# THE MYSTERY OF THE TENTH VOWEL

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0.   The presence of an abstract segment leaves a number of hints of its existence scattered throughout the phonology. The following example is instructive in that it involves a number of highly productive morphological processes, all of which are quite transparent save those aspects that in- volve the abstract segment. Purely phonological rules give other hints that all is not as it appears on the surface. Finally, a distributional asymmetry and a highly marked combination of features leaves no doubt as to the identity of the culprit in this caper.

The language in question is Dida,[1] an Eastern Kru language of the Ivory Coast. This particular dialect is from the village of Zaroko in the Watta region. The vocalic system of Dida is given below in (1).

(1)

advanced

retracted

Tones:

$\acute{T}$ hi $\bar{T}$ mid

$\bar{T}$ mid-hi $\grave{T}$ low
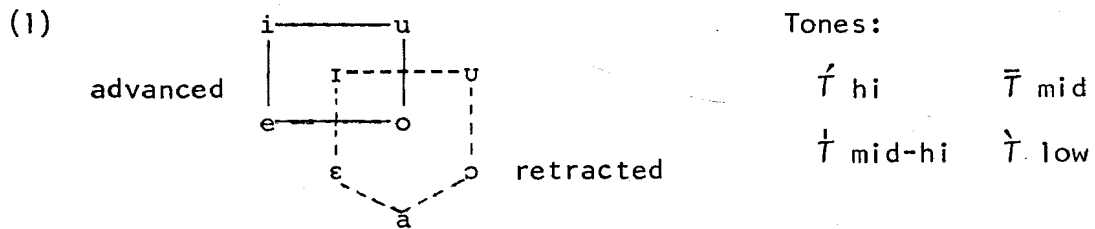
Dida vowels are divided into two classes, as is typical of so many African languages: the advanced [+ATR] vowels and the retracted [-ATR] vowels, where advanced and retracted refer to the tongue root position. It is important to note at once that the fifth retracted vowel, a, is *not* a neutral vowel. It behaves like a retracted vowel with respect to vowel harmony and various assimilation rules.

Dida has four lexical tones whose representations appear on the right in (1). Note that $\underline{T}$ is a tone bearing unit. Tone plays no role in any of the arguments to come and nothing more will be said about it here. For the sake of accuracy and to aid verification, all tones will be represented in the forms below. The tones will be those of a broad phonetic transcrip- tion rather than underlying ones.

1.   Clue #1. -The Concretizer

Dida has a process of noun suffixation involving what we call a con- cretizer. The addition of this suffix gives the sense of a particular object in mind rather than a general abstract idea. In many cases the concretizer corresponds to the definite article in English. Its use is illustrated in the sentences of (2).

(2) a. m̀ pé sáká   'I am preparing rice'

     I prepare rice

   b. m̀ pé sáká-a

     I prepare rice-concr

(2a) refers to the activity of "rice preparation" without referring to
any particular rice while (2b) refers to a specific portion of rice that
the speaker has in mind. The form of the suffix and its effect on the
final vowel of the noun give us our first clue that something is amiss.

In (3) we give an example of nouns ending in each of the nine surface
vowels of Dida. A tenth form is added which does not appear to follow the
same pattern as the other nine. An analytic table sums up the situation.
Along side of each of the vowels we give the sequence resulting from the
adjoining of the concretizer suffix.

(3)

dí	díɔ́	'villages'	i	iɔ
lɪ́	lɪ́ɔ́	'songs'	ɪ	ɪɔ
sū	sūɔ̄	'tree'	u	uɔ
gɔ́lú	gɔ́lúɔ́	'pirogue'	ʊ	ʊɔ
lé	léɛ̀	'spear'	e_1	ɛɛ
t.lɛ̄	t.lɛ̄ɛ̄	'serpent'	ɛ	ɛɛ
yō	vɔ̄ɔ̄	'lie (n.)'	o	ɔɔ
sɔ̄	sɔ̄ɔ̄	'arm'	ɔ	ɔɔ
j.là	j.làà	'lion'	a	aa
s.lé	s.léé / s.lɔ́ɔ́	'house'	e_2	$\left\{\begin{matrix} ee \\ ɔɔ \end{matrix}\right\}$

It is clear from the forms in (3) that the suffix vowel is ɔ. Its tone is
a copy of the preceding tone except that in the case of a stem final high
tone, the suffix takes a mid-high tone. Looking at the analytic table at
the right of (3) we immediately note that the stem final high vowels, i, ɪ,
u, ʊ have nothing to tell us. What appears on the surface is simply the
sequence of the high vowel in question followed by the suffix vowel ɔ; no
rules are involved here. We also note that two patterns of suffixation are
associated with the vowel e. Let us set aside for a moment the vowel at
the bottom of the table (marked e_2 in the analytic table) and consider the
others. First we note that both members of all the sequences agree with

(2) a. m� pe saka   'I am preparing rice'

       I prepare rice

    b. m̃ pe saka-a

       I prepare rice-concr

(2a) refers to the activity of "rice preparation" without referring to any particular rice while (2b) refers to a specific portion of rice that the speaker has in mind. The form of the suffix and its effect on the final vowel of the noun give us our first clue that something is amiss.

In (3) we give an example of nouns ending in each of the nine surface vowels of Dida. A tenth form is added which does not appear to follow the same pattern as the other nine. An analytic table sums up the situation. Along side of each of the vowels we give the sequence resulting from the adjoining of the concretizer suffix.

(3)

dí	díɔ́	'villages'	i	iɔ
lí	líɔ́	'songs'	ɪ	ɪɔ
sū	sūɔ̄	'tree'	u	uɔ
gɔlú	gɔlúɔ́	'pirogue'	ʊ	ʊɔ
le	lɛɛ	'spear'	e₁	εε
t.lɛ̄	t.lɛ̄ɛ̄	'serpent'	ε	εε
yō	vɔ̄ɔ̄	'lie (n.)'	o	ɔɔ
sɔ̄	sɔ̄ɔ̄	'arm'	ɔ	ɔɔ
j.là	j.làà	'lion'	a	aa

s.lé	s.léé / s.lɔ́ɔ́	'house'	e₂	$\begin{Bmatrix} ee \\ ɔɔ \end{Bmatrix}$

It is clear from the forms in (3) that the suffix vowel is $\underline{ɔ}$. Its tone is a copy of the preceding tone except that in the case of a stem final high tone, the suffix takes a mid-high tone. Looking at the analytic table at the right of (3) we immediately note that the stem final high vowels, $\underline{i}$, $\underline{ɪ}$, $\underline{u}$, $\underline{ʊ}$ have nothing to tell us. What appears on the surface is simply the sequence of the high vowel in question followed by the suffix vowel $\underline{ɔ}$; no rules are involved here. We also note that two patterns of suffixation are associated with the vowel $\underline{e}$. Let us set aside for a moment the vowel at the bottom of the table (marked $\underline{e}_2$ in the analytic table) and consider the others. First we note that both members of all the sequences agree with

respect to the feature ATR and that they are, in fact, [-ATR] vowels. Since the suffix vowel ɔ is [-ATR], it is natural to assume that it is this vowel that has caused the change (where applicable) in the stem vowel. We may try to represent this idea by formulating a rule along the lines of (4).

$$(4) \quad \begin{bmatrix} V \\ -hi \end{bmatrix} \rightarrow [\text{-ATR}] \quad / \quad \underline{\quad} + \begin{bmatrix} -\text{ATR} \\ \text{concr} \end{bmatrix}$$

Application of (4) gives the results shown in (5).

(5)   Desired Result

eɔ	---(4)----→	εɔ		εε
εɔ	N.A.	εɔ		εε
oɔ	---(4)----→	ɔɔ		ɔɔ
ɔɔ	N.A.	ɔɔ		ɔɔ
aɔ	N.A.	aɔ		aa

Comparing the sequences derived by rule (4) with the ultimate desired results shown on the right, we see at once that a second rule is needed. In this rule it is the stem vowel that determines the values of the remaining vowel features, back, low and round. This rule is given in (6) with the full derivations shown in (7).

$$(6) \quad V \rightarrow \begin{bmatrix} \alpha \text{back} \\ \beta \text{low} \\ \gamma \text{round} \end{bmatrix} \quad / \quad \begin{bmatrix} V \\ -hi \\ \alpha \text{back} \\ \beta \text{low} \\ \gamma \text{round} \end{bmatrix} + \begin{bmatrix} \text{concr} \underline{\quad\quad} \end{bmatrix}$$

(7)	eɔ	---(4)---→	εɔ	---(6)----→	εε
	εɔ	---N.A.---→	εɔ	---(6)----→	εε
	oɔ	---(4)---→	ɔɔ	---(6)----→	ɔɔ
	ɔɔ	---N.A.---→	ɔɔ	---(6)----→	ɔɔ
	aɔ	---N.A.---→	aɔ	---(6)----→	aa

Rules (4) and (6) show that the two vowels, the stem vowel and the suffix vowel, participate in a sort of "division of labor". The ATR value is assigned by the suffix vowel, and the other vowel features come from the stem vowel. Since rules (4) and (6) are restricted to non-high vowels, the

four high vowels are not affected by the rules and the sequences come
through the derivation unscathed. The vowel e_1 behaves perfectly normal-
ly and undergoes the rules to yield the sequence εε as it should. Let
us now turn to e_2. Of all the nouns ending in a phonetic [e] approxima-
tely half show the e_1 pattern while the other half behave like e_2.
Stems of the e_2 type have two concrete forms which appear to be in free
variation: ee and ɔɔ. Rules (4) and (6) applying to an underlying
e would yield neither of these forms. Rather than attempt to modify the
rules in an arbitrary way let us simply regard the e_2 situation as a
mystery for the time being and turn to the next clue.

2.   Clue #2.   -The Pronominal System

Dida has an unusual type of pronominal system that is based in part
on phonological features. Generally speaking, the form of the pronoun is
determined by the quality of the final vowel of the noun stem to which the
pronoun refers. We are speaking here of subject pronouns, object pro-
nouns, relative pronouns, resumptive pronouns, etc. The form of these
pronouns may be only a vowel or it may have a preceding consonant. We
are dealing here with vocalic alternations which follow the same rules
whether or not a consonant is present in the particular pronominal form.
The phonological basis of Dida pronominalization may be overridden by
certain semantic features. For example, all human nouns have a pronoun
in ɔ regardless of their final vowel. The ɔ pronouns are only animate.
The ɪ pronouns are reserved for most non-human plurals. Leaving aside
these considerations, a very clear picture emerges as to how a particular
pronominal form is selected. In (8) a series of nouns, grouped according
to their final stem vowel is given, along with their corresponding pro-
noun. In this case we have used the subject pronoun, which has a mid-
high tone.

(8)

díɩ́	'villages' ⎫	ɪ́	kōsūù	'fire' ⎫	ʊ́
líɩ́	'songs' ⎭		bōgù	'foot' ⎭	
ɓ.lé	'cow' ⎫		kófíò	'monkey' ⎫	
àbùdàyɛ̀ɛ̀	'sugar cane' ⎭	ɛ́	kɔ̀ɔ́	'man' ⎭	ɔ́
j.là	'lion' ⎫	á			
k͡pē	'bench' ⎭				

The process of pronoun formation is not a purely phonological one. That
is, the noun whose final vowel determines the form of the pronoun need not

be present in the sentence. This is exactly parallel to more normal cases
of pronominalization where the pronoun is selected on the basis of morpho-
logical or semantic features. In those cases as well, the antecedent need
not be present for the selection to take place. What is unusual here is
the fact that the selection is based (at least in part) on phonological
grounds. Thus, the sentence (9)

(9)   á lé

        pron eat

would be translated as 'some (non-human) noun which ends in <u>a</u> or certain <u>e</u>'s
is eating'. Let us now turn to the phonological conditioning.

Abstracting away from the examples in (8) we obtain the situation in
(10).

(10) $\left. \begin{array}{c} i \\ \text{I} \end{array} \right\}$ I $\qquad\qquad$ $\left. \begin{array}{c} u \\ \text{u} \end{array} \right\}$ u

$\qquad$ $\left. \begin{array}{c} e_1 \\ \varepsilon \end{array} \right\}$ ε $\qquad\qquad$ $\left. \begin{array}{c} o \\ \text{o} \end{array} \right\}$ ɔ

$\qquad\qquad$ $\left. \begin{array}{c} e_2 \\ a \end{array} \right\}$ a

We note that the pronouns are exactly the set of retracted vowels of Dida.
Further, the form of the pronoun may be derived by simply taking the [-ATR]
version of the final vowel of the noun stem. Thus, <u>dí</u> ends in the vowel <u>i</u>
whose [-ATR] counterpart is <u>ı</u> which is the form of the pronoun. <u>kɔɔ</u> ends
in <u>ɔ</u> which is already [-ATR], and that is the form of its pronoun. All this
seems quite straightforward, except for the fact that we once again have
two classes of nouns in <u>e</u>. About half the nouns ending in this vowel be-
have like <u>ɓ.lé</u> and take <u>ε</u> as their pronoun. We have called this vowel e_1.
The remaining nouns behave like <u>kpé</u> and take <u>a</u> as their pronoun. We call
these e_2. Note that e_1 is clearly the regular case. If we apply our
principle to <u>ɓ.lé</u> we get the pronoun <u>ε</u> which is correct. There is no way
to do the same for the e_2 nouns, which have <u>a</u> as their pronoun. Once again
let us assume that our principle for the phonological basis of pronoun
selection is correct. The e_2 nouns await an insightful solution.

At this point an obvious question presents itself. We have dealt
with two morphological processes up to this point: the concretizer and
pronominalization. In both cases we encountered two types of <u>e</u>'s: a well-
behaved type which we called e_1 and a recalcitrant type labelled e_2. Is
there a correlation between the e_1's with respect to the concretizer and
the e_1's with respect to pronominalization? Put in specific terms, <u>s.lé</u>
'house' had as its concrete form <u>s.léé</u> or <u>s.lɔɔ</u> making it an e_2 noun
for this process. What is its pronominal form? It is <u>a</u>, making it an
e_2 noun with respect to pronominalization as well. In fact, all nouns in
-<u>e</u> taking a concrete form in -<u>εε</u> also have a pronoun in <u>ε</u>. All nouns

having a concrete form in -ee/-ɔɔ have a pronoun in a. The correlation
is perfect: once an e_1, always an e_1. What is more, the correlation is
exact with respect to regularity. The e_1 noun is the regular case both
for the concretizer and for pronominalization and the concrete e_1 nouns
are also the pronominalization e_1 nouns. Could this be a coincidence?
But we will leave the nouns for the moment, and turn to a morphological
process involving verbs.

3.   Clue #3.   -The Question Suffix

In Dida, direct questions are formed by adding a suffix to the last
element of the sentence. When the verb is the final morpheme of the sen-
tence, the suffix invariably has a mid tone. When added to other syn-
tactic categories, the tone of the suffix is a copy of the final tone of
the item to which it is attached. In this section we will deal with verb
suffixation. As we will see later, the same sequences result from adding
this suffix to other categories. The data are organized as they were
for the concretizer suffix above. Sample verb stems are provided for each
surface vowel. An analytic table summarizing the resulting sequences
appears on the right.

(11)	ǹ líị̀	'you ate'	ǹ líìē	'did you eat?'	i	ie
	ǹ m.nị̀ị̀	'you left'	ǹ m.nììā	'did you leave?'	ɪ	ɪa
	ǹ gūgū	'you think'	ǹ gūgūē	'do you think?'	u	ue
	ǹ zʊ́ʊ̀	'you put'	ǹ zʊʊ́ā	'did you put?'	ʊ	ʊa
	ǹ lē	'you eat'	ǹ lēē	'do you eat?'	e	ee
	ǹ nánɛ́	'you walk'	ǹ nánɛ́ɛ̄	'do you walk?'	ɛ	ɛɛ
	ɔ́ dō	'he pisses'	ɔ́ dēē	'does he piss?'	o	ee
	ɔ́ kɔ́lɔ̄	'he coughs'	ɔ́ kɔ́láā	'does he cough?'	ɔ	aa
	ǹ gbā	'you speak'	ǹ gbāā	'do you speak?'	a	aa

This suffix presents a bewildering variety of manifestation: e, a and ɛ.
There are, however, certain generalizations that can be made. The suffix
vowel is always [-ATR] when it follows a stem vowel which is [-ATR]. This
suggests a rule which is more or less the mirror image of (4). In that
rule the ATR value of the suffix determined the ATR value of the whole
sequence. Here it is the ATR value of the stem vowel that determines the
ATR value of the sequence. Note also that in this case the rule applies
to *all* vowels, and is not restricted to non-high vowels as was the case

for rule (4). Let us assume that the suffix vowel is [+ATR], in part to account for its differences from the concretizer suffix. With this assumption, our rule comes out as in (12) below.

$$(12) \quad V \rightarrow [-ATR] \ / \ [-ATR] \ [+\underline{\quad\quad}]_{quest}$$

Rule (12) is the simplest possible formulation and ideally, our final formulation will retain more or less this form. If we assume that the treatment of VV sequences of the concrete noun form is typical of the behavior of such sequences in Dida, we would expect to find a similar "division of labor" in these forms involving the question suffix. Recall that in the concrete noun forms, it was the suffix that determined the ATR value while the stem vowel determined the other vowel features. Here we see that the ATR value is set by the stem vowel, while the remaining features appear to be inherited from the suffix vowel. This latter point is seen most clearly in a form like ɔ deè 'does he piss?'. The stem vowel of this verb is -o. The resulting sequence is -ee. Clearly the fronting of the stem vowel must have something to do with the suffix vowel, whatever its quality may turn out to be. With this in mind we propose rule (13) to account for the state of affairs described above.

$$(13) \quad \begin{bmatrix} V \\ -hi \end{bmatrix} \rightarrow \begin{bmatrix} \alpha back \\ \beta low \\ \gamma round \end{bmatrix} \ / \ \underline{\quad\quad} \begin{bmatrix} \alpha back \\ \beta low \\ \gamma round \\ quest \end{bmatrix}$$

Note that rule (13), like rule (6), and unlike rule (12), is restricted to non-high vowels.

For the moment we will not push our analysis further. Many aspects of the question suffix remain mysterious. Let us close with the observation that the suffix appears to be something like e after [+ATR] stem vowels and something like a after [-ATR] stem vowels. Our ultimate analysis should account for this e ~ a alternation.

As we noted above, the question suffix appears on the final element of the sentence. When affixed to a noun this suffix shows the identical set of alternations as those of (11). The question particle that follows nouns does not take a mid tone as is the case for the verbal question suffix. Rather its tone is a copy of the tone of the stem vowel of the noun (cf. (14)).

(14) ɔ́ p.lá̰ k͡pḭ̄-ḛ̄   'does he sell benches?'

    he sell benches ?

    ɔ́ lè sàká-á   'does he eat rice?'

    he eat rice ?

    ɔ́ sà zà̰à̰ dí-é   'does he tell stories to John?'

    he tell John stories?

It will be interesting to apply the question particle to nouns ending in
e_1 and e_2 as established from their concrete and pronominal forms. We use
l̄è 'spear' for e_1 and s.lé 'house' for e_2.

(15) n̰ b.lḭ̀ḭ̀ lè-è   'did you steal a spear?'

    you stole spear ?

    n̰ p.lā̰ s.lé-é   'do you sell a house?'

    you sell house ?

We see in (15) that both e_1 and e_2 plus the question particle yield the
identical result. This is one more factor that our analysis must account
for.

4. Clue #4. -Vowel Harmony

Dida exhibits ATR-harmony in a wide variety of morpho-syntactic con-
texts. The process is optional in certain cases but it is characteristic
of normal spoken Dida. In the examples to follow we illustrate the appli-
cation of vowel harmony in several contexts.

(16) ɔ́ p.lá 'he sells'   ó lé 'he eats'

    ɛ́ ŋɔ́nɔ́ 'it sleeps'   é gʷó 'it runs'

    ɔ́ j.là̰ 'his lion'   ó dí 'his stories'

    m.nḭ̄-lḭ̄ 'departure'   yī-lī 'arrival'

    ɲī-y ɛ̀ɛ̀ 'one hair'   vū-yḛ̄ḛ̀ 'one palm seed'

The phonological aspects of the harmony process seem quite simple, leaving
aside details of contexts. The rule may be expressed as follows:

(17) V → [αATR] / X [αATR] Y

        where X......Y is the appropriate morpho-syntactic context
        for the application of the rule.

Note that there is a strong similarity between this rule, on the one hand, and (4) and (12), on the other. All these rules may well be the manifestation of a very general ATR-harmony process. Consider now the following alternations:

(18) wa̋ nán̍ɛ̍   'they walk'   we̋ ye̋   'they come'

       na̍ lú   'my song'   ne̋ su̅   'my tree'

       n̩ ká m.nɩ̍ 'I will leave'   n̩ ké yɩ̍ 'I will come'

In (18) we have another case of an a ~ e alternation. The contexts are identical to what is a harmony context for other vowels. The best solution then should have (18) follow as a particular manifestation of (17). We would also like to relate the a ~ e alternations here with those of the question suffix of the preceding section.

5.   The Mystery Solved: A Tenth Vowel

    The problems raised in sections 1-4 are easily resolved if we posit a tenth vowel for Dida. This vowel must be the [+ATR] counterpart to a. We will represent this tenth vowel by the symbol A. A is an abstract segment in the sense that it never appears on the surface. Accordingly we must posit a rule of absolute neutralization, (19).

(19) A → e

As can be seen, by virtue of this rule, A never surfaces but is realized rather as e unless modified by some earlier applying rule. Let us apply this solution to our four problems and see what all this abstractness will buy us. We shall present the four points in the reverse order of their original appearance.

5.1 Vowel Harmony

    With our analysis involving rule (19) and the vowel harmony rule independently motivated for the other vowels, we can account for all the forms of (16) and (18) in a uniform manner. The relevant derivations are given in (20).

(20) underlying	ɛ́ ŋɔ́nɔ̀	ɔ̀ lè	wánánɛ̀	nà sū
(17)	——	ò lè	——	nÀ sū
(19)	——	——	——	nè sū
surface	ɛ̀ ŋɔ́nɔ̀	ò lè	wà náɛ̀	nè sū

The pronouns of (20) harmonize with the following stems. The derivations
are quite direct. In the final column we see that a has passed through an
intermediate stage, viz. A. This vowel undergoes the absolute neutraliza-
tion rule yielding e. The a ~ e alternations are directly linked with the
other vowel harmony alternations. The abstract segment A and the absolute
neutralization rule (19) are crucial to this result.

5.2 The Question Suffix

In order to account for the vowel sequences of (11), we proposed two
general rules, repeated here for convenience.

(12) $\quad V \rightarrow [-ATR] \ / \ [-ATR] \begin{bmatrix} + \\ quest \end{bmatrix}$

(13) $\quad \begin{bmatrix} V \\ -hi \end{bmatrix} \rightarrow \begin{bmatrix} \alpha back \\ \beta low \\ \gamma round \end{bmatrix} \ / \ \underline{\quad} \begin{bmatrix} \alpha back \\ \beta low \\ \gamma round \\ quest \end{bmatrix}$

Our problem was establishing the underlying representation of the question
suffix. This suffix manifests an a ~ e alternation. In view of the analysis
established above, it is an obvious move to posit A as the underlying repre-
sentation of the question suffix. The results of this move are shown below.

(21)   Desired Result

				Desired Result
/iA/ — N.A. ⟶ iA — N.A.⟶ iA — (19) ⟶ [ie]				ie
/ɪA/ — (12) ⟶ ɪa — N.A.⟶ ɪa — N.A. ⟶ [ɪa]				ɪa
/uA/ — N.A. ⟶ uA — N.A.⟶ uA — (19) ⟶ [ue]				ue
/ʊA/ — (12) ⟶ ʊa — N.A.⟶ ʊa — N.A. ⟶ [ʊa]				ʊa
/eA/ — N.A. ⟶ eA — (13)⟶ AA — (19) ⟶ [ee]				ee
/ɛA/ — (12) ⟶ ɛa — (13)⟶ aa — N.A. ⟶ [aa]				ɛɛ
/oA/ — N.A. ⟶ oA — (13)⟶ AA — (19) ⟶ [ee]				ee
/ɔA/ — (12) ⟶ ɔa — (13)⟶ aa — N.A. ⟶ [aa]				aa
/aA/ — (12) ⟶ aa — (13)⟶ aa — N.A. ⟶ [aa]				aa

If $\underline{A}$ is taken as the form of the question suffix, our very general rules (12) and (13) yield the correct sequence in all but one case.

Given the sequence $\underline{\varepsilon\text{-}A}$, we would expect to derive *aa, but in fact $\underline{\varepsilon\varepsilon}$ is correct. There are a number of possible ways of patching up (13) to give the correct result. None of them strikes us as obviously correct. Let us treat the $\underline{\varepsilon\text{-}A}$ sequence as irregular. Suppose they are marked as not undergoing (13) but rather undergo (6) (which is modified in some appropriate way).

(6')
$$V \rightarrow \begin{bmatrix} \alpha back \\ \beta low \\ \gamma round \end{bmatrix} / \begin{bmatrix} V \\ -hi \\ \alpha back \\ \beta low \\ \gamma round \end{bmatrix} \begin{bmatrix} + \underline{} \\ \left\{\begin{matrix} concrete \\ quest \end{matrix}\right\} \end{bmatrix}$$

We get the following derivation:

(22) $/\varepsilon A/ \xrightarrow{\quad(12)\quad} \varepsilon a \xrightarrow{\quad[13\ blocked]\quad} \varepsilon a \xrightarrow{\quad(6)\quad} [\varepsilon\varepsilon]$

The degree of ad hocness does not seem to be related to our analysis. It appears that the treatment of $\underline{\varepsilon\text{-}A}$ sequences is a genuine irregularity of Dida and any analysis of these sequences will be obliged to handle this case as some form of exception. Note that on the assumption that the question suffix is $\underline{A}$, we can employ two extremely natural and general rules: (12) and (13) to arrive at the desired results. This analysis allows us to pinpoint the exact area of exceptionality. An ultimate validation of this analysis would be to find a dialect of Dida where the addition of the question suffix to an $-\underline{\varepsilon}$ final stem yields $\underline{aa}$ rather than $\varepsilon\varepsilon$. We will return later to another aspect of the question suffix, but now we pass on to the problem of pronominalization.

5.3 The Pronominal System

As we noted above, the form of a pronoun is the [-ATR] counterpart of the stem final vowel of the noun to which it refers. Thus, the pronoun $\underline{\imath}$ may refer to dí 'villages', lí 'songs', etc.; the pronoun ε may refer to lè 'spear', t.lɛ̄ 'serpent', etc. The only apparent exceptions to these generalizations were the group of -$\underline{e}$ final nouns which took $\underline{a}$ as their pronoun. We labelled this vowel e_2. Suppose e_2 is $\underline{A}$, the [+ATR] counterpart of $\underline{a}$. It follows that a word like s.lé$_2$, now analyzed as $\underline{s.lA}$ will take $\underline{a}$ as its pronoun and the phonological aspect of pronominalization becomes completely regular. e_1 nouns, of course, end in -$\underline{e}$. Thus, lè$_1$ analyzed as lè takes $\underline{\varepsilon}$ as its pronoun. Rule (19) will ultimately convert $\underline{s.lA}$ to s.lé. In section 5.4 we will continue to identify e_2 as $\underline{A}$ and e_1 as $\underline{e}$. But let us return briefly to the question suffix. We noted in section 3 that the question suffix was *not* sensitive to the e_1 - e_2 distinction, in contrast

to the concretizer suffix. This fact should follow from our analysis with-
out need for any further rules or conditions. We assumed that the underlying
form of this suffix was -$\underline{A}$. Let us compare the derivation of $\underline{e}_1$ and $\underline{e}_2$ nouns,
running them through rules (12), (13) and (19).

(23) /1ėÅ/ — N.A. $\longrightarrow$ 1ėÅ —— (13) $\longrightarrow$ 1ÅÅ — (19) $\longrightarrow$ [1ėé]

/s.1ÁÁ/— N.A. $\longrightarrow$ s.1ÁÁ — (13) $\longrightarrow$ s.1ÁÁ— (19) $\longrightarrow$ [s.1éé]

Rule (13), ATR assimilation effects no change. Rule (13) assimilates the
stem vowel of 1ė to that of the suffix yielding 1Å-Å. The segmental aspects
of this sequence are now identical to those of s.1Á-Á. Both forms undergo
the absolute neutralization rule (19). Thus, in the case of the question
suffix our analysis makes just the right prediction: no difference in the
surface sequences between -$\underline{e}$ nouns and -$\underline{A}$ nouns. In the next section we
will see that our analysis also predicts a different output between concrete
forms of -$\underline{e}$ nouns and -$\underline{A}$ nouns.

5.4 The Concretizer

     As was discussed in section 5.3, we will identify $\underline{e}_1$ as $\underline{e}$ and $\underline{e}_2$ as $\underline{A}$.
To account for V-V sequences involving the concretizer suffix we posited two
rules repeated here.

(4) $\begin{bmatrix} +voc \\ -hi \end{bmatrix} \rightarrow [-ATR] \ / \ \underline{\quad} \ \begin{bmatrix} -ATR \\ concrete \end{bmatrix}$

(6') $V \rightarrow \begin{bmatrix} \alpha back \\ \beta low \\ \gamma round \end{bmatrix} / \begin{bmatrix} V \\ -hi \\ \alpha back \\ \beta low \\ \gamma round \end{bmatrix} \begin{bmatrix} \overline{\quad\quad} \\ \left\{ \begin{matrix} concrete \\ quest \end{matrix} \right\} \end{bmatrix}$

If we apply (4) and (6') to forms with $\underline{e}$ and $\underline{A}$ we obtain the following
results:

Desired Results:

(24) /eɔ/ — (4) $\longrightarrow$ɛɔ — (6') $\longrightarrow$[ɛɛ]   ɛɛ

/Aɔ/ — (4) $\longrightarrow$aɔ — (6') $\longrightarrow$[aa] $\left\{ \begin{matrix} ee \\ ɔɔ \end{matrix} \right\}$

Even with $\underline{e}_2$ identified as $\underline{A}$, rules (4) and (6') do not produce the desired
result. We obtain $\underline{aa}$ and not either $\underline{ee}$ or ɔɔ which we want. A concrete
interpretation of $\underline{e}_2$ as $\underline{e}$ fares no better. It would, of course, yield ɛɛ
which is equally incorrect. The behavior of $\underline{A}$ in concrete forms is also
exceptional. Notice that this is obvious in one sense: no other vowel allows
two possibilities in free variation for its concrete form. How then are we
to account for these two forms? It is clear that the "division of labor"

aspect of V-V sequences has broken down. Rather than the suffix vowel de-
termining the ATR feature and the stem vowel the remaining features, either
the stem vowel determines all the features or the suffix vowel does so.
Instead of rules (4) and (6'), we need either (4) and (13) or (12) and (6').
Rules (11) and (12) must be suitably modified to apply to these forms. If
(12) is but an instantiation of (17) the morpho-syntactic contexts of that
rule would have to be modified accordingly. Assuming such modifications to
be made we arrive at the derivations shown in (25).

(25) /Aɔ/ — (4) ⟶aɔ   — (13) ⟶[ɔɔ]

$\quad$ /Aɔ/ — (11) → Ao   — (6') ⟶ AA — (19) ⟶ [ee]

In the first derivation of (25), the suffix vowel determines all the features
yielding ɔɔ. In the second derivation, it is the stem vowel that determines
all the features, yielding AA, which then undergoes the absolute neutraliza-
tion rule resulting in ee. Winnie Wood has pointed out that the same two
results could have been obtained using e rather than A as in (26).

(26) eɔ — (4) ⟶ εɔ   — (13) ⟶[ɔɔ]

$\quad$ eɔ — (12) → eo   — (6') ⟶[ee]

Be that as it may, the e_2 nouns of the concrete forms correlate perfectly
with the e_2 nouns with respect to pronominalization. Since those e_2 nouns
have already been established as A to account for the pronouns in a, it
would be most perverse not to use A, at least to define the class of excep-
tionally behaving nouns. Thus, while concretization does not provide direct
evidence for a tenth vowel, it does provide indirect evidence. It is
precisely the set of sounds independently established as ending in -A which
behave strangely with respect to the concrete suffix. It is perhaps not
coincidental that the abstract vowel leaves another calling card, the
aberrant behavior of the concretizer.

6.   We have just presented a detailed look at the Dida evidence for an
abstract vowel. The evidence here is purely internal. However, comparative
Kru studies promise the possibility of external evidence to support this
analysis. The evidence is instructive in that it involves some of the most
frequent and productive morphological processes in the language: concretiza-
tion, question formation, pronominalization. Based on comparative data, the
absolute merger (19) which was beyond question a historical change in Dida,
appears fairly ancient and yet the evidence for the tenth vowel remains as
shiningly obvious as if the change had happened yesterday. Since our know-
ledge of Dida is by no means total, it may well be that we have not ex-
hausted all the clues pointing to the existence of a tenth vowel. But with
the evidence presented so far this remains one of the clearest examples of
an internally motivated abstract vowel.

Footnote