The Nature and Underlying Representations of Long Vowels and Diphthongs in Fataluku

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Fataluku is an underdocumented Papuan language spoken by approximately 37,000 individuals in East Timor, a nation in island Southeast Asia. After providing some background information on the phonology of Fataluku, this paper discusses the presence and phonological representations of surface long vowels and diphthongs. The evidence shows that vowel length is indeed contrastive, but both long vowels and diphthongs are represented underlyingly as sequences of vowels rather than as true unit phonemes.

1. INTRODUCTION.1 Fataluku ([fataluku], ISO 639-3 ddg) is a Papuan (that is, non-Austronesian) language with approximately 37,000 speakers on the eastern end of East Timor, a country in island Southeast Asia (Lewis, Simons, and Fennig 2013). Previous reports have indicated significant dialectal variation (van Engelenhoven 2009; Lewis, Simons, and Fennig 2013), although the nature and extent of this variation is still largely unknown. Fataluku is a member of the Timor-Alor-Pantar family of languages, which includes approximately thirty languages spoken on Timor and nearby islands (Schapper, Huber, and van Engelenhoven 2012, to appear; Holton et al. 2012; Schapper and Huber 2012). While some have proposed that the Timor-Alor-Pantar languages are related to Papuan languages spoken on the Bird’s Head Peninsula of New Guinea (see Hull 2004; Ross 2005; and the literature review in Schapper, Huber, and van Engelenhoven 2012), more recent research has cast doubt on this connection (see Robinson and Holton 2012; Schapper and Huber 2012; Holton et al. 2012).

Previous work on Fataluku includes a dissertation written in French (Campagnolo 1973), a sketch of the morphosyntax (Hull 2005), and a few articles investigating various topics in the language (van Engelenhoven 2009, 2010 on the morphosyntax; Stoel 2008 on the suprasegmental phonology). One interesting aspect of the phonology of Fataluku concerns long vowels and diphthongs: a few analyses have been proposed, but no consensus has yet been reached. A crucial question for understanding Fataluku phonology is:

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does Fataluku have contrastive vowel length? A related question is: how are surface long vowels and diphthongs represented underlyingly?

The present study seeks to clarify the status of long vowels and diphthongs in Fataluku based on data from elicitation and recordings of wordlists, sentence lists, and monologues from native speakers. The data were analyzed both auditorily and using the phonetic analysis software Praat (Boersma and Weenink 2012). This paper focuses on the variety of Fataluku spoken by young adults in the vicinity of the towns of Lospalos and Com, two of the main urban centers in the Fataluku-speaking region, corresponding roughly to the “Central dialect” in the classification given by van Engelenhoven (2010:185). Section 2 gives some brief background information on the phoneme inventory and phonotactics of Fataluku, because of the scarcity of documentation on the language. Section 3 gives evidence that vowel length is contrastive, and, thus, must be represented underlyingly. Section 4 presents phonological evidence showing that surface long vowels and surface diphthongs are represented underlyingly as sequences of identical and nonidentical vowels, respectively, rather than as true unit phonemes. The paper will conclude with a summary of the results and some directions for future research.

2. PHONEME INVENTORY AND PHONOTACTICS. The consonant and vowel phonemes of Fataluku are given in tables 1 and 2.

| TABLE 1. THE CONSONANT PHONEMES OF FATALUKU |
|---------------------------------------------|
| BILABIAL | LABIODENTAL | DENTAL | PALATAL | VELAR | GLOTTAL |
|-------------|-------------|--------|---------|-------|---------|
| VOICELESS STOPS | p | t | k | ? |
| VOICED STOPS | (b) | (d) | (g) |
| VOICELESS AFFRICATE | ts |
| VOICELESS FRICATIVES | f | s | h |
| VOICED FRICATIVES | v | z |
| NASALS | m | n |
| TAP/TRILL | r |
| LATERAL | l |
| GLIDE | j |

| TABLE 2. THE VOWEL PHONEMES OF FATALUKU |
|-----------------------------------------|
| FRONT UNROUNDED | CENTRAL UNROUNDED | BACK ROUNDED |
|-----------------|-------------------|-------------|
| HIGH            | i                 | u           |
| MID             | e                 | o           |
| LOW             | a                 |             |

2.1 PHONETIC REALIZATIONS. Tables 1 and 2 show my current analysis of the phonemes of Fataluku. A few of the phonemes are worthy of additional comment. Fataluku has only one native series of stops, which are phonemically voiceless and usually realized phonetically with a small amount of aspiration. Voiced stops are only attested...
in loan words, and are, thus, included in parentheses in the phoneme chart above. While there are no native voiced stops, Fataluku does have the voiced fricatives /v/ and /z/ in its native vocabulary. The labiodental fricative /v/ is realized most often as [v], but [v], [β], and [w] are all in free variation. The dental fricative /z/ is realized most often as [z], but it can also be realized as the affricate [ʣ] word-initially.

There is some interesting variation in the realization of /z/ and /j/. Speakers are conscious of dialectal and individual variation between [z] and [j] in some words, as with [taza] ~ [taja] ‘sleep’ or [aza] ~ [aja] ‘rain’, for instance. The main consultants for this project distinguish phonemically between /j/ and /z/, with near minimal pairs such as [paja] ‘liquid’ and [aza] ‘rain’. For this reason, the two are analyzed as separate phonemes in the chart above, although it is possible that this distinction has been neutralized for some speakers. More research is needed on the variation.

2.2 SYLLABLE STRUCTURE. In native Fataluku vocabulary, the basic syllable structure is (C)V(V)(C) (examples shown in table 3). Fataluku favors open syllables, and a substantial percentage of syllables in the language are of the shape V or CV. In general, Fataluku allows only the final syllable of a word to be closed; consonant clusters are very rare, except in loanwords. There are a few marginal examples of consonant clusters in native vocabulary, but they can be understood as resulting from recent or currently productive morphological changes. For instance, the compound /naal-paal/ ‘parents’ has a medial cluster, but it is quite clearly derived from the words /naal/ ‘mother’ and /paal/ ‘father’. Another example is /an-t/ ‘I (emphatic)’, a contraction from the pronoun /ana/ ‘I’ and the subordinating morpheme /t/.

Although others (Campagnolo 1973, for example) have attributed stress to Fataluku, at this point I do not find evidence to support the presence of stress in the variety of Fataluku studied here. It seems preferable to treat the phenomena that previous researchers have analyzed as stress or tone as resulting from intonation. However, Fataluku prosody is still poorly understood, and it is the subject of ongoing investigation.

| TABLE 3. POSSIBLE SYLLABLE TYPES IN FATALUKU |
|---------------------------------------------|
| V                          | a             | ‘1SG.ACC’ |
| CV’                         | maka          | ‘kick’    |
| VC                          | em            | valency marker |
| CVC                         | tapil         | ‘almost’  |
| VV                          | a:            | ‘2SG.NOM’ |
| CVV                         | lai           | ‘cloth’   |
| VVC                         | ait           | ‘maybe’   |
| CVVC                        | laik          | ‘areca’   |

† I am not aware of any content words in Fataluku that consist of a single syllable with a short vowel. I propose that there is a minimum word constraint that requires content words to contain at least two moras.

3. The symbol /v/ was chosen to represent this phoneme because it is most commonly realized as [v]. Labeling this phoneme as a labiovelar approximant /w/ would also be a reasonable alternative.
4. Surface long vowels and surface diphthongs are here treated as underlying sequences of vowels, an analysis substantiated in section 4.
2.3 LIMITATIONS ON CONSONANT DISTRIBUTION. One notable characteristic of the phonotactics of Fataluku concerns the occurrence of consonants word-finally. In the present sample of 1,200 words, most consonants are widely attested in word-final position, but several phonemes are rare or unattested word-finally. The consonants /ʦ/, /p/, /m/, and /f/ are each attested in only one or two marginal examples, most of which have lost a final vowel (for example, /iheʦ/ ‘Tuesday’, from /i/ + /ets-e/ ‘two’, /nop/ < /nop-e/ ‘tomorrow’, /em/ < /em-e/ ‘take’, /laf/ < /lafai/ ‘big’), while /ʔ/, /z/, /j/, and /w/ are unattested word-finally. While it is possible that these gaps are an artifact of the particular sample available, it is more likely that the absence of these particular consonants in word-final position is the result of specific changes that have taken place over the history of the language. Since Schapper, Huber, and van Engelenhoven (to appear) do not give examples of word-final *p, *b, *d, *m, or *w (which have reflexes in other positions in Fataluku as /f/, /p/, /ʦ/, /m/, and /v/, respectively) in their reconstruction of Proto–Timor-Alor-Pantar, it seems likely that there is a historical explanation for the skewed distribution of these consonants in Fataluku. Explaining these data is not crucial to the point at hand, although it does present an interesting direction for future research.

3. VOWEL LENGTH

3.1 BACKGROUND. Several authors have mentioned vowel length in Fataluku, but they have often disagreed with one another. Van Engelenhoven (2009:334, 2010) reports that there are examples of contrastive vowel length in the variety spoken around the town of Loré (the “South” dialect), and that “long vowels … are either absent or obsolete in the other dialects.” Hull (2005:1–5) mentions “long vowels” in the variety spoken in Lospalos (the “Central” dialect), although he does not go into detail in his analysis. On the other hand, other authors who have analyzed the South dialect have claimed that vowel length is predictable from the suprasegmental environment. Campagnolo (1973) analyzes the differences in vowel length as the result of a phonemic “long accent,” which raises the pitch and increases the duration of the vowel it is attached to. Stoel (2008:75) revises Campagnolo’s analysis, replacing the concept of “accent” with that of “tone,” and making some other modifications, while nevertheless agreeing that vowel length is predictable.

3.2 SURFACE LONG VOWELS IN THE LOSPALOS DIALECT. In the variety studied here, each of the five vowel qualities has a long counterpart, as shown in the examples in (1). In the present sample, the surface long vowels occur much less frequently than their short counterparts. The vowel [aː] is the most common of the long vowels, followed by the mid vowels [eː] and [oː], which are somewhat less common. The long high vowels [iː] and [uː] are even less frequent, and there are only a few examples of each. Long vowels are most frequent in the penultimate syllable of disyllabic words, but they can also occur in other positions.5

5. All examples are in broad phonetic transcription, unless otherwise stated. All morphemes are glossed, except for the verbalizing suffix -e (-ʔe after a vowel), which occurs on the vast majority of verbs and adjectival verbs (including numbers). This suffix is indicated with a hyphen but is not glossed, in order to enhance readability.
LONG VOWELS AND DIPHTHONGS IN FATALUKU

(1) a. [i]     [iː]  
  tsila ‘frog’    pi: ‘palm nut’  
  pipi ‘goat’    hiːɾ-e ‘to wait’  
  tsiʔiɾ-e ‘to be heavy’  hiːɾu ‘sword’

b. [e]     [eː]  
  tsele ‘corn’  le: ‘house’  
  vele ‘skin’  neːɾ-e ‘to be flat’  
  tsetsen ‘pandanus fruit’  keːl-e ‘to laugh’

c. [a]     [aː]  
  valał-e ‘to be fast’  tsa:l ‘grandparent’  
  ukani ‘one’  aːtsan-e ‘to be enough’  
  ale ‘rice’  vaːl-e ‘to give birth’  
  rata ‘old’  aːːmir-e ‘on-sit’

d. [o]     [oː]  
  tomok-e ‘to be soft’  oːp ‘ashes’  
  oʔos-e ‘to steal’  tsoː-ne ‘far-located’  
  sorot ‘book, paper’  hoːʔe ‘burn’  
  olo ‘bird’  loːhaj ‘to cut’

e. [u]     [uː]  
  ula ‘about, maybe’  huːla ‘spoon’  
  upu ‘back’  suːk-e ‘to duck’  
  luku ‘to speak’  nuːtsets-e ‘to wash’

3.3 EVIDENCE THAT VOWEL LENGTH IS PHONEMIC. The strongest evidence that vowel length is contrastive comes from the presence of several minimal and near-minimal pairs. Because long vowels occur less frequently than short vowels, the number of minimal pairs is somewhat limited. However, the pairs of words in (2) and (3)—minimal pairs in (2) and near-minimal pairs in (3)—clearly indicate the contrast in vowel length.

(2) Short             Long
  ner-e ‘to follow’    neːɾ-e ‘to be flat’  
  a 1SG.ACC’    a: ‘2SG.NOM’  
  atsan-e ‘to be mature (of plants)’  aːtsan-e ‘to be enough’

(3) Short             Long
  ula ‘maybe, about’  huːla ‘spoon’  
  tsele ‘corn’  keːl-e ‘to laugh’  
  sun-e ‘to blow (as of the wind)’  suːk-e ‘to duck’  
  ale ‘rice’  vaːl-e ‘to give birth’

Further confirmation that vowel length is contrastive is that, when asked, speakers are able to identify the words in minimal pairs for vowel length as sounding different from each other, as opposed to true homophones, such as [vaɾi] ‘always’ and [vaɾi] ‘nest’, which sound the same. Speakers also have trouble recognizing words if they are pronounced with the incorrect vowel length. There have even been instances in which a speaker has explicitly stated (to paraphrase), “[a:kina] is a word that means ‘firm’, but [akina] is not a word. If you say [akina], I will not understand what you mean.” Thus, evi-
dence not only from the structural facts of the language, but also from speakers’ perception and metalinguistic awareness, supports the conclusion that vowel length is not predictable in this variety of Fataluku.

3.4 AN ALTERNATIVE ANALYSIS. As noted above, it has been proposed that vowel length can be predicted in at least some dialects of Fataluku from suprasegmental features. The strongest proposal in this regard is that of Stoel (2008:75), who argues that vowel length in the Loré dialect is predictable based on “tone.” In his analysis, the contrast in vowel length between pairs such as [lo:re] ‘leave’ and [lore] ‘sow’ is derived from an underlying difference in tone through the application of several rules and constraints.

The core of Stoel’s analysis is that every content word in Fataluku has a high tone associated with either the first or the second syllable (indicated by Stoel with a superscripted H following the syllable). He analyzes the word [lo:Hre] ‘leave’ as having a high tone on the first syllable underlingly, /lo:iHre/, while the word [loHre] ‘sow’ has a high tone on the second syllable, /loreH/. Constraints on foot shapes allow feet of the shape (σ,σ), (σ,σ[H]) or (σ[H]), but not *(σ[H],σ). For this reason, a word that has a high tone on the first syllable, like /lo:Hre/ ‘leave’, will be footed as /(lo:H)re/, while a word with a high tone on the second syllable is footed as /(loreH)/. He posits a rule that lengthens the vowel in a syllable if it is the only syllable in the word that is footed. Thus (lo:H)re ‘leave’ becomes (lo:iH)re, but (loreH) does not change. This rule accounts for the contrast in vowel length. Additionally, there is one final rule that causes a final high tone to move to the penultimate syllable, yielding the surface forms [lo:iHre] ‘leave’ and [loHre] ‘sow’. Thus, by Stoel’s analysis, the surface difference in vowel length between the words is completely predictable based on the underlying association of tone, but the tonal contrast itself is neutralized, as shown in table 4.

Stoel’s analysis is an intriguing possibility, but there are several important differences between the dialect Stoel describes and dialect studied here. There appear to be lexical differences between the dialects; a Lospalos speaker did not recognize either the word [lo:re] ‘leave’ or [lore] ‘sow’. Also, preliminary research has indicated that word-level prosody is predictable in the variety of Fataluku examined here. However, the crucial difference between the two dialects concerns the distribution of surface long vowels. In the dialect Stoel analyzes, long vowels can only occur in monosyllabic words or the first syllable of disyllabic words, and his analysis only predicts long vowels in these positions. However, in the variety of Fataluku I describe here, long vowels can occur in various

| TABLE 4. A SAMPLE DERIVATION ILLUSTRATING STOEL’S (2008) ANALYSIS |
|---------------------------------------------------------------|
| **UR** | /lo:iHre/ ‘leave’ | /loreH/ ‘sow’ |
| Footing | (lo:iH)re | (loreH) |
| Lengthening | (lo:iH)re | — |
| Tone move | — | (lo:Hre) |
| SR | [lo:iHre] | [lo:Hre] |
positions in words of one, two, three, or even four syllables, as illustrated by the words in (4). Stoel’s analysis does not account for these data.6

(4) a. **One-syllable words**  
   tsi:  ‘thunderstorm’  
   le:  ‘house’  
   lo:  ‘cuscus sp.’  
   tsa:l  ‘grandparent’  
   la:n  ‘friend’

b. **Two-syllable words**  
   huma:r  ‘soul’  
   tso:-ne  ‘far-located’  
   su:k-e  ‘to duck’  
   fa:t-e  ‘four’  
   hu:la  ‘spoon’

c. **Three-syllable words**  
   a:kina  ‘to be firm’  
   ne:nukas  ‘plant sp.’  
   a:tsan-e  ‘to be enough’  
   hu:leven  ‘young’  
   a:heʔe  ‘to be stuck’  
   fu:leh-e  ‘to return’  
   maʔut:u-l-e  ‘to be lazy’  
   tso:n-ana  ‘the farthest one’ (lit. far-nominalize)

d. **Four-syllable words**  
   a:tan-ana  ‘question’ (lit. ask-nominalize)  
   aʔa-na:t-e  ‘replace’ (lit. at-stand)

### 3.5 DISCUSSION.

To sum up, the variety of Fataluku under investigation here has a vowel-length contrast that is not predictable either from the segmental or the suprasegmental environment, and, thus, it must be represented underlingly. Evidence for the contrast between long and short vowels on the surface comes from speaker metalinguistic awareness, speaker phoneme perception, and a number of minimal and near-minimal pairs. The present results, thus, support Hull’s (2005) report—which mentions that Lospalos Fataluku has long vowels—providing evidence to support this analysis.

It is interesting to compare these results with the proposition presented by van Engelenhoven (2009:334), who claims that vowel length is “absent or obsolete” in all dialects except Loré. While it is not entirely clear what van Engelenhoven means here by “obsolete,” it appears to suggest the idea of a contrast that is becoming more restricted in its distribution. Vowel length does have a relatively low functional load, in the sense that only a few lexical items are distinguished solely by vowel length. There are also some instances in which speakers have trouble stating whether a particular vowel in a word is long or short. It is possible that the vowel length contrast was once more widespread in the language, and

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6. These data cannot be explained by claiming that Stoel’s analysis applies to morphemes, rather than words. Although this analysis would correctly predict the vowel length of certain forms like tso:-nana, it would also incorrectly predict that no monosyllabic morphemes could contain short vowels (cf. ner-e ‘follow’, heʔe ‘be scarce’, pit-e ‘shine’, sun-e ‘blow’, etc.).
that the contrast is beginning to be neutralized, as implied by van Engelenhoven. Such an
analysis might also be able to explain the disagreement among researchers.

However, an alternative is that vowel length is not undergoing change, but is simply
less salient for speakers—as well as researchers—than other segmental contrasts because
of its low functional load. The history and distribution of vowel length is an important
direction for future research. A systematic investigation of vowel length in each of the
various dialects of Fataluku would be very helpful in order to clarify its distribution in the
Fataluku-speaking area. It would also be helpful to do a controlled comparison of
younger speakers and older speakers in this regard. If vowel length were in fact being
lost, we would expect older speakers to be more consistent in their use of vowel length,
especially for the particular lexical items in which younger speakers are not confident.

4. THE UNDERLYING REPRESENTATIONS OF LONG VOWELS AND
Diphthongs

4.1 POSSIBLE REPRESENTATIONS. While there are still some lingering
questions about vowel length, it is clear that it must be represented underlyingly syn-
chronically in some fashion. This raises the question of how exactly it is represented
underlyingly, as there are a number of possibilities. A related question is how diphthongs
are represented underlyingly. Fataluku has six diphthongs that fall in sonority: [ei], [ai],
[oi], [eu], [au], and [ou]. As with long vowels, the best underlying representation for
diphthongs is not immediately clear.

In an article analyzing the underlying representation of surface diphthongs in Hawai-
ian, Rehg (2007:120) writes that there are in fact four possible sources of a surface falling
diphthong. These are as follows: “(1) /V/, an underlying unit phoneme that involves a
gliding articulation from the position of one vowel to that of another; (2) /VV/, an under-
lying sequence of two non-identical vowels, in which the second vowel is less sonorant
than the first; (3) /VG/, an underlying sequence of a vowel followed by a glide; or (4) /V,
a vowel subject to one or more rules of diphthongization.” The possible analyses of long
vowels are parallel to the possible analyses of diphthongs, as a long vowel can be repre-
sented as: /Vː/, an underlying unit phoneme; /VV/, an underlying sequence of two identi-
cal vowels; or /V/, a vowel lengthened by phonological rule.

Rehg (2007:120) explains that only surface diphthongs of source (1), in which each is
represented as a single phoneme underlyingly, are “true diphthongs,” while those from
other sources are “apparent diphthongs.” In the same way, we shall consider long vowels
that are underlying unit phonemes, represented as /Vː/, to be true long vowels, while
those from other sources are apparent long vowels.

Rehg states that the analysis of long vowels and diphthongs as underlying sequences
of vowels—identical vowels in the case of long vowels and nonidentical vowels in the
case of diphthongs—is the simplest analysis, and that this should be the default analysis in
a particular language in the absence of evidence to the contrary. This is the analysis pro-
posed by Campagnolo (1973) for Fataluku diphthongs. Hull (2005:5), on the other hand,
claims that Fataluku has “true diphthongs and not simply vocalic sequences as in other Timorese languages.” The discussion below will examine the evidence for each of the possible analyses of long vowels and diphthongs in turn, demonstrating that both surface long vowels and surface diphthongs are represented as sequences of vowels in Fataluku.8

4.2 EVIDENCE AGAINST THE SINGLE VOWEL ANALYSIS. Of the various possibilities, the easiest to rule out is the analysis of vowels and diphthongs as single vowels that are lengthened or diphthongized. As was shown above, analyses that attempt to predict the presence of long vowels by a rule that lengthens short vowels are not able to account for their distribution in Lospalos Fataluku. This type of analysis does not adequately explain the distribution of diphthongs either. There are at least six phonetic diphthongs ([ei̯], [ai̯], [oi̯], [eu̯], [au̯], and [ou̯]) that can occur in the same environments as short and long monophthongs. There is no apparent way of predicting these diphthongs as allophones of the five attested monophthongs, as shown by the following minimal and near-minimal pairs.9

(5) a. [e(ː)] kav-e ‘to marry’ lavei ‘crocodile’
    le: ‘house’ fei̯ ‘pretty’

b. [e(ː)] ner-e ‘to follow’ neur-e ‘to chase’
    ner-e ‘to be flat’ neur-e ‘to chase’

c. [o(ː)] or-e ‘to quarrel’ kör-e ‘to stir’

d. [o(ː)] pok-e ‘to punch’ pōk-e ‘to throw at’
    hok ‘mud’ mōk ‘cloud’
    tso:-ne ‘far-located’ kōn-e ‘to be dark’

4.3 EVIDENCE AGAINST THE VOWEL-GLIDE ANALYSIS. There are several pieces of evidence that show that the vowel-glide analysis is also not correct for Fataluku. The first piece of evidence is based on a test suggested by Rehg (2007) for Hawaiian. Since it is typically recognized that Hawaiian has only open syllables, it would be unmotivated to adopt an analysis in which glides form syllable codas. While Fataluku syllable structure is less restricted than Hawaiian, a similar argument applies.

As discussed above, two-consonant sequences are very rare in native Fataluku words, with only a few possible exceptions across morpheme boundaries. However, diphthongs frequently precede consonants within native morphemes, for instance [majs-e]/[majs-e] ‘to be straight’, [kaːj-l-e]/[kaːj-l-e] ‘to be bent’, and [aːsjeːl-e]/[aːsjeːl-e] ‘to

8. This is not to say that all surface long vowels and diphthongs are necessarily derived from the same source, but rather, that this is the primary source. As shown below, surface long vowels and diphthongs can also be derived from a sequence of a vowel followed by a glottal stop and another vowel /ʔ/.

9. It would be theoretically possible to propose six abstract vowel qualities, which are diphthongized in all environments. This “abstract vowel” analysis is essentially a more abstract version of the unit phoneme analysis, but without support for this added abstraction it is not to be preferred.
rub, scour’. Even beyond this, there are monomorphemic words that have a diphthong directly before a final consonant, for instance *[ajt]/*[ajt] ‘maybe’, *[lajk]/*[lajk] ‘areca’, and *[mok]/*[mowk] ‘cloud’. Analyzing diphthongs with the vowel-glide analysis would mean allowing consonant clusters and complex codas within a morpheme in native vocabulary. While this does not mean that the vowel-glide analysis is necessarily impossible, such an analysis is not to be preferred, as it requires a revision of the phonotactics that has no other independent motivation.

Another piece of evidence comes from the variation found in the realization of the glide /j/ in Fataluku. As discussed above, in many words that have /j/, this /j/ can be replaced by [z]. For instance, the word for ‘necklace’ is pronounced [paja] by some, but can also be pronounced as [paza]. However, attempting to replace the second element of a surface diphthong with [z] results in unacceptable pronunciations. For instance, replacing the word *[lafaj] ‘to be big’ with **[la:jfaz] or the word *[paj] ‘pig’ with **[paz] results in completely unacceptable sequences. While the historical phonology of Fataluku dialects is not yet well understood, the fact that the correspondence between /j/ and /z/ does not hold for the second element of surface diphthongs does provide some evidence against the vowel-glide analysis.

A final argument against the vowel-glide analysis is based on another test Rehg applies to Hawaiian. One of the arguments Rehg (2007:125) gives against analyzing Hawaiian surface diphthongs as vowel-glide sequences is that, in precontact Hawaiian, /w/ was not “the non-syllabic counterpart of /u/,” but likely had a significant degree of frication. He points out that a [w] produced with frication is much more like a consonant than like the vocalic component of a diphthong. The description of the Hawaiian /w/ as an approximant with some frication also describes the Fataluku phoneme /v/ quite well: sometimes it has labiodental frication, sometimes it has bilabial frication, and sometimes it is a labiovelar approximant with no frication at all. Using the same phoneme to represent a fricative and a vocalic portion of a diphthong is a rather abstract analysis, which is difficult to justify for Fataluku, given the presence of more natural alternatives. It is much more natural to analyze surface diphthongs as being derived from a vocalic source.

4.4 DIPHTHONGS AND LONG VOWELS AS UNDERLYING SEQUENCES. The two remaining possible sources are underlying single unit phonemes and underlying sequences of vowels. There are several pieces of evidence suggesting that Fataluku surface diphthongs are underlingly sequences of vowels. The first argument comes from parsimony. Rehg (2007) notes that treating surface diphthongs as underlying unit phonemes greatly increases the phoneme inventory of a language. For this reason, he favors the underlying vowel sequence analysis over the true diphthong analysis in every case, unless there is evidence to the contrary. In Fataluku, analyzing long vowels as unit phonemes would add five phonemes to the inventory, and analyzing diphthongs as unit phonemes would add at least six more phonemes, yielding a total of at least sixteen vowel phonemes. Such an analysis more than triples the vowel inventory.

The second piece of evidence comes from the range of possible surface diphthongs permitted in Fataluku. Rehg (2007:126) states that “in a language like English true diagonal diphthongs have a highly skewed distribution”; however, in Hawaiian, one can pre-
dict which surface diphthongs appear based upon phonological criteria and the speech rate. Fataluku is like Hawaiian in this regard, in that the attested surface diphthongs follow regular rules, without gaps. Example (6) shows all possible combinations of a non-high vowel preceding a high vowel. In a parallel way, all possible long vowels are attested, as illustrated by (1) in 3.2 above.

(6) a. [ai]  
[laːfai]  ‘to be big’  [au̯ɾu]  ‘lime’

b. [ei]  
[lavei]  ‘crocodile’  [ʣe̯ɾu]  ‘wife’

c. [oi]  
[ʦo̯h-e]  ‘to mash’  [arapou̯]  ‘buffalo’

The third reason why it is preferable to treat surface diphthongs as underlying sequences of vowels is that it simplifies the description of speech rate differences. Speech rate can have a large influence on how closely two adjacent vowel qualities are pronounced, and it is not always clear whether two vowel qualities are produced in the same syllable or different syllables. For example, in slow speech, the word /rau/ ‘to be good’ can be pronounced [ɾa.u], with [a] and [u] in different syllables, but in speech at more natural speeds, it is realized as [ɾaːu], with the two vowel qualities indisputably in the same syllable. Adopting the vowel-sequence analysis requires proposing a process that joins two vowels into the same syllable in rapid speech, a process that is phonetically motivated and attested in other languages (for example, Hawaiian, as discussed in Rehg 2007). On the other hand, adopting the unit-phoneme analysis requires proposing a rule that splits a single phoneme into separate syllables in slow speech. While this is not necessarily impossible, it is rather contrived.

For these reasons, I argue that Fataluku has neither true long vowels nor true diphthongs. Rather, adjacent vowels may be realized in the same syllable as a surface long vowel or diphthong under certain phonological conditions (although, as noted above, this syllabification is not required at slower speech rates). These conditions can be stated as follows:

(7) The syllabification of adjacent vowels

Two adjacent vowels may be realized in the same syllable if either of the following is true:

• The vowels are identical to each other;
• The first vowel is nonhigh and the second vowel is high.

There is a compelling piece of independent evidence that this analysis of surface long vowels and diphthongs is correct. This evidence comes from the phonetic realization of words with an intervocalic glottal stop. The glottal stop is a phoneme in Fataluku, as demonstrated by minimal pairs such as /raʔu/ ‘plate’ and /rau/ ‘good’ (the second of which can never have an intervocalic glottal stop). However, the glottal stop is frequently deleted in faster speech. When an intervocalic glottal stop is deleted, two identical vowels are realized as a single long vowel, as in /maʔar/ [maːɾ] ‘person’, while two nonidentical vowels are realized as a diphthong, as in /ɾaʔu/ [ɾau̯] ‘plate’. These examples serve as independent evidence that Fataluku has the preceding rule—rule (7)—for the syllabification of adjacent vowels, regardless of one’s analysis of surface long vowels and diph-
thongs. Thus crucially, analyzing surface long vowels and diphthongs as sequences of vowels is completely parsimonious, as it does not require the addition of any phonemes or any rules that are not independently motivated by other facts about the language.

5. **CONCLUSION.** The variety of Fataluku under examination here has 18 consonant phonemes /p, t, k, ?, (b), (d), (g), ts, f, s, h, v, z, m, n, r, l, j/ and 5 vowel phonemes /a, e, i, o, u/. Fataluku syllable structure is (C)V(V)(C), and consonant clusters are rare, especially within native morphemes. There is a contrast between surface long and short vowels that is not predictable from other segmental or suprasegmental conditions. Surface long vowels and diphthongs are represented underlyingly as sequences of identical and nonidentical vowels, respectively, which are syllabified in the same syllable. Key evidence from the realization of words containing an intervocalic glottal stop demonstrates that adjacent vowel phonemes can indeed be syllabified into the same syllable in rapid speech, making the analysis here an optimally economic solution.

One generalization of the present findings beyond Fataluku concerns the representations of long vowels and diphthongs cross-linguistically. One potential research question is whether all possible underlying sources of long vowels and diphthongs are equally common, or whether some are more widely attested among the languages of the world. This study presents a few new phonological tests that may be useful in determining the underlying representations of complex segments in other languages. This study also contributes to the number of languages for which the underlying representations of long vowels and diphthongs are known. The fact that the basic phonology of Fataluku shares similarities with the phonology of many other languages of the Pacific implies that the analysis proposed here may be much more common than previously thought. As the evidence is accumulated for more and more languages, we can begin to make firmer claims about the representations of long vowels and diphthongs cross-linguistically.

One future research direction that would be especially relevant to the present findings is an examination of the development of vowel length across generations, to see whether vowel length is being lost. A study of the distribution of contrastive vowel length among the various dialects of Fataluku would also be interesting. Although vowel length has been discussed in the Central and South dialects to some extent, little has been written about vowel length in the other dialects. Because of the extensive variation that has been reported (Lewis, Simons, and Fennig 2013), broad-scale sociolinguistic investigations on the linguistic differences among the various dialects and sociolects are definitely needed.

To conclude, much has been learned about Fataluku in recent years; however, many important questions remain. In the phonology alone, there are many fruitful avenues for future research, of which the above suggestions are merely a sampling. It is hoped that future research on this language can continue to illuminate Fataluku and its neighboring languages, and, thus, also our understanding of language and the human language faculty as a whole.
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