

## Phonological strategies for intensifying adjectives in Javanese

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Javanese, an Austronesian language widely spoken in Indonesia, has an interesting array of ways to intensify adjectives achieved through vowel lengthening (*asat* ‘dried’, *asa:t* ‘very dried’), u-insertion (*panas* ‘hot’, *puanas* ‘very hot’) and vowel raising/tensing (*gepeṅ* ‘flat’, *gepiṅ* ‘very flat’). This paper offers a new account of phonological intensification in Javanese, based on much more extensive data than earlier accounts, including a systematic dictionary study and judgments from eight native speakers. A unified analysis is offered with each of the three patterns represented as floating features  $\mu$  for vowel lengthening,  $\mu$ , [+high, +back] for u-insertion, and [+high, +ATR] for vowel raising/tensing. We also address the related issue of the behavior of the central vowels /ə/ and /a/ through a reanalysis of the surface vowel inventory.

### 1. Introduction\*

Javanese, an Austronesian language spoken by 84,300,000 people in Indonesia (Lewis, Simons & Fennig, 2015), has an interesting array of ways to intensify adjectives as illustrated in (1a-c). This can be achieved through vowel lengthening, u-insertion, and vowel raising/tensing.

#### (1) Forms of intensification in Javanese

	Base form		Intensified Form
a.	Vowel lengthening		
	akas ‘hard and dry’	aka:s	‘very hard and dry’
	asat ‘dried’	asa:t	‘very dried’
b.	U-insertion		
	abaṅ ‘red’	uabaṅ	‘very red’
	panas ‘hot’	puanas	‘very hot’
c.	Vowel Raising/Tensing		
	gepeṅ ‘flat’	gepiṅ	‘very flat’
	akor ‘harmonious’	akur	‘very harmonious’

The adjectives are intensified by lengthening of the final vowel in (1a), insertion of [u] before the first vowel of the word in (1b), and raising/tensing of the final vowel in (1c) (also in this case “undoing” the effect of laxing triggered by a final closed syllable).

Intensification of adjectives is a common process in the world’s languages and a wide range of strategies is observed. Many languages use a syntactic strategy in the form of an intensifying adverb. This is what is done in English with the adverbs *very* and *really* placed to the left of the adjectives as shown in (2).

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\* We thank the editors of this volume and two anonymous reviewers for valuable feedback. We also thank the Javanese speakers who participated in this study.

(2) **Forms of English intensification**

- a. His face became **very** red after spending hours under the sun.
- b. He was **really** tired after running for ten miles.

Similar to English, Javanese can also intensify its adjectives with adverbs *banget* and *tenan* to the right of the adjectives as shown in (3).

(3) **Intensification with syntactic strategies in Javanese**

- a. *Dheweke ayu*  
She pretty  
'She is pretty'
- b. *Dheweke ayu banget*  
She pretty very  
'She is very pretty'
- c. *Dheweke ayu tenan*  
She pretty very  
'She is very pretty'

However, in Javanese, the patterns in (1) are much more common and highly productive. Note that the phonological and syntactic strategies cannot be combined in the same utterance and as a result, Javanese speakers must choose between them.

Some languages intensify their adjectives by means of morphological processes, such as affixation or reduplication. In Tagalog, the adjectives are intensified by way of prefixation or reduplication as shown in (4).

(4) **Forms of intensification in Tagalog**

- a. prefixation in Tagalog  
*ma-ganda* 'beautiful'      *napakaganda*<sup>1</sup> 'very beautiful'  
*tamad* 'lazy'      *napakatamad* 'very lazy'  
(Schachter and Otanes, 1972: 232)
- b. reduplication in Tagalog  
*pagod* 'tired'      *pagod na pagod* 'very tired'  
*mataba* 'fat'      *mataba ng mataba* 'very fat'  
(Schachter and Otanes, 1972: 231)

As seen in (4a), intensifying in Tagalog can be done by attaching the prefix *napaka* to the target adjectives *maganda* 'beautiful' and *tamad* 'lazy'. In (4b), the adjectives *pagod* 'tired' and *mataba* 'fat' are intensified by full reduplication and the addition of a particle *na* or *ng*.

A much rarer case of adjective intensification is through a phonological strategy. One such case is in Sui, a Tai-Kadai language spoken in Guizhou, China. In Sui, the adjectives are intensified by reduplication and either rhyming or alliteration as shown in (5). (The numbers on the adjectives indicate its tonal pattern.) This pattern of intensification is productive in Sui.

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<sup>1</sup> The adjectival prefix marker *ma-* is not included in the intensified form.

(5) **Forms of intensification in Sui**

## a. reduplication and rhyming in Sui

*ka:t7* ‘agile’      *ka:t7 tea:t8* ‘very agile’  
*?mej5* ‘selfish’      *?mej5 tej1* ‘very selfish’ (often referring to a child)  
 (Stanford, 2007: 91)

## b. reduplication and alliteration in Sui

*ka:t7* ‘agile’      *ka:t7 kow1* ‘very agile’  
*?mej5* ‘selfish’      *?mej5 ?mo:t7* ‘very selfish’  
 (Stanford, 2007: 91)

In (5a), the adjectives are intensified through reduplication and rhyming. The reduplicated form [te:t8] and [tej1] have the same rimes as the base adjectives [ka:t7] ‘agile’ and [?mej5] ‘selfish’, but different onsets; whereas, in (5b) the base adjectives undergo reduplication and alliteration, and have the same onsets as the reduplicated forms [kow1] and [?mo:t7], but different rimes.

It can also be observed in (5) that a given adjective can undergo both types of intensification. The use of the different types of intensifying in Sui often has a subtle semantic/pragmatic distinction. The alliteration intensifying form [?mej5 ?mo:t7] in (5b) means ‘selfish in general usage’, while the rhyming form [?mej5 tej1] in (5a) means ‘very selfish referring to children’.

Javanese provides a second case like Sui where intensification of adjectives is phonological. Furthermore, Javanese intensification exhibits another interesting property. The speaker can further intensify the quality described by the adjectives by using more than one means of phonological intensification. (However as noted above, it is not possible to mix phonological and syntactic strategies.)

(6) **Multiple intensification in Javanese**

3 types of intensification, with different degrees of intensification

a. *apar* ‘new’

b. *apir* ‘very new’  
*apa:r*  
*uapar*

c. *uapa:r* ‘very, very new’  
*uapir*  
*api:r*

d. *uapi:r* ‘very, very, very new’

As seen in (6), multiple patterns of intensification are possible as illustrated here for the adjective [apar]. One, two, or three patterns can apply resulting in increasing degrees of intensity. In this case, based on phonological factors, all the three intensifying forms are grammatical, though as discussed below there are some phonological restrictions that hold in some cases. Also it should be noted that vowel raising/tensing is preferred over other forms of intensification. This might be in part due to social factors where u-insertion is thought to be too colloquial or *kampung* ‘low style typical of villages’.

The data in (6) pose a question of whether all the patterns of intensification are part of Javanese grammar. The previous treatments of Javanese intensification only discuss vowel

raising and tensing which has been termed the *Elative Form* (Dudas, 1976, Benua, 1999, Wolf, 2008). In particular, Dudas (1976) states that vowel raising and tensing are often accompanied by vowel lengthening which should not be regarded as the true form of adjective intensifying in Javanese (cf. Dudas, 1976: 181). However, cross-linguistically, we find other languages use lengthening (in these cases consonant gemination) to mark intensification such as Cahuilla, an Uto-Aztecan language, and Japanese as exemplified in (7) and (8).

(7) **Adjective intensifying in Cahuilla**

<i>wélnet</i>	‘mean one’	<i>wéllnèt</i>	‘very mean one’
<i>čéxiwèn</i>	‘it is clear’	<i>čéxxìwen</i>	‘it is very clear’

(Seiler, 1977: 58)

(8) **Adjective intensifying in Japanese**

<i>su.goi</i>	‘terrible’	<i>sug.goi</i>	‘very terrible’
<i>o.nazi</i>	‘same’	<i>on.nazi</i>	‘very similar’

(Uda, 1991: 134)

Thus there is no reason a priori that lengthening should be treated separately from u-insertion and vowel raising/tensing and here we develop a unified account.

Additionally, previous treatments (Dudas 1976, Benua 1999 and Wolf 2008) leave unresolved the issues of how schwa and /a/ are treated. Dudas (1976) mentions briefly that the adjectives with final [ə] can only be intensified with adverb [baŋət] ‘very’ but offers no further explanation of the issue. As shown in (9), adjectives with final /ə/ cannot be intensified into either high vowels [i, u].

(9) **The constraints on vowel raising for /ə/**

<i>ajəm</i>	‘peaceful, relieved’	<i>*ajim</i>	‘very peaceful, relieved’
		<i>*ajum</i>	

Another problem is the distribution of the vowel /a/. Javanese has no word final [a] as observed by Dudas (1976), Suharno (1982) and Hargus (1993). Dudas (1976) and later Kenstowicz (1986) and Mester (1988), account for the restriction with an a-raising rule.

(10) **The A-raising rule**

$a \rightarrow \text{ɔ} / \text{ \_\_\_\_\_\_ } \#$

The details of this rule are important: (1) the vowel /a/ is not just raised but also undergoes backing. We do not see other vowels in Javanese undergoing both backing and raising at the same time in the surface forms and (2) the vowel [ɔ] is [-ATR] and Javanese phonotactics do not allow [-ATR] vowels in open syllables.

Finally, the previous treatments of intensification are based on limited data. All recent treatments in the theoretical literature (Benua 1999, Schindwein 1988, Wolf 2008) are based on Dudas (1976) who gathered her data from a single Javanese speaker. While the data seem reliable as far as they go, there is a need to consider data from a wider group of speakers and to look at larger set of adjectives.

In this paper, we present an integrated analysis of the three phonological adjective-intensifying patterns in Javanese, based on a corpus of adjectives in the Javanese English dictionary by Robson & Wibisono (2002), complemented by a survey of several speakers. We treat the three intensifying patterns as three different strategies available to the speaker, using vowel lengthening, u-insertion, and vowel raising/tensing. The strategies are analyzed

as floating features and moras,  $\mu$ ,  $\mu$ , [+high, +back], [+high, +ATR] docked at certain edges of the base adjectives (Zoll 1998, Benua 1999, Wolf 2008) in an Optimality Theoretic approach.

For the problems of the vowels /ə/ and /a/, we offer a solution with a reanalysis of Javanese surface vowel inventory, arguing that /ə/ has two surface realizations, one of which is unspecified for ATR, while the other surfaces as [+ATR, +high] as a result of raising/tensing. In the case of /a/, we argue that it backs to [ʌ], similar to [ɔ], but with a [+ATR] specification rather than [-ATR] posited for [ɔ], building on Archangeli's (1995) observation that feature combination [+ATR, +low] is the least sympathetic combination.

In sum, the present paper offers a comprehensive treatment of Javanese adjective intensification by unifying the analysis of the vowel lengthening, u-insertion, and vowel raising/tensing with a larger set of data and addressing the problems of the vowels /ə/ and /a/ through a reanalysis of the surface vowel inventory. The paper is organized as follows: Section 2 provides background on the Javanese vowel inventory and alternations; Section 3 discusses the corpus of data; Section 4 provides a unified analysis of the adjective intensifier marker using an Optimality Theoretic approach; and Section 5 concludes the paper.

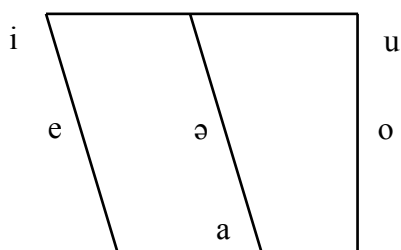
## 2. Javanese vowel alternations

In this section, we provide a brief excursus of vowel alternations in Javanese and argue that a re-analysis leads to a more accurate vowel inventory. This, in turn, is an important key to addressing the representational issues of the vowels /ə/ and /a/, which come into play in the observed patterning of vowel raising/tensing as one strategy of intensification. This section includes a discussion of the Javanese vowel inventory, Javanese ATR alternations, and the reanalysis of the vowels /ə/ and /a/, focusing particularly on word final position, since this is where we see an interplay with intensification.

### 2.1 Vowel inventory

The Javanese vowel inventory has been previously discussed by Samsuri (1958), Sumukti (1971), Dudas (1976), Schindwein (1988), Benua (1999), and Archangeli (1995). Overall, there is general agreement about Javanese having an underlying six vowel system as follows.

#### (11) Javanese underlying vowels inventory



Dudas (1976) assumes the vowel feature specifications shown in (12):

**(12) Dudas (1976): Javanese phonemic vowels**

	i	e	u	o	a	ə
high	+	-	+	-	-	-
low	-	-	-	-	+	-
front	+	+	-	-	-	-
back	-	-	+	+	-	-
tense	+	+	+	+	-	-

Dudas' (1976) phonemic vowel inventory is an improvement over older treatments from Samsuri (1958) and Sumukti (1971) identifying the tense/lax pairs as allophones and not as separate phonemes. Dudas's (1976) vowel inventory is widely followed by later treatments of Javanese phonology (Schlindwein, 1988 and Benua, 1999).

We basically follow Dudas' (1976) proposed underlying vowel inventory and feature specifications for the present work, incorporating the important refinement proposed by Archangeli (1995) and Schlindwein (1988), replacing the feature [tense] with [ATR]. (Although, we continue to use the term “laxing” to refer to the process that renders a vowel with [+ATR] as [-ATR] and “tensing” to refer to the opposite process.) Further we argue that the feature [ATR] is underlyingly unspecified for all vowels. To reflect this in our transcription, when referring to underlying vowels, they are presented in all caps to indicate that ATR is not specified. Our proposed feature specifications for the underlying vowel inventory are shown in (13).<sup>2</sup>

**(13) Javanese phonemic vowels**

	I	E	U	O	A	Ə
high	+	-	+	-	-	(-)
low	-	-	-	-	+	(-)
front	+	+	-	-	(-)	-
back	-	-	+	+	-	-

Unlike the underlying vowel inventory, the surface inventory generates more disagreement. Many of the later treatments of Javanese vowels base their analysis on Dudas' (1976) surface inventory of ten vowels shown in (14):

<sup>2</sup> There is some indeterminacy in the underlying feature specifications for the central vowels /A/ and /Ə/. These values are indicated in parentheses. This could be determined in part by theoretical assumptions, but is also informed by the patterns of intensification as discussed below in Section 3.

(14) **Dudas (1976): ten surface vowels**

	i	ɪ	u	ʊ	e	ɛ	o	ɔ	ə	a
high	+	+	+	+	-	-	-	-	-	-
low	-	-	-	-	-	-	-	-	-	+
front	+	+	-	-	+	+	-	-	-	-
back	-	-	+	+	-	-	+	+	-	-
tense	+	-	+	-	+	-	+	-	-	-

However, this inventory cannot solve the problems of vowels /ə/ and /ʌ/ as explained later in Section 2.2. We argue that the problems can be resolved by positing a slightly different inventory of Javanese surface vowels with twelve vowels. Our proposed surface inventory differs in including two additional surface vowels, the vowels [ɨ] and [ʌ]. The former is an allophone of the vowel /ə/ which only appears in final syllables in the intensifying form; and the latter is an allophone of the vowel /ʌ/ which appears in final open syllables. To motivate this proposed inventory, we first discuss Javanese ATR alternations.

**2.2 Javanese ATR alternations**

An important characteristic of Javanese vowel phonology is the ATR alternations. These alternations determine the surface vowel inventory of Javanese and are best explained by the Grounding Hypothesis originally proposed by Archangeli and Pulleyblank (1994, p. 177) as quoted in (15).

(15) **The Grounding Hypothesis**

- “a. Feature co-occurrence conditions invoked by languages are phonetically motivated. b. The stronger the phonetic motivation for a condition C
  - i. The greater the likelihood of invoking C
  - ii. The greater the likelihood of assigning a wide scope to C in the grammar, and vice versa.”

Based on the Grounding Hypothesis, the features of interest for vowel distribution are [high], [low], and [ATR]. Archangeli (1995) notes that the combination [+high, +ATR] is a phonetically sympathetic combination and therefore occurs more frequently. On the other hand, the grammar also allows the antagonistic combination [+high, -ATR] in a limited context, depending on phonological environment.

Besides vowel height, the ATR feature in Javanese is also influenced by syllable structure. The high vowels are [-ATR] in final closed syllables and [+ATR] in non-final closed syllables. (Note that most base forms are disyllabic in Javanese, so we often refer to the “initial” or “final” syllable.)

(16) **Javanese [ATR] alternation and syllable structure**

root UR	unaffixed	affixed	
/Apɪʔ/	[a.pɪʔ]	[a.pi.ʔ-e]	‘good’
/wɪwɪt/	[wi.wɪt]	[wi.wi.t-an]	‘beginning’
(following Wolf, 2008:4)			

As seen in (16), the vowel [ɪ] is [-ATR] found only in closed syllables. However, in affixed forms, resulting in the vowel being in an open syllable, it surfaces as [+ATR] [i].

Considering the facts above, we propose that Javanese underlying vowels are unspecified for ATR. The ATR specification of a vowel is determined by two factors, its height as the Grounding Hypothesis suggests, and its syllable structure. It is not surprising that high vowels have the feature [+ATR], since it is the most sympathetic combination based on the Grounding Hypothesis. However, the less sympathetic combination, [+high, -ATR] can occur in limited context in final closed syllables. This motivates the allophones of the underlying high vowels /I/ and /U/ as shown in (17). Underlying /I/ surfaces as [i] in open syllables and [ɪ] in final closed syllables and underlying /U/ surfaces as [u] and [ʊ] in similar environments.


(17) **Javanese ATR alternation for high vowel**

UR	surface forms	
/wəɖɪ/	[wəɖi]	‘scared’
/cɪɪɪʔ/	[cɪɪɪʔ]	‘small’
/lUgU/	[lugu]	‘naïve’
/gUmUn/	[gumʊn]	‘amazed’

In Optimality Theoretic terms, we propose that this alternation is a result of two competing constraints, \*[+ATR], CLOSED FINAL (similar to Benua’s 1999 constraint \*ATR-CLOSED), part of Archangeli’s (1995) Grounding Hypothesis, [+high, +ATR], and a general markedness constraint \*[-ATR].<sup>3</sup> The observed surface patterns can be modeled through constraint interaction as illustrated in (18).

(18) **Constraints for high vowels**

\*[+ATR], CLOSED FINAL >> [+HIGH, +ATR] >> \*[-ATR]

/rɪnd <sup>h</sup> ɪʔ/	*[+ATR], CLOSED FINAL	[+HIGH, +ATR]	*[-ATR]
[rɪnd <sup>h</sup> ɪʔ]	*		
 [rɪnd <sup>h</sup> ɪʔ]		*	*
[rɪnd <sup>h</sup> ɪʔ]	*	*	*

Now we turn to the mid vowels /E/ and /O/. Unlike the high vowels, the Grounding Hypothesis does not strictly determine the ATR specification of the mid vowels. The mid vowels /E/ and /O/ exhibit a wider distribution of the feature specification [-ATR] in three environments, (1) in final closed syllables, (2) in initial syllables before word final tense high vowels, and (3) in initial syllables before final (closed) syllables containing /ə/ (Dudas, 1976: 61). The facts suggest that the Grounding Hypothesis holds more weakly for the mid vowels, letting other factors play a greater role in determining the ATR values.

<sup>3</sup> We state these constraints informally. We also do not address the issue of positively vs. negatively stated constraints.



The alternations motivate two allophones for each of the underlying mid vowels /E/ and /O/. As illustrated in (19), the vowel /E/ and /O/ surface as [ɛ] and [ɔ] in the three environments (a, b, c) and as the [+ATR] vowels, [e] and [o] elsewhere (d).<sup>4</sup>


(19) **Javanese ATR alternation for mid vowels**

- a. Final closed syllables
  - [akɛh] ‘much’
  - [ketɔʔ] ‘visible’
- b. Initial syllables before word final tense high vowels
  - [mɛri] ‘envious’
  - [tɔpi] ‘hat’
- c. Initial syllables before final closed syllables containing /Ə/
  - [kɛrsən] ‘a cherry-like fruit’
  - [bəsən] ‘bored’
- d. Elsewhere
  - [ʃetol] ‘small fish’
  - [ʃoro] ‘cockroach’

The mid vowel alternations in the final closed syllable can be modeled with the two competing constraints, \*[+ATR], CLOSED FINAL and \*[-ATR].

(20) **Constraints for mid vowels**

\*[+ATR], CLOSED FINAL >> \*[-ATR]

/AkEh/	*[+ATR], CLOSED FINAL	*[-ATR]
[akeh]	*	
 [akɛh]		*

Now we turn to the problematic vowels /Ə/ and /A/. In both cases, there are restrictions on these vowels in closed syllables. Since both vowels are central vowels, this suggests another constraint, \*[+ATR], [-FRONT, -BACK] interacting with \*[+ATR], CLOSED FINAL.

First consider the vowel /Ə/. In Javanese, schwa is a phonemic vowel, as shown by the minimal pairs:

(21) **Minimal pairs for /Ə/**

- səpi ‘quiet’      sapi ‘cow’
- səbar ‘disperse’      sabar ‘patient’
- barəŋ ‘together’      barəŋ ‘thing’
- arəŋ ‘coal’      arəŋ ‘rare’

However, it has limited distribution compared to other phonemic vowels in Javanese, being forbidden in a final open syllable as seen in (22).

<sup>4</sup> The ATR alternations of mid vowels are further complicated by exhibiting an ATR harmony in penultimate position. Since our focus here is on the ATR patterns in final syllables – the locus of intensification as marked by vowel raising/tensing, we do not pursue the harmony pattern here.

(22) **The distribution of vowel [ə] in open syllables**

/pə̃nə̃r/	[pənər]	‘right, in a straight line’
	*[pənə]	
/də̃rəs/	[dərəs]	‘heavy (flows, rain)’
	*[dərə]	

This resembles the case of the [-ATR] surface vowels, which cannot appear in final open syllables. High ranking of both \*[+ATR], [-FRONT, -BACK] and \*[-ATR] results in a lexical gap.

Now we turn to the last problem, the vowel /A/. As mentioned earlier, Dudas (1976) claims that the low vowel /A/ has two allophones, [ɔ] in final open syllables and [a] elsewhere,

(23) **Dudas’ A-raising rule**

/a/	→ [ɔ]	/ ___ #
/dʒiwa/	[dʒiwɔ]	‘soul’
/medʒa/	[medʒɔ]	‘table’

(following Dudas 1976: 39–40)

If we are explicit about the feature values of [ɔ], we see that it is problematic since it is [-ATR] but appears in a final open syllable, while as noted above, the word-final vowels in Javanese are strictly [+ATR]. One solution is to propose that this allophone is [+ATR] based on the broader generalization that word-final vowels are [+ATR] in Javanese. Archangeli (1995) suggests that there are two homophonous [ɔ]s, one [-ATR] as a result of laxing of /o/ and one [+ATR] as a result of raising of /a/. Building on this suggestion and based on impressionistic observation, we suggest that there are two nearly homophonous vowels [ɔ] and [ʌ]. The difference between the surface vowels [ʌ] and [ɔ] is perceptually subtle, but to be clear about the difference, we use [ʌ] as the transcription for the phone bearing the features [+back, +ATR] and [ɔ] for the phone bearing the features [+back, -ATR].

Javanese phonotactics requires /A/ to become [+ATR] in a final open syllable. However, as observed by Archangeli (1995), [+ATR, +low] is the least sympathetic combination. Further this combination also violates \*[+ATR], [-FRONT, -BACK]. The simplest repair is backing the vowel /A/ to [ʌ] in final open syllables. Thus we argue that what has been described in the literature as a *raising* rule is most basically a **backing** rule. We leave unresolved the question of whether it also involves raising and rounding (due to structure preservation). This predicts that what is treated in previous accounts as two sources of [ɔ] are actually distinct vowels differing in their ATR values. This suggestion warrants fuller investigation including phonetic analysis, perceptual studies, speakers’ judgments and so forth. Some evidence from Adisasmito-Smith (2004) supports this conclusion: Based on her acoustic phonetic analysis of the vowels from three Javanese speakers, Adisasmito-Smith finds a difference between /A/ in final open syllables and /O/ in final closed syllables.

In (24), the vowel /A/ surfaces as [ʌ] in open syllables and the vowel /O/ surfaces as [o] in open syllables and as [ɔ] in closed syllables. Following the proposed analysis, the former is [+ATR] and therefore can appear in open final syllables, while the latter is [-ATR] and occurs only in final closed syllables.


(24) **The surface forms of the vowels /A/ and /O/**

/EdAn/	[edan]	‘crazy’
/bOlAh/	[bolah]	‘thread’
/rAtA/	[rʌtʌ] <sup>5</sup>	‘flat’
/lOrO/	[loro]	‘two’
/And <sup>h</sup> Oŋ/	[and <sup>h</sup> ɔŋ]	‘horse cart’
/dOndOm/	[dɔndɔm]	‘to sew’

The constraint interaction that gives rise to the vowel [ʌ] is described as follows.

(25) **Constraint interaction for the vowel /A/**

\*[+ATR], [-FRONT, -BACK]>> \*[-ATR]

/rAtA/	*[+ATR], [-FRONT, -BACK]	*[-ATR]
[rata]	*	*
 [rʌtʌ]		

Thus we propose two different surface vowels, [ʌ] and [ɔ], for the underlying vowel /A/ in open syllables and the underlying vowel /O/ in final closed syllables respectively:

(26) **The feature values of the vowels [ʌ] and [ɔ]**

	ɔ	ʌ
high	-	-
low	-	?
front	-	-
back	+	+
ATR	-	+

To sum up this section, we address the problems of the vowels /ə/ and /A/ by reanalyzing the vowel inventory of Javanese into twelve surface vowels and reanalyzing the features of the vowels. We address more fully the allophones of /ə/ in Section 3.

<sup>5</sup> The penultimate vowel also surfaces as [ʌ] due to the further effect of Vowel Harmony.

(27) **Javanese surface vowels**

		lax- ing		lax- ing		lax- ing		lax- ing		intens		back- ing
	i	ɪ	U	ʊ	e	ɛ	o	ɔ	ə	ɨ	a	ʌ
high	+	+	+	+	-	-	-	-	-	+	-	-
low	-	-	-	-	-	-	-	-	-	-	+	?
front	+	+	-	-	+	+	-	-	-	-	-	-
back	-	-	+	+	-	-	+	+	-	-	-	+
ATR	+	-	+	-	+	-	+	-	-	+	-	+

The vowel alternation in Javanese can be summarized as follows:

(28) **Javanese vowel alternations**

UR	Surface			
		Laxing	Backing	Intensification
I	ɪ			
U	ʊ			
E	ɛ			
O	ɔ			
A			ʌ	
Ə	ə			ɨ

With this background on the Javanese vowels, we are ready to return to the question of phonological intensification.

### 3. Pattern of phonological intensification

In this section, we present the results from a corpus study and questionnaire administered to several speakers of Javanese and the resulting observed patterns of intensification in Javanese. As mentioned in Section 1, one of the problems of the previous analyses is the limited set considered. Therefore, we built a corpus of 1303 Javanese adjectives for the present analysis.

#### 3.1 Corpus and questionnaire findings

A corpus of 1303 adjectives was collected from Robson & Wibisono's (2002) Javanese-English dictionary. We then classified them according to their degree of commonness based on the first author's judgments, with the goal of identifying a core set of adjectives commonly known to most speakers.

(29) **The classification of 1303 adjectives by degree of commonness**

<b>Very Common</b>	<b>300</b>	<b>23%</b>
Common	332	25%
Rare but Used	385	30%
Archaic	8	1%
Unknown	278	21%

In the present study, we limit the analysis and discussion to the group of very common adjectives. Based on the 300 forms, we constructed a wordlist to be used as a questionnaire.

From the list of the very common adjectives, we identified the possible form of the intensification based on the first author's intuitions as a native speaker. The intensification includes vowel lengthening, u-insertion, and vowel raising/tensing. Since it seemed likely that different speakers might show variation, we designed a questionnaire to test how much consensus there is between speakers and whether there are sub-patterns observed. The questionnaire contained the list of the 300 very common adjectives and blank columns for all possible patterns of intensification. We also prepared questions for a follow-up interview to ensure that the language consultants produced all possible forms based on their own judgment.

Data were collected from eight Javanese speakers, between the ages of 40-65, in and around Yogyakarta, Indonesia during the summers of 2010 and 2012. Strikingly, no significant variation was observed across speakers in the present study. Rather, patterns were consistent with phonological restrictions. Since we did not find interspeaker differences in our sample, we have pooled the results to report on the observed phonological conditioning. As pointed out by a reviewer, other speakers indeed might have other judgments, due to dialect or idiolect differences. The patterns are consistent across less common adjectives as well, but intensification is most natural in this set so we form our analysis based on this subset of the data.

### **3.2 Patterns of phonological intensification**

We now discuss the intensification pattern of Javanese adjectives based on the list of the very common adjectives.

#### **3.2.1 Vowel lengthening**

There is no restriction on vowel lengthening. All 300 adjectives can undergo vowel lengthening, as exemplified in (30).

(30) **Vowel lengthening**<sup>6</sup>

stem	intensified form	
[abaŋ]	[aba:ŋ]	‘red’
[abət]	[abɔ:t]	‘heavy’
[səpi]	[səpi:]	‘quiet’
[gasɪʔ]	[gasɪ:ʔ]	‘early’

**3.2.2 U-insertion**

In u-insertion, [u] is inserted before the initial vowel. Note there is some variation in pronunciation of u-insertion as [u] or [w], so it is difficult to determine if these forms surface as disyllabic or trisyllabic.

(31) **U-insertion**

stem	intensified form	
[dʒaŋgal]	[dʒuaŋgal]	‘weird’
[edan]	[uedan]	‘crazy’
[enaʔ]	[uenaʔ]	‘comfortable’
[garɪŋ]	[guarɪŋ]	‘dry’

It is observed that most adjectives can undergo u-insertion. There are only 57 adjectives out of 300, or 19% of the total adjectives, which do not undergo u-insertion. For u-insertion, two restrictions hold. The first is based on the vowel of the first syllable: Insertion cannot apply if the vowel of the first syllable of the word is [u]. There is a constraint \*UU. The second holds with complex onsets if the onset cluster contains a liquid, with a constraint \*CLUV. These two restrictions account for all forms that do not undergo u-insertion.

(32) **The constraints for U-insertion**

	stem		intensified form
a.	*UU		
	[gumɔŋ]	‘amazed’	*[guumɔŋ] ‘very amazed’
	[susah]	‘sad’	*[suusah] ‘very sad’
b.	*CLUV		
	[mləŋɛʔ]	‘juicy, soft’	*[mluəŋɛʔ] ‘very juicy, soft’
	[kləmər]	‘slow & lazy’	*[kluəmər] ‘very slow & lazy’
c.	[mbaŋu]	‘becoming juicy’	[mbuaŋu] ‘becoming very juicy’

It can be seen in (32a) that the u-insertion in [gumɔŋ] is not allowed since it is inserted adjacent to an identical vowel. In (32b), u-insertion is disallowed since the first syllable has a complex onset containing a liquid. From the corpus data, initial clusters include [ml], [ɲl], [bl], [kr] and the application of the u-insertion is blocked for all of them. Interestingly it is not blocked with initial homorganic nasal-stop clusters, as shown in (32c). (This could be taken to bear on the structure of homorganic nasal stop clusters.)

**3.2.3 Vowel raising/tensing**

Next, we discuss vowel raising/tensing, which is conditioned in large part according to the height of the final vowel of the stem. Unlike vowel lengthening and u-insertion, which are

<sup>6</sup> Impressionistically, when the final coda is a bilabial nasal, the nasal consonant is lengthened instead of the vowel, [adəm], [adəm:] ‘cold’. This observation warrants fuller investigation.

largely unconstrained, the outcome of vowel raising/tensing is directly conditioned by vowel height and final syllable structure.

To consider the pattern of raising and tensing, we first need to consider the final syllable types.

**(33) The final syllable types of very common adjectives**

Underlying form	Surface Form	V#	VC
I: 57: 19%	i	11	
	ɪ		46
U: 55: 18%	u	13	
	ʊ		42
E: 30: 10%	e	5	
	ɛ		25
O: 36: 12%	o	7	
	ɔ		29
Ə: 59: 20%	ɨ		59
A: 63: 21%	a		44
	ʌ	19	
Total: 300		55: 18%	245: 82%

Overall final closed syllables (245 cases out of 300 or 82%) are much more common than open final syllables (55 cases or 18%). This is in line with Dudas' (1976) observation that final open syllables occur less frequently in Javanese. We see a relatively even distribution of different vowels in final syllables, though the mid vowels /E/ and /O/ are less common and as discussed above, there is no schwa in open final syllables.

We start our discussion with the high vowels.

## (34) The high vowels /I/ and /U/

Underlying form	Syllable type	Surface form	Intensifying form
/I/: 57: 19%	V#: 11 out of 57: 19%	i	i: 11 out of 11: 100%
	VC: 46 out of 57: 81%	ɪ	i: 46 out of 46: 100%
/U/: 55: 18%	V#: 13 out of 55: 24%	u	u: 13 out of 13: 100%
	VC: 42 out of 55: 76%	ʊ	u: 42 out of 42: 100%
Total: 112: 100%	V#: 24 out of 112: 21%		
	VC: 88 out of 112: 79%		

There are 112 out of 300 adjectives with syllable-final high vowels. It can be seen in (34) that the majority of them (79%) are in closed syllables. Underlying /I/ and /U/ have two surface forms: The vowels [ɪ, ʊ] appear in closed syllables, and [i, u] elsewhere. As observed in (34) and exemplified in (35) adjectives with word-final [i, u] do not undergo vowel change in the intensifying form. This could be seen as being disallowed or applying vacuously. On the other hand, all adjectives with word-final [ɪ, ʊ] in the closed syllables are tensed into vowel [i, u], [+high, +ATR].

## (35) Pattern of intensification of the high vowels

	Underlying	Surface	Intensified	Gloss
a.	/I/			
i.	[i] → [i] in open final syllables			
	/AsI/	[asli]	[asli]	‘original’
	/gəmi/	[gəmi]	[gəmi]	‘thrifty’
	/məri/	[məri]	[məri]	‘envious’
	/rUgi/	[rugi]	[rugi]	‘unprofitable’
ii.	[ɪ] → [i] in closed final syllables			
	/AlIm/	[alɪm]	[alim]	‘pious’
	/ApIʔ/	[apɪʔ]	[apimʔ]	‘good’
	/mbəliŋ/	[mbəliŋ]	[mbelim]	‘naughty’
	/ɲɲɪr/	[ɲɲɪr]	[ɲɲim]	‘garroulus’
b.	/U/			
i.	[u] → [u] in open final syllables			
	/bIrU/	[biru]	[biru]	‘blue’
	/lAjU/	[ləju]	[ləju]	‘withered’
	/ləsU/	[ləsu]	[ləsu]	‘tired’
	/lUʃU/	[luʃu]	[luʃu]	‘funny’
ii.	[ʊ] → [u] in closed final syllables			
	/ArUm/	[arʊm]	[arum]	‘fragrant’
	/bɪŋUŋ/	[bɪŋʊŋ]	[bɪŋum]	‘confused’
	/blAbUr/	[blabʊr]	[blabur]	‘hazy’
	/bUŋkUʔ/	[bʊŋkʊʔ]	[bʊŋkumʔ]	‘hunched’



We see a highly regular pattern for all relevant adjectives. As seen in (35), whereas the high vowels [i, u] cannot be changed further, the allophones [ɪ, ʊ] are tensed to [i, u], with the specifications [+high, +ATR], in violation of the surface generalization that vowels are [-ATR] in closed final syllables.

We now discuss the mid vowels /E/ and /O/.

(36) **The mid vowels /E/ and /O/**

Underlying form	Syllable type	Surface form	Intensifying form
/E/: 30	V#: 5 out of 30: 17%	e	i: 2 out of 5: 40% gəɖ <sup>h</sup> e luwe  e: 3 out of 5: 60% ɖjimpe kere rame
	VC: 25 out of 30: 83%	ɛ	i: 25 out of 25: 100%
/O/: 36	V#: 7 out of 36: 19%	o	u: 7 out of 7: 100%
	VC: 29 out of 36: 81%	ɔ	i: 1 out of 29: 4% kinclɔŋ  u: 28 out of 29: 96%
Total: 50 : 100%	V#: 12 out of 66: 18%		
	VC: 54 out of 66: 82%		

As seen in (36) and exemplified in (37a), the vowel /E/ has two surface forms, [e] and [ɛ]. The allophone [ɛ] occurs in closed syllables, while [e] occurs elsewhere. Adjectives with syllable-final [e] and [ɛ] are all raised into [i] in the intensified form except three adjectives, [ɖjimpe], [kere] and [rame], probably due to semantic reasons.<sup>7</sup> As shown in (37b), the vowel /o/ also has two surface forms, [o] and [ɔ]. With only one exception, both of the surface forms are raised to the high back vowel [u] in the intensified form.

<sup>7</sup> The words *kere* and *rame* already have intensified meaning: *kere* means ‘very poor’ and *rame* means ‘very noisy’. Thus it appears that these adjectives do not further intensify with raising/tensing.

(37) **Pattern of intensification of the mid vowels**

	Underlying	Surface	Intensified	Gloss
a.	/E/			
i.	[e] → [i] in open final syllables			
	/gƏd <sup>h</sup> E/	[gəd <sup>h</sup> e]	[gəd <sup>h</sup> i]	‘big’
	/lUwE/	[luwe]	[luwi]	‘hungry’
	/mlEŋsE/	[mlɛŋse]	[mlɛŋsi]	‘dislocated’
ii.	[ɛ] → [i] in closed final syllables			
	/AwEt/	[awɛt]	[awit]	‘long lasting’
	/mlƏŋɛʔ/	[mləŋɛʔ]	[mləŋiʔ]	‘mushy’
	/mlEŋʃEŋ/	[mlɛŋʃɛŋ]	[mlɛŋʃiŋ]	‘inaccurate’
	/ʃrEwEt/	[ʃrɛwɛt]	[ʃrɛwit]	‘talkative’
b.	/O/			
i.	[o] → [u] in open final syllables			
	/blEro/	[blɛro]	[blɛru]	‘glassy’
	/bOd <sup>h</sup> O/	[bod <sup>h</sup> o]	[bod <sup>h</sup> u]	‘stupid’
	/dʒƏrO/	[dʒɛro]	[dʒɛru]	‘deep’
	/kod <sup>h</sup> o/	[kod <sup>h</sup> o]	[kod <sup>h</sup> u]	‘hard-headed’
ii.	[ɔ] → [u] in closed final syllables			
	/AbOt/	[abɔt]	[abut]	‘heavy’
	/AdOh/	[adɔh]	[aduh]	‘far’
	/AlOn/	[alɔn]	[alun]	‘slow’
	/AsOr/	[asɔr]	[asur]	‘low’

While there are a few exceptions, again we see a very regular pattern with both raising and in relevant cases tensing applying, resulting in the feature specifications [+high, +ATR], in violation of the surface generalization that vowels are [-ATR] in closed final syllables.

Now we turn to the mid central vowel /Ə/. There are 59 adjectives with mid central vowels in the final syllable all in closed syllables and they all surface as [ə]. In the intensified form, [ə] remains central, raising and tensing to [ɪ] with the features [+high, +ATR].

(38) **The mid central vowel /Ə/**

Underlying form	Syllable type	Surface form	Intensifying form
Ə: 59 out of 300: 20%	VC: 59 out of 59: 100%	ə	ɪ: 59 out of 59: 100%

(39) **Pattern of intensification of the mid central vowel**

Underlying	Surface	Raising/Tensing	Gloss
/Ad <sup>h</sup> Əm/	[ad <sup>h</sup> əm]	[ad <sup>h</sup> ɪm]	‘cold’
/AjƏm/	[ajəm]	[ajɪm]	‘peaceful’
/kArƏp/	[karəp]	[karɪp]	‘willing’
/bAntƏr/	[bantər]	[bantɪr]	‘fast’

Thus with few exceptions mid vowels raise and tense to [+high, +ATR], maintaining their front/back specifications.

The final underlying vowel is the low vowel /A/. There are 63 out of 300 adjectives with syllable final /A/.

(40) **The low vowel /A/**

Underlying form	Syllable type	Surface form	Intensifying form
A: 63 out of 300: 21%	V#: 19 out of 63: 30%	ʌ	u: 19 out of 19: 100%
	VC: 44 out of a 63: 70%	a	i: 32 out of 45: 71%  NA: 2 out of 45: 4% edan krasan  u: 4 out of 45: 9% ena? kəpena? pena? dʒuəna?  i: 4 out of 45: 9% akas gijat iklas rəŋgaŋ  i ~ i: 2 out of 45: 4% ʃəd <sup>h</sup> a?, ʃənd <sup>h</sup> a?

The low central vowel /A/ has two surface forms, [a] and [ʌ]. All adjectives with syllable final [ʌ] undergo raising to [u] in the intensified form. This provides direct support for the analysis proposed in Section 2, that the allophone of /A/, which occurs in final open syllables is indeed [+back].

The intensification of forms with [a] in final closed syllables shows more variation. The majority, 32 out 45, are raised into [i] in the intensified form which suggest that [a] is [-back] and perhaps is unspecified for [front]. We take this pattern to be the dominant pattern, though note that there is more variation in this one case than with other vowels, with two forms not able to be further intensified with vowel raising/tensing (perhaps a semantic restriction); four intensified to vowel [i] and two intensified to either [i] or [i]. This variability might support

this vowel being specified only as [+low]. The consistency across the eight speakers also suggests that there might be some degree of lexicalization in these forms.

(41) **The pattern of intensification of the low vowel**

	Underlying	Surface	Intensified	Gloss
i.	[ʌ] → [u] in open final syllables			
	/d <sup>h</sup> Awʌ/	[d <sup>h</sup> ʌwʌ]	[d <sup>h</sup> ʌwu]	‘long’
	/gəɪʌ/	[gəɪʌ]	[gəɪu]	‘disappointed’
	/ləgʌ/	[ləgʌ]	[ləgu]	‘relieved’
	/lOmʌ/	[lOmʌ]	[lomu]	‘generous’
ii.	[a] → [i] in closed final syllables			
	/AZbAŋ/	[abaŋ]	[abiŋ]	‘red’
	/AkrAb/	[akrab]	[akrib]	‘intimate’
	/ArAŋ/	[araŋ]	[ariŋ]	‘rare’
	/ʃəd <sup>h</sup> aʔ/	[ʃəd <sup>h</sup> aʔ]	[ʃəd <sup>h</sup> iʔ]	‘close’

Thus the main pattern is similar to that seen with the mid vowels. Crucially, the outcome is based on the surface specification of the base form, accounting for the split of underlying /A/ intensified as [u] in some cases and [i] in others. In open syllables, [ʌ] a back vowel is raised to [u], while in closed syllables [a] is (usually) raised to [i].

**3.3. Patterns of multiple intensification**

As mentioned above in Section 1, there are multiple forms of intensification observed. For some adjectives all possible combinations of the three patterns of intensification are observed. As shown in (42), multiple patterns of intensification involving all possible combinations, indicating increasing degrees of intensity, are observed as illustrated for the adjectives [aŋar] and [abaŋ].

(42) **Multiple intensification in Javanese – All combinations**

a.	/AŋAr/	‘new’	i.	[aŋar]			
				[aŋir]	‘very new’		
				[aŋa:r]			
			ii.	[uana:r]	‘very, very new’		
				[uaŋir]			
				[aŋi:r]			
			iii.	[uani:r]	‘very, very, very new’		
b.	/AbAŋ/	‘red’	i.	[abaŋ]			
				[abiŋ]	‘very red’		
				[aba:ŋ]			
			ii.	[uaba:ŋ]	‘very, very red’		
				[uabiŋ]			
				[abi:ŋ]			
			iii.	[uabi:ŋ]	‘very, very, very red’		

While in other cases restrictions are observed as shown in (43).

## (43) Restrictions on multiple degrees of intensification

- a. Two types of intensification, one constraint, with multiple intensification  
 /mErI/ ‘jealous’ [mɛri]  
 i. [mɛri:] ‘very jealous’  
 [muɛri]  
 ii. [muɛri:] ‘very, very jealous’
- b. Two types of intensification, one constraint, with multiple intensification  
 /blAbUr/ ‘hazy’ [blabɔr]  
 i. [blabur] ‘hazy’  
 [blabɔ:r] ‘very hazy’  
 ii. [blabu:r] ‘very, very hazy’
- c. One type of intensification, two constraints, no multiple intensification  
 /lUgU/ ‘naïve’ [lugu]  
 i. [lugu:] ‘very naïve’

In (43a), the adjective [mɛri] cannot undergo vowel raising/tensing since the pattern applies vacuously when the word final vowels are either [i] or [u]. On the other hand, u-insertion fails to apply in (43b) since the onset of the first syllable of the adjective [blabɔr] is a liquid cluster. In (43c), only vowel lengthening can apply since u-insertion is blocked by the vowel [u] in the first syllable of the adjective [lugu] and the vowel raising/tensing is blocked or applies vacuously by the vowel [u] in the final syllable.

Thus we find that restrictions on multiple degrees of intensification are *phonological*, not *semantic*. In other words the observed restrictions on multiple intensification are just the sum of the restrictions seen for each of the three forms of intensification. These findings pose an interesting semantic and morphological issue regarding applications of multiple strategies of intensification. This may be no different from the iterative process seen in cases like English, *very*; *very, very*; *very, very, very*. This question, which warrants fuller consideration, is beyond the scope of this paper.

With this description of the patterns, we are now in a position to develop our analysis.

#### 4. An optimality theoretic analysis of phonological intensification in Javanese

In this section, we present an integrated analysis of an Optimality Theoretic account of phonological intensification of Javanese adjectives. Optimality Theory is chosen since it offers flexibility with violability of constraints and at the same time is more constrained than a rule-based theory in that it creates no intermediate derivational stages (Zoll 1998: 33).

##### 4.1 The forms of intensification

In the present analysis, we offer a unified approach of the three patterns of intensification, vowel lengthening, u-insertion, and vowel raising/tensing. We posit these three forms as alternative strategies which are determined by certain phonological conditions. Vowel lengthening and vowel raising/tensing are always aligned to the rightmost syllable, while u-insertion is always aligned word-initially.

Next, we posit that the forms are instances of floating features, in the form of  $\mu$  for vowel lengthening,  $\mu$ , [+high, +back] for u-insertion, and [+high, +ATR] for vowel raising/tensing. Note that Benua (1999) and Wolf (2008) already claim that the Elative Form or the vowel raising/tensing is a morpheme in the form of the floating features [+high, +ATR], but they do

not discuss the other forms of intensifying. We develop this insight with floating material for each of the three forms.

We base our claim on Zoll's (1998) definition of floating features. First, floating features are only sub-segments and not full segments. Second, the appearance of floating features on the surface depends on the association with the root node of a full segment in the base. Sub-segments lack a root node and cannot be realized unless they are able to associate with the prosodified structure. Based on Zoll (1998), the representation of Javanese morphemes can be described as follows.

(44) **The representation of Javanese floating features**

Floating Features:	vowel lengthening:	$\mu$ – ALIGN RIGHT
	u-insertion:	$\mu$ , [+high, +back] – ALIGN LEFT
	vowel raising/tensing:	[+high, +ATR] – ALIGN RIGHT

**4.2 Constraints of the floating features**

The docking of the floating features is regulated with a series of constraints within an OT account. In this subsection, we discuss the constraints and their rankings accounting for the realization of floating features in the surface form. We propose the constraints ALIGN LEFT/RIGHT, MAX FLT added to the constraints developed above in Section 2.2. The markedness constraints \*[+ATR], CLOSED FINAL, \*[+ATR], [-FRONT, -BACK], and \*[-ATR] still play a role, but are outranked by ALIGN LEFT/RIGHT, MAX FLT, which account for the realization of intensification.

Low-ranking, but nevertheless important, is the general markedness constraint that prohibits [-ATR], since this feature specification is generally marked in Javanese as seen by its limited distribution.

(45) **\*[-ATR]**

[-ATR] is prohibited

Next is the markedness constraint involving the final closed syllables where the feature [-ATR] plays a role. As discussed in Section 2, we use a constraint \*[+ATR], CLOSED FINAL similar to Benua's (1999) constraint, \*ATR-CLOSED.

(46) **Closed syllable laxing**

\*[+ATR], FINAL CLOSED

[+ATR] vowels in final closed syllables are prohibited

Finally, we have a markedness constraint concerning co-occurrence of [+ATR] and central vowels.

(47) **ATR restrictions on central vowels**

\*[+ATR], [-FRONT, -BACK]

Central vowels are not specified as [+ATR]

The most important constraint in realizing the three forms of intensification is MAX FLT proposed by Wolf (2008) which outranks the markedness constraints and ensures the floating structure of the three forms of intensification are realized.

(48) **MAX FLT**

For all tokens  $\alpha$  that are floating input,  $\alpha$  has a correspondent in the output.  
(Wolf 2008)


In addition, it is also important to include the alignment constraints, ALIGN RIGHT or ALIGN LEFT, based on the alignment of the floating features.

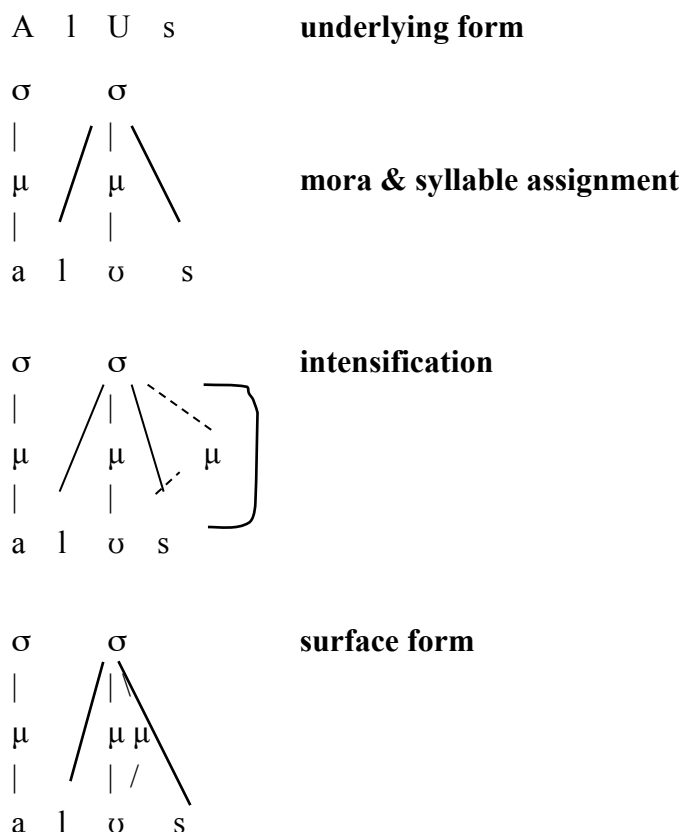
As seen above in Section 2, the general markedness constraint \*[-ATR] is outranked by a more specific markedness constraints, \*[+ATR], CLOSED FINAL and \*[ATR], [-FRONT, -BACK], to yield a surface form which obeys Javanese phonotactics. These constraints are all outranked by MAX FLT, which ensures the realization of intensification in the surface form, and ALIGN RIGHT or ALIGN RIGHT which determine which edge of the word the floating structure is realized on.

**4.3 Vowel lengthening**

As illustrated above in (30), vowel lengthening is aligned to the word final vowel. The form for vowel lengthening is a mora,  $\mu$ . It is understood that the presence of a floating mora must be attached to a root node to be realized. The floating structure then scans a possible host, a vowel at the right edge of the adjectives, as prescribed by the right alignment constraint of the form. The proposed constraint ranking ensures the realization of vowel lengthening: ALIGN RIGHT, MAX FLT  $\mu$  >> \*[+ATR], FINAL CLOSED >> \*[-ATR] as shown in (49). This results in the structures sketched out in (50).

(49) **Constraint interaction for vowel lengthening**

/AIUs/ $\mu$	ALIGN RIGHT	MAX FLT $\mu$	*[+ATR], FINAL CLOSED	*[-ATR]
[alɔs]	*	*		
[alus]	*	*	*	
 [alɔ:s]				*
[a:lɔs]	*			*

(50) **Vowel lengthening phonological structure**<sup>8</sup>

Since there is no constraint on vowel length in Javanese, this form of intensification is never blocked.

#### 4.4 U-insertion


Now we turn to the second form of Javanese adjective intensification, u-insertion. As illustrated above in (32), the form is aligned at the left edge of the word, before the first vowel. It is blocked when the first vowel of the syllable is [u]. The floating structure for this form is also a mora, associated with the features [+high, +back]. This structure is not directly connected to a root node and docks to a potential vowel host, while respecting left alignment.

U-insertion results from the interaction of a series of constraints as follows: ALIGN LEFT, MAX FLT μ, [+HIGH, +BACK] >> \*[+ATR], FINAL CLOSED >> \*[-ATR].

<sup>8</sup> We present these illustrations in stages for clarity, but do not mean to imply these are step-wise derivations.



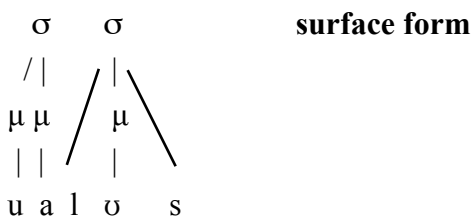
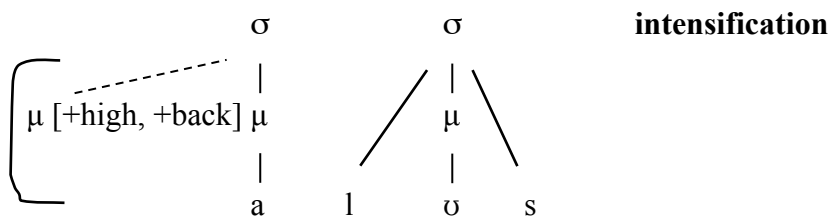
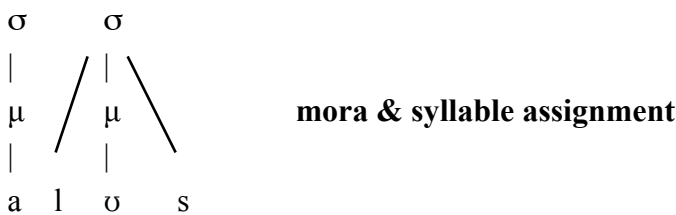
(51) **Constraint interaction for U-insertion**

/AIUs/ μ, [+high, +back]	ALIGN LEFT	MAX FLT μ, [+HIGH, +BACK]	*[+ATR], FINAL CLOSED	*[-ATR]
[alos]	*	*	*	
 [ualos]				
[alous]	*		*	*
[alou:s]	*			**

We assume that the form [uu] is blocked by the OCP, thus forms such as \*[guumɔn] ‘amazed’ do not occur.

(52) **U-Insertion phonological structure**

A l U s                      **underlying form**




**4.5 Vowel raising/tensing**

As illustrated above in (35) and (37), vowel raising/tensing targets the rightmost vowel. Since the form has a right alignment constraint, the floating features will dock at a potential vowel at the right edge of the adjective.

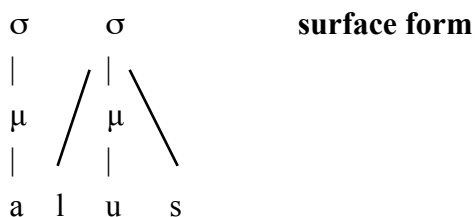
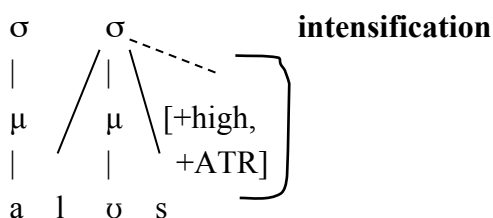
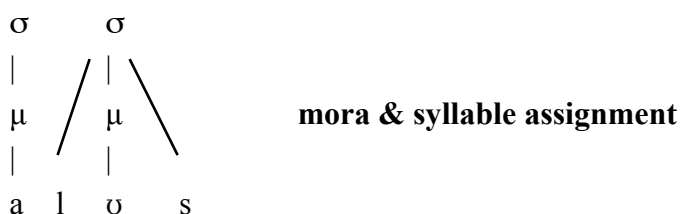
The observed vowel raising/tensing results from the following constraints: ALIGN RIGHT, MAX FLT [+HIGH, +ATR] >> \*[+ATR], FINAL CLOSED >> \*[-ATR]. This general schema accounts for the regular outcomes of vowel raising/tensing for high and mid vowels detailed above in Section 3.2.3. The few exceptions noted above must be listed in the lexicon as such.

(53) **Constraint interaction for vowel raising/tensing**

/AIUs/ [+high, +ATR]	ALIGN RIGHT	MAX FLT [+HIGH, +ATR]	*[+ATR], FINAL CLOSED	*[-ATR]
 [alus]			*	
[alos]	*	*		
[ilos]	*			


(54) **Vowel raising/tensing phonological structure**

A l U s                      **underlying form**



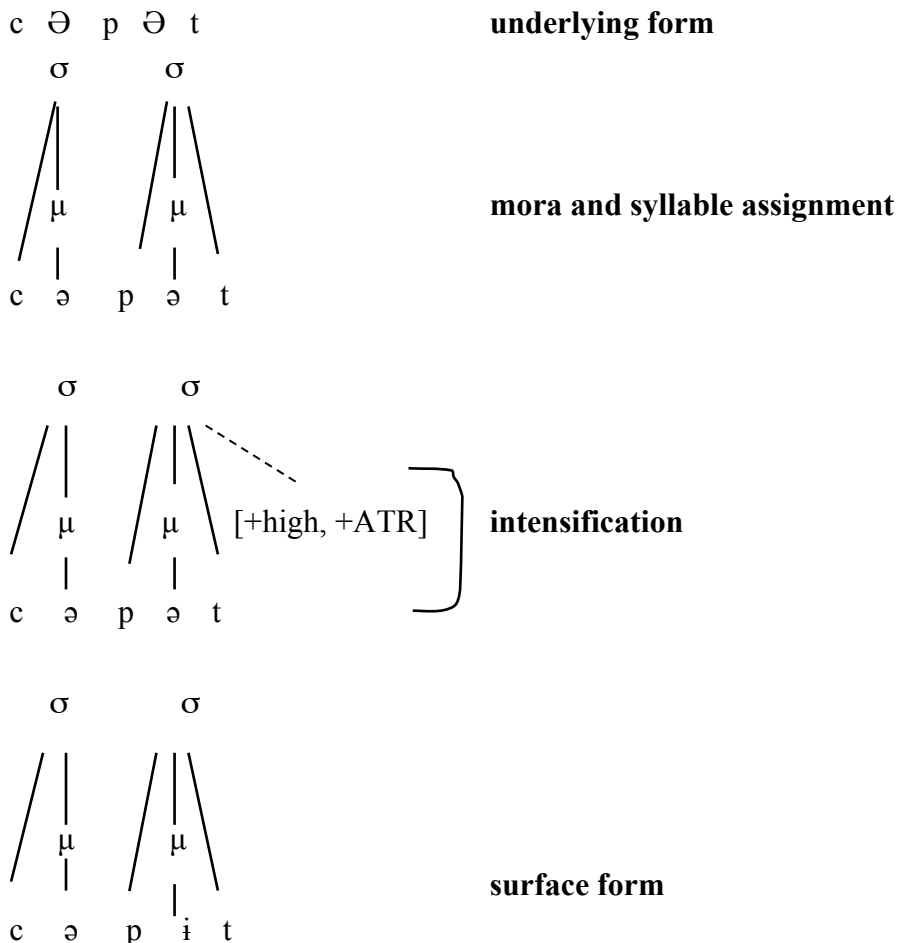
The same general constraint ranking applies to the central vowels / $\text{\textcircled{e}}$ / and /A/ as well, with ALIGN and MAX FLT outranking \*[+ATR], [-FRONT, -BACK] (motivated above in 2.2). This results in [i] for / $\text{\textcircled{e}}$ / and either [i] or [u] for /A/ depending on the surface variant of /A/. We illustrate this for / $\text{\textcircled{e}}$ / with the constraint ranking in (55) and resulting structure in (56).

(55) Constraint interaction for vowel raising/tensing of /ə/

/cəpət/ [+high, +ATR]	ALIGN RIGHT	MAX FLT [+HIGH, +ATR]	*[+ATR], FINAL CLOSED	*[+ATR], [-FRONT, -BACK]	*[-ATR]
[cəpət]	*	*			*
 [cəpit]			*		
[cipət]	*				*

As a result of intensification, the vowel becomes both [+high, +ATR] caused by the floating features docking at the rightmost syllable.

(56) Vowel raising/tensing for /ə/ phonological structure



4.6 Summary

In each of the three cases of the phonological intensification, MAX FLT plays a crucial role in the analysis, overriding the markedness constraints and forcing [+ATR] specifications in closed syllables. The intuition is that the realization of the morphological information

outranks the phonological constraints. (Another approach to this would be following Kurisu 2001 REALIZE MORPHEME.)

As discussed above in Section 3.3, the multiple patterns of intensification are constrained only by the phonological constraints on both u-insertion and vowel raising/tensing. Our analysis can be extended by noting that all of the three forms can be simultaneously realized, since all relevant constraints can be simultaneously satisfied. We leave unresolved the technical question of how the semantics of multiple intensification work.

## 5. Conclusions

In this paper, we provide a new account of phonological intensification of Javanese adjectives. First we provide a richer empirical basis, looking at the 1303 adjectives found in Robson & Wibisono's Javanese English dictionary, focusing on the patterns found in the 300 most common adjectives. Based on judgments from eight speakers, we found the patterns to be remarkably consistent, suggesting the main factors constraining these patterns are phonological. We present an integrated analysis of the three phonological patterns of intensification in Javanese, vowel lengthening, u-insertion, and vowel raising/tensing by treating them as three possible forms of intensification. The forms are instances of floating features and structure:  $\mu$  for vowel lengthening,  $\mu$ , [+high, +back] for u-insertion, and [+high, +ATR] for vowel raising/tensing. The realization of these forms is based on their alignment. Vowel lengthening and vowel raising/tensing are aligned at the rightmost edge of the word, while u-insertion is aligned at the leftmost edge.

The paper also proposes a solution for the problem of the vowels / $\Theta$ / and /A/. This problem is solved by a reanalysis of the vowel features and a new surface vowel inventory of 12 vowels, which include two new surface vowels, the vowel [i] and the vowel [ $\Lambda$ ]. Vowel raising/tensing intensification of / $\Theta$ / results in [+high, +ATR], [i]; while the form of vowel /A/ in open syllables is argued to be [+ATR, +back], [ $\Lambda$ ].

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