THE MYSTERY OF THE TENTH VOWEL

Jonathan Derek Kaye
Journal of Linguistic Research (1980)

Presented by Elnaz Azimi and William Oliver

Dida

- The language discussed in this article is Dida.
- Dida is spoken in the Ivory Coast in West Africa.
- Kaye (1980) argues that Dida has a 10th mystery vowel that only exists in its underlying form.

Evidence that a 10th Vowel Exists

- Kaye shows four phonological rules that do not work quite well without considering the existence of a 10th vowel in the respective environments.
- However, when he posits that there is a 10th underlying vowel, then the rules work.

Presentation Outline

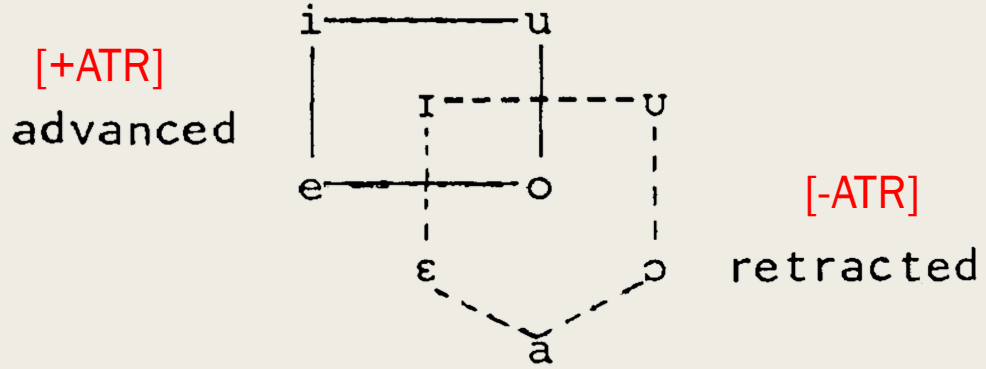
I. Show the Four Phonological Environments for which **the Rules do not Work without the 10th Vowel**

II. Introduce the 10th Vowel

III. Show the Four Phonological Environments for which the **Rules Work Well with 10th Vowel**

Advanced Tongue Root Feature [ATR]

- [ATR] is a vowel feature that involves moving the base of the tongue forward and lowering the larynx
  - Advanced vowels [+ATR]:
    [i] [u] [e] [o]
  - Retracted vowels [-ATR]:
    [ɪ] [ʊ] [ɛ] [ɔ] [a]



Four Phonological Environments that Provide Evidence for 10th Vowel

1. The Concretizer
2. The Pronominal System
3. The Question Suffix
4. Vowel Harmony

Phonological Environment #1: The Concretizer

- Dido has a “concretizer” suffix /ɔ/ that refers to specific objects rather than objects in general.
- It corresponds to the definite article “the” in English.

a. m pe saka 'I am preparing rice'

I prepare rice

b. ṁ pe saka-a

I prepare rice-concr

Phonological Environment #1: The Concretizer

stem	stem + complementizer	translation	last sound of stem	last sound of stem and sound of complementizer	
dí	dí˧˥ɔ	'villages'	i	iɔ	No change
lɪ́	lɪ́˧˥ɔ	'songs'	ɪ	ɪɔ	
sū	sūɔ̄	'tree'	u	uɔ	
gɔ˧˥lú	gɔ˧˥lú˧˥ɔ	'pirogue'	u	uɔ	
le˧˥	lɛ˧˥ɛ˧˥	'spear'	e1	ɛɛ	Assimilation
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.lée˧˥ s.lɔ́˧˥ɔ	'house'	e2	ee ɔɔ	10th Vowel Here And Pattern Not Clear

Phonological Environment #1: The Concretizer

Rule 1
Retraction
regressive

$$\begin{bmatrix} V \\ -hi \end{bmatrix} \rightarrow [-ATR] \;/\; \_\_ + \begin{bmatrix} -ATR \\ concr \end{bmatrix}$$

ɛɔ	--- (1) ----→	ɛɔ
ɛɔ	N.A.	ɛɔ
ɔɔ	--- (1) ----→	ɔɔ
ɔɔ	N.A.	ɔɔ
aɔ	N.A.	aɔ

Rule 2
Assimilation
progressive

$$V \rightarrow \begin{bmatrix} \alpha back \\ \beta low \\ \gamma round \end{bmatrix} \;/\; \begin{bmatrix} V \\ -hi \\ \alpha back \\ \beta low \\ \gamma round \end{bmatrix} + \begin{bmatrix} concr \_\_ \end{bmatrix}$$

ɛɔ	--- (2) ----→	ɛɛ
ɛɔ	--- (2) ----→	ɛɛ
ɔɔ	--- (2) ----→	ɔɔ
ɔɔ	--- (2) ----→	ɔɔ
aɔ	--- (2) ----→	aa

Rule 1 feeds Rule 2

last sound of stem	last sound of stem and sound of complementizer	
i	iɔ	No change
ɪ	ɪɔ	
u	uɔ	
ʊ	ʊɔ	
e_1	ɛɛ	Assimilation
ɛ	ɛɛ	
o	ɔɔ	
ɔ	ɔɔ	
a	aa	
e_2	{ee, ɔɔ}	10th Vowel Here And Pattern Not Clear

Phonological Environment #2: The Pronominal System

- Dida has a unusual pronoun system where the final vowel of the stem determines its pronoun.
- For example, all words that end in [i] have [ɪ] as its pronoun.
- The pronouns are: [ɪ] [ʊ] [ɛ] [ɔ] [a].

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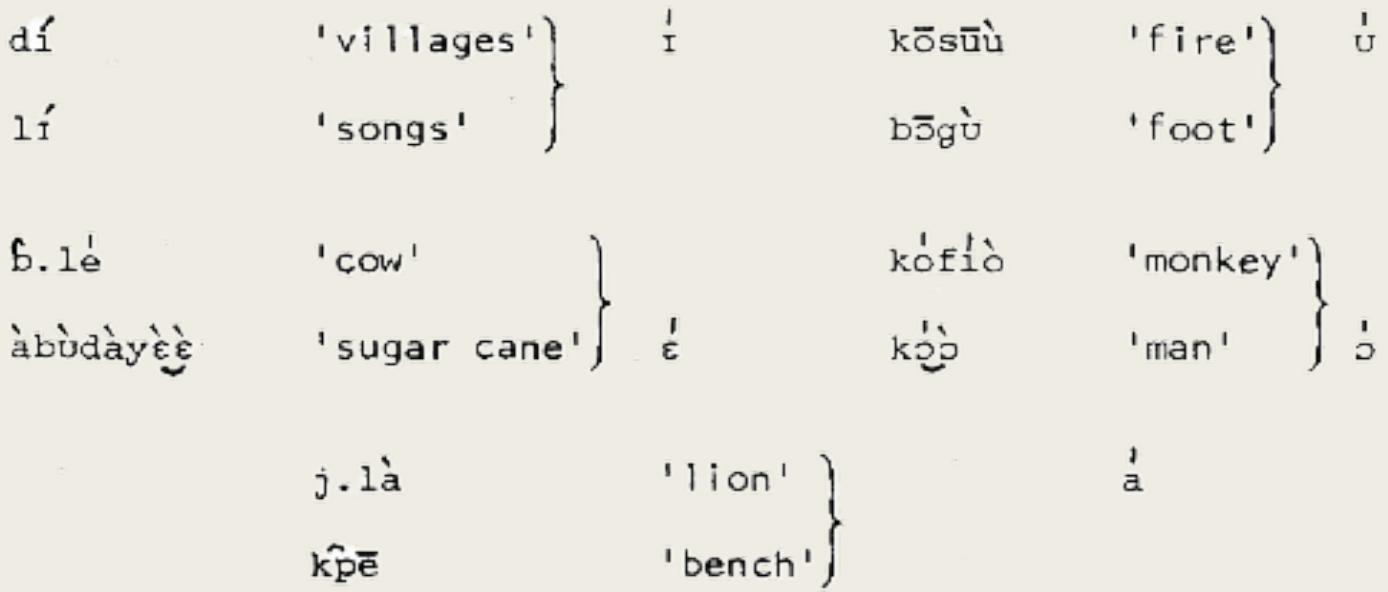
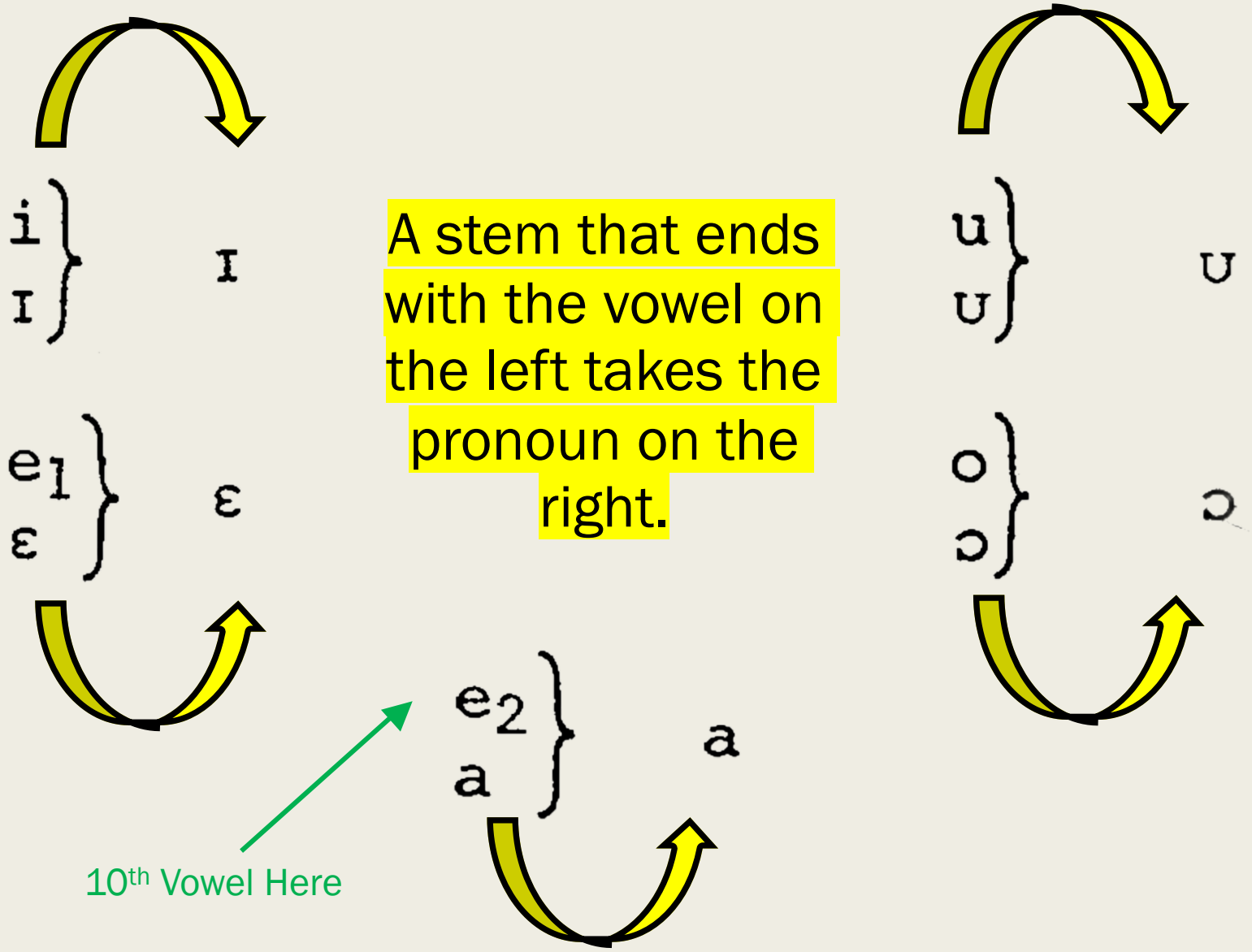
- The pronouns are: [ɛ] [ʊ] [a] [ɔ] [ɪ].



Phonological Environment #2: The Pronominal System

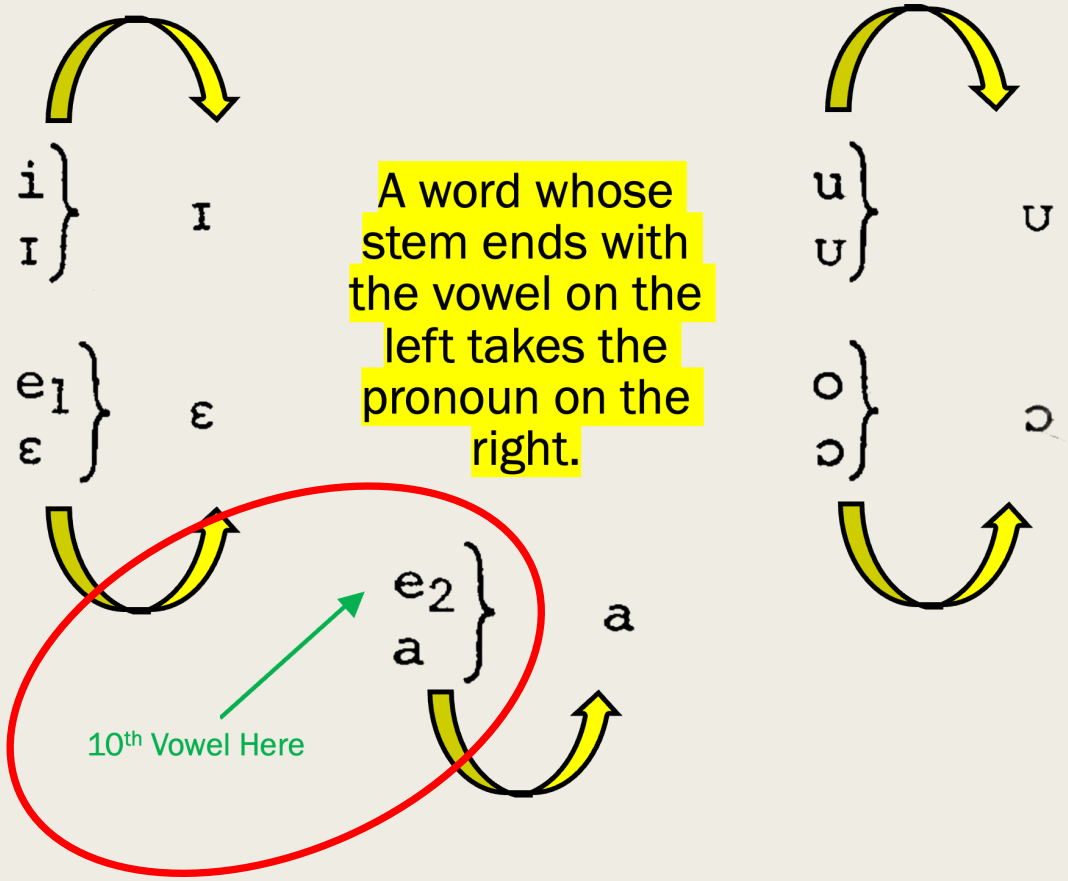


Pronoun Retraction Rule

[V#] + [-ATR] = Pronoun

1. Take stem-final vowel
2. Make that vowel [-ATR]

So, if the vowel is already [-ATR] like [ɪ] [ʊ] [ɛ] [ɔ] [a] then the pronoun is just that vowel.



Phonological Environment #3: The Question Suffix

- In Dida, questions are formed by adding question suffixes [e], [ɛ], or [a].
- However, we cannot see a pattern that determines when which suffix appears.

Phonological Environment #3: The Question Suffix

In Dida, questions are formed by adding a question suffix.

word without question suffix		word with question suffix		last sound of stem	last sound of stem and question suffix
ǹ lḭ̀ḭ̀	'you ate'	ǹ lḭ̀ḭ̀ē	'did you eat?'	i	ie
ǹ m.nḭ̀ḭ̀	'you left'	ǹ m.nḭ̀ḭ̀ā	'did you leave?'	ɪ	ɪa
ǹ gūgū	'you think'	ǹ gūgūē	'do you think?'	u	ue
ǹ zʊ̀ʊ̰̀	'you put'	ǹ zʊ̀ʊ̀ā	'did you put?'	ʊ	ʊa
ǹ lē	'you eat'	ǹ lēē	'do you eat?'	e	ee
ǹ náńɛ́	'you walk'	ǹ náńɛ́ɛ̄	'do you walk?'	ɛ	ɛɛ
ɔ́ dō	'he pisses'	ɔ́ dēē	'does he piss?'	o	ee
ɔ́ kɔ́lɔ̄	'he coughs'	ɔ́ kɔ́lāā	'does he cough?'	ɔ	aa
ǹ gb̂ā	'you speak'	ǹ gb̂āā	'do you speak?'	a	aa

No Evidence of 10th Vowel with the Question Suffix

Phonological Environment #3: The Question Suffix

It appears that these two rules may be making the question suffix, but they do not always work.

Rule 3 (Retraction)

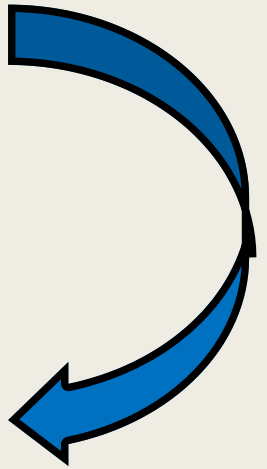
progressive

$$V \rightarrow [\text{-ATR}] \;/\; [\text{-ATR}] \; [+\underline{\quad}\,\text{quest}]$$

Rule 4 (Assimilation)

regressive

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



Rule 3 feeds Rule 4

Phonological Environment #4: Vowel Harmony

- Dida has an optional ATR-harmony in some morpho-syntactic contexts.
  - *Vowel harmony is when a vowel changes its features according to another vowel.*
  - *ATR harmony is when a vowel changes its [ATR] feature according to another vowel.*
- X …Y is the appropriate morpho-syntactic context for the application of this rule.
  - *There are morpho-syntactic contexts, let's call them X and Y, between which the vowel gets the [ATR] feature from another vowel.*

Rule 5:

Vowel Harmony Rule

Phonological Environment #4: Vowel Harmony

- Dida has an optional ATR-harmony in some morpho-syntactic contexts.
- We see ATR harmony here because both vowels have the same [ATR] features.

Both vowels are [-ATR]		Both vowels are [+ATR]	
ɔ́ p.là	'he sells'	ó lé	'he eats'
ɛ́ ŋɔ́nɔ́	'it sleeps'	é gʷó	'it runs'
ɔ́ j.là	'his lion'	ó dí	'his stories'
m.nī-lī	'departure'	yī-lī	'arrival'
ɲɪ́-y ɛ̀ɛ̀	'one hair'	vū-yēè	'one palm seed'

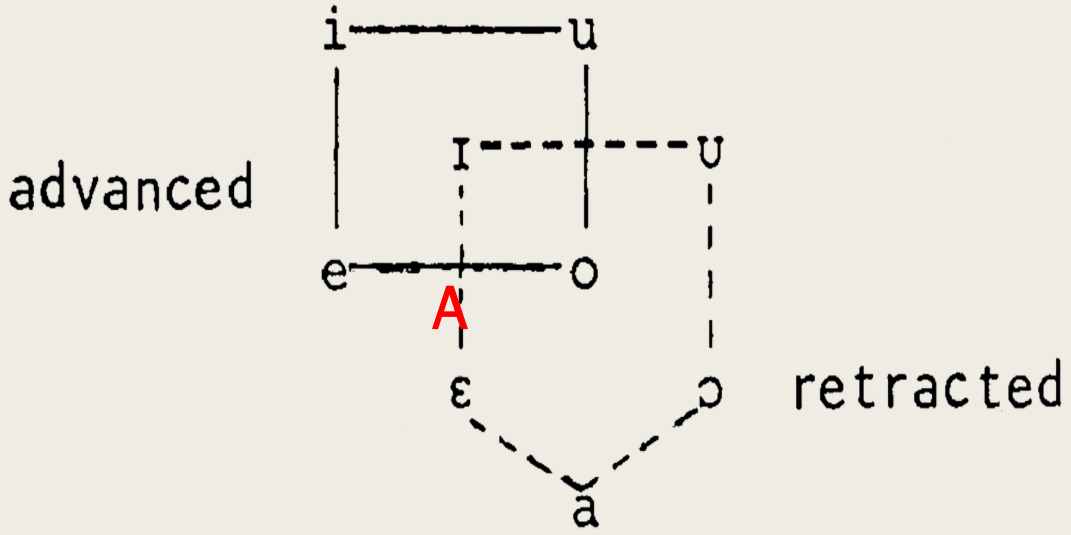
Phonological Environment #4: Vowel Harmony

- Another a-e alternation, this time in the context of vowel harmony

wà nánɛ	'they walk'	wè yé	'they come'
na lú	'my song'	ne sū	'my tree'
n ká m.nɪ	'I will leave'	n ké yɪ	'I will come'

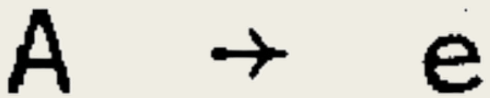
The 10th Vowel: /A/

- The 10th vowel is the [+ATR] counterpart to [a].
- Let's call this 10th vowel /A/.
- /A/ never is represented in the surface structure but rather only exists as its abstract underlying form.



The 10th Vowel: /A/

- When /A/ does not undergo any phonological process that realizes it as a certain vowel, it surfaces as [e] by default.
- Let's call this rule Neutralization, Rule 6.



Phonological Environment #4: Vowel Harmony

- With the 10th vowel /A/, we now have vowel harmony.

We don't have ATR harmony.

underlying	ɛ̀ ŋɔ́nɔ̀	ɔ̀ lɛ̀	wànáɛ́nɛ̀	nà sū
V → [αATR] / X [αATR] Y	———	ò lɛ̀	———	nÀ sū
A → e	———	———	———	nè sū
surface	ɛ̀ ŋɔ́nɔ̀	ò lɛ̀	wà náɛ̀	nè sū

Now, we have ATR harmony

Phonological Environment #3: The Question Suffix

- In Dida, questions are formed by adding a question suffix.
- However, it is unclear what the underlying form of the suffix is.

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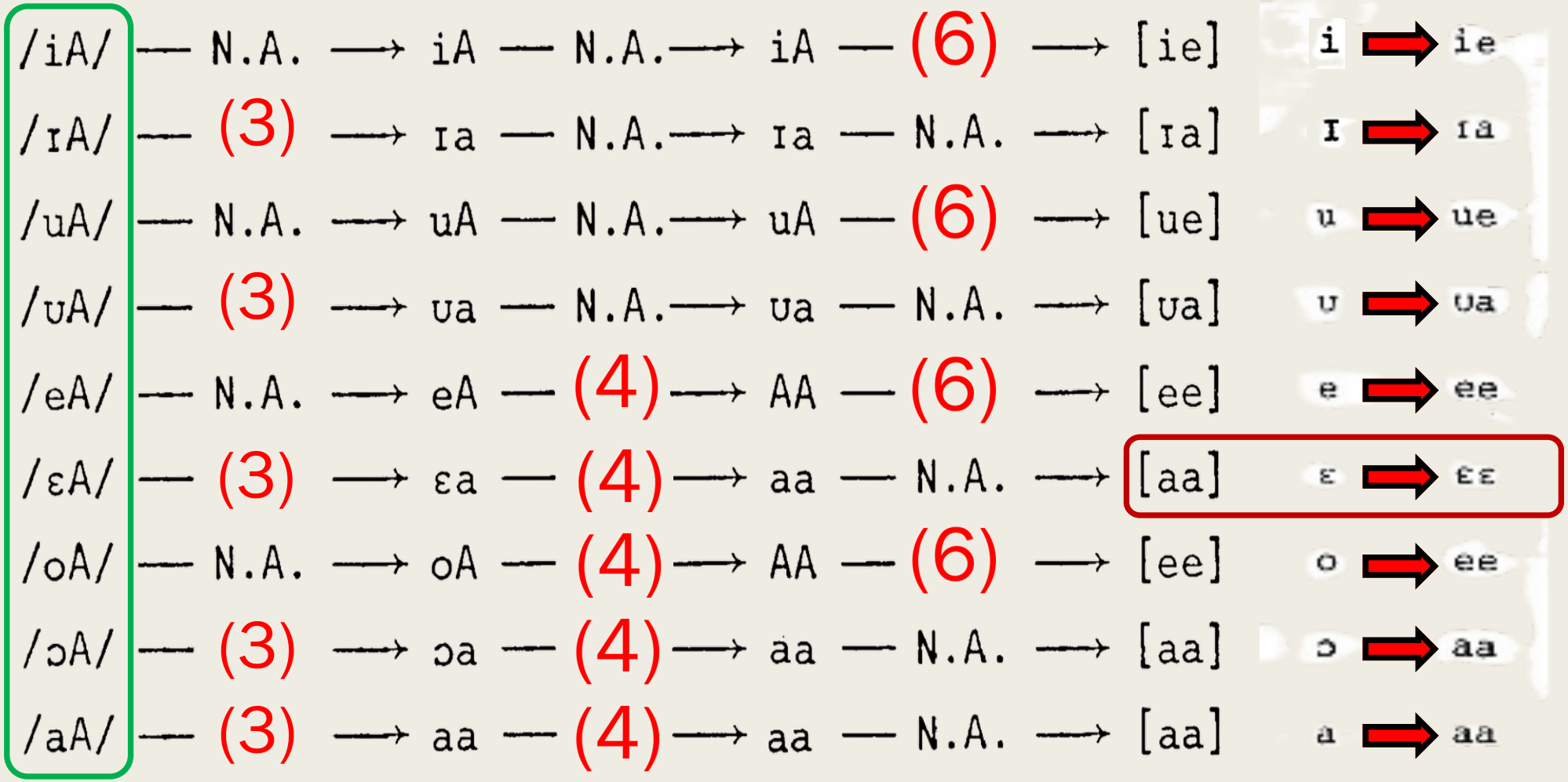
No Evidence of 10th Vowel with the Question Suffix

Phonological Environment #3: The Question Suffix

- In Dida, questions are formed by adding a question suffix.
- However, it is unclear what the underlying form of the suffix is.
- If we make /A/ the underlying form of the suffix, then it works.

Phonological Environment #3: The Question Suffix

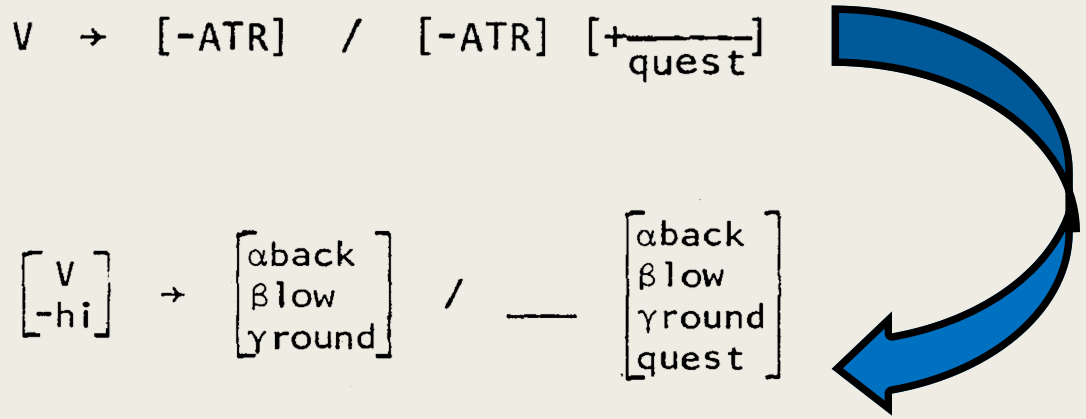
- In Dida, questions are formed by adding a question suffix.
- The question suffix is the 10th vowel.



Phonological Environment #3: The Question Suffix

It appears that these two rules may be making the question suffix, but they do not always work.

(3) Rule (Retraction)



(4) Rule (Assimilation) regressive

Rule 3 feeds Rule 4

Phonological Environment #3: The Question Suffix

Now with /A/ and Rule 3, it works.

(3) Rule (Retraction)

$$V \rightarrow [\text{-ATR}] \;/\; [\text{-ATR}] \left[+ \frac{\quad}{\text{quest}} \right]$$

Rule 3 feeds Rule 4

(4) Rule (Assimilation)

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

Rule 4 feeds Rule 6

(6) Rule (Neutralization)

$$A \rightarrow e$$

Phonological Environment #3: The Question Suffix

	UR	/eA/	/ɛA/	/oA/
Rule 3	V → [-ATR] / [-ATR] [+quest ____]	-------	ɛa	-------
Rule 4	[V, -hi] → [αback, βlow, γround] / ___ [αback, βlow, γround, quest]	AA	aa	AA
Rule 6	A → e	ee	-------	ee
	SR	[ee]	[aa]	[ee]

e# ⟶ ee# #ɛ ⟶ ɛɛ# o# ⟶ ee#

Phonological Environment #3: The Question Suffix

/eA/ — N.A. → eA — (4) → AA — (6) → [ee] e ➡ ee

/ɛA/ — (3) → ɛa — (4) → aa — N.A. → [aa] ɛ ➡ ɛɛ

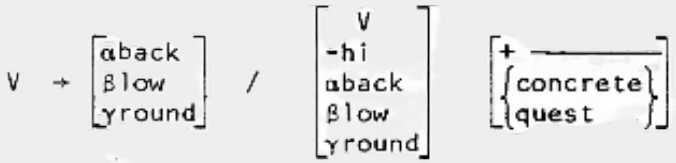
/oA/ — N.A. → oA — (4) → AA — (6) → [ee] o ➡ ee

- To account for this one problem where his rules do not work, Kaye says that it is an exception and posits an additional rule that only this line follows.
- Let's call this Rule 7.

$$V \rightarrow \begin{bmatrix} \alpha back \\ \beta low \\ \gamma round \end{bmatrix} / \begin{bmatrix} V \\ -hi \\ \alpha back \\ \beta low \\ \gamma round \end{bmatrix} \begin{bmatrix} + \_\_\_\_\_ \\ \{concrete \\ quest\} \end{bmatrix}$$

Phonological Environment #3: The Question Suffix

The Exception Case

	UR	/ɛA/
Rule 3		ɛa
Rule 7		ɛɛ
	SR	[ɛɛ]

Phonological Environment #2: The Pronominal System

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- For example, all words that end in [i] have [ɪ] as its pronoun.
- The pronouns are: [ɪ] [ʊ] [ɛ] [ɔ] [a].

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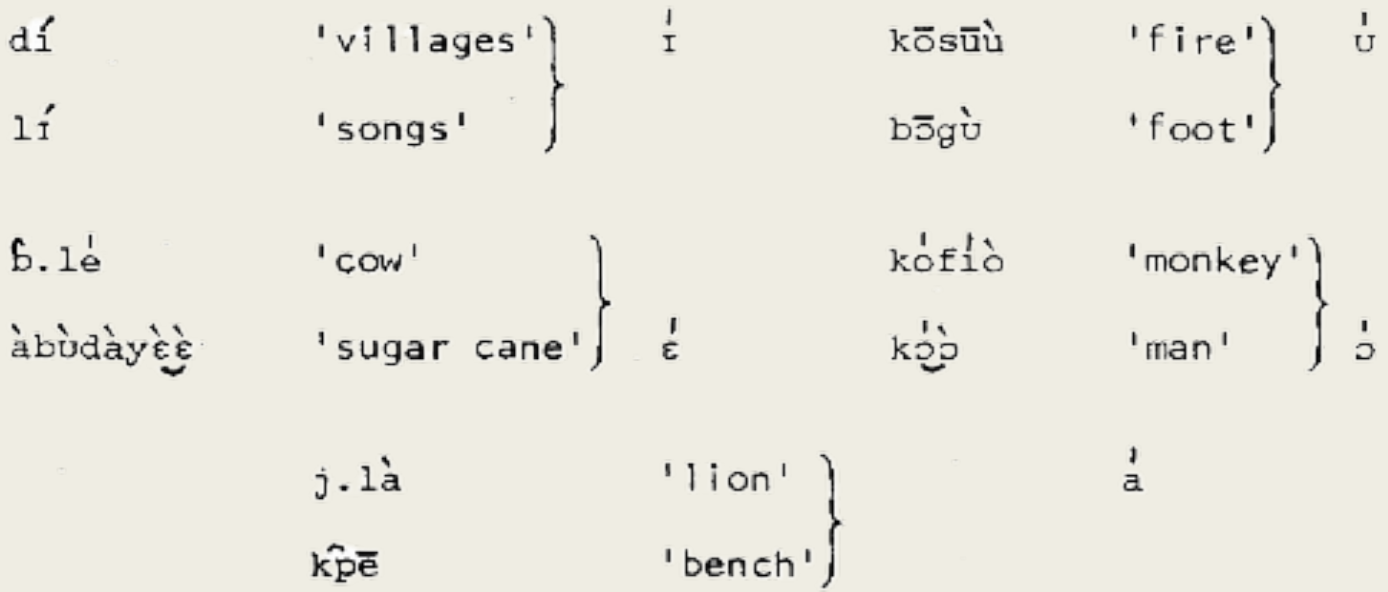
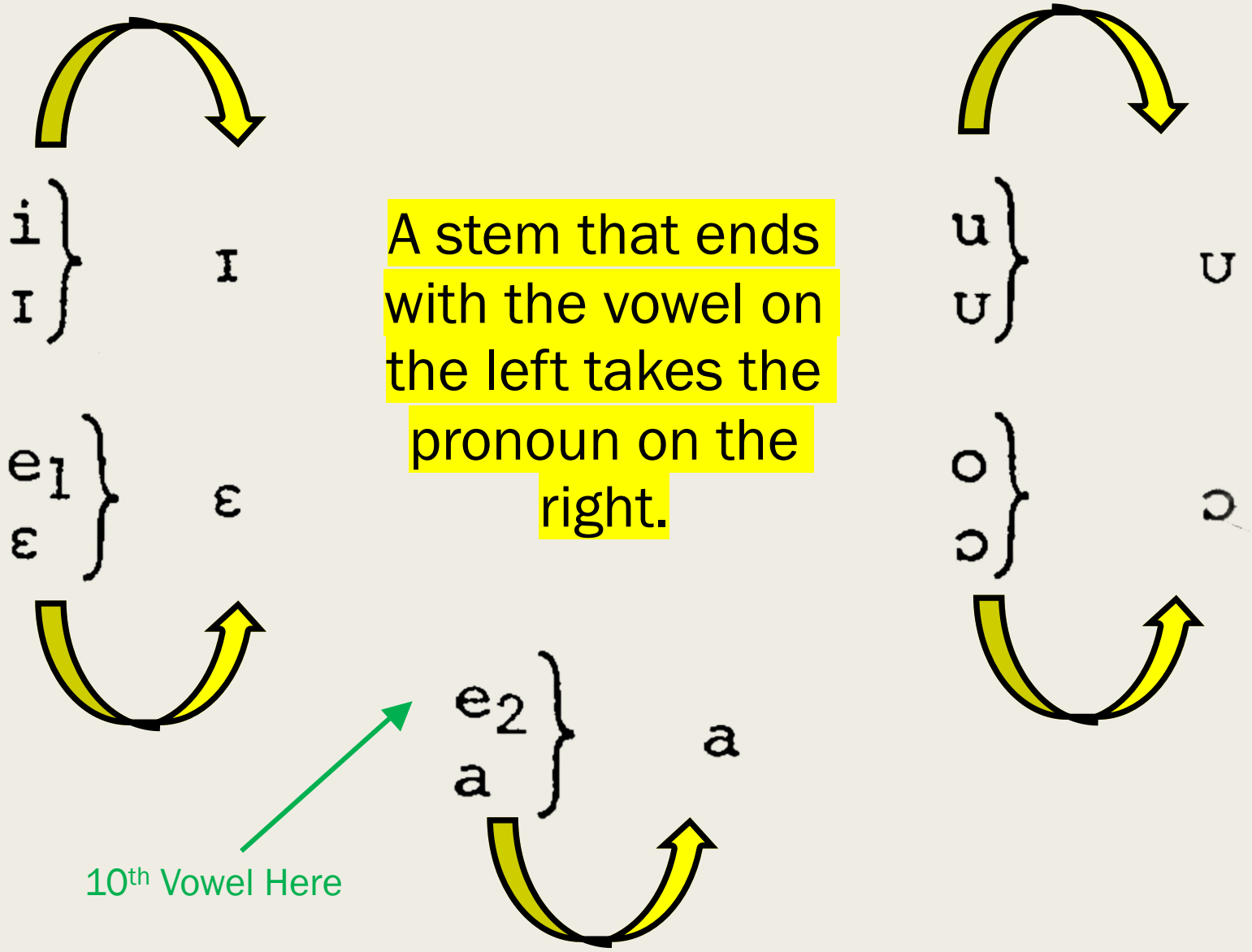


Phonological Environment #2: The Pronominal System



Pronoun Retraction Rule

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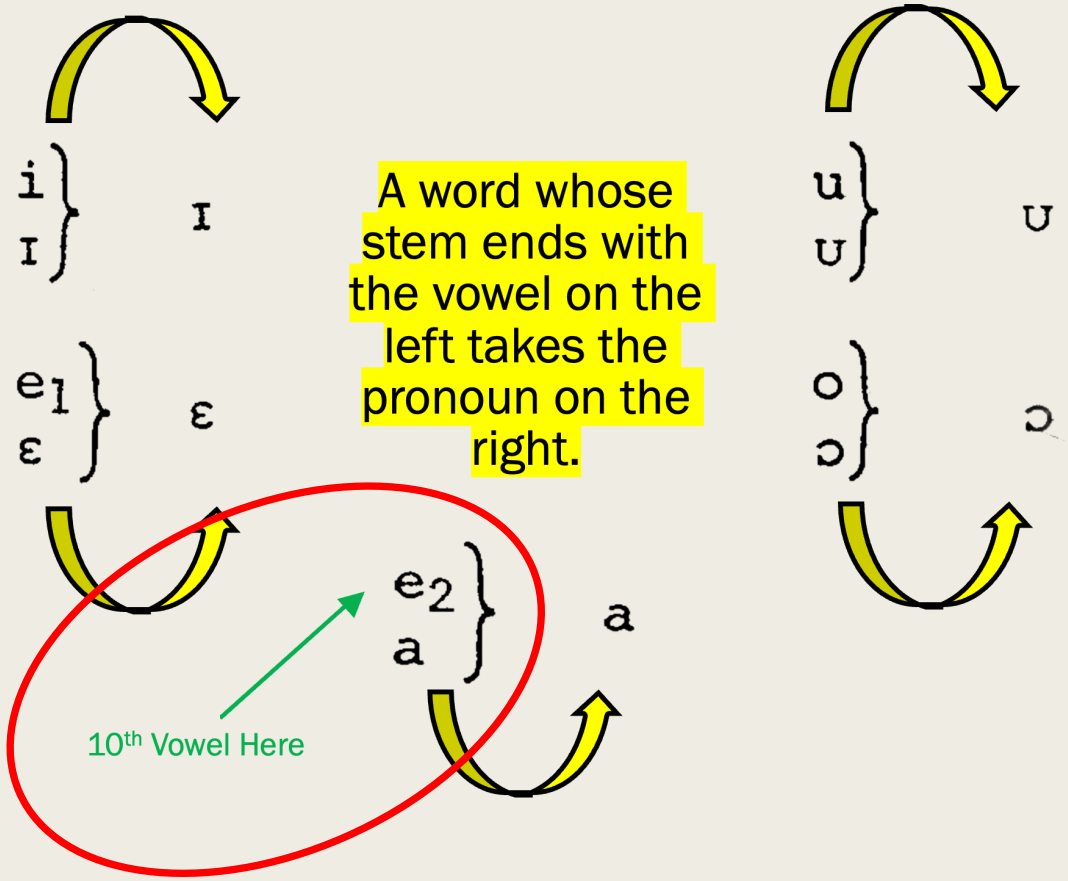

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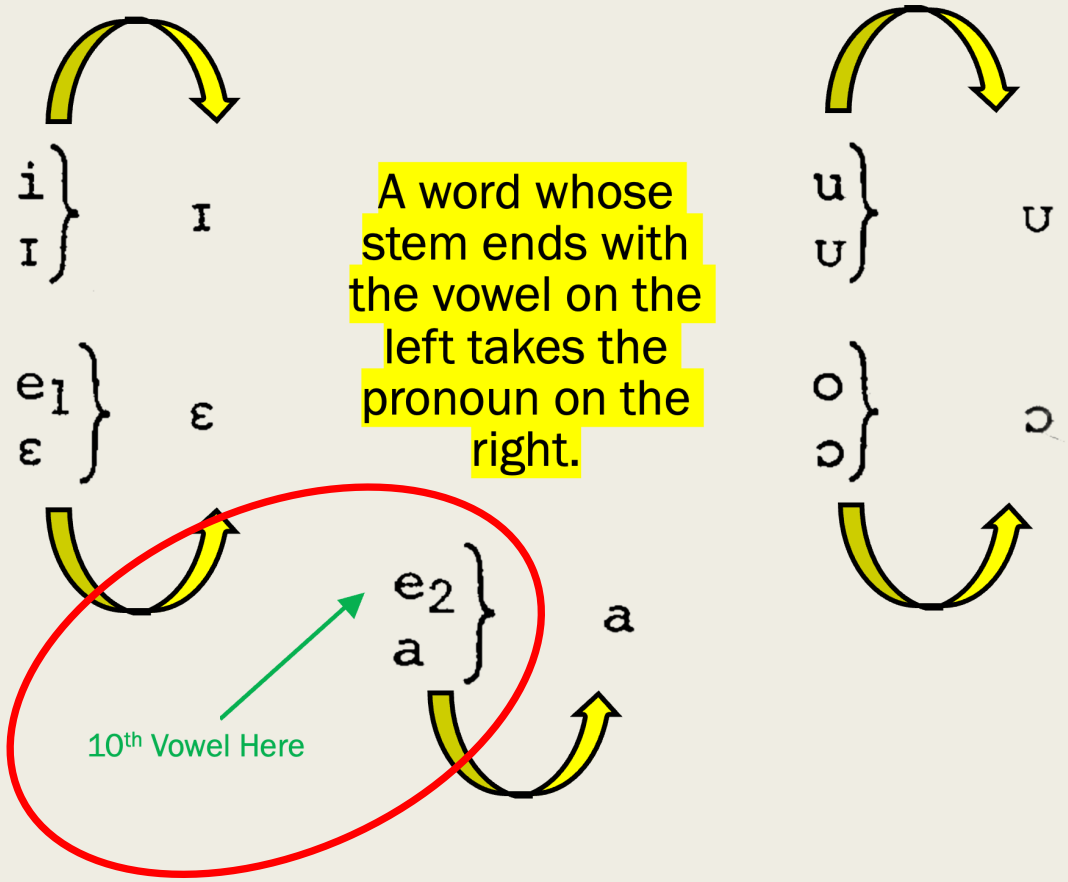
So, if the vowel is already [-ATR] like [ɪ] [ʊ] [ɛ] [ɔ] [a] then the pronoun is just that vowel.

10th Vowel is the [+ATR] counterpart to [a], so /A/ becomes [a] as it takes the [-ATR] feature.



/A/ + [-ATR] → [a]

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sū	sūɔ	'tree'	u	uɔ
gɔ꜀lú	gɔ꜀lú꜀	'pirogue'	ʊ	ʊɔ
le꜀	lɛ꜀ɛ꜀	'spear'	e_1	ɛɛ
t.lɛ̄	t.lɛɛ̄	'serpent'	ɛ	ɛɛ
yō	vɔɔ̄	'lie (n.)'	o	ɔɔ
sɔ̄	sɔɔ̄	'arm'	ɔ	ɔɔ
j.là	j.làà	'lion'	a	aa
s.lé	s.lée꜀ s.lɔ꜀ɔ꜀	'house'	e_2	ee ɔɔ

No change

Assimilation

10th Vowel Here And Pattern Not Clear

Phonological Environment #1: The Concretizer

Rule 1
Retraction

$$\begin{bmatrix} V \\ -hi \end{bmatrix} \rightarrow [-ATR] \;/\; \_\_ + \begin{bmatrix} -ATR \\ concr \end{bmatrix}$$

ɛɔ	--- (1) ----→	ɛɔ
ɛɔ	N.A.	ɛɔ
ɔɔ	--- (1) ----→	ɔɔ
ɔɔ	N.A.	ɔɔ
aɔ	N.A.	aɔ

Rule 2
Assimilation

$$V \rightarrow \begin{bmatrix} \alpha back \\ \beta low \\ \gamma round \end{bmatrix} \;/\; \begin{bmatrix} V \\ -hi \\ \alpha back \\ \beta low \\ \gamma round \end{bmatrix} + \begin{bmatrix} concr \_\_ \end{bmatrix}$$

ɛɔ	--- (2) ----→	ɛɛ
ɛɔ	--- (2) ----→	ɛɛ
ɔɔ	--- (2) ----→	ɔɔ
ɔɔ	--- (2) ----→	ɔɔ
aɔ	--- (2) ----→	aa

Rule 1 feeds Rule 2

last sound of stem	last sound of stem and sound of complementizer	
i	iɔ	No change
ɪ	ɪɔ	
u	uɔ	
ʊ	ʊɔ	
e_1	ɛɛ	Assimilation
ɛ	ɛɛ	
o	ɔɔ	
ɔ	ɔɔ	
a	aa	
e_2	{ee, ɔɔ}	10th Vowel Here And Pattern Not Clear

Phonological Environment #1: The Concretizer

UR	/eɔ/
Rule 1 Retraction: $\begin{bmatrix} V \\ -hi \end{bmatrix} \rightarrow [-ATR] \; / \; \_\_ + \begin{bmatrix} -ATR \\ concr \end{bmatrix}$	ɛɔ
Rule 2 Assimilation progressive: $V \rightarrow \begin{bmatrix} \alpha back \\ \beta low \\ \gamma round \end{bmatrix} \; / \; \begin{bmatrix} V \\ -hi \\ \alpha back \\ \beta low \\ \gamma round \end{bmatrix} + [concr \; \_\_]$	ɛɛ
SR	[ɛɛ]

This does not work because we do not get the desired results.

Desired Results:

ɛɛ

{ee, ɔɔ}

Path 1

UR	/Aɔ/
Rule 1 Retraction: $\begin{bmatrix} V \\ -hi \end{bmatrix} \rightarrow [-ATR] \; / \; \_\_ + \begin{bmatrix} -ATR \\ concr \end{bmatrix}$	aɔ
Rule 4 Assimilation regressive: $\begin{bmatrix} V \\ -hi \end{bmatrix} \rightarrow \begin{bmatrix} \alpha back \\ \beta low \\ \gamma round \end{bmatrix} \; / \; \_\_ \begin{bmatrix} \alpha back \\ \beta low \\ \gamma round \\ quest \end{bmatrix}$	ɔɔ
SR	[ɔɔ]

There are 2 paths that /Aɔ/ can be realized. This is Path 1.

Phonological Environment #1: The Concretizer

Path 2

UR	/Aɔ/
Rule 2 Assimilation progressive: $V \rightarrow \begin{bmatrix}\alpha\text{back}\\ \beta\text{low}\\ \gamma\text{round}\end{bmatrix} / \begin{bmatrix}V\\ -\text{hi}\\ \alpha\text{back}\\ \beta\text{low}\\ \gamma\text{round}\end{bmatrix} + \begin{bmatrix}\text{concr}\ \_\_\end{bmatrix}$	AA
Rule 5 (Nuetralization): A → e	ee
SR	[ee]

There are 2 paths that /Aɔ/ can be realized. This is Path 2.

Conclusion: Key Takeaways

- Dida appears to have a tenth vowel /A/ that never is realized at the surface level but exists as an underlying form.
- Kaye's 10th vowel /A/ solves almost all the problems, but in some environments the solution is cleaner than in others.