. Their analysis puts us in the position to cast new light on some under-described issues of Javanese phonology, such as the realization of word-final stops, the syllabification of consonant clusters, and processes of vowel-lowering. We also call attention to instances where Javanese phonotactics are violated, arguing that the phonemic status of a number of vowels and consonants is changing. This is especially the case with the phoneme /ɔ/, which was historically an allophone of /a/ but has now gained phonemic status, as demonstrated by Walikan data.

Keywords: Phonology; Phonotactics; Javanese; Reversed Language; Phonemic Manipulation

1. INTRODUCTION.[1] Javanese (*basa Jawa* [ˈbɔ̤.sɔ ˈɟɔ̤.wɔ]) is part of the Malayo-Polynesian branch of Austronesian (Horne 1961; Simons and Fennig 2018). With sixty-nine million speakers in Indonesia, it is the country's biggest local language. Javanese is divided into three main dialect clusters: Western Javanese, Central Javanese, and Eastern Javanese (Hatley 1984; Nothofer 1980, 2006; Ras 1985). Malangan Javanese, spoken in the city of Malang, falls under the Eastern Javanese cluster. Other Eastern Javanese varieties that have received scholarly attention include Surabayan Javanese (Hoogervorst 2008;

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Krauße 2017), Paciran Javanese (Vander Klok 2012), and Tengger Javanese (Conners 2008). The phonology of Malangan Javanese has only recently been described by Yannuar (2019a) and the current paper is based on that initial analysis.

This paper seeks to provide a better understanding of Malangan Javanese phonology by including its reversed language, Walikan [ˈwa.lɪʔ.an], in the analysis. This allows us to provide a more extensive analysis than an earlier paper by Yannuar and Kadarisman (2019). The regular patterns of Walikan word reversal will be used to investigate the structure of Malangan Javanese segments and syllables, and the nature of phonotactic constraints found in this dialect. Our findings allow for the following generalizations about Malangan Javanese phonology: (i) the phonation-type distinction of so-called "heavy" versus "light" stop is neutralized in word-final position, (ii) the glottal stop [ʔ] is a realization of /k/ in syllable-final position, (iii) the fricative /h/ is distinctive in word-final position, (iv) consonant clusters in word-initial as well as word-medial position are tautosyllabic, and (v) the phonemic status and allophonic alternations of the vowels /e/ ∼ [ɛ], /o/ ∼ [ɔ], and /a/ ∼ [ɔ] are currently undergoing change in Malangan Javanese. The latter can be shown to have reached phonemic status.

The paper is structured as follows. Section 2 introduces Walikan, its functions in society, and its relation to other reversed languages. Section 3 briefly discusses the methods and materials used in this study. Section 4 introduces the orthographic, phonemic, and phonetic representations of relevance to this article. Section 5 first discusses the consonants of Malangan Javanese that have received attention in phonological and phonetic studies of other Javanese varieties (Adisasmito-Smith 2004; Brunelle 2010; Fagan 1988; Hayward 1999; Vander Klok et al. 2018). Next, we investigate the phonology and phonotactics of Walikan and its implications for Malangan Javanese phonology more broadly in the realm of consonants. Section 6 looks at consonant clusters and consonant sequences and the ways these are reversed in Walikan. Section 7 examines the realization of vowels in Malangan Javanese and Walikan, arguing on the basis of reversed forms that a number of vowels appear to be gaining phonemic status in Malangan Javanese. Section 8 concludes.

2. WALIKAN AND ITS FUNCTIONS. As mentioned above, Walikan speakers reverse words from Malangan Javanese—and to a lesser degree from Indonesian, Arabic, and English—and use these newly formed words in sentences that are structured according to the syntax of Malangan Javanese.[2] Speakers tend not to reverse every single word in an utterance; typically, only a few content words are in Walikan and the rest in non-Walikan Malangan Javanese. The word-reversal process originally served as a secret code, able

2. We indicate the source language of loans only where relevant for our analysis, and only of loans that are perceived as such according to the intuitions of the first author, a native speaker of Malangan Javanese.

to produce distinct forms that outsiders could not understand. In the past, Walikan was used as an antilanguage, whereas today, it functions as a marker of a shared Malang identity (Yannuar 2019a).

Walikan is produced by reversing segments at the word level. For example, a word like *dinɔ* 'day' becomes *ɔnid* in Walikan. This manipulation strategy serves to deliberately change linguistic forms as part of certain cultural and social contexts (Storch 2011). Word reversal is a widespread phenomenon that has been observed in many languages.[3] The term "reversed language" is commonly used in linguistic studies of such varieties (Bagemihl 1988, 1989; Dreyfuss 1983; Hoogervorst 2014; Lefkowitz 1989). Speakers of Walikan predominantly use the so-called Total Segment Reversal strategy: a direct inversion of all segments in a word.[4] In this type of reversal, the first segment of a word will be the last segment of the reversed form, the second segment will be the penultimate segment, and so on. For example, a disyllabic word $C_1V_2.C_3V_4C_5$ will become $C_5V_4.C_3V_2C_1$.

Reversal in Walikan is based on the phonemic form of a word, rather than its phonetic surface realization. Reversed words must conform to the phonology and phonotactics of Malangan Javanese. For example, the Malangan Javanese word *arek* [ˈʔa.rɛʔ] 'kid' is reversed as *kera* [ˈ**k**ɛ.ra] and not as *[ˈ**ʔ**ɛ.ra**ʔ**], since it is the underlying form and not the surface form that is being manipulated. The above example shows that while the word-final velar stop /k/ is realized as [ʔ] in that position, it is underlyingly /k/ as it systematically appears as [k] in the word-initial position of a reversed word (see section 5.3). By examining the shapes of Walikan words in this way, and comparing them to the realizations of the original Malangan Javanese forms, we can thus gain insights into the phonemic structure of vowels and consonants in the Malangan Javanese matrix language.[5]

The above example of *arek* [ˈʔa.rɛʔ] 'kid' and its reversed from *kera* [ˈkɛ.ra] furthermore demonstrates that, in many but not all cases, the underlying form of a word is identical to its orthographical form. Nevertheless, we argue that Walikan manipulates primarily the phonemic rather than the orthographic form of a word.[6] Reversal takes place on a word level and generally does not affect

3. Bagemihl (1989) presents a typological description of word reversal and a framework of ten different types. Some alternative reversal processes attested in Walikan are typologically identical to the linguistic process of metathesis, which likewise involves a phonological reordering of sounds. However, metathesis never involves a *total* reversal of word segments, which Walikan does.
4. The most productive type of reversal in Yannuar's (2019b) corpus of Walikan is Total Segment Reversal (96%). The other 4% (26 out of 750 tokens) deviate from the Total Segment Reversal rule and can be categorized as Transposition or Sequence Exchange (Yannuar 2019a).
5. Similar claims have been made with regard to other secret languages or language practices (see Gil 2002; Laycock 1972; Lefkowitz 1989).
6. That is not to say that orthography is completely inconsequential; in a small number of instances, it has evidently overridden phonology, as for example, in the reversed form *ruot* [ˈru.^{w}ɔ͡t̪] from English *tour* 'tour, trip,' and a small number of words in which the digraph <ng> (representing the phoneme /ŋ/) yields the sequence [gn̪] (with an epenthetic schwa) in reversed form: *tukang* [ˈtu.kaŋ] 'worker' becomes *gnakut* [gn̪.ˈna.ko͡t̪], *utang* [ˈʔu.taŋ] 'debt' becomes

affixes. Instead, Walikan forms may take on the same, unreversed affixes as their originals (1). Note that the underlying forms and their surface realizations are juxtaposed in this section; their precise relationship is clarified in section 4.

(1) Reversal of affixed words[7]

/bal-bal-an/	[ˈbal̪.ba̪.lan]	>	/lab-lab-an/	[ˈlap̄.la.p̄an]	‘to play football’
/m-bawa/	[ˈmba̪.wa]	>	/ŋ-awab/	[ˈŋa.wap̄]	‘to bring’
/m-bajar/	[ˈmba̪.jar]	>	/ŋ-rajab/	[ˈŋra.jap̄]	‘to pay’
/ŋ-(k)opi/	[ˈŋɔ.pi]	>	/ŋ-ipok/	[ˈŋi.pɔʔ]	‘to drink coffee’

In a small number of examples, affixes and locative particles are treated as part of the root. As a result, the corresponding Walikan forms do not require renewed affixation or cliticization (2).

(2) Reversal of affixed forms treated as inseparable words

/kətəmo-**n**/	[kə.t̪ə.ˈmɔn]	>	/nomətək/	[ˈnɔ.mə.t̪ɔʔ]	‘busted’
/gujo-**n**/	[ˈgu̪.jɔn]	>	/nojug/	[ˈnɔ.ɟu̪k̄]	‘to joke’
/**di** mana/	[di̪.ˈma.na]	>	/anamid/	[ˈʔa.na.mit̪̄]	‘where’ < Ind.
/**sə**-təŋah/	[sə.t̪ə.ˈŋah]	>	/hatəŋəs/	[ˈha.t̪ə.ŋəs]	‘half’
/**ŋ**-ərti/	[ŋər.ˈt̪i]	>	/itrəŋ/	[ˈʔi.t̪rəŋ]	‘to understand (Actor Voice)’

An even smaller number of affixed forms can be reversed in both ways: wholesale reversal or root reversal with renewed affixation (3). This suggests that their morphological status is perceived as ambiguous by Malangan Javanese speakers.

(3) Multiple reversal options of affixed words

/**m**–(w)eḍok/	[ˈmɛ.ḍɔʔ]	>	/koḍe**m**/	[ˈkɔ.ḍɛm]	‘to womanise’
			/**ŋ**–(k)oḍew/	[ˈŋɔ.ḍɛ]	
/ḍewe-**an**/	[ˈḍe̤.we.ʲan]	>	/**na**eweḍ/	[ˈna.ɛ.wɛt̪̄]	‘to be alone’
			/eweḍ-**an**/	[ˈʔɛ.wɛ.t̪an]	

3. METHODS AND MATERIALS. The Walikan words used for the present study constitute “corpus external evidence,” a collection of data created by native speakers through their intuitive knowledge of the rules of their language (Alidou 1997; Bagemihl 1989; Lefkowitz 1991; Ohala and Jaeger 1986). Our data were collected through extensive fieldwork undertaken by the first author. The data set includes 725 Walikan words collected from more than 100 native speakers plus a substantial number of written Walikan materials observed in the media and public areas. Of those 725 Walikan words, 350 were compiled from a corpus of natural spoken data. The spoken data amount to 50 hours and

gnatu [gə̤.ˈna.t̪u], etc. In addition, there is some evidence of the schwa /ə/ being realized as an open-mid front unrounded vowel /ɛ/ in Walikan, which is presumably triggered by the grapheme <e> that represents both phonemes orthographically (section 7.4). Such examples are irregular and few in number. As will be demonstrated throughout this article, the most regular reversal strategy dictates that all segments retain their phonemic value.

7. The arrow ‘>’ is used in this article to indicate transformation from original words to their reversed forms.

35 minutes of recorded face-to-face sessions and is archived as Yannuar (2019b). These fieldwork sessions consisted of interviews, conversations, elicitations, and narratives of the Frog Story (Mayer 1969). Recordings were made using a Zoom H4n SP audio recorder and a Samsung NX Mini camera. In addition, the spoken corpus included spoken forms of Walikan available in public media: approximately 3 hours of songs, video clips, YouTube videos, recordings of a local TV news, and a radio show. The spoken data were first transcribed using ELAN (ELAN 2015) and then imported into FLEx (FLEx 2015) for glossing.

The written Walikan data set consists of 172 additional Walikan words culled from local newspaper columns, printed texts on T-shirts, and read from pictures taken around the public spaces of Malang. Combined, the spoken and written corpus amounted to 522 words, to which were added 203 Walikan words mentioned in previous studies that were confirmed to exist by informants, thus creating the final list of 725 Walikan words underlying the present study. The pronunciation of the written Walikan inventory was also supplied by the informants.

4. REPRESENTATION. The Malangan Javanese data examined in this study can be represented in multiple ways. As mentioned in section 2, there is considerable overlap between phonemic representations and their orthographical counterparts. Notable exceptions include a number of digraphs, such as <th> for /ʈ/, <dh> for /ɖ/, <ny> for /ɲ/, and <ng> for /ŋ/ (see section 5.1). A number of Malang Javanese vowels are lumped together in colloquial writing; the graph <e> can be used for /e/ and /ə/, whereas, <o> can be used for /o/ and /ɔ/ (see section 7.1). Vowel diacritics may be used to distinguish these phonemes, but this is not consistently done by the speech community. In all these instances, we observe that phonemic reversal strategies prevail over orthographic ones.

As the relation between the phonemic and phonetic representations is largely predictable, the underlying forms of Walikan words will be omitted in the subsequent sections of this paper. The most important points of discrepancy are given in (4):

(4) a. Heavy stops /b d̪ ɖ ɟ g/ in root-final position are realized as light on the surface (section 5.2).
b. Some loanwords and composite forms exhibit a glottal stop [ʔ] in word-medial position.[8]
c. Prenasalized stops trigger a homorganic articulation of the preceding nasals: /nt̪/ [n̪t̪], /nd̪/ [n̪d̪], /nʈ/ [nʈ], /nɖ/ [nɖ], /nc/ [ɲc], /nɟ/ [ɲɟ]. These nasals lack phonemic status.
d. Closed syllables trigger vowel-lowering of /i/ to [ɪ], /u/ to [ʊ] (section 7.2), /e/ to [ɛ] (section 7.4), and /o/ to [ɔ] (section 7.5).

8. For example, *bakso* [ˈbaʔ.so] 'meatballs' (< Chinese), *mbakju* [ˈmbaʔ.ju] 'older sister' (< *mbak-ju*), and *sakmene* [saʔ.ˈme.ne] 'as much as this' (< *sak-mene*).

TABLE 1. UNDERLYINGLY HEAVY STOPS IN WORD-FINAL POSITION.

Root			With suffix		
/abab/	[ˈʔa.baʙ̚]	‘breath’	/abab-e/	[ˈʔa.baʙ̚.pe]	‘the breath’
/urip/	[ˈʔu.rɪp̚]	‘life’	/urip-e/	[ˈʔu.rɪ.pe]	‘the life’
/ojoɖ/	[ˈʔɔ.jɔʈ̚]	‘root’	/ojoɖ-e/	[ˈʔɔ.jɔ.ʈe]	‘the root’
/ruwəʈ/	[ˈru.wəʈ̚]	‘complicated’	/ruwəʈ-e/	[ˈru.wə.ʈe]	‘so complicated!’
/semog/	[ˈsɛ.mɔk̚]	‘sexy’	/semog-e/	[ˈsɛ.mɔ.ke]	‘so sexy!’
/bapak/	[ˈbaʙ̚.paʔ]	‘father’	/bapak-e/	[ˈbaʙ̚.paʔ.e]	‘the father’

Like other Javanese varieties, Malangan Javanese exhibits distinct sets of heavy stops /b ɖ ɖ̟ ɟ g/ and light stops /p ʈ ʈ̟ c k/, as discussed in sections 5.1 and 5.2. This heavy–light distinction is neutralized word-finally, so that there is no acoustic difference in this position between /b/ and /p/, or /ɖ/ and /ʈ/. The phonemes /g/ and /k/, by contrast, are pronounced differently in word-final position, respectively as /k̚/ and /ʔ/. Suffixation does not affect the realization of these phonemes (table 1).

On the basis of synchronic data, there is no phonological evidence to assume underlying /abab/ instead of /abap/, or /ojod/ instead of /ojoʈ/; in fact, the underlying heaviness of final stops only becomes apparent in their reversed forms (section 5.2).

Throughout this paper, word stress is indicated on the basis of the first author’s intuition as a native speaker. As a rule, stress in disyllabic words is penultimate, except if the penultimate syllable contains a schwa. In trisyllabic words, stress is barely audible but generally falls on the antepenultimate syllable, except if this is a schwa, in which case stress remains penultimate.

5. CONSONANTS. In this section, we first present an overview of the consonants of Malangan Javanese, giving particular attention to issues that have received attention in previous studies of Javanese consonants: the distinction between “heavy” and “light” consonants, the “retroflex” consonants, and the status of the glottal stop (section 5.1). The distinction between “heavy” and “light” consonants is neutralized word-finally, but Walikan data show that it is present underlyingly (section 5.2). Walikan words also provide evidence for two phenomena that distinguish the Malangan Javanese dialect from other Eastern Javanese dialects: it lacks a phonemic glottal stop, and it does not drop the glottal fricative /h/ in word-final position (section 5.3). We then discuss Walikan repair strategies in which illegal consonants—word-final palatal stops and bilabial approximants—are adapted or deleted (section 5.4). Section 5.5 demonstrates on the basis of reversed words that the intervocalic glides [w] and [j] are not treated as separate phonemes. Section 5.6 briefly discusses the rule ordering in affixed words.

5.1. OVERVIEW OF CONSONANTS. Malangan Javanese has twenty consonants, as presented in table 2. Orthographical representations that differ from IPA are given in angle brackets in this table.

TABLE 2. MALANGAN JAVANESE CONSONANTS.

	Bilabial	Dental	Alveolar	Retroflex	Palatal	Velar	Glottal
"Light" stops	p	t̪ <t>		ʈ <th>	c	k	
"Heavy" stops	b	d̪ <d>		ɖ <dh>	ɟ <j>	g	
Nasals	m		n		ɲ <ny>	ŋ <ng>	
Fricatives			s				h
Trill			r				
Lateral			l				
Approximants	w				j <y>		

The Malangan Javanese stops deserve some discussion. Unlike what their orthography suggests, they are not distinguished by voicing: all are acoustically voiceless and distinguished by the relative opening of the vocal folds (Brunelle 2010). The phonetic properties of /p t̪ ʈ c k/ versus /b d̪ ɖ ɟ g/ in Javanese varieties have been described as "lax" versus "tense" (Hayward 1999), "heavy" versus "light" (Fagan 1988; Hoogervorst 2008; Horne 1961), "slack voiced" versus "stiff voiced" (Ladefoged and Maddieson 1996; Thurgood 2004), and "breathy" versus "clear" (Adisasmito-Smith 2004). Here, we have chosen the terms "heavy" and "light" to describe the two contrasting sets, but nothing in the phonological analysis presented in this paper depends on this terminological preference. In Malangan Javanese, heavy consonants have a slightly aspirated realization. In addition, the /b/ is labialized. These consonants trigger breathiness on the vowel directly following them, including in recent loanwords. Such breathy vowels are allophones of plain vowels and cannot occur after light consonants, as the Walikan data throughout this study confirm.

The Javanese /ʈ/ and /ɖ/ are designated here as retroflex stops following Suharno (1982), but they are less retracted than the retroflex consonants in Dravidian or Indo-Aryan languages (Blust 2013:191). They have also been described as alveolar stops (Horne 1974) or apico-alveolar stops (Wolff and Poedjosoedarmo 1982). A palatographic investigation conducted with one male speaker of Central Javanese showed that the retroflex stops are articulated by raising the tip of the tongue so that it touches the back of the alveolar ridge, and that the "light" /ʈ/ is more retracted than its "heavy" counterpart /ɖ/ (Hayward and Muljono 1991). A closer phonetic analysis of Javanese retroflexes, possibly comparing different dialects and/or related languages displaying one or more retroflex stops such as Madurese and Balinese, has to our knowledge not yet been conducted. Malangan Javanese speakers are generally able to differentiate retroflex stops [ʈ, ɖ] from dental stops [t̪, d̪], especially through contrastive examples. However, they sometimes pronounce the retroflex stops, /ʈ/ and /ɖ/, as their dental counterparts, [t̪] and [d̪], respectively. Thus, *puʈu* [ˈpu.ʈu] 'snack made of rice flour and coconut' may be realized as *puʈu* [ˈpu.t̪u] and *buɖal* [ˈbu̪.ɖal] 'to leave' as *buɖal* [ˈbu̪.d̪al].[9] The original

9. This variable realization is likely due to influence from Indonesian, which has only one set of /t/ and /d/, the former dental [t̪] and the latter alveolar [d].

heavy alveolar stop /d/ is retained in Indonesian loanwords—such as *di mana* [di̪.ˈma.na] 'where', *dua* [ˈdu.ʷa] 'two', *sodara* [sɔ.ˈda̪.ra] 'relative', and *səpeda* [sə.ˈpɛ.da̪] 'bicycle' (< Dutch)—although, some speakers might realize it as [ɖ].

Finally, the glottal stop [ʔ] is analyzed as nonphonemic in Malangan Javanese. It is the phonetic realization of /k/ in word-final and root-final position. In addition, it appears in some loanwords and irregular forms (Yannuar 2019a:78–80). In word-final position, all Malangan Javanese stops are realized as unreleased. Throughout the paper, this is denoted phonetically with an upper-right corner diacritic <◌̚>. Consonants that are phonotactically illegal in word-final position are the palatal stops /c, ɟ/ and the bilabial approximant /w/. This restriction is directly relevant for the shape of so-formed Walikan attestations (section 5.4).

5.2. THE NEUTRALIZATION OF HEAVY CONSONANTS. As mentioned above, Javanese stops—in the Malang variety and elsewhere—are distinguished by larynx lowering rather than voicing (Brunelle 2010). As a result, the phoneme inventory shows two sets of stops: 'heavy' stops /b d̪ ɖ ɟ g/ and 'light' stops /p t̪ ʈ c k/. In word-final position, heavy consonants become light. In addition, the so-formed word-final stops are obligatorily unreleased, for instance: *b > p̚/_#.

When a word with a heavy consonant in initial position undergoes Total Segment Reversal in Walikan, this heavy consonant is moved to word-final position, where neutralization applies. This is illustrated in (5) for the heavy bilabial stop /b/, which in word-final position is realized as a light bilabial stop [p]. The examples, furthermore, show that the breathy vowels originally following word-initial heavy consonants are likewise neutralized in their new position, as breathiness is dependent on the preceding consonant.

(5) /b/ realized as [p] in word-final position
[ˈbe̤.caʔ] > [ˈka.ce̤p̚] 'pedicab'[10]
[ˈbɔ̤.kɔŋ] > [ˈŋɔ.kɔp̚] 'buttocks'

Word-final neutralization of the heavy dental stop /d̪/ and the heavy retroflex stop /ɖ/ in word-final position can be observed in (6). Both /d̪/ and /ɖ/ are realized as the light dental stop [t̪].

(6) /d̪/ and /ɖ/ are realized as [t̪] in word-final position
[ˈd̪ʊ̤.lʊr] > [ˈrʊ.lʊt̪̚] 'sibling; relative'[11]
[ˈd̪ɔ̤.d̪ɔ̤l] > [ˈlɔ.d̪ɔ̤t̪̚] 'to sell'
[ˈɖe̤.we] > [ˈʔɛ.wɛt̪̚] 'oneself; alone'
[ˈd̪i̤.nɔ] > [ˈʔɔ.nɪt̪̚] 'day'

10. Note that in Central Javanese dialects the high–mid front vowel /e/ is realized as [e] in an open syllable, yielding the form [ˈbe̞.caʔ]. Realization of vowels is discussed further in detail in section 7.
11. In Central Javanese dialects, the high-back vowel /u/ is realized as [u] in an open syllable preceding a closed syllable, yielding the form [ˈd̪ʊ̞.lʊr].

In word-final position, the light retroflex stop /ʈ/ is also realized as an unreleased light dental stop [t̪], as shown in (7). This obeys Javanese phonotactics, in which retroflex consonants cannot occur word-finally. For the same reason, *ḍewe* [ˈɖe̞.we] 'oneself; alone' in (6) is realized as [ˈʔɛ.wɛt̪] rather than *[ˈʔɛ.wɛɖ].

(7) /ʈ/ is realized as [t̪] in word-final position
[ˈʈi.ʈiʔ] > [ˈki.ʈit̪] 'a little'

Example (8) shows the word-final neutralization of the heavy velar stop /g/, which is realized as a light velar stop [k]. As it is underlyingly heavy, it is not pronounced as a glottal stop [ʔ] as in (11).

(8) /g/ is realized as [k] in word-final position
[ˈgə̟.ləm] > [ˈmə.lək] 'to want'
[ˈgɔ̟.rɛŋ] > [ˈŋɛ.rɔk] 'fried'
[gə̟r.ˈmɔ] > [ˈʔɔ.mrək] 'pimp'

Walikan reversed forms also reveal another interesting phonological feature of Malangan Javanese: some word-final consonants show up as light on the surface, yet are underlyingly heavy. This can be seen after Total Segment Reversal, which moves such consonants to the word-initial position where they are realized as heavy, and the vowels following these heavy consonants become breathy, as shown in (9). The word [ˈʔa.bə̤p] 'breath', for example, is underlyingly /abab/. As discussed in section 4, this underlying heaviness is not revealed by nonreversed data.

(9) /C_{heavy}/ is realized as [C_{light}] in word-final position

/arab/	[ˈʔa.rap]	>	/bara/	[ˈba̤.ra]	'Arab'
/abab/	[ˈʔa.bə̤p]	>	/baba/	[ˈba̤.ba̤]	'breath'
/mohamad/	[mo.ˈha.mat̪]	>	/damahom/	[ɖa̤.ˈma.hɔm]	(a name)
/kəlud/	[kə.ˈlʊt̪]	>	/duləḳ/	[ˈɖu̟.lək]	(a toponym)
/semog/	[ˈsɛ.mɔk]	>	/gomes/	[ˈgɔ̟.mɛs]	'sexy'

In sum, Walikan words provide evidence for the surface neutralization of phonation contrasts in word-final consonants, yet also show that the contrast is underlyingly still present.

5.3. THE STATUS OF GLOTTAL STOP AND /h/. The phonemic status of a glottal stop in Javanese dialects is a topic of debate. In some closely related Eastern Javanese dialects, the glottal stop has been analyzed as at least partly phonemic (Hoogervorst 2008; Krauße 2017). In Malangan Javanese, however, the glottal stop [ʔ] chiefly shows up as the regular allophonic realization of /k/ in root-final position, corresponding to its historical and orthographic status. As shown in (10), words with an underlying /k/ in word-final position are realized with a final [ʔ]. When Total Segment Reversal moves these final consonants to the initial position, they are indeed realized as [k]; *kubam* 'drunk' and *kaceb* 'pedicab'.

(10) [ʔ] is underlyingly /k/ in word-final position
[ˈma.bʊ̈ʔ] > [ˈku.bʊ̈m] ‘drunk’
[ˈbɛ̈.caʔ] > [ˈka.cɛp̄] ‘pedicab’

As suffixes do not affect the realization of root-final /k/ (see section 4), this phoneme remains realized as [k] in reversed form (11).

(11) [ʔ] is underlyingly /k/ in root-final position
/walik–an/ [ˈwa.lɪʔ.an] > /kiwal–an/ [ˈki.wa.lan] ‘reversed language’
/kasi-i/ [ˈka.siʔ.i] > /isak-i/ [ˈʔi.saʔ.i] ‘give to sb.’ < Ind.
/kənal–an/ [kə.ˈnal.an] > /lanək–an/ [ˈla.nəʔ.an] ‘acquaintance’

The allophonic relation between /k/ and [ʔ] is also shown in (12). A light velar stop /k/ in word-initial position always becomes [ʔ] in word-final position after the Total Segment Reversal process.

(12) /k/ is realized as [ʔ] in word-final position
[ˈki.wɔ] > [ˈʔɔ.wɪʔ] ‘left’
[ˈkɔ.n̪t̪ɔl] > [ˈlɔ.n̪t̪ɔʔ] ‘male genitals’[12]
[kə.t̪ə.ˈmɔn] > [ˈnɔ.mə.t̪əʔ] ‘busted’

It is not uncommon for Walikan to draw from basilectal forms. These may exhibit a word-final glottal stop not attested in other varieties, such as Malangan Javanese *matɛʔ* ‘to die’ (mesolectal Javanese: *mati*) and *taeʔ* ‘shit’ (mesolectal Javanese: *tai*) or Malangan Indonesian *mintaʔ* ‘to ask for’ (mesolectal Indonesian: *minta*) and *bawaʔ* ‘to bring’ (mesolectal Indonesian: *bawa*). When such words are reversed as in (13), the word-final glottal stop likewise appears as /k/ in the word-initial position. The common spelling of these words as *matek*, *taek*, *mintak*, and *bawak* suggests that the sound is reinterpreted as an underlying /k/ in analogy with the examples in (10) and (11). Here, orthography follows phonology rather than the other way around.

(13) [ʔ] in word-final position is reanalyzed as /k/
[ˈma.t̪ɛʔ] > [ˈkɛ.t̪am] ‘to die, dead’
[ˈmi.n̪t̪aʔ] > [ˈkat̪.nɪm] ‘to ask for’[13]
[ˈba̤.waʔ] > [ˈka.wap̄] ‘to bring’t
[ˈt̪a.eʔ] > [ˈke.ʲat̪] ‘shit’

The corpus contains one loanword exhibiting the same process of reanalysis on a syllabic level (14).

(14) [ʔ] in syllable-final position is reanalyzed as /k/
[ˈba̤ʔ.so] > [ˈʔɔ.skap̄] ‘meatballs’ (< Chinese)

When speakers were asked to produce additional examples, [ʔ] in syllable-final position was likewise reanalyzed as /k/ (15).

12. In most other Javanese varieties the corresponding form is *konṭol*, yet the retroflex stop appears to be losing its phonemic status in Malangan Javanese as mentioned in section 5.1.
13. Homorganic consonant clusters in Walikan are typically retained, see section 6.2. The words *katnim* [ˈkat̪.nɪm] ‘to ask’ and *tapmə* [ˈt̪ap̄.mə] ‘four’ are exceptions, presumably as they are from mesolectal Indonesian. These are the only words in our corpus that exhibit reversed homorganic clusters. This is discussed more detail in section 6.

(15) [ʔ] in syllable-final position is reanalyzed as /k/
[ˈbaʔ.wan] > [ˈnaw.kap̄] ‘a kind of vegetable fritter’ (< Chinese)
[ˈmaʔ.mʊr] > [ˈrʊm.kam] ‘prosperous’ (< Arabic)

The alternation of [k] and [ʔ] in the above Walikan examples substantiate that speakers take the underlying phonemic form of a segment as input for the reversal process, treating word-final glottal stops [ʔ] as allophones of /k/. Word-initial glottal stops, conversely, correspond to zero in reversed Walikan words, indicating that they are not phonemic, and function as phonetic onsets to underlyingly vowel-initial words (16).

(16) [ʔ] is reanalyzed as zero in prevocalic position
a. [ˈʔu.d̪ạn] > [ˈna.d̪ụ] ‘rain’
[ˈʔa.rɛʔ] > [ˈkɛ.ra] ‘kid’
[ˈʔɛ.d̪ạn] > [ˈna.d̪ẹ] ‘crazy’
b. [ˈsi.ɟi̤] > [ˈʔi.ɟi̤s] ‘one’
[ˈdu.ʷa] > [ˈʔa.ut̪] ‘two’ (< Ind.)
[ˈpɛ.st̪a] > [ˈʔa.st̪ɛp̄] ‘party’ (< Ind.)

Another area where Javanese dialects show variation is in the pronunciation of the word-final glottal fricative /h/. Several Eastern Javanese subdialects have dropped the Javanese final /h/ (presumably under the influence of Madurese, Hoogervorst 2008; Kisyani-Laksono 1998; Krauße 2017). In Malangan Javanese, however, final /h/ is retained, as confirmed by Walikan data presented in (17). In these examples, reversals of words with a word-final /h/ yield /h/ as onset of the reversed word, while reversals with a phonetic glottal stop as onset are not correct.

(17) /h/ is retained in reversed forms
[ˈmu.rah] > [ˈha.rum] *[ˈʔa.rum] ‘cheap’
[ˈka.bɛ̤h] > [ˈhɛ.ba̤ʔ] *[ˈʔɛ.ba̤ʔ] ‘all’
[sə.ˈkɔ.lah] > [ˈha.lɔ.kəs] *[ˈʔa.lɔ.kəs] ‘school’

Interestingly, /h/ also appears word-initially in a number of Walikan forms whose nonreversed counterparts at present *lack* a word-final /h/, as shown in (18). An underlying /h/ was historically present in pronunciations like *səpedah* (< Dutch *velocipede*) and *mutiah* (< Arabic *muṭīʿa*), which are indeed still attested among older speakers. The word-initial /h/ in the Walikan forms does not reflect orthographical influence here, as the forms are always spelled without a word-final /h/.

(18) /h/ is underlyingly present in some reversed forms
[sə.ˈpɛ.da̤] > [ˈha.dɛ̤.pəs] ‘bicycle’[14]
[ˈmu.t̪i.ʲa] > [ˈha.i.t̪um] (a name)

In sum, Walikan words provide additional evidence for two phenomena that distinguish Malangan Javanese from the other Eastern Javanese dialects: Malangan Javanese has no phonemic glottal stop and does not drop its final glottal fricative.

14. However, *adepəs* [ˈʔa.dɛ̤.pəs] is also attested.

5.4. FINAL PALATAL STOPS AND /w/ ADAPTED OR DELETED. The Malangan Javanese palatal stops /c/ and /ɟ/ and the bilabial approximant /w/ are disallowed in word-final position. When in reversed words they do end up in word-final position, they are realized as the stop with the closest phonotactically legal place of articulation: the light dental stop [t̪], as shown in (19).[15]

(19) /c/ and /ɟ/ are realized as [t̪] in word-final position
[ɟa̤.ˈkar.t̪a] > [ˈʔa.t̪ra.kat̪̄] (a toponym)
[cə.ˈla.na] > [ˈʔa.na.lət̪̄] 'trousers' (< Ind.)

The word-final bilabial approximant /w/ in Walikan words is realized as a light bilabial stop [p], as shown in (20), presumably via a heavy bilabial stop [b] which became neutralized.[16]

(20) /w/ is realized as [p] or deleted in word-final position
[ˈwɛ.d̪ɔ̤ʔ] > [ˈkɔ.d̪ɛ̤p̄] ~ [ˈkɔ.d̪ɛ] 'woman'
[wə.ˈd̪ʊ̤s] > [ˈsu.d̪ɛ̤p̄][17] ~ [ˈsu.d̪ɛ̤] 'goat'
[wə.ˈd̪i̤] > [ˈʔi.d̪əp̄] 'to be afraid'

The alternation between [w] and [p̄] does not apply to a number of loanwords. In addition to the elicited example *nawkab* [ˈnaw.kap̄] 'kind of vegetable fritter' from *bakwan* [ˈbaʔ.wan] (15), consider the English loanword *səlow* [sə.ˈlow] 'slow', which is reversed as *woləs* [ˈwɔ.ləs].

In some instances, speakers have the alternative option to delete the illegal final consonant /w/, so that *wedok* [ˈwɛ.d̪ɔ̤ʔ] 'woman' becomes [ˈkɔ.d̪ɛ] and *wəḍus* [wə.ˈḍʊ̤s] 'goat' becomes [ˈsu.ḍɛ̤], as in (20). The phonotactics of Malangan Javanese, which forbid word-final bilabial approximants, are thus obeyed by either adapting or deleting this 'illegal' final consonant.

5.5. THE GLIDES [w] AND [j]. The glides [w] between /u/ and /a/ and [j] between /i/ and /a/ are not analyzed as separate phonemes in Malangan Javanese. Their reversed forms no longer contain /w/ and /j/, as seen in (21). (Nor are the glides present in the orthographical forms of these words: *dua*, *keluarga*, *Mutia*.)

(21) The glides /w/ and /j/

[ˈdu.wa]	>	[ˈʔa.ut̪̄]	'two' (< Ind.)
[kə.lu.ˈwar.ga̤]	>	[ʔa.gra.ˈu.ləʔ]	'family' (< Ind.)
[ˈmu.t̪i.ja]	>	[ˈha.i.t̪um]	(a name)
[ˈdu.wa]	>	[ˈʔa.ut̪̄]	'two' (< Ind.)

5.6. RULE ORDERING IN AFFIXED WORDS. Affixed words in Walikan demonstrate a rule ordering where the neutralization of heavy consonants, the

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15. Younger speakers may retain the palatal stops /c, ɟ/ in word-final position (Yannuar, 201[illegible]).
16. In colloquial Malangan Javanese, the fortition of /w/ into /b/ is commonly attested. For example, *weneh* [ˈwɛ.nɛh] 'to give' may be realized as [ˈbɛ̤.nɛh], especially by older speakers.
17. The unexpected vowel realization in this form is discussed in section 7.4.

adaptation of palatal stops, and the realization of /k/ as [ʔ] in root-final position apply before the resyllabification (22).

(22) Phonotactic adjustment precedes resyllabification

/di-bajar–i/	[d̪i.ˈba.ja.ri]	>	/di-rajab-i/	[d̪i.ˈra.ja.pi]	‘being paid for’
/cipok-an/	[ˈci.pɔʔ.an]	>	/kopic-an/	[ˈkɔ.pi.t̪an]	‘to kiss sb.’
/dodol-an/	[ˈd̪ɔ.d̪ɔl.an]	>	/lodod-an/	[ˈlɔ.d̪ɔ.t̪an]	‘items to sell’
/ɖewe-an/	[ˈɖe.we.ʲan]	>	/eweɖ-an/	[ˈʔɛ.wɛ.t̪an]	‘to be alone’

6. CONSONANT CLUSTERS AND SEQUENCES.

In this section, we first present the types of consonant clusters that are allowed in word-initial and word-medial position in Malangan Javanese (section 6.1). By reversing words in Walikan, the order of the consonants is also reversed, which may result in ill-formed clusters. Three repair strategies are employed to deal with forbidden sequences: maintaining the original order of the cluster (section 6.2), deleting a consonant (section 6.3), and/or reordering the consonants (section 6.4). Through these strategies, Walikan forms are made to conform to the phonotactics of Malangan Javanese. The syllabification of intervocalic consonant sequences is discussed in section 6.5.

6.1. OVERVIEW OF CONSONANT CLUSTERS.

Malangan Javanese syllables allow consonant clusters of eight types, shown in table 3. These tautosyllabic clusters occur in word-initial and word-medial position. They cannot occur word-finally.[18]

A number of three-consonants clusters are attested (table 4). Historically, they only occurred word-medially. Word-initially, they are only attested in loanwords.

6.2. WORD-MEDIAL CLUSTERS RETENTION.

Total Segment Reversal cannot be applied to words exhibiting certain word-medial clusters, as doing so

TABLE 3. CLUSTERS OF TWO CONSONANTS IN MALANGAN JAVANESE SIMPLEX WORDS.

Cluster type	Example	Root-initial position	Root-medial position
Fricative-stop	/sp/	[ˈspɪr.t̪ʊs] ‘burning fuel for lamps’ (< Dutch)	[ˈka.spe] ‘cassava’ (< Portuguese)
Fricative–liquid	/sl/	[ˈsli.mʊ̯t̪] ‘blanket’	[ˈʔa.sli] ‘origin, original’ (< Arabic)
Fricative-stop	/st̪/	[st̪aŋ] ‘handlebar of bike’ (< Dutch)	[ˈŋas.t̪ɔ] ‘to bring (polite)’ (< Sanskrit)
Glide-liquid	/wr/	[wrə.ˈnɔ] ‘color’ (< Sanskrit)	[ˈka.wrʊh] ‘knowledge’
Nasal-liquid	/mr/	[ˈmri.pa̯t̪] ‘eye’ (HON)	[ˈʔa.mrɪn] ‘lover’
Nasal-stop	/mb/	[mbah] ‘grandparent’	[ˈt̪ɔ.mbɔ] ‘medicine’
Stop-glide	/bj/	[ˈbja.ja.ʔ] ‘careless’	[gə.ˈbjə̯k] ‘wooden wall’

18. One exception is the English loanword *rileks* [ˈri.lɛ̯ks] ‘relaxed’.

TABLE 4. CLUSTERS OF THREE CONSONANTS IN MALANGAN JAVANESE SIMPLEX WORDS.

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Cluster type	Example	Root-initial position	Root-medial position
Nasal-stop-liquid	/ɲɟl/	no data†	[ˈʔa.ɲɟlək̚] ‘plummeted’
Nasal-stop-glide	/mbj/	no data	[ˈʔa.mbjar] ‘shattered’
Nasal-fricative-liquid	/ŋsl/	no data	[ˈme.ŋsle] ‘not straight’
Fricative-stop-liquid	/st̪r/	[ˈst̪rip̚] ‘stripe’ (< Dutch)	[ˈʔi.st̪ri] ‘wife’ (< Sanskrit)

† Some Malangan Javanese words exhibit this type of cluster in word-initial position, for example, ***njləmbrət̪*** ‘messy’ and ***nd̪rawasi*** ‘worrisome’. However, such forms are polymorphemic: the initial /n/ is a nasal prefix (N̊-) that serves as an active verb marker separable from the verbal root.

would yield an ill-formed medial cluster in the Walikan form. In such cases, as shown in (24), the original order of the cluster is maintained. Such retained clusters can be tautosyllabic (table 2) or three-consonant clusters (table 3).

(23) Ill-formed medial clusters are avoided
$C_1V_2.C_3C_4V_5$ > $*V_5.C_4C_3V_2C_1$ > $V_5.C_3\ C_4V_2C_1$
[ˈma.mbṳ] > *[ˈʔu**b.m**am] > [ˈʔu.mbam] ‘smelly’

This tendency to maintain word-medial clusters generally applies to homorganic nasal-stop clusters, stop-liquid clusters, and fricative-stop clusters (24). Reversing such clusters would yield stop-nasal, stop-fricative, and liquid-stop sequences, which are strongly disfavored in Malangan Javanese and primarily seen in loans (e.g., [ˈba̤**ʔ.s**o] ‘meatballs’) and composite words (e.g., [sa**ʔ.**ˈ**m**e.ne] ‘as much as this’). Other possible repair strategies, such as schwa epenthesis or the adaptation of palatal final stops (see section 5.4), are likewise disfavored. Here, Walikan differs significantly from loanword integration in generic Malangan Javanese, in which schwa epenthesis is common; for example, *kaləm* ‘calm’ (< Dutch *kalm*), *ḍinəs* ‘government service’ (< Dutch *dienst*), and *saləp* ‘ointment’ (< Dutch *zalf*).[19]

(24) Clusters are maintained in word-medial position
[ˈra.mbṳt̪̚] > [ˈt̪u.mba̤r] ‘hair’ (< Ind.)
[ˈsɛ.mpaʔ] > [ˈka.mpɛs] ‘underwear’
[ˈt̪ə.mpɪʔ] > [ˈki.mpət̪̚] ‘vagina’
[ˈsʊ.n̪t̪ɪʔ] > [ˈkɪ.n̪t̪ʊs] ‘to inject’
[ˈkɔ.n̪t̪ɔl] > [ˈlɔ.n̪t̪ɔʔ] ‘male genitals’
[ˈsa.ɳɖa̤l] > [ˈla.ɳɖa̤s] ‘sandal’
[ˈpə.ɳɖɛ̤ʔ] > [ˈkɛ.ɳɖə̤p̚] ‘short (of size)’
[ˈmʊ.klɪs] > [ˈsi.klʊm] (a name)
[ˈsʊ.krɔn] > [ˈnɔ.krʊs] (a name)
[ˈpɛ.st̪a] > [ˈʔa.st̪ɛp̚] ‘party’ (< Ind.)

Three-consonant clusters of the type nasal-stop-liquid and fricative-stop-liquid are also retained word-medially, as shown in (25). The liquid-stop-nasal

19. Cross-linguistically, anaptyxis and prothesis are common strategies to leave clusters intact (Fleischhacker, 2002). It has been shown for Tagalog that the splitability of clusters is increased by the sonority of the second sound (Zuraw, 2007).

*/rcn/ and liquid-stop-fricative */rʈs/ clusters that would otherwise emerge are phonotactically illegal.

(25) Nasal-stop-liquid and fricative-stop-liquid clusters are maintained
[ˈmɛ.ɲcrɛʈ] > [ˈʈɛ.ɲcrɛm] ‘diarrhea’
[ˈlɪ.sʈrɪk] > [ˈkɪ.sʈrɪl] ‘electricity’

6.3. CONSONANT DELETION. The second strategy to repair illegal consonant clusters is to delete one of the consonants. The only examples known to us display the relatively rare word-initial clusters /mb/ and /nɖ/, the phonemic status of which is ambiguous. In (26), an illegal cluster in the reversed form is “repaired” by deleting the sequence-initial consonant of the newly formed coda.

(26) Segment deletion of /b/ in /mb/
$C_1C_2V_3C_4$ > *$C_4V_2C_2C_1$ > $C_4V_2C_1$
[mbaḥ] > *[ha**bm**] > [ham] ‘grandparent’

The above strategy in which the stop is deleted is relatively rare and irregular. The Walikan forms in (27) and (28) exhibit the more common strategy of nasal deletion.

(27) Segment deletion of /m/ in /mb/
$C_1C_2V_3.V_4C_5$ > *$C_5.V_4V_3C_2C_1$ > $C_5.V_4V_3C_2$
[mbo̱.is] > *[ˈsiˑjɔ**bm**] > [ˈsiˑjɔp̄] ‘boyish’ (< Eng.)

(28) Segment deletion of /n/ in /nɖ/
$C_1C_2V_3.C_4V_5$ > *$V_5.C_4V_3C_2C_1$ > $V_5.C_4V_3C_2$
[ˈnɖɛ̱.sɔ] > *[ˈʔɔ.sɛ**ɖn**/ > [ˈʔɔ.sɛʈ̄] ‘provincial; hill-billy’

In (29), the sequence-final /m/ and the /k/ (glottal stop [ʔ] in the nonreversed original) are deleted to create legitimate onsets and avoid unacceptable codas, since glide-stop clusters */jk/ and stop-nasal clusters */bm/ are illegal.

(29) Segment deletion of /m/ in /mb/
$C_1C_2V_3C_4.C_5V_6$ > *$V_6.C_5.C_4V_3C_2C_1$ > $V_6.C_5V_3C_2$
[ˈmbaʔ.ju] > *[ˈʔu.**jk**a**bm**] > [ˈʔu.jap̄] ‘older sister’

Consonant deletion can also be observed in reversed words exhibiting a consonant cluster in word-medial position, although, this is relatively rare. There are only three tokens in the corpus which display this innovation: *ʈənʈara* [ʈə.ˈ**nʈ**a.ra] > *aranəʈ* [ˈʔa.ra.**nə**ʈ̄] ‘soldier’, *suŋkan* [ˈsu.**ŋk**an] > *nakus* [ˈna.**k**ʊs] ‘shy’, and *bencoŋ* [ˈbɛ̱.**ɲc**ɔŋ] > *ŋoceb* [ˈŋɔ.**cɛ**p̄] ‘transvestite’. The majority (80%) of such forms retain the original word-medial consonant cluster, as discussed in section 6.2.

6.4. CONSONANT REORDERING. Consonant reordering, that is, creating legitimate onsets and avoiding unacceptable codas, is another strategy in Walikan to repair illegal consonant clusters. The following examples display the word-initial cluster /ml/.[20] This cluster is the result of prenasalization before

20. We have not come across Walikan forms of words originally containing other nasal-liquid clusters, such as /mr/ and /wr/.

roots starting with /l/, which has become unproductive in current speech. In (30), the first consonant in a prohibited coda cluster is reordered to become part of an acceptable onset cluster.

(30) Consonant reordering to create onset clusters

$C_1C_2V_3.C_4V_5$	>	$*V_5.C_4V_3C_2C_1$	>	$V_5.C_4C_2V_3C_1$
[mlə.ˈbu̯]	>	*[ˈʔu.bə**lm**]	>	[ˈʔu.blə̯m] ‘to enter’
[ˈmla.ku]	>	*[ˈʔu.ka**lm**]	>	[ˈʔu.klam] ‘to walk’

Of the three-consonant clusters listed in table 4, the Walikan data show that /ɲɟl/ can be used to repair an unacceptable coda. In (31), the sequence-initial consonant in a prohibited coda cluster is reordered to become part of an acceptable three-consonant onset.

(31) Consonant reordering to create a three-consonant onset cluster

$C_1C_2V_3.C_4C_5V_6$	>	$*V_6.C_5C_4V_3C_2C_1$	>	$V_6.C_5C_4C_3V_2C_1$
[ˈblɔ.ɲɟɔ]	>	*[ˈʔɔ.ɲɟɔ**lp̄**]	>	[ˈʔɔ.ɲɟlɔp̄] ‘to shop’

Another Walikan attestation with an illegal coda cluster exhibits a different strategy, as shown in (32). The verb *mlaju* /ˈmla.ju/ ‘to run’ constitutes a prenalization of the root *plaju* /ˈpla.ju/ in the same meaning. Both display permissible onset clusters: nasal-liquid /ml/ and stop-liquid /pl/. Reversal would yield *[ˈʔu.ja**lm**], with an illegal liquid-nasal coda, whereas reordering would yield *[ˈʔu.la**jm**], with an illegal glide-liquid coda. Thus, an epenthetic schwa is inserted between the glide and liquid, yielding [ˈʔu.la.jəm]. Together with a small set of Walikan forms exhibiting [gn̯] for /gn/ (section 2), this is the only example of an epenthesis strategy found in our data. Alternatively, the epenthetic schwa could have been inserted in *[ˈʔu.ja**lm**] to create a permissible form *[ˈʔu.ja.l**ə**m], but this form is unattested.

(32) Consonant reordering followed by schwa epenthesis

$C_1C_2V_3.C_4V_5$	>	$*V_5.C_2V_3C_4C_1$	>	$V_5.C_2V_3.C_4əC_1$
[ˈmla.ju]	>	*[ˈʔu.la**jm**]	>	[ˈʔu.la.jəm] ‘to run’

A more complex example, featuring competing phonological processes, is the reversal of *klambi* [ˈkla.mbi] ‘clothing’ to *imblak* [ˈʔi.mblaʔ] in (33). Total reversal would have yielded *[ˈʔi**b.m**a**l?**], with two illegal clusters (stop-nasal, liquid-stop). Using the strategy to retain the homorganic cluster /mb/ would yield *[ˈʔi.mba**l?**], which still features an illegal liquid-stop coda. Thus /l/ is moved to the syllable onset, producing the form [ˈʔi.mblaʔ] whose nasal-stop-liquid cluster is permitted in word-medial onsets (cf. table 4).

(33) Complex consonant reordering to create a three-consonant onset cluster in the reversed form of *klambi* ‘clothing’

$C_1C_2V_3.C_4C_5V_6$	[ˈkla.mbi]
> $*V_6C_5.C_4V_3C_2C_1$	*[ˈʔi**b.m**a**l?**]
> $*V_6.C_4C_5V_3C_2C_1$	*[ˈʔi.mba**l?**]
> $V_6.C_4C_5C_2V_3C_1$	[ˈʔi.mblaʔ]

6.5. HETEROSYLLABIC CONSONANT SEQUENCES. Adjacent consonants can also be separated by a syllable boundary in Malangan Javanese. Table 5 lists the heterosyllabic consonant sequences attested in our data. Note that many of these only occur in loanwords or compound words. This would suggest that such sequences are possible but not favored in Walikan, and the data discussed earlier in this section indeed bear this out.

Our data contain various Walikan forms of words originally exhibiting heterosyllabic consonant sequences which are resyllabified with an onset cluster (34). For instance, a liquid in coda position followed by a syllable with a stop onset yields a reversed word with a stop-liquid onset cluster.

(34) Consonant sequence reversal to form new onset clusters

[kər.ˈd̪i]	>	[ˈʔi.d̪rə̈ʔ]	‘to work hard’
[ˈmar.sɔ]	>	[ˈʔɔ.sram]	(a name)
[ŋər.ˈt̪i]	>	[ˈʔi.t̪rəŋ]	‘to understand (AV)’
[gə̈r.ˈmɔ]	>	[ˈʔɔ.mrək]	‘pimp’
[ˈbaʔ.so]	>	[ˈʔɔ.skap]	‘meatballs’
[ˈpal.su]	>	[ˈʔu.slap]	‘fake’
[ˈbə̈r.kat̪]	>	[ˈt̪a.krəp]	‘blessed food’
[kə.lu.ˈʷar.gaˌ]	>	[ʔa.gra.ˈu.ləʔ]	‘family’ (< Ind.)
[ˈri.lɛ̈ks]	>	[ˈskɛ.lɪr]	‘relaxed’ (< English)
[mər.ɟɔ.ˈsa.ri]	>	[ʔi.ra.ˈsɔ.ɟrəm]	(a toponym)

TABLE 5. HETEROSYLLABIC CONSONANT SEQUENCES IN MALANGAN JAVANESE.

Sequence type	Attestation	Root-medial position
Liquid-stop/glide/nasal	/r.t̪/	[ˈʔar.t̪i] ‘meaning’ (< Sanskrit)
	/r.d̪/	[kər.ˈd̪i] ‘to work hard’
	/r.ɖ/	[ˈsar.ɖɛn] ‘sardines’ (< Dutch)
	/r.c/	[mər.ˈcɔn] ‘fireworks’
	/r.k/	[ˈmʊr.kɔ] ‘greedy’ (< Sanskrit)
	/r.g/	[mər.ˈgə̈] ‘because’ (< Sanskrit)
	/r.s/	[kər.ˈsɔ] ‘to want’ (< Sanskrit)
	/r.m/	[gə̈r.ˈmɔ] ‘pimp’
	/r.w/	[ˈgaˌr.wɔ] ‘spouse (polite)’ (< Sanskrit)
	/l.k/	[t̪əl.ˈkʊn] ‘turkey’ (< Dutch)
	/l.s/	[ˈpal.su] ‘false’ (< Portuguese)
	/l.m/	[ˈŋel.mu] ‘knowledge’ (< Arabic)
Stop-stop	/k.t̪/	[ˈprak.t̪ɛk]† ‘practice’ (< Dutch)
	/ʔ.t̪/	[səʔ.ˈt̪i] ‘supernatural powers’ (< Sanskrit)
	/ʔ.ɖ/	[ˈpaʔ.ɖɛ̈] ‘uncle older than parents’
	/p.t̪/	[ˈsap.t̪u] ‘Saturday’ (< Arabic)
	/t̪.b/	[ˈkʊt̪.baˌh] ‘sermon’ (< Arabic)
	/k.b/	[ˈt̪ak.bɪr] ‘the phrase *Allāhu akbar*’ (< Arabic)
Stop-nasal	/ʔ.m/	[saʔ.ˈme.ne] ‘as much as this’
Stop-liquid	/ʔ.l/	[ˈpaʔ.lɪʔ] ‘uncle younger than parents’
Stop-fricative	/ʔ.s/	[ˈbaʔ.so] ‘meatballs’ (< Chinese)
	/p.s/	[ˈnap.su] ‘urge’ (< Arabic)

† Due to its loanword status, the expected pronunciation *[ˈpra**ʔ**.t̪ɛ**ʔ**] is uncommon.

7. VOWELS. In this section, we present an overview of the vowels of Malangan Javanese and the major phonological processes that apply to them (section 7.1). In the following sections 7.2–7.6, we describe in more detail how pairs of vowels are realized before and after reversal, using evidence from Walikan words to determine whether the phonological processes and constraints of Malangan Javanese are productively applied or losing ground.

7.1. OVERVIEW OF VOWELS. Malangan Javanese conventionally exhibits six phonemic vowels /i, u, e, ə, o, a/ as presented in table 6. Their common spelling is given in angle brackets, although, diacritics are often omitted in Malangan Javanese writings. This inventory of Malangan Javanese vowels is in line with the one reported for Central Javanese (Adisasmito-Smith 2004; Dudas 1976; Hayward 1999; Nothofer 2006; Uhlenbeck 1978; Yallop 1982).

Note that we have included /ə/ as seventh vowel to the inventory in table 6; in this section, we present arguments that it has gained phonemic status. The mid-front vowel /ɛ/ is phonemic only in a limited set of contexts, as indicated by the question mark and further discussed in section 7.3.

As will be discussed below, four of the vowels /i u e o/ show allophonic variation based on their position in the root syllable (open vs. closed), and may also be influenced by vowels in the following syllable, while schwa /ə/ is consistently realized as [ə] in Malangan Javanese. In Walikan, it is occasionally realized as [ɛ], which we argue is reinforced by writing (section 7.4).

Historically, /ɔ/ was an allophone of /a/ in word-final open syllables and in the syllables preceding them (Nothofer 2006; Uhlenbeck 1978). But, as we will demonstrate in section 7.6, /ɔ/ is never interpreted as /a/ in Walikan, indicating that this historical allophonic correspondence is currently disappearing.

The high vowels /i/ and /u/ are generally realized as [ɪ] and [ʊ] in final closed syllables, in the open syllables preceding them, and in open syllables preceding closed syllables containing other high vowels. Some speakers pronounce these allophones closer to [e] and [o] than [ɪ] and [ʊ].

The mid vowels /e/ and /o/ are realized as [ɛ] and [ɔ] in final closed syllables. They are also realized as such in penultimate open syllables preceding either an open syllable with a high vowel or a closed syllable with a nonhigh vowel. In the Eastern Javanese dialect of Surabaya, [ɛ] and [ɔ] have been described as

TABLE 6. MALANGAN JAVANESE VOWELS.

	Front	Central	Back
High	i <i>		u <u>
High–mid	e <é>		o <o>
Mid	ɛ <è>?	ə <e>	ɔ <ò>
Low		a <a>	

phonemic vowels on the basis of competing historico-phonological processes (Hoogervorst 2008; Krauße 2017). In our current description of Malangan Javanese, [ɛ] and [ɔ] are analyzed as the allophones of /e/ and /o/. However, they seem to be gaining phonemic status, as will be shown in sections 7.3 (/e/ and /ɛ/) and 7.5 (/o/ and /ɔ/).

7.2. REALIZATIONS OF /i/ AND /u/. The phonemes /i/ and /u/ are realized as [i] and [u] in open syllables or before syllables with nonhigh vowels, and lowered to [ɪ] and [ʊ] in final closed syllables. This lowering also affects high vowels in the preceding open syllables, a principle that is referred to as vowel harmony. This has also been documented in other Eastern Javanese dialects (Conners 2008; Hoogervorst 2008). Vowel-lowering in antepenultimate syllables appears to be absent in Central or Western Javanese dialects.

The same process of lowering can be observed in Walikan words. Example (35) shows how /i/ and /u/, which are originally realized as [ɪ] and [ʊ] on account of their position in closed syllables, become part of open syllables after reversal. Since there is no high vowel in the following closed syllable, they are no longer realized as [ɪ] and [ʊ], but as their allophones [u] and [i].

(35) /i/ and /u/ are realized as [i] and [u] in open syllables

[ˈpa.kɪs]	>	[ˈsi.kap͡]	(a toponym)
[pə.ˈtɪs]	>	[ˈsi.t̪əp͡]	‘shrimp paste’
[ˈma.lɪŋ]	>	[ˈŋi.lam]	‘thief’
[ˈma.bʊʔ]	>	[ˈku.bam]	‘drunk’
[ˈma.nʊʔ]	>	[ˈku.nam]	‘penis’
[ˈsa.bʊn]	>	[ˈnu.bas]	‘soap’
[ˈmʊ.klɪs]	>	[ˈsi.klʊm]	(a name)

By contrast, Walikan forms displaying a single high vowel /i u/ in a closed syllable do not always show the expected process of vowel-lowering. Instead, /i/ and /u/ may occur in closed syllables as [i] and [u]. This is illustrated in (36). For instance, *pirɔ* [ˈpi.rɔ] ‘how much’ is reversed to *ɔrip* [ˈʔɔ.rip͡] and not *[ˈʔɔ.rɪp͡], violating the Malangan Javanese phonotactics which require vowel-lowering in this position.[21]

(36) /i/ and /u/ are realized as [i] and [u] in final closed syllables

a.	[ˈpi.rɔ]	>	[ˈʔɔ.rip͡]	‘how much’
	[ˈsi.ŋɔ]	>	[ˈʔɔ.ŋis]	‘lion’
	[ˈsi.kat̪͡]	>	[ˈt̪a.kis]	‘to fight; to finish off’
b.	[ˈru.wət̪͡]	>	[ˈt̪ɛ.wur]	‘complicated’
	[ˈbu.d̪ul]	>	[ˈla.d̪up͡]	‘to depart’
	[ˈbu.le]	>	[ˈʔɛ.lup͡]	‘white person’
	[ˈsu.we]	>	[ˈʔɛ.wus]	‘long (time)’

21. An exception is the Walikan word *ɔnic* [ˈʔɔ.nɛt̪͡] from *cinɔ* [ˈci.nɔ] ‘Chinese (pejorative)’. In this isolated case, the high-front vowel /i/ in the final closed syllable is reinterpreted as the low mid-front vowel [ɛ] in Walikan.

However, when both syllables of a disyllabic word contain high vowels, vowel-lowering occurs across the word, in both open and closed syllables, as shown in (37).

(37) /i/ and /u/ are realized as [ɪ] and [ʊ] in both syllables
a. [ˈpɪ.tu̱ʔ] > [ˈkɪ.tʊ̱p̚] ‘chicken’
[ˈsɪ.kɪl] > [ˈlɪ.kɪs] ‘foot’
b. [ˈpʊ.kʊl] > [ˈlʊ.kʊp̚] ‘to hit’
[ˈsʊ.kʊn] > [ˈnʊ.kʊs] ‘breadfruit; a toponym’

A few words in Malangan Javanese do not exhibit lowering of a high-front vowel /i/ in a final closed syllable and its preceding syllable (Yannuar 2011: 9:84–85). They behave atypically in both Malangan Javanese and Walikan (38). AQ3

(38) /i/ remains [i] in closed syllables
[ˈti.tiʔ] > [ˈki.ti̱t̚] ‘a little’
[ˈpi.pis] > [ˈsi.pi̱p̚] ‘to urinate’

This atypical behavior requires further explanation, but the reduplication-like structure of the above examples might be relevant; it is possible that the high degree of internal self-similarity plays a role in blocking the otherwise expected vowel-lowering.[22]

In some Walikan words, the realization of /i/ and /u/ in closed syllables shows variability, reflecting competing processes: the default vowel-lowering of /i/ and /u/ in closed syllables versus the maintenance of their original phonetic value, as in (39). The observed variability of [u] ~ [ʊ] and [i] ~ [ɪ] in closed syllables is only attested if the nonreversed originals exhibit /i/ and /u/ in open syllables (39).

(39) /i/ and /u/ are optionally lowered in closed syllables
[ˈgu̱.jɔn] > [ˈnɔ.ɟʊ̱k̚] ~ [ˈnɔ.ɟu̱k̚] ‘to joke’
[ˈmi.n̪̱taʔ] > [ˈkat̪̱.nɪm] ~ [ˈkat̪̱.nim] ‘to ask for’
[ˈtu.kaŋ] > [gə̱.ˈna.kʊ̱t̚] ~ [gə̱.ˈna.ku̱t̚] ‘worker’
[ˈru.ɟə̱ʔ] > [ˈka.ɟʊ̱r] ~ [ˈka.ɟu̱r] ‘seasoned unripe fruit salad’

7.3. REALIZATIONS OF /e/ AND /ɛ/. In Malangan Javanese, the high–mid front vowel /e/ is realized as [ɛ] in closed syllables. In open syllables, it is realized as [e], except when it precedes either an *open* syllable with a high vowel, or a *closed* syllable with any of the other vowels /e o ə a/. The same rules apply to Walikan forms, shown in (40). The reversal of [ˈʔɛ.wɛ̱t̚] from *ḍewe* [ˈḍe̱.we] ‘oneself, alone’ additionally shows that /e/ is realized as [ɛ] in both syllables, complying with the expected rules of vowel-lowering.

(40) /e/ is realized as [ɛ] in word-initial position
[gə̱.ˈḍe̱] > [ˈʔɛ.ḍə̱k̚] ‘big’
[ˈsa.te̱] > [ˈʔɛ.t̪̱as̚] ‘satay’
[ˈḍe̱.we] > [ˈʔɛ.wɛ̱t̚] ‘oneself, alone’

22. If so, this has a precedent in Tagalog (Zuraw, 2002). We thank one of the reviewers for pointing this out.

In a final open syllable, /e/ systematically appears as [e]. This is also seen in the Walikan forms in (41), in which *[ˈka.nɛ] and *[ˈna.d̪ɛ̪] would be ungrammatical.

(41) /e/ is realized as [e] in word-final position
[ˈʔɛ.naʔ] > [ˈka.ne] 'delicious, nice'
[ˈʔɛ.d̪an] > [ˈna.d̪e̪] 'crazy'

The examples in (40) and (41) support the analysis that [ɛ] is the allophone of /e/, appearing in predictable positions. However, some speakers of Walikan pronounce /e/ as [e] even when it occurs in a closed syllable or an open syllabling precedes a closed syllable (42). This degree of variability indicates that the Malangan Javanese rules regarding the realization of [e] vis-à-vis [ɛ] do not, or no longer, apply strictly in Walikan.

(42) /e/ is realized as [ɛ] or [e] in word-initial or word-final position
[ˈsa.t̪e] > [ˈʔɛ.t̪as] ~ [ˈʔe.t̪as] 'satay'
[ˈd̪e̪.we] > [ˈʔɛ.wɛ̪t̪] ~ [ˈʔe.we̪t̪] 'oneself; alone'
[sə.ˈla.we] > [ˈʔɛ.la.wəs] ~ [ˈʔe.la.wəs] 'twenty-five'[23]

The above example of *ḍewe* [ˈd̪e̪.we] exhibiting variation between [ˈʔɛ.wɛ̪t̪] and [ˈʔe.we̪t̪] demonstrates variable rule application rather than variation on the level of individual segments; in the latter case, we would additionally expect the unattested forms *[ˈʔ**ɛ**.w**ɛ**t̪] and *[ˈʔ**ɛ**.we̪t̪].

There are also Walikan words where [ɛ] appears in positions that violate Malangan Javanese rules. In (43), the Walikan reversed form yields an [ɛ] in a word-final open syllable and in the open syllable preceding it. In default Malangan Javanese, [e] has to be realized as [e] in final open vowels and is not lowered in the preceding open syllable (cf. *ḍewe* 'oneself; alone'). The examples below demonstrate that some Walikan attestations do not comply to these rules. Previously, in (20), additional words displaying /ɛ/ in word-final position were discussed.

(43) [ɛ] in word-final position
[ˈʔɛ.bɛ̪s] > [ˈsɛ.bɛ̪] 'father'
[ˈʔɛ.lɛʔ] > [ˈkɛ.lɛ] 'ugly'

The Walikan forms in (43) are rare attestations of /e/ being realized as [ɛ] word-finally: *[ˈs**e**.b**e̪**] and *[ˈk**e**.l**e**] would conform to Malangan Javanese phonotactics but are unattested. Therefore, we can conclude on the basis of [ˈsɛ.bɛ] and [ˈkɛ.lɛ] that [ɛ] is gaining phonemic status in Malangan Javanese.

To sum up, some Walikan forms do not strictly follow the Malangan Javanese rules regarding the distribution of [e] and [ɛ]. The examples in (40) and (41) show that [ɛ] is still considered an allophone of /e/, but (42) and (43) indicate a change in progress where [ɛ] functions as separate phoneme, independent from /e/. It is uncertain in which direction this process will evolve.

23. In this instance, the formation of *elawəs* [ʔɛ.ˈla.wəs] 'twenty-five' from *səlawe* [sə.ˈsɛ.la.we] involves Total Segment Reversal which is then followed by Segment Exchange (Yannuar 2019:147). The reason for this additional innovation is unclear.

AQ5

7.4. REALIZATIONS OF /e/ AND /ə/. As discussed in section 2, /e/ and /ə/ are both written as <e> in Javanese. This convention presumably triggered a degree of variation between these orthographically undistinguished phonemes in Walikan. However, the examples discussed below indicate that there is no free variation and speakers have to choose one particular variant.

In Malangan Javanese as well as other Javanese varieties, the mid-central vowel /ə/ is a fully independent phoneme. It cannot occur word-finally. The same restriction is seen in Walikan words, where the /ə/ of an input word is realized as [ɛ] when it ends up in final position through the reversal process, as in (44).[24] (In these examples, Walikan still violates the phonotactics of Malangan Javanese, in which we would expect [e] rather than [ɛ] in final position).

(44) [ə] is realized as [ɛ] in word-final position
[ʔə.ˈnɔm] > [ˈmɔ.nɛ] ‘young’
[ʔə.ˈnam] > [ˈma.nɛ] ‘six’ (< Ind.)

The Walikan forms in (45) show variable pronunciations of [ə], unlike the attestations in (44) that behave regularly.

(45) [ə] is sporadically realized as either [ə] or [ɛ] in closed syllables
[kə.ˈba̤.lɛn] > [ˈnɛ.la.bə̤ʔ] ~ [ˈnɛ.la.bɛ̤ʔ] (a toponym)
[sə.ˈla.we] > [ˈʔɛ.la.wəs] ~ [ˈʔɛ.la.wɛs] ‘twenty-five’
[t̪ə.ˈn̪t̪a.ra] > [ˈʔa.ra.nət̪̚] ~ [ˈʔa.ra.nɛt̪̚][25] ‘a soldier’ (< Ind.)

The influence of orthography is also confirmed by the two isolated examples in (46). The form *ruwət* [ˈru.wət̪̚] is reversed as [ˈt̪ɛ.wur] rather than *[t̪ə.ˈwur], while *wəḍus* [wə.ˈɖʊ̤s] yields [ˈsu.ɖɛ̤p̚] or [ˈsu.ɖɛ̤] instead of the expected *[ˈsu.ɖə̤p̚]. The nonexistence of *[ˈsu.ɖə̤], however, is expected on account of its illegal word-final schwa.

(46) [ə] is sporadically realized as [ɛ]
[ˈru.wət̪̚] > [ˈt̪ɛ.wur] ‘complicated’
[wə.ˈɖʊ̤s] > [ˈsu.ɖɛ̤p̚] ~ [ˈsu.ɖɛ̤] ‘goat’

7.5. REALIZATIONS OF /o/ AND /ɔ/. The high–mid back vowel /o/ is realized as [ɔ] in closed syllables. In open syllables, this phoneme is realized as [o] except when it either precedes an *open* syllable with a high vowel, or a *closed* syllable with any of the other vowels /e o ə a/. We have also seen this type of lowering with /e/ (section 7.3). The same rules apply to Walikan forms, as shown in (47).

(47) /o/ is realized as [o] in a word-final position
[ˈʔɔ.raŋ] > [gə̤.ˈna.ro][26] ‘person’ (< Ind.)
[ˈʔɔ.mɔŋ] > [gə̤.ˈno.mo] ‘to speak’

24. The only attestation of a Walikan word with a final schwa in our corpus is *tapmə* [ˈt̪ap̚.mə] ‘four’, the reversed form of *əmpat* (< Ind.), see also footnote 14.
25. See section 6.3 about consonant deletion.

The realization in Malangan Javanese of /o/ as [ɔ] in closed syllables and the open syllables preceding them is also attested in their reversed forms, as shown in (48).

(48) /o/ is realized as [ɔ] in closed syllables and the preceding open syllables
[ˈbɔ̤.t̪ɔl] > [lɔ.t̪ɔp̄] 'bottle'
[ˈbɔ̤.kɔŋ] > [ŋɔ.kɔp̄] 'buttocks'

Consistent with Malangan Javanese rules, /o/ in Walikan forms is realized as /ɔ/ in an open syllable preceding a closed syllable with a low-central vowel /a/ (49).

(49) /o/ is realized as [ɔ] in open syllables preceding syllables with /a/
[ˈba̤.lɔn] > [ˈnɔ.lap̄] 'prostitute'
[ˈt̪a.kɔn] > [ˈnɔ.kat̪̄] 'to ask'

The above examples support the analysis that [ɔ] is an allophone of /o/, as it appears in predictable contexts. However, as with [e] and [ɛ] discussed in section 7.3, some Walikan speakers alternate between [ɔ] and [o] in closed syllables and in open syllables preceding a closed syllable that contains /e/, /ə/, or /a/, see (50).

(50) /o/ is realized as either [ɔ] or [o] in word-initial or word-final position

[ˈt̪o.ko]	>	[ˈʔɔ.kɔt̪̄] ~ [ˈʔo.kot̪̄]	'store'
[ˈso.t̪o]	>	[ˈʔɔ.t̪ɔs] ~ [ˈʔo.t̪os]	'a kind of soup'
[ˈso.lo]	>	[ˈʔɔ.lɔs] ~ [ˈʔo.los]	(a toponym)
[sɔ.ˈda̤.ra]	>	[ˈʔa.ra.dɔ̤s] ~ [ˈʔa.ra.do̤s]	'relative' (< Ind.)
[sə.ˈkɔ.lah]	>	[ˈha.lɔ.kəs] ~ [ˈha.lo.kəs]	'school'

Just like the examples in (45), the forms in (50) indicate that the Malangan Javanese rules regarding the distribution of high–mid vowels do not, or no longer, apply strictly in Walikan. They also confirm that variation does not take place on the level of individual segments, but results from variable rule application.

In two Walikan examples, the /o/ can only be pronounced as [o] despite its occurrence in closed syllables (51). This suggests that /o/ is no longer systematically undergoing lowering in closed syllables. In other words, the distribution of [o] is expanding.

(51) /o/ is sporadically realized as only [o] in closed syllables
[ˈbo̤.ɟo̤] > [ˈʔo.ɟo̤p̄] 'spouse'
[ˈfo.t̪o] > [ˈʔo.t̪of] 'photograph' (< Dutch)

As in (38), the suspension of vowel-lowering in the above examples may have been influenced by the identical vowels in both syllables, although this does not happen on a regular base.

26. In most cases, the velar nasal [ŋ] yields /ŋ/ rather than /g.n/ in reversed forms. The two examples given here are exceptions, likely influenced by the orthography in which /ŋ/ corresponds to <ng> as discussed in section 2.

7.6. DISTRIBUTION OF /a/ AND /ɔ/. In Malangan Javanese, as in most other Central and Eastern Javanese dialects, the historical low-central vowel /a/ (as attested in Old Javanese, Zoetmulder 1982) is realized as [ɔ] in word-final open syllables, see (52).[27] This innovation also spreads to /a/ in the preceding syllable unless it is blocked either by a heterorganic consonant cluster or a heterosyllabic consonant sequence. Single consonants or homorganic consonant clusters (with or without liquids), by contrast, do not block this change as seen in table 7. As will be demonstrated below, this historical rule is no longer fully productive.[28]

One [a] ~ [ɔ] alternation is still active in Malangan Javanese, suggesting that the rule remains synchronic in a limited domain. If followed by the derivational applicative suffix *–(n)i*, /a/ does not change into [ɔ], see (52).

(52) Examples of /a/ realized as [a] preceding the applicative suffix *-(n)i*

*m-(p)ara	[ˈmɔ.rɔ]	‘to approach (intr.)’
> *m-(p)ara-ni	[ma.ˈra.ni]	‘to approach (trans.)’
*n-ɟaga	[ˈɲɟɔ̤.gɔ̤]	‘to guard’
> *n-ɟaga-ni	[ˈɲɟa̤.ga̤.ni]	‘to prevent that’

Inflectional suffixes, by contrast, are not part of the phonological word domain of this rule. Therefore, definite/possessive suffixes do not block the *a > ɔ/_# rule, as shown in (53). This marks a contrast with Central Javanese dialects, where inflectional suffixes block the realization of /a/ as [ɔ] in the word-final position in the same way that derivational suffixes do.

TABLE 7. REALIZATIONS OF /a/ IN WORD-FINAL POSITION.

Old Javanese (Zoetmulder 1982)	Malangan Javanese	
Single consonants/homorganic consonant clusters		
<gawa>	[ˈgɔ̤.wɔ]	‘to take’
<kana>	[ˈkɔ.nɔ]	‘there’
<mata>	[ˈmɔ.t̪ɔ]	‘eye’
<tampa>	[ˈt̪ɔ.mpɔ]	‘to receive’
<wańśa>	[ˈbɔ̤.ŋsɔ]	‘people’ (< Sanskrit)
<cakra>	[ˈcɔ.krɔ]	‘a weapon in wayang puppetry’ (< Sanskrit)
<candra>	[ˈcɔ.nd̪rɔ]	‘moon (poetic)’ (< Sanskrit)
Heterorganic consonant clusters/heterosyllabic consonant sequences		
<aṅasta>	[ˈŋa.st̪ɔ]	‘to bring (polite)’ (< Sanskrit)
<tan apa>	[ˈt̪an.pɔ]	‘without’
<dharma>	[ˈd̪a̤r.mɔ]	‘donation’ (< Sanskrit)
<mārga>	[ˈmar.gɔ̤]	‘because’ (< Sanskrit)

27. In Western Javanese dialects and Tengger, by contrast, /a/ remains [a] under all circumstances.
28. In mesolectal Malangan Javanese, only the final /a/ in *ora* ‘no/not’ is still realized as [a]. Recent loanwords are also exempt from this process, whereas older ones are affected by it. Names form another exception: the final */a/ is realized as [ɔ], yet it remains [a] in the preceding syllable.

(53) Examples of /a/ reanalyzed as [ɔ] preceding inflectional suffixes[29]

*tamba	[ˈt̪ɔ.mbɔ̤]	‘medicine’
> *tamba-ne	[ˈt̪ɔ.mbɔ̤.ne]	‘the medicine’
*kanca	[ˈkɔ.ɲcɔ]	‘friend’
> *kanca-ku	[ˈkɔ.ɲcɔ.ku]	‘my friend’
*mata	[ˈmɔ.t̪ɔ]	‘eye’
> *mata-mu	[ˈmɔ.t̪ɔ.mu]	‘your eyes’

Malangan Javanese has one isolated example where speakers realize /a/ in root-final position alternatively as [ɔ] or [a], see (54). This suggests that the *a > ɔ/_# rule described in table 5 is not consistently applied in the domain of fixed expressions.

(54) Variation between [a] and [ɔ] in a fixed expression
*səpura-ne [sə.ˈpu.rɔ.ne] ~ [sə.ˈpu.ra.ne ‘sorry’

These variable realizations presumably contributed to the dissociation of [ɔ] in root-final position as an allophone of /a/, except in the specific context of the applicative suffix *-(n)i* where the allophony remains productive. This is undoubtedly reinforced by the influence of Indonesian and other languages in contact. The reanalysis of /ɔ/ as an independent phoneme is also seen in the loanword *sprent̪ɔ* [ˈsprɛ.n̪t̪ɔ] ‘jump rope’ (< Dutch *springtouw*), which lacks a historical */a/. In Walikan, /a/ and /ɔ/ function as nonalternating segments. Since the allophony has completely ceased to be productive, reversals yielding a word-final /a/ are systematically pronounced as [a] rather than [ɔ], (55).

(55) /a/ and [ɔ] in Walikan
[ˈʔa.naʔ] > [ˈka.na] ‘child’
[ˈʔa.rɛʔ] > [ˈkɛ.ra] ‘kid’

The historical */a/ in word-final position, now realized as [ɔ], likewise retains its realization as [ɔ] in Walikan, see (56). This corroborates that /ɔ/ has lost its allophonic status with /a/ and has become a separate phoneme.

(56) /a/ and [ɔ] in Walikan

*sapa	[ˈsɔ.pɔ]	>	[ˈʔɔ.pɔs] ‘who’
	[ˈla.pɔ][30]	>	[ˈʔɔ.pal] ‘what are you doing?’
*tiba	[ˈt̪i.bɔ̤]	>	[ˈʔɔ.bi̤ t̪̄] ‘to fall’
*jaga	[ˈɟɟ.gɔ̤]	>	[ˈʔɔ.gɔ̤t̪̄] ‘to guard’

Considering that 40% of the Walikan vocabulary we collected consists of reversed Indonesian words,[31] the influence of this language to the discussed process of dissociation is likely. Note that in Indonesian, /a/ in word-final position always remains [a] and is never realized as [ɔ].

29. This process also takes place in other East Javanese dialects, such as Surabayan Javanese, Paciran Javanese, and Osing.
30. The occurrence of /aCɔ/ in this form is phonologically irregular, see table 5. Historically, it reflects the phrase *olah ɔpɔ* ‘do what?’
31. For more information on Indonesian-based Walikan forms, see Yannuar (2019

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8. CONCLUSIONS. The deliberate word manipulations created in Walikan largely comply with the phonological system of Malangan Javanese, the embedding matrix language. The phonemic forms of words, rather than their phonetic realizations, are taken as input for reversal. The reversal process can be summarized as follows:

1. The manipulation affects the underlying forms rather than the surface forms.
2. Walikan is structure-preserving and predominantly yields phonotactically legal sequences.
3. Most instances of allophony in Walikan are regular and predictable.

In some exceptional cases, orthographical conventions can influence the reversal or even override phonology, as in the reversal of the segment <ng> [ŋ] as [gn̪]. However, such orthographically influenced processes are irregular and constitute a small minority; /ŋ/ is typically retained in Walikan, as are other phonemes orthographically represented with digraphs. We also suspect that orthography has reinforced the allophony between [k] and [ʔ]; the latter predictably occurs in syllable codas as an allophone of the former (section 5.3). Orthography may furthermore have triggered a degree of variation between /e/ and /ə/, yet, this variation is not regular, free, or predictable (section 7.4). In sum, despite some exceptions, reversal predominantly takes place on a phonemic rather than orthographic level.

An even smaller set of Walikan forms are based on earlier pronunciations of Malangan Javanese rather than the ones currently in evidence. This is seen in some loanwords with a word-final /h/. In these examples, the phoneme is not represented in writing and only pronounced by elderly speakers. The underlying /h/ becomes evident from Walikan forms, but not or no longer from their nonreversed counterparts (section 5.3).

Walikan words generally obey Malangan Javanese phonology and phonotactics. This can be seen from the way segments are realized and ill-formed consonant clusters are avoided or repaired. Malangan Javanese phonology affects the neutralization of heavy final consonants (section 5.2), the alternation between velar and glottal stops, the status of the word-final glottal fricative (section 5.3), the realization of palatal stops and bilabial approximants in word-final position (section 5.4), consonant sequences and clusters' constraints (section 6), prenasalized stops (section 6.3), and the phonemic statuses of the vowel sets /e/ ~ [ɛ] (section 7.3), /o/ ~ [ɔ] (section 7.5), and /a/ ~ [ɔ] (section 7.6).

In the domain of consonant clusters and sequences, different strategies are in place to fix phonotactic problems introduced by reversal. One strategy is consonant reordering, which is predictably applied to avoid unacceptable codas (section 6.4). Another strategy is consonant deletion, which is only attested in nasal-stop clusters. Here, the nasal consonant is typically deleted to avoid

a stop-nasal sequence (section 6.3). Word-medial clusters are commonly maintained, especially if their reversal would yield disfavored stop-nasal, stop-fricative, or liquid-stop sequences (section 6.2). These repair strategies are unique to Walikan and differ significantly from the way generic Malangan Javanese treats clusters in loanwords. In loanwords, cluster maintenance serves to achieve maximal auditory similarity between input and output. In Walikan, by contrast, schwa epenthesis or other strategies to ensure input–output similarity are rare.

Nevertheless, the Walikan forms examined in this study also shed light on broader phonological issues Malangan Javanese. It is interesting to note that rules of vowel allophony are not respected in the same way as those of consonant allophony. A small number of historically allophonic vowel relations have now become phonemic, even though predictable alternations remain the norm. We have argued in favour of the phonemic status of the segment /ɔ/ (section 7.6) and against the phonemic status of [ɪ] and [ʊ] (section 7.2). A number of reversed Walikan words furthermore reveal that the allophonic relation between /o/ ~ [ɔ] (section 7.5) and /e/ ~ [ɛ] (section 7.3) shows signs of becoming phonemic. It is not entirely clear whether this indicates a phonological change that is currently taking place in Malangan Javanese more generally, possibly reinforced by contact with Indonesian and other languages, or whether the expected alternations are blocked by identical vowels in adjacent syllables.

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