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 histori-
cally 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* [ˈbɔ.sɔ ˈɟɔ.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;

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

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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.

74 to produce distinct forms that outsiders could not understand. In the past,
75 Walikan was used as an antilanguage, whereas today, it functions as a marker
76 of a shared Malang identity (Yannuar 2019a).
77   Walikan is produced by reversing segments at the word level. For example, a
78 word like *dinɔ* 'day' becomes *ɔnid* in Walikan. This manipulation strategy
79 serves to deliberately change linguistic forms as part of certain cultural and
80 social contexts (Storch 2011). Word reversal is a widespread phenomenon that
81 has been observed in many languages.[3] The term "reversed language" is com-
82 monly used in linguistic studies of such varieties (Bagemihl 1988, 1989;
83 Dreyfuss 1983; Hoogervorst 2014; Lefkowitz 1989). Speakers of Walikan pre-
84 dominantly use the so-called Total Segment Reversal strategy: a direct inver-
85 sion of all segments in a word.[4] In this type of reversal, the first segment
86 of a word will be the last segment of the reversed form, the second segment
87 will be the penultimate segment, and so on. For example, a disyllabic word
88 $C_1V_2.C_3V_4C_5$ will become $C_5V_4.C_3V_2C_1$.
89   Reversal in Walikan is based on the phonemic form of a word, rather than its
90 phonetic surface realization. Reversed words must conform to the phonology
91 and phonotactics of Malangan Javanese. For example, the Malangan Javanese
92 word *arek* [ˈʔa.rɛʔ] 'kid' is reversed as *kera* [ˈkɛ.ra] and not as *[ˈʔɛ.raʔ], since
93 it is the underlying form and not the surface form that is being manipulated. The
94 above example shows that while the word-final velar stop /k/ is realized as [ʔ] in
95 that position, it is underlyingly /k/ as it systematically appears as [k] in the
96 word-initial position of a reversed word (see section 5.3). By examining the
97 shapes of Walikan words in this way, and comparing them to the realizations
98 of the original Malangan Javanese forms, we can thus gain insights into the
99 phonemic structure of vowels and consonants in the Malangan Javanese matrix
100 language.[5]
101   The above example of *arek* [ˈʔa.rɛʔ] 'kid' and its reversed from *kera* [ˈkɛ.ra]
102 furthermore demonstrates that, in many but not all cases, the underlying form of
103 a word is identical to its orthographical form. Nevertheless, we argue that
104 Walikan manipulates primarily the phonemic rather than the orthographic form
105 of a word.[6] Reversal takes place on a word level and generally does not affect

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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 iden-
tical 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 instan-
ces, it has evidently overridden phonology, as for example, in the reversed form *ruot* [ˈru.ʷɔʈ]
from English *tour* 'tour, trip,' and a small number of words in which the digraph <ng> (rep-
resenting the phoneme /ŋ/) yields the sequence [gən] (with an epenthetic schwa) in reversed
form: *tukang* [ˈtu.kaŋ] 'worker' becomes *gnakut* [gə.ˈna.kuʈ], *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/ [ˈba̠l.ba̠.lan] > /lab-lab-an/ [ˈlap̄.la.pan] 'to play football'
/m-bawa/   [ˈmba̠.wa]   > /ŋ-awab/   [ˈŋa.wap̄]   'to bring'
/m-bajar/   [ˈmba̠.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.t̠ə.ˈmɔn] > /nomətək/ [ˈnɔ.mə.t̠əʔ] 'busted'
/gujo-**n**/   [ˈgu̠.jɔn]   > /nojug/   [ˈnɔ.ɟu̠k̄]   'to joke'
/**di** mana/   [di̠.ˈma.na]   > /anamid/   [ˈʔa.na.mi t̠]   'where' < Ind.
/**sə**-təŋah/   [sə.t̠ə.ˈŋah]   > /hatəŋəs/   [ˈha.t̠ə.ŋəs]   'half'
/**ŋ**-ərti/   [ŋər.ˈt̠i]   > /itrəŋ/   [ˈʔi.t̠rəŋ]   '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)ed̠ok/ [ˈmɛ.d̠ɔʔ]   > /kod̠e**m**/   [ˈkɔ.d̠ɛm]   'to womanise'
                               /**ŋ**–(k)od̠ew/   [ˈŋɔ.d̠ɛ]
/d̠ewe-**an**/   [ˈd̠e̠.we.ʲan] > /**na**ewed̠/   [ˈna.ɛ.wɛ t̠]   'to be alone'
                               /ewed̠-**an**/   [ˈʔɛ.wɛ.t̠an]

3. METHODS AND MATERIALS. The Walikan words used for the pres-
ent 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

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gnatu [ga̠.ˈna.t̠u], 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.

128 35 minutes of recorded face-to-face sessions and is archived as Yannuar
129 (2019b). These fieldwork sessions consisted of interviews, conversations,
130 elicitations, and narratives of the Frog Story (Mayer 1969). Recordings were
131 made using a Zoom H4n SP audio recorder and a Samsung NX Mini camera.
132 In addition, the spoken corpus included spoken forms of Walikan available in
133 public media: approximately 3 hours of songs, video clips, YouTube videos,
134 recordings of a local TV news, and a radio show. The spoken data were first
135 transcribed using ELAN (ELAN 2015) and then imported into FLEx (FLEx
136 2015) for glossing.
137   The written Walikan data set consists of 172 additional Walikan words
138 culled from local newspaper columns, printed texts on T-shirts, and read from
139 pictures taken around the public spaces of Malang. Combined, the spoken and
140 written corpus amounted to 522 words, to which were added 203 Walikan
141 words mentioned in previous studies that were confirmed to exist by inform-
142 ants, thus creating the final list of 725 Walikan words underlying the present
143 study. The pronunciation of the written Walikan inventory was also supplied by
144 the informants.

145 **4. REPRESENTATION.** The Malangan Javanese data examined in this
146 study can be represented in multiple ways. As mentioned in section 2, there
147 is considerable overlap between phonemic representations and their ortho-
148 graphical counterparts. Notable exceptions include a number of digraphs, such
149 as <th> for /ʈ/, <dh> for /ɖ/, <ny> for /ɲ/, and <ng> for /ŋ/ (see section 5.1).
150 A number of Malang Javanese vowels are lumped together in colloquial writ-
151 ing; the graph <e> can be used for /e/ and /ə/, whereas, <o> can be used for
152 /o/ and /ɔ/ (see section 7.1). Vowel diacritics may be used to distinguish these
153 phonemes, but this is not consistently done by the speech community. In all
154 these instances, we observe that phonemic reversal strategies prevail over
155 orthographic ones.
156   As the relation between the phonemic and phonetic representations is largely
157 predictable, the underlying forms of Walikan words will be omitted in the
158 subsequent sections of this paper. The most important points of discrepancy
159 are given in (4):

(4) a. Heavy stops /b ḏ 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: /nʈ/ [ɳʈ], /nḏ/ [ɳḏ], /nʈ/ [ɳʈ], /nɖ/ [ɳɖ], /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).

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8. For example, *bakso* [ˈbạʔ.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.ba̠p͇]	'breath'	/abab-e/	[ˈʔa.ba̠.pe]	'the breath'
/urip/	[ˈʔu.rɪp͇]	'life'	/urip-e/	[ˈʔu.rɪ.pe]	'the life'
/ojoɖ/	[ˈʔɔ.jɔʈ͇]	'root'	/ojoɖ-e/	[ˈʔɔ.jɔ.ʈe]	'the root'
/ruwəʈ/	[ˈru.wəʈ]	'complicated'	/ruwəʈ-e/	[ˈru.wə.ʈe]	'so complicated!'
/semog/	[ˈsɛ.mɔk͇]	'sexy'	/semog-e/	[ˈsɛ.mɔ.ke]	'so sexy!'
/bapak/	[ˈba̠.paʔ]	'father'	/bapak-e/	[ˈba̠.paʔ.e]	'the father'

Like other Javanese varieties, Malangan Javanese exhibits distinct sets of heavy stops /b ɖ d̪ ɟ g/ and light stops /p t̪ ʈ 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 /d̪/ and /t̪/. The phonemes /g/ and /k/, by contrast, are pronounced differently in word-final position, respectively as /k̄/ 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 /ojot̪/; 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* [ˈbu.ɖal] 'to leave' as *buɖal* [ˈbu.d̪al].[9] The original

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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* [di̯.ˈma.na] 'where', *dua* [ˈdu.ʷa] 'two', *sodara* [sɔ.ˈda̤.ra] 'relative', and *səpeda* [sə.ˈpɛ.da̤] '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 d̤ 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
    [ˈbɛ̤.caʔ] > [ˈka.cɛp̚] '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
    [ˈd̪ṳ.lʊr] > [ˈrʊ.lʊt̪̚] 'sibling; relative'[11]
    [ˈd̪ɔ̤.ɖɔl] > [ˈlɔ.ɖɔt̪̚] 'to sell'
    [ˈɖe̤.we] > [ˈʔɛ.wɛt̪̚] 'oneself; alone'
    [ˈɖi̤.nɔ] > [ˈʔɔ.nɪt̪̚] 'day'

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10. Note that in Central Javanese dialects the high–mid front vowel /e/ is realized as [e] in an open syllable, yielding the form [ˈbe.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 [ˈd̪u.lʊr].

In word-final position, the light retroflex stop /ʈ/ is also realized as an unre-
leased 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 [ˈd̪e̤.we] 'oneself; alone' in (6) is realized as [ˈʔɛ.wɛt̪] rather than
*[ˈʔɛ.wɛd̪].

(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
 [ˈgɔ̤.ləm] > [ˈmə.lək̚]   'to want'
 [ˈgɔ̤.rɛŋ] > [ˈŋɛ.rɔk̚]   'fried'
 [gə̤r.ˈmɔ] > [ˈʔɔ.mrək̚] '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.ba̤p̚] 'breath', for example, is underly-
ingly /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.rap̚]	>	/bara/	[ˈba̤.ra]	'Arab'
/abab/	[ˈʔa.ba̤p̚]	>	/baba/	[ˈba̤.ba̤]	'breath'
/mohamad/	[mo.ˈha.mat̚]	>	/damahom/	[d̪a̤.ˈma.hɔm]	(a name)
/kəlud/	[kə.ˈlʊt̚]	>	/dulək/	[ˈd̪ṳ.lək̚]	(a toponym)
/semog/	[ˈsɛ.mɔk̚]	>	/gomes/	[ˈgɔ̤.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
　　　['ma.bʊ̯ʔ]　>　['ku.ba̤m]　'drunk'
　　　['bɛ̤.caʔ]　 >　['ka.cɛp̚]　'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/　['wa.lɪʔ.an]　>　/kiwal–an/　['ki.wa.lan]　'reversed language'
　　　/kasi-i/　　 ['ka.siʔ.i]　　 >　/isak-i/　　 ['ʔi.saʔ.i]　 'give to sb.' < Ind.
　　　/kənal–an/　[kə.'nal.an]　>　/lanək–an/　['la.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
　　　['ki.wɔ]　　 >　['ʔɔ.wɪʔ]　　'left'
　　　['kɔ.ɳʈɔl]　 >　['lɔ.ɳʈɔʔ]　'male genitals'[12]
　　　[kə.ʈə.'mɔn]　>　['nɔ.mə.ʈəʔ]　'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/
　　　['ma.ʈɛʔ]　>　['kɛ.ʈam]　'to die, dead'
　　　['mi.ɳʈaʔ]　>　['kaʈ̚.nɪm]　'to ask for'[13]
　　　['ba̤.waʔ]　>　['ka.wap̚]　'to bring't
　　　['ʈa.eʔ]　　>　['ke.ʲaʈ̚]　'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/
　　　['ba̤ʔ.so]　>　['ʔɔ.skap̚]　'meatballs' (< Chinese)

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

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12. In most other Javanese varieties the corresponding form is *konʈol*, 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* ['kaʈ.nɪm] 'to ask' and *tapmə* ['ʈap̚.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/
    ['baʔ.wan] > ['naw.kap̄] 'a kind of vegetable fritter' (< Chinese)
    ['maʔ.mʊr] > ['rʊm.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. ['ʔu.d̠an] > ['na.d̠u] 'rain'
         ['ʔa.rɛʔ] > ['kɛ.ra] 'kid'
         ['ʔɛ.d̠an] > ['na.d̠e] 'crazy'
    b. ['si.ɟ̠i] > ['ʔi.ɟ̠is] 'one'
         ['du.ʷa] > ['ʔa.ut̠] 'two' (< Ind.)
         ['pɛ.st̠a] > ['ʔa.st̠ɛp̄] '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
    ['mu.rah] > ['ha.rum]   *['ʔa.rum] 'cheap'
    ['ka.bɛh] > ['hɛ.ba̠ʔ]   *['ʔɛ.ba̠ʔ] 'all'
    [sə.'kɔ.lah] > ['ha.lɔ.kəs] *['ʔa.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 *muṭīˈa*), 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.'pɛ.d̠a] > ['ha.d̠ɛ.pəs] 'bicycle'[14]
    ['mu.t̠i.ʲa] > ['ha.i.t̠um] (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.

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14. However, *adepəs* ['ʔa.d̠ɛ.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.kat̪͆] (a toponym)
    [cə.ˈla.na] > [ˈʔa.na.lət̪͆] '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.d̪ɔʔ] > [ˈkɔ.d̪ɛp͆] ~ [ˈkɔ.d̪ɛ]   'woman'
    [wə.ˈd̪ʊs] > [ˈsu.d̪ɛp͆][17] ~ [ˈsu.d̪ɛ] 'goat'
    [wə.ˈd̪i] > [ˈʔi.d̪əp͆]   'to be afraid'

The alternation between [w] and [p͆] does not apply to a number of loanwords. In addition to the elicited example *nawkab* [ˈnaw.kap͆] '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.d̪ɔʔ] 'woman' becomes [ˈkɔ.d̪ɛ] and *wəḍus* [wə.ˈd̪ʊs] 'goat' becomes [ˈsu.d̪ɛ], 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.ut̪]   'two' (< Ind.)
    [kə.lu.ˈwar.ga̤] > [ʔa.gra.ˈu.ləʔ] 'family' (< Ind.)
    [ˈmu.t̪i.ja]   > [ˈha.i.t̪um]   (a name)
    [ˈdu.wa]   > [ˈʔa.ut̪]   'two' (< Ind.)

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

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

(22) Phonotactic adjustment precedes resyllabification
/di-bajar–i/ [d̪i.ˈba̪.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'
/dewe-an/ [ˈd̪e.we.ʲan] > /ewed-an/ [ˈʔɛ.wɛ.t̪an] 'to be alone'

373
374 **6. CONSONANT CLUSTERS AND SEQUENCES.** In this section, we
375 first present the types of consonant clusters that are allowed in word-initial
376 and word-medial position in Malangan Javanese (section 6.1). By reversing
377 words in Walikan, the order of the consonants is also reversed, which may
378 result in ill-formed clusters. Three repair strategies are employed to deal
379 with forbidden sequences: maintaining the original order of the cluster
380 (section 6.2), deleting a consonant (section 6.3), and/or reordering the conso-
381 nants (section 6.4). Through these strategies, Walikan forms are made to con-
382 form to the phonotactics of Malangan Javanese. The syllabification of
383 intervocalic consonant sequences is discussed in section 6.5.

384 **6.1. OVERVIEW OF CONSONANT CLUSTERS.** Malangan Javanese syl-
385 lables allow consonant clusters of eight types, shown in table 3. These tauto-
386 syllabic clusters occur in word-initial and word-medial position. They cannot
387 occur word-finally.[18]
388 A number of three-consonants clusters are attested (table 4). Historically,
389 they only occurred word-medially. Word-initially, they are only attested in
390 loanwords.

391 **6.2. WORD-MEDIAL CLUSTERS RETENTION.** Total Segment Reversal
392 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.mʊt̪] '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.pat̪] 'eye' (HON)	[ˈʔa.mrɪn] 'lover'
Nasal-stop	/mb/	[mbah] 'grandparent'	[ˈt̪ɔ.mbɔ̪] 'medicine'
Stop-glide	/bj/	[ˈbja̪.jaʔ] 'careless'	[gə̪.ˈbjɔk̚] 'wooden wall'

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18. One exception is the English loanword *rileks* [ˈri.lɛks] 'relaxed'.

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

AQ1 Cluster type	Example	Root-initial position	Root-medial position
Nasal-stop-liquid	/ɲɟl/	no data†	[ˈʔa.ɲɟlɔk̚] 'plummeted'
Nasal-stop-glide	/mbj/	no data	[ˈʔa.mbjar] 'shattered'
Nasal-fricative-liquid	/ŋsl/	no data	[ˈme.ŋsle] 'not straight'
Fricative-stop-liquid	/str/	[ˈstrip̚] 'stripe' (< Dutch)	[ˈʔi.s̪tri] 'wife' (< Sanskrit)

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

393　would yield an ill-formed medial cluster in the Walikan form. In such cases, as
394　shown in (24), the original order of the cluster is maintained. Such retained
395　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.mbu̪]　　　>　*[ˈʔub.mam]　　>　[ˈʔu.mbam]　　'smelly'

396
397　　　This tendency to maintain word-medial clusters generally applies to homo-
398　rganic nasal-stop clusters, stop-liquid clusters, and fricative-stop clusters (24).
399　Reversing such clusters would yield stop-nasal, stop-fricative, and liquid-
400　stop sequences, which are strongly disfavored in Malangan Javanese and pri-
401　marily seen in loans (e.g., [ˈbaʔ.so] 'meatballs') and composite words (e.g.,
402　[saʔ.ˈme.ne] 'as much as this'). Other possible repair strategies, such as schwa
403　epenthesis or the adaptation of palatal final stops (see section 5.4), are like-
404　wise disfavored. Here, Walikan differs significantly from loanword integration
405　in generic Malangan Javanese, in which schwa epenthesis is common; for
406　example, *kaləm* 'calm' (< Dutch *kalm*), *ɖinəs* 'government service' (< Dutch
407　*dienst*), and *saləp* 'ointment' (< Dutch *zalf*).[19]

(24)　Clusters are maintained in word-medial position
　　　[ˈra.mbʊt̪]　>　[ˈt̪u.mbar]　'hair' (< Ind.)
　　　[ˈsɛ.mpaʔ]　>　[ˈka.mpɛs]　'underwear'
　　　[ˈt̪ə.mpɪʔ]　>　[ˈki.mpət̪]　'vagina'
　　　[ˈsʊ.ṉt̪ɪʔ]　>　[ˈkɪ.ṉt̪ʊs]　'to inject'
　　　[ˈkɔ.ṉt̪ɔl]　>　[ˈlɔ.ṉt̪ɔʔ]　'male genitals'
　　　[ˈsa.ṉɖal]　>　[ˈla.ṉɖas]　'sandal'
　　　[ˈpə.ṉɖɛʔ]　>　[ˈkɛ.ṉɖəp̚]　'short (of size)'
　　　[ˈmʊ.klɪs]　>　[ˈsi.klʊm]　(a name)
　　　[ˈsʊ.krɔn]　>　[ˈnɔ.krʊs]　(a name)
　　　[ˈpɛ.sta]　>　[ˈʔa.stɛp̚]　'party' (< Ind.)

408
409
410　　　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).

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

(25) Nasal-stop-liquid and fricative-stop-liquid clusters are maintained
['mɛ.ɲcrɛ̄t̚] > ['t̪ɛ.ɲcrɛm] 'diarrhea'
['lɪ.st̪rɪk̚] > ['kɪ.st̪rɪl] 'electricity'

413
414 **6.3. CONSONANT DELETION.** The second strategy to repair illegal con-
415 sonant clusters is to delete one of the consonants. The only examples known to
416 us display the relatively rare word-initial clusters /mb/ and /nḏ/, the phonemic
417 status of which is ambiguous. In (26), an illegal cluster in the reversed form is
418 "repaired" by deleting the sequence-initial consonant of the newly formed coda.

(26) Segment deletion of /b/ in /mb/
$C_1C_2V_3C_4 > {}^*C_4V_2C_2C_1 > C_4V_2C_1$
[mba̰h] > *[ha**bm**] > [ham] 'grandparent'

419
420 The above strategy in which the stop is deleted is relatively rare and irregu-
421 lar. The Walikan forms in (27) and (28) exhibit the more common strategy of
422 nasal deletion.

(27) Segment deletion of /m/ in /mb/
$C_1C_2V_3.V_4C_5 > {}^*C_5.V_4.V_3C_2C_1 > C_5.V_4V_3C_2$
[mbɔ̰.is] > *['si.ʲɔ**bm**] > ['si.ʲɔp̚] 'boyish' (< Eng.)
(28) Segment deletion of /n/ in /nḏ/
$C_1C_2V_3.C_4V_5 > {}^*V_5.C_4V_3C_2C_1 > V_5.C_4V_3C_2$
['nḏɛ.sɔ] > *['ʔɔ.sɛ**dn**/ > ['ʔɔ.sɛ̄t̚] 'provincial; hill-billy'

423
424 In (29), the sequence-final /m/ and the /k/ (glottal stop [ʔ] in the nonreversed
425 original) are deleted to create legitimate onsets and avoid unacceptable codas,
426 since glide-stop clusters */jk/ and stop-nasal clusters */bm/ are illegal.

(29) Segment deletion of /m/ in /mb/
$C_1C_2V_3C_4.C_5V_6 > {}^*V_6.C_5.C_4V_3C_2C_1 > V_6.C_5V_3C_2$
['mbaʔ.ju] > *['ʔu.**jkabm**] > ['ʔu.jap̚] 'older sister'

427
428 Consonant deletion can also be observed in reversed words exhibiting a con-
429 sonant cluster in word-medial position, although, this is relatively rare. There
430 are only three tokens in the corpus which display this innovation: *t̪ənt̪ara*
431 [t̪ə.'n̪t̪a.ra] > *aranət̪* ['ʔa.ra.nət̪̚] 'soldier', *suŋkan* ['su.ŋkan] > *nakus* ['na.kʊs]
432 'shy', and *bencɔŋ* ['bɛ.ɲcɔŋ] > *ɲoceb* ['ɲɔ.cɛp̚] 'transvestite'. The majority
433 (80%) of such forms retain the original word-medial consonant cluster, as
434 discussed in section 6.2.

435 **6.4. CONSONANT REORDERING.** Consonant reordering, that is, creating
436 legitimate onsets and avoiding unacceptable codas, is another strategy in
437 Walikan to repair illegal consonant clusters. The following examples display
438 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 clus-
ters, 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.ˈbṳ] > *[ˈʔu.bəlm] > [ˈʔu.blə̥m] 'to enter'
[ˈmla.ku] > *[ˈʔu.kalm] > [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.ɲɟɔlp̚] > [ˈʔɔ.ɲɟlɔp̚] '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.jalm], with an illegal liquid-nasal coda, whereas reordering would yield *[ˈʔu.lajm], 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 [gə̥n] 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.jalm] to create a permissible form *[ˈʔu.ja.ləm], 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.lajm] > [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 *[ˈʔib.malʔ], with two illegal clusters (stop-nasal, liquid-stop). Using the strategy to retain the homorganic cluster /mb/ would yield *[ˈʔi.mbalʔ], 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]
> $*V_6C_5.C_4V_3C_2C_1$ *[ˈʔib.malʔ]
> $*V_6.C_4C_5V_3C_2C_1$ *[ˈʔi.mbalʔ]
> $V_6.C_4C_5C_2V_3C_1$ [ˈʔi.mblaʔ]

6.5. HETEROSYLLABIC CONSONANT SEQUENCES.

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.d̪rə̰ʔ]	'to work hard'
[ˈmar.sɔ]	>	[ˈʔɔ.sram]	(a name)
[ŋər.ˈt̪i]	>	[ˈʔi.t̪rəŋ]	'to understand (AV)'
[gər.ˈmɔ]	>	[ˈʔɔ.mrək]	'pimp'
[ˈba̰ʔ.so]	>	[ˈʔɔ.skap̚]	'meatballs'
[ˈpal.su]	>	[ˈʔu.slap̚]	'fake'
[ˈbər.kat̚]	>	[ˈt̪a.krəp̚]	'blessed food'
[kə.lu.ˈʷar.ga̰]	>	[ʔa.gra.ˈu.lə̰ʔ]	'family' (< Ind.)
[ˈri.lɛks]	>	[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.d̪/	[ˈsar.dɛn] 'sardines' (< Dutch)
	/r.c/	[mər.ˈcɔn] 'fireworks'
	/r.k/	[ˈmʊr.kɔ] 'greedy' (< Sanskrit)
	/r.g/	[mər.ˈga̰] 'because' (< Sanskrit)
	/r.s/	[kər.ˈsɔ] 'to want' (< Sanskrit)
	/r.m/	[gər.ˈmɔ] 'pimp'
	/r.w/	[ˈga̰r.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/	[ˈprak̚.t̪ek̚]† 'practice' (< Dutch)
	/ʔ.t̪/	[sə̰ʔ.ˈt̪i] 'supernatural powers' (< Sanskrit)
	/ʔ.d̪/	[ˈpa̰ʔ.d̪ḛ] 'uncle older than parents'
	/p.t̪/	[ˈsap̚.tu] 'Saturday' (< Arabic)
	/t̪.b/	[ˈkʊt̪.ba̰h] 'sermon' (< Arabic)
	/k.b/	[ˈt̪ak̚.bɪr] 'the phrase *Allāhu akbar*' (< Arabic)
Stop-nasal	/ʔ.m/	[sa̰ʔ.ˈme.ne] 'as much as this'
Stop-liquid	/ʔ.l/	[ˈpa̰ʔ.lɪʔ] 'uncle younger than parents'
Stop-fricative	/ʔ.s/	[ˈba̰ʔ.so] 'meatballs' (< Chinese)
	/p.s/	[ˈnap̚.su] 'urge' (< Arabic)

AQ2 appears at the row "Stop-stop".

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† Due to its loanword status, the expected pronunciation *[ˈpra̰ʔ.t̪ɛ̰ʔ] is uncommon.

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

488   **7.1. OVERVIEW OF VOWELS.** Malangan Javanese conventionally exhib-
489   its six phonemic vowels /i, u, e, ə, o, a/ as presented in table 6. Their common
490   spelling is given in angle brackets, although, diacritics are often omitted in
491   Malangan Javanese writings. This inventory of Malangan Javanese vowels
492   is in line with the one reported for Central Javanese (Adisasmito-Smith
493   2004; Dudas 1976; Hayward 1999; Nothofer 2006; Uhlenbeck 1978; Yallop
494   1982).

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

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

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

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

513   The mid vowels /e/ and /o/ are realized as [ɛ] and [ɔ] in final closed syllables.
514   They are also realized as such in penultimate open syllables preceding either an
515   open syllable with a high vowel or a closed syllable with a nonhigh vowel. In
516   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>	

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

522 **7.2. REALIZATIONS OF /i/ AND /u/.** The phonemes /i/ and /u/ are real-
523 ized as [i] and [u] in open syllables or before syllables with nonhigh vowels,
524 and lowered to [ɪ] and [ʊ] in final closed syllables. This lowering also affects
525 high vowels in the preceding open syllables, a principle that is referred to
526 as vowel harmony. This has also been documented in other Eastern Javanese
527 dialects (Conners 2008; Hoogervorst 2008). Vowel-lowering in antepenul-
528 timate syllables appears to be absent in Central or Western Javanese
529 dialects.
530   The same process of lowering can be observed in Walikan words. Example
531 (35) shows how /i/ and /u/, which are originally realized as [ɪ] and [ʊ] on
532 account of their position in closed syllables, become part of open syllables after
533 reversal. Since there is no high vowel in the following closed syllable, they are
534 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
    ['pa.kɪs]   > ['si.kap̚]   (a toponym)
    [pə.'tɪs]   > ['si.t̪əp̚]   'shrimp paste'
    ['ma.lɪŋ]   > ['ɲi.lam]   'thief'
    ['ma.bʊ̥ʔ]   > ['ku.bam̥]   'drunk'
    ['ma.nʊʔ]   > ['ku.nam̥]   'penis'
    ['sa.bʊ̥n]   > ['nu.bas̥]   'soap'
    ['mʊ.klɪs]   > ['si.klʊm]   (a name)

535 By contrast, Walikan forms displaying a single high vowel /i u/ in a closed
536
537 syllable do not always show the expected process of vowel-lowering. Instead,
538 /i/ and /u/ may occur in closed syllables as [i] and [u]. This is illustrated in (36).
539 For instance, *pirɔ* ['pi.rɔ] 'how much' is reversed to *ɔrip* ['ʔɔ.rip̚] and not
540 *['ʔɔ.rɪp̚], violating the Malangan Javanese phonotactics which require vowel-
541 lowering in this position.[21]

(36)   /i/ and /u/ are realized as [i] and [u] in final closed syllables
    a. ['pi.rɔ]   > ['ʔɔ.rip̚]   'how much'
      ['si.ŋɔ]   > ['ʔɔ.ŋis]   'lion'
      ['si.kat̚]   > ['t̪a.kis]   'to fight; to finish off'
    b. ['ru.wət̚]   > ['t̪ɛ.wur]   'complicated'
      ['bu̥.d̪al]   > ['la.d̪up̚]   'to depart'
      ['b̥u̥.le]   > ['ʔɛ.lup̚]   'white person'
      ['s̥u.we]   > ['ʔɛ.wus]   'long (time)'

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21. An exception is the Walikan word *ɔnic* ['ʔɔ.nɛt̚] from *cinɔ* ['ci.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.

543
542   However, when both syllables of a disyllabic word contain high vowels,
544   vowel-lowering occurs across the word, in both open and closed syllables,
545   as shown in (37).

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

547
546   A few words in Malangan Javanese do not exhibit lowering of a high-front
5.**AQ3**   vowel /i/ in a final closed syllable and its preceding syllable (Yannuar 201 9:84–
549   85). They behave atypically in both Malangan Javanese and Walikan (38).

(38)   /i/ remains [i] in closed syllables
　　　[ˈtʲi.tʲiʔ]   >   [ˈki.tʲit̄]   'a little'
　　　[ˈpi.pis]   >   [ˈsi.pip̄]   'to urinate'

551
550   This atypical behavior requires further explanation, but the reduplication-
552   like structure of the above examples might be relevant; it is possible that the
553   high degree of internal self-similarity plays a role in blocking the otherwise
554   expected vowel-lowering.[22]

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

(39)   /i/ and /u/ are optionally lowered in closed syllables
　　　[ˈgu.jɔn]   >   [ˈnɔ.ɹʊk̄] ~ [ˈnɔ.ɹuk̄]   'to joke'
　　　[ˈmi.n̪ta̪ʔ]   >   [ˈkat̪.nɪm] ~ [ˈkat̪.nim]   'to ask for'
　　　[ˈtu.kan̪]   >   [gə.ˈna.kʊt̪] ~ [gə.ˈna.kut̪]   'worker'
　　　[ˈru.ɹa̪ʔ]   >   [ˈka.ɹʊr] ~ [ˈka.ɹur]   'seasoned unripe fruit salad'

561
562   **7.3. REALIZATIONS OF /e/ AND /ɛ/.** In Malangan Javanese, the high–mid
563   front vowel /e/ is realized as [ɛ] in closed syllables. In open syllables, it is real-
564   ized as [e], except when it precedes either an *open* syllable with a high vowel,
565   or a *closed* syllable with any of the other vowels /e o ə a/. The same rules apply
566   to Walikan forms, shown in (40). The reversal of [ˈʔɛ.wɛt̪̄] from *ɖewe* [ˈd̪e̪.we]
567   'oneself, alone' additionally shows that /e/ is realized as [ɛ] in both syllables,
568   complying with the expected rules of vowel-lowering.

(40)   /e/ is realized as [ɛ] in word-initial position
　　　[gə.ˈd̪e̪]   >   [ˈʔɛ.də̄k]   'big'
　　　[ˈsa.t̪e]   >   [ˈʔɛ.t̪as]   'satay'
　　　[ˈd̪e̪.we]   >   [ˈʔɛ.wɛt̪̄]   '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.d̪ɛ] would be ungrammatical.

(41) /e/ is realized as [e] in word-final position
    [ˈʔɛ.naʔ] > [ˈka.ne] 'delicious, nice'
    [ˈʔɛ.d̪an] > [ˈna.d̪e] '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'
    [ˈd̪e.we]   > [ˈʔɛ.wɛt̪] ~ [ˈʔe.wet̪]   'oneself; alone'
    [sə.ˈla.we] > [ˈʔɛ.la.wəs] ~ [ˈʔe.la.wəs] 'twenty-five'[23]

The above example of *ḍewe* [ˈd̪e.we] exhibiting variation between [ˈʔɛ.wɛt̪] and [ˈʔe.wet̪] demonstrates variable rule application rather than variation on the level of individual segments; in the latter case, we would additionally expect the unattested forms *[ˈʔe.wɛt̪] and *[ˈʔɛ.wet̪].

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.bɛs] > [ˈsɛ.bɛ] 'father'
    [ˈʔɛ.lɛʔ] > [ˈkɛ.lɛ] 'ugly'

The Walikan forms in (43) are rare attestations of /e/ being realized as [ɛ] word-finally: *[ˈse.bɛ] and *[ˈke.le] 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.

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23. In this instance, the formation of *elawəs* [ʔɛ.ˈla.wəs] 'twenty-five' from *səlawe* [sə.ˈla.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.ˈba̰.lɛn] > [ˈnɛ.la.bə̰ʔ] ~ [ˈnɛ.la.bɛ̰ʔ] (a toponym)
　　　[sə.ˈla.we] > [ˈʔɛ.la.wəs] ~ [ˈʔɛ.la.wɛs] 'twenty-five'
　　　[tə.ˈn̰ta.ra] > [ˈʔa.ra.nə̰t͡] ~ [ˈʔa.ra.nɛ̰t͡]²⁵ 'a soldier' (< Ind.)

The influence of orthography is also confirmed by the two isolated examples in (46). The form *ruwət* [ˈru.wə̰t͡] is reversed as [ˈt̰ɛ.wur] rather than *[tə.ˈwur], while *wəḍus* [wə.ˈd̰ṵs] yields [ˈsu.d̰ɛp͡] or [ˈsu.d̰ɛ] instead of the expected *[ˈsu.d̰əp͡]. The nonexistence of *[ˈsu.d̰ə], however, is expected on account of its illegal word-final schwa.

(46) [ə] is sporadically realized as [ɛ]
　　　[ˈru.wə̰t͡] > [ˈt̰ɛ.wur]　　　　　　　'complicated'
　　　[wə.ˈd̰ṵs] > [ˈsu.d̰ɛp͡] ~ [ˈsu.d̰ɛ] '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] > [gə̰.ˈna.ro]²⁶ 'person' (< Ind.)
　　　[ˈʔɔ.mɔŋ] > [gə̰.ˈno.mo] 'to speak'

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24. The only attestation of a Walikan word with a final schwa in our corpus is *tapmə* [ˈt̰ap͡.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
['bɔ̯.tɔl] > [lɔ.tɔp̚] 'bottle'
['bɔ̯.kɔŋ] > [ŋɔ.kɔp̚] '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/
['ba̯.lɔn] > ['nɔ.lap̚] 'prostitute'
['t̪a.kɔn] > ['nɔ.kat̚] '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
['t̪o.ko] > ['ʔɔ.kɔt̚] ~ ['ʔo.kot̚] 'store'
['so.t̪o] > ['ʔɔ.tɔs] ~ ['ʔo.tos] 'a kind of soup'
['so.lo] > ['ʔɔ.lɔs] ~ ['ʔo.los] (a toponym)
[sɔ.'da̯.ra] > ['ʔa.ra.dɔs] ~ ['ʔa.ra.dos] 'relative' (< Ind.)
[sə.'kɔ.lah] > ['ha.lɔ.kəs] ~ ['ha.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
['bo̯.ɟo̯] > ['ʔo.ɟop̚] 'spouse'
['fo.t̪o] > ['ʔo.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.

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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.

659 **7.6. DISTRIBUTION OF /a/ AND /ɔ/.** In Malangan Javanese, as in most
660 other Central and Eastern Javanese dialects, the historical low-central vowel
661 /a/ (as attested in Old Javanese, Zoetmulder 1982) is realized as [ɔ] in word-
662 final open syllables, see (52).[27] This innovation also spreads to /a/ in the pre-
663 ceding syllable unless it is blocked either by a heterorganic consonant cluster or
664 a heterosyllabic consonant sequence. Single consonants or homorganic conso-
665 nant clusters (with or without liquids), by contrast, do not block this change as
666 seen in table 7. As will be demonstrated below, this historical rule is no longer
667 fully productive.[28]

668   One [a] ~ [ɔ] alternation is still active in Malangan Javanese, suggesting that
669 the rule remains synchronic in a limited domain. If followed by the derivational
670 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	[ˈɲɟɔ.gɔ]	'to guard'
>	*n-ɟaga-ni	[ˈɲɟa̠.ga̠.ni]	'to prevent that'

671
672   Inflectional suffixes, by contrast, are not part of the phonological word
673 domain of this rule. Therefore, definite/possessive suffixes do not block the *a
674 > ɔ/_# rule, as shown in (53). This marks a contrast with Central Javanese dia-
675 lects, where inflectional suffixes block the realization of /a/ as [ɔ] in the word-
676 final position in the same way that derivational suffixes do.

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

Single consonants/homorganic consonant clusters		
Old Javanese (Zoetmulder 1982)	**Malangan Javanese**	
\<gawa\>	[ˈgɔ.wɔ]	'to take'
\<kana\>	[ˈkɔ.nɔ]	'there'
\<mata\>	[ˈmɔ.t̪ɔ]	'eye'
\<tampa\>	[ˈt̪ɔ.mpɔ]	'to receive'
\<waṅśa\>	[ˈbɔ.ŋsɔ]	'people' (< Sanskrit)
\<cakra\>	[ˈcɔ.krɔ]	'a weapon in wayang puppetry' (< Sanskrit)
\<candra\>	[ˈcɔ.ndrɔ]	'moon (poetic)' (< Sanskrit)
Heterorganic consonant clusters/heterosyllabic consonant sequences		
\<aṅasta\>	[ˈŋa.st̪ɔ]	'to bring (polite)' (< Sanskrit)
\<tan apa\>	[ˈt̪an.pɔ]	'without'
\<dharma\>	[ˈd̪ar.mɔ]	'donation' (< Sanskrit)
\<mārga\>	[ˈmar.gɔ]	'because' (< Sanskrit)

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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.mbɔ̞]   'medicine'
    > *tamba-ne   [ˈt̪ɔ.mbɔ̞.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'

678
679   Malangan Javanese has one isolated example where speakers realize /a/ in
679   root-final position alternatively as [ɔ] or [a], see (54). This suggests that the
680   *a > ɔ/_# rule described in table 5 is not consistently applied in the domain
681   of fixed expressions.

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

683
682   These variable realizations presumably contributed to the dissociation of [ɔ]
684   in root-final position as an allophone of /a/, except in the specific context of
685   the applicative suffix -(n)i where the allophony remains productive. This is
686   undoubtedly reinforced by the influence of Indonesian and other languages
687   in contact. The reanalysis of /ɔ/ as an independent phoneme is also seen in
688   the loanword *sprentɔ* [ˈsprɛ.n̪t̪ɔ] 'jump rope' (< Dutch *springtouw*), which
689   lacks a historical */a/. In Walikan, /a/ and /ɔ/ function as nonalternating seg-
690   ments. Since the allophony has completely ceased to be productive, reversals
691   yielding a word-final /a/ are systematically pronounced as [a] rather than
692   [ɔ], (55).

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

694
693   The historical */a/ in word-final position, now realized as [ɔ], likewise
695   retains its realization as [ɔ] in Walikan, see (56). This corroborates that /ɔ/
696   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.bɔ]   > [ˈʔɔ.bi̥t̪] 'to fall'
    *jaga [ˈɟɔ.gɔ]   > [ˈʔɔ.gɔ̥t̪] 'to guard'

698
697   Considering that 40% of the Walikan vocabulary we collected consists of
699   reversed Indonesian words,[31] the influence of this language to the discussed
700   process of dissociation is likely. Note that in Indonesian, /a/ in word-final posi-
701   tion 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?'
AQ6 31. For more information on Indonesian-based Walikan forms, see Yannuar (2019

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 [gən]. 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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