

## Apophony theory in phonology and morphology

*Apophony* is a vocalic alternation, which is

- (i) context-free  
and (ii) the vehicle of a grammatical opposition (1.1)

(i) English and German strong verbs:

"to sing"	present:	s <u>ɪ</u> ng
	preterite:	s <sup>3</sup> / <sub>4</sub> ng

(ii) Verbal forms in Classical Arabic:

"to write"	perfective, 3ms:	kat <u>ab</u> -a
	imperfective, 3ms:	ya-kt <u>ub</u>

(iii) Verbal forms in Kabyle Berber:

"to look for"	perfective, 3ms:	i- <u>nuda</u>
	imperfective, 3ms:	y <sup>h</sup> -ts- <u>nadi</u>

(iv) Nouns in Hausa:

"lamp"	singular:	fitil <u>aa</u>
	plural:	fitil <u>uu</u>

 (1.2)

— Apophonic phenomena are reputed to be unpredictable and as such fully lexicalized: both vowels involved in an apophonic alternation have to be lexicalized (see e.g. list of strong verbs in Germanic, irregular verbs in Kabyle Berber are dispatched in 21 classes).

### Critics on this position

— Both vowels involved in an apophonic alternation are lexicalized => a mere listing of the couples (A, B), the only condition on A and B is A - B.

— If apophonic alternations are lexicalized then we expect apophony to involve any two vowels.

(CA)	<i>Perf.</i>	<i>Imperf.</i>	<i>Perf.</i>	<i>Imperf.</i>
	a	u	* u	i
	i	a	* u	a
	a	i	* i	u
	u	u	* i	i
			* a	a

 (1.3)

(KB)	<i>Imperf.</i>	<i>Perf.</i>	<i>Imperf.</i>	<i>Perf.</i>
	i	i	* a	i
	i	a	* u	i
	a	u	* @	i
	u	u	* a	a
	@	@	* u	a
			* @	a
			* @	u
			* @	i
			* @	a
			* @	u

 (1.4)

### Aims of this course

(i) to show that in certain cases the alleged "irregularity" in apophonic systems can be reduced.

(ii) to evaluate the implications of this result on the morphology of various languages, mainly Afro-Asiatic, possibly Indo-European.

(1.5)

**- week 1: Apophony theory, data and analyses**

In their analysis of the Classical Arabic verbal system, Guerssel & Lowenstamm 1996 propose that the two vowels involved in an apophonic alternation are related by a derivation (Apophonic Path). According to this analysis, the derived term of an apophonic alternation is unambiguously predictable on the basis of the source term. Only the source term needs to be lexicalized. We will examine apophonic systems in languages from various families (see references), this examination reveals that the Apophonic Path is also active in these languages. This suggests that the Apophonic Path is a universal mechanism.

- 1: Apophony in Classical Arabic (Afro-Asiatic)
- 2: Apophony in Berber (Afro-Asiatic)
- 3: Apophony in German (Indo-European)
- 4: Apophony in Beja (Afro-Asiatic)

**- week 2: Apophony in morphology**

Apophonic alternations are cases of non-concatenative morphology: a grammatical opposition is expressed via a vowel alternation.

(i) Apophony theory establishes precise relationships between templates in Semitic => predictions on the organization of the template set.

(ii) Apophony has been argued to play a role in (a) languages that have clearly a templatic morphology (Semitic: CA), (b) languages that are less clearly templatic (Berber, Cushitic: Beja) and (c) languages usually defined as non-templatic (Indo-European: German, Spanish). This result has a consequence on our understanding of the division "templatic" vs. "non-templatic" languages.

(iii) A word-to-word approach vs. a root-based model of Afro-Asiatic morphology.

- 1: Template organization in Semitic, the Akkadian case
- 2: Apophony in a non-templatic language, Spanish
- 3: The mental representation of Semitic words

— References:

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- Ségéral, Philippe & Tobias Scheer. 1996. "A generalized theory of Ablaut: the case of Modern German Strong Verbs." In Ortman, Albert., Ray Fabri & Teresa Parodi (eds.), *Models of Inflection*. Tübingen: Niemeyer, 28-59.



(iii) Partial polarity:

(a)			(b)		
<i>Input:</i>	labis	Darab	<i>Input:</i>	yaDrib	yalbas
<i>Perfective</i>			<i>Imperfective</i>		
	i > a	a > i		a > i	i > a
<i>Output:</i>			<i>Output:</i>		
<i>Imperfective</i>	yalbas	yaDrib	<i>Perfective</i>	Darab	labis

(2.6)

(c) - An alternative to partial polarity

(a)				(b)					
<i>Input:</i>	i	a	x	u	<i>Input:</i>	i	x	a	u
<i>Perfective</i>					<i>Imperfective</i>				
	3	1	2	4		1	2	3	4
<i>Output:</i>					<i>Output:</i>				
<i>Imperfective</i>	a	i	u	u	<i>Perfective</i>	a	a	i	u

(2.7)

(a)				(b)					
<i>Input:</i>	u	x	i	a	<i>Input:</i>	x	u	i	a
<i>Perfective</i>					<i>Imperfective</i>				
	4	1	3	2		4	2	1	3
<i>Output:</i>					<i>Output:</i>				
<i>Imperfective</i>	u	i	a	u	<i>Perfective</i>	u	a	a	i

(2.8)

where: 1. Darab-yaDrib                      3. labis-yalbas  
 2. katab-yaktub                            4. kabur-yakbur

(i) apophony maps the Perfective melody into that of the Imperfective.

(ii) Darab-yaDrib is the verb type bearing "x", viz. Dar(x)b-yaDrib- (2.9)

D	r	b		k	t	b
CVCVCVCV				CVCVCVCV		
	-					
a				a	a	

(2.10)

- -> i  
 i -> a  
 a -> u  
 u -> u

Darb-yaDrib  
 labis-yalbas  
 katab-yaktub  
 kabur-yakbur(2.11)

- -> i -> a -> u -> u (2.12)

(d) - The apophonic mechanism

<i>Perfective</i>		<i>Imperfective</i>
D	r	b
CVCVCVCV		
	-	
a		
	_____ AP _____	↑

(2.13)

l	b	s		y	l	b	s
CVCVCVCV				CVCVCVCV			
a		i		a		a	
	_____ AP _____			↑			

(2.14)



*Perfective Passive*  
 C<sub>1</sub> C<sub>2</sub> C<sub>3</sub>  
 | | |  
 CV[CV]CVCV

u i  
 [fu9il] [yuf9al]

*Imperfective Passive*  
 y C<sub>1</sub> C<sub>2</sub> C<sub>3</sub>  
 | | | |  
 CV[CV]CVCV

u a  
 (2.23)

Derivational path:

<i>Active A</i>	<i>Perfective</i>	=>	B	<i>Imperfective</i>	
		v			
<i>Passive</i>	C	=>	D		(2.24)

**4. The domain of apophony: extension to other forms**

*Perfective, Active*  
 II kattab  
 VIIInkatab ya-nkatib

*Imperfective, Active*  
 yu-kattib

II *Perfective Active*  
 k t b  
 | / | |  
 CV[CV]CVCV  
 a |  
 a a

*Imperfective Active*  
 y k t b  
 | | / | |  
 [CV]CV[CV]CVCV  
 u | i  
 (2.25)

VII *Perfective Active*  
 n k t b  
 | | | |  
 [affCV] CV[CV]CVCV  
 a |  
 \* a  
 \*

*Imperfective Active*  
 y n k t b  
 | | | |  
 CV +[affCV] CV[CV]CVCV  
 a | i  
 \* a  
 \*

\*\*\*\*\*no apophony\*\*\*\*\* (2.26)

**5. Conclusion**

<i>Root</i>		<i>Lexical vocalization</i>
Drb	<=>	—
lbs	<=>	i
ktb	<=>	a
kbr	<=>	u

(2.27)

The classes of vowel correspondences are a by-product of the operation of the ablaut function:  
 — -> i -> a -> u -> u. (2.28)

**References:**

- (1) Guerssel, Mohand & Jean Lowenstamm (1993), *Apophony in Classical Arabic*, ms. UQAM / Paris7.
- (2) Guerssel, Mohand & Jean Lowenstamm (1996), *Ablaut in Classical Arabic measure I active verbal forms*. In: Lecarme, Jacqueline, Jean Lowenstamm & Ur Shlonsky (eds): *Studies in Afroasiatic Grammar*. 123-134. The Hague: HAG.
- (3) McCarthy, John (1979), *Formal Problems in Semitic Morphology and Phonology*. Ph.D. Dissertation, Cambridge, Mass.
- (4) McCarthy, John (1981), *A prosodic theory of nonconcatenative morphology*. In: *Linguistic Inquiry* 12:3.
- (5) McCarthy, John (1989), *Guttural Phonology*, ms. Amherst.

## Apophony in Kabyle Berber verbal system

**Content:**

An apophonic analysis of the aspectual opposition in Kabyle Berber.

The status of the "negative" preterite stem.

Data and analysis from Bendjaballah 1999, 2000.

### 1. Introduction

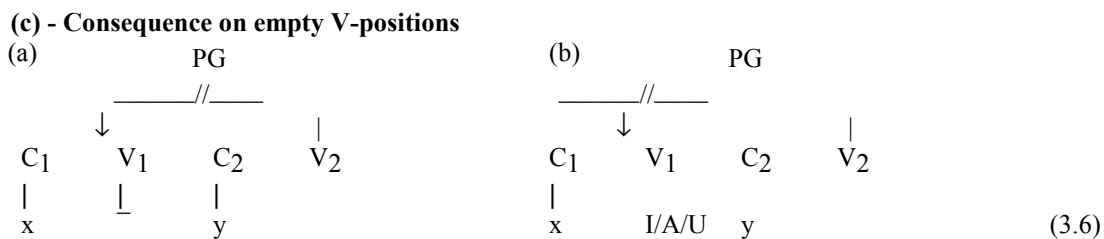
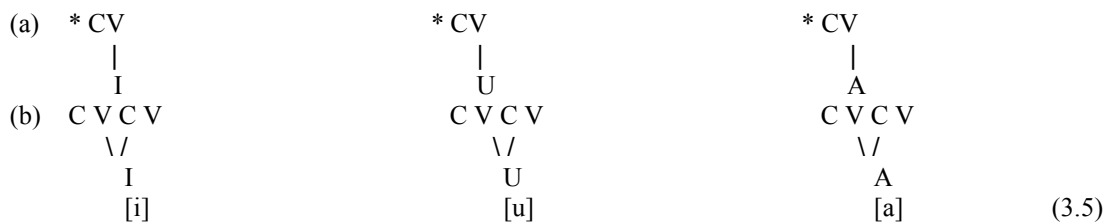
— Within each aspectual category, every verb has two stems: the imperfective stems are the 'aorist' and the 'intensive aorist', the perfective stems are the 'preterite' and the 'negative preterite'. All in all there are four lexical forms for each verb (3.1)

	<i>Imperfective stems</i>		<i>Perfective stems</i>		<i>gloss</i>
	<i>aorist</i>	<i>intensive aorist</i>	<i>preterite</i>	<i>negative pret.</i>	
a.	xḍ@m	x@dd@m	xḍ@m	xḍim	'to work'
	bb@R	t@bb@R	bb@R	bbiR	'to dive'
b.	nadi	tsnadi nuda		nuda	'to look for'
	mil tsmil	mal		mal	'to lean'
	R@TTi	tsR@TTi	R@TTa	R@TTa	'to muffle up'
c.	ad@r	ttsad@r	ud@r	udir	'to go down'

### 2. The representation of Berber vowels

(a) - **Vocalic system of Berber:**      i                      u  
@  
a (3.3)

(b) - **Hypothesis**  
 In Berber, vocalic elements must be associated with two V positions. (3.4)



<u>skeletal level</u>	(a) Peripheral vowels.
	CVCV CVCV CVCV
	V        V        V
<u>segmental level</u>	I        U        A        I
<u>phonetic realization</u>	[i]        [u]        [a]
	(b) [@] is ambiguous.
	CV    CV    CV    CV
	U    A
	[@]    [@][@]    [@] (3.7)

## 3. The verbal system of Berber: presentation and issues

IMPERFECTIVE		PERFECTIVE	
stem I (aorist)	stem II (intensive aorist)	stem III (preterite) preterite)	stem IV (negative)
x <u>d</u> @m 'work!'	x@dd@m 'usually work!'	y@-x <u>d</u> @m 'he worked'	ur y@-xdim 'he didn't work'
mil 'lean!'	t <u>smil</u> 'usually lean!'	i-mal 'he leaned'	ur i-mal 'he didn't lean'

(3.8)

## (a) - Verb types

	IMPERF.	PERFECTIVE		gloss	total
	I Aorist	III Positive preterite	IV Negative preterite		
a.	1. x <u>d</u> @m	x <u>d</u> @m	x <u>dim</u>	'to work'	682
	2. bb@R	bb@R	bbiR	'to dive'	60
	3. <u>bri</u>	<u>bri</u>	<u>bri</u>	'to cut'	53
	4. <u>çil</u>	<u>çil</u>	<u>çil</u>	'to measure'	2
	5. <u>dub</u>	<u>dub</u>	<u>dub</u>	'to be exhausted'	40
	6. <u>šukk</u>	<u>šukk</u>	<u>šukk</u>	'to suspect'	44
b.	7. ad@r	ud@r	udir	'to go down'	30
	8. a <u>ç</u> <sup>wi</sup>	u <u>çi</u>	u <u>çi</u>	'to wake up'	5
	9. R@TTi	R@TTa	R@TTa	'to muffle up'	45
	10. fa <u>t</u>	fu <u>t</u>	fu <u>t</u>	'to miss'	38
	11. mil	mal	mal	'to lean'	35
	12. qirr	qarr	qarr	'to admit'	7
	13. fak <u>k</u>	fu <u>k</u>	fu <u>k</u>	'to finish'	8
	14. dr <u>uri</u>	dr <u>ura</u>	dr <u>ura</u>	'to need'	17
	15. na <u>di</u>	nu <u>da</u>	nu <u>da</u>	'to look for'	27
	16. x <u>tir</u>	x <u>tar</u>	x <u>tar</u>	'to choose'	10
17. nnaR	nnaR	nnaR	'to fight'	6	
c.	18. w@ll@h	w@ll@h	w@ll@h	'to guide'	659
	19. <u>bur</u> @ <u>ç</u> \$iw@r	<u>bur</u> @ <u>ç</u> \$aw@r	<u>bur</u> @ <u>ç</u> \$aw@r	'to bless' 'to consult'	97 11
	20. \$a <u>b</u>	\$a <u>b</u>	\$a <u>b</u>	'to whiten (hair)'	42
	21. ix <u>fif</u> a <u>g</u> <sup>w</sup> ar u <u>zzur</u>	ux <u>faf</u> u <u>gar</u> u <u>zzar</u>	ux <u>faf</u> u <u>gar</u> u <u>zzar</u>	'to be light' 'to exceed' 'to be scattered'	48

(3.9)

Vocalic alternation between stem I and stem III	
verb types (3.9.a)	NO
verb types (3.9.b)	YES

(3.10)

stem I \ stem III	i	a	u	@
i	YES	YES	NO	NO
a	NO	NO	YES	NO
u	NO	NO	YES	NO
@	NO	NO	NO	YES

(3.11)



identity of the vowel (stem I, stem III)	(i, i)	(i, a)	(a, u)	(u, u)	(@, @)
Verb with one radical vowel	3, 4	11, 12, 16	10, 13, 17	5, 6	1, 2
Verb with two radical vowels	8	9, 14, 15	7, 8, 15	14	7, 9

(3.12)

Voc. alternation between stem III and stem IV	
verb types (3.9.1), (3.9.2), (3.9.7)	YES
other verb types	NO

(3.13)

	'regular' verbs (no vocalic alternation stem I/III)	'irregular' verbs (vocalic alternation stem I/III)
no alternation stem III / stem IV	types 3 to 6	types 8 to 17
alternation stem III / stem IV	types 1 and 2	type 7

(3.14)

	ref. in (3.9)	IMPERF.	PERFECTIVE		verbs
		stem I	stem III	stem IV	
A	11, 12, 16	i	a	a	mil, qirr, x̣tir
	10, 13, 17	a	u	u	faṭ, fakk, nnaR
	5, 6	u	u	u	ḍub, \$ukk
	15	a i	u a	u a	nadi
	14	u i	u a	u a	druri
B	1, 2	@	@	i	xd@m, bb@R
	7	a @	u @	u i	ad@r
C	9	@ i	@ a	@ a	R@TTi
D	3, 4	i	i	i	bri, çil
	8	a i	u i	u i	ag <sup>wi</sup>

(3.15)

#### 4. The apophonic derivation: evidence from group A

Apophonic path:  $\bar{\quad} \rightarrow I \rightarrow A \rightarrow U \rightarrow U$  (3.16)

##### (a) - The transparent cases of application of the apophonic path: group A

	Imperfective (stem I)	Perfective (stems III&IV)	verb type
(a) apophonic step. i -> a	mil	mal	11
	qirr	qarr	12
	x̣tir	x̣tar	16
	faṭ	fuṭ	10
	fakk	fukk	13
a -> u	nnaR	nnaR	17
	ḍub	ḍub	5
	\$ukk	\$ukk	6
(b) combinations. (a -> u, i -> a)	nadi	nuda	15
	druri	drura	14

(3.17)

**(b) - Directionality of AP and morphological complexity**

(a) <i>Imperfective.</i>	2s	mil	'lean!'
	2mp	mil-@n	id.
	2fp	mil-@nt	id.
(b) <i>Perfective.</i>			
	<i>Positive preterite:</i>		
	2s	t-mal-@D	'you leaned'
	2mp	t-mal-@m	id.
	2fp	t-mal-@mt	id.
	<i>Negative preterite:</i>		
2s	ur t-mal-@D	'you did not lean'	
2mp	ur t-mal-@m	id.	
2fp	ur t-mal-@mt	id.	

(3.18)

**(c) - By-products of the analysis**

verbal stem: Imperf./Perf.	traditional presentations	apophonic analysis
mil / mal	irregular	i -> a
fat / fut	irregular	a -> u
dub / dub	regular	u -> u
	<u>dichotomy:</u> regular / irregular verb	<u>one mechanism:</u> Imp -> Perf = instantiation of an apophonic step

(3.19)

verbal stem: Imperf./Perf.	traditional presentations	apophonic analysis
nadi / nuda	2 alternating vowels	a i -> u a
druri / drura	1 alternating vowel, only	u i -> u a
	<u>number of alternating vowels</u> is variable	<u>uniform application</u> of AP to the entire vocalic melody

(3.20)

**5. Opacity and the status of the 'negative preterite'**

**(a) - Group B verbs are problematic**

	IMPERFECTIVE	PERFECTIVE		status	gloss
	stem I	stem III	stem IV		
a.	x <u>d</u> @m	x <u>d</u> @m	x <u>dim</u>	regular	'to work'
b.	bb@R	bb@R	bbiR	regular	'to dive'
c.	ad@r	ud@r	udir	irregular	'to go down'

(3.21)

**(b) - Analysis of the 'negative preterite'**

	IMPERFECTIVE		PERFECTIVE	
	/	\	/	\
	positive	negative	positive	negative
a.	x <u>d</u> @m	ur x@ <u>dd</u> @m ara	y@-x <u>d</u> @m	ur y@-x <u>dim</u> ara
	'work!'	'do not work!'	'he worked'	'he did not work'
b.	bbeR	ur t@ <u>bb</u> @R ara	y@-bb@R	ur y@-bbiR ara
	'dive!'	'do not dive!'	'he dived'	'he did not dive'
c.	ad@r	ur <u>ttsad</u> @r ara	y- <u>ud</u> @r	ur y- <u>udir</u> ara
	'go down!'	'do not go down!'	'he went down'	'he did not go down'

(3.22)

	1. <u>Positive Imp.</u>	2. <u>Negative Imp.</u>	
(a)	CVCVCV       x <u>d</u> m [x <u>d</u> @m]	CVCVCVCV   \ /   x <u>d</u> m [x@ <u>dd</u> @m]	
(b)	CVCVCV V   b R [bb@R]	CVCVCVCV   V   t b R [t@bb@R]	
(c)	CVCVCVCV V     a <u>d</u> r [a <u>d</u> @r]	CVCVCVCVCV \ / V     ts a <u>d</u> r [ttsa <u>d</u> @r]	(3.23)
	1. <u>Positive Perf.</u>	2. <u>Negative Perf.</u>	
(a)	CVCVCV       x <u>d</u> m [x <u>d</u> @m]	CVCVCVCV     \ /   x <u>d</u> i m [x <u>d</u> im]	
(b)	CVCVCV V   b R [bb@R]	CVCVCVCV V V   b i R [bbiR]	
(c)	CVCVCVCV V     a <u>d</u> r [a <u>d</u> @r]	CVCVCVCVCV V   V   u <u>d</u> i r [u <u>d</u> ir]	(3.24)

Negative preterite formation:

- (a) Insertion of a CV unit in the template of the positive stem. Site of insertion is immediately before the last CV unit of the template: (CV)CVCVCV -> (CV)CVCV[CV]CV  
 (b) Identification of this position ([<sub>n</sub>CV]) by the vocalic melody. (3.25)

(a) <u>positive</u> (stem III)	(b)	(c) <u>negative</u> (stem IV)
i	i	i
CVCVCV	CVCV [ <sub>n</sub> CV] CV	CVCV [ <sub>n</sub> CV] CV
->	->	
(3.25a)	(3.25b)	
x <u>d</u> m	x <u>d</u> m	x <u>d</u> m
[x <u>d</u> @m]		[x <u>d</u> im]
		(3.26)

IMPERFECTIVE		PERFECTIVE	
aorist (stem I)		+ pret. (stem III)	- pret. (stem IV)
-		i	i
	→		
	<i>apophony</i>		
CVCVCV	->	CVCVCV	CVCV [ <sub>n</sub> CV] CV
x <u>d</u> m		x <u>d</u> m	x <u>d</u> m
[x <u>d</u> @m]		[x <u>d</u> @m]	[x <u>d</u> im]
			(3.27)



## 6. The 'negative preterite': extension of the analysis to groups A, C and D

### (a) - Data

verb type	reference	example (stem I)	Perfective stems	
			pos. (stem III)	neg. (stem IV)
a. CVC <sub>i</sub> C <sub>i</sub>	6, 12, 13 (group A)	fakk	fukk	fukk
b. CVCV	15 (group A)	nadi	nuda	nuda
c. CCVCV	14 (group A)	druri	drura	drura
d. CCV	3 (group D)	bri	bri	bri
e. VCV	8 (group D)	aç <sup>w</sup> i	ugi	ugi
f. C@C <sub>i</sub> C <sub>i</sub> V	9 (group C)	R@TTi	R@TTa	R@TTa
g. CVC	4, 5, 10, 11 (groups A&D)	mil	mal	mal
h. CCVC	16, 17 (group A)	nnaR	nnuR	nnuR

(3.33)

### (b) - Identity stem III / IV due to an impossible insertion of the negative infix

(a) stem III: [fukk]

u  
 $\wedge$   
 CVCVCVCV  
 | V  
 f k

(b) stem IV = stem III: [fukk]

u [nCV]  
 $\wedge$  ↓  
 CVCVCVCV  
 | V  
 f k

(3.34)

(a) stem III: [nuda]

u a  
 $\wedge$   $\wedge$   
 CVCVCVCV  
 | |  
 n d

(b) stem IV = stem III: [nuda]

u a  
 $\wedge$   $\wedge$   
 CVCVCVCV  
 | |‡  
 n d [nCV]

(3.35)

### (c) - Identity stem III / IV due to an impossible identification of the neg. infix

(a) stem III: [mal]

a  
 $\wedge$   
 CVCVCV  
 | |  
 m l

(b) [nCV] insertion

a  
 $\wedge$   
 CVCV[nCV]CV  
 | |  
 m l

(3.36)

(a) impossible propagation

a  
 $\wedge$  ‡  
 CVCV[nCV]CV  
 | |  
 m l

(b) stem IV = stem III: [mal]

a  
 $\wedge$   
 CVCV[nCV]CV  
 | ↓ |  
 m - l

(3.37)

## 7. Why [i] does not alternate in group D

IMPERFECTIVE <u>stem I</u>	PERFECTIVE		<u>status</u>	<u>gloss</u>
	<u>stem III</u>	<u>stem IV</u>		
a. <u>bri</u>	<u>bri</u>	* <u>bra</u>	regular	'to cut a piece'
b. aç <sup>w</sup> i	uçi	* uça	irregular	'to wake up'
c. çil	çil	* çal	regular	'to measure'

(3.38)

The [i] that surfaces in the verbs of group D is not part of the vocalic melody but the realization of a radical glide. Since the apophonic mechanism applies to the vocalic melody only, an element that surfaces as a vocalic [i] but reflects a radical glide is not affected by the apophonic derivation. It thus remains [i] in all verbal stems. (3.39)

## (a) - 'Defective' verbs

- The deverbal noun: a test for the identification of [i]

<u>verb</u> (stem I)	<u>gloss</u>	<u>derived noun</u>	<u>gloss</u>	<u>rad. cons</u>
<b>xd@m</b>	'to work'	<b>axdam</b>	'the act of working'	x $\underline{d}$ m
<b>ag<sup>W</sup>@m</b>	'to draw'	<b>ag<sup>W</sup>am</b>	'the act of drawing'	g <sup>W</sup> m
<b>qq@n</b>	'to bind'	<b>tugqna</b>	'the act of binding'	qn

(3.40)

Verb type  $C_1C_2@C_3$  -> noun:  $aC_1C_2aC_3$ 

<u>stem I</u>	<u>verb</u>	<u>stem III</u>	<u>derived noun</u>	<u>rad. cons</u>	<u>gloss</u>
x $\underline{d}$ @m		x $\underline{d}$ @m	<b>ax<math>\underline{d}</math>am</b>	x $\underline{d}$ m	'to work'
b $\underline{d}$ @r		b $\underline{d}$ @r	<b>ab<math>\underline{d}</math>ar</b>	b $\underline{d}$ r	'to quote'
b $\underline{H}$ @t		b $\underline{H}$ @t	<b>ab<math>\underline{H}</math>at</b>	b $\underline{H}$ t	'to inquire'

(3.41)

Verb type  $C_1C_2i$ , i non alt. -> noun:  $aC_1C_2ay$ 

<u>stem I</u>	<u>verb</u>	<u>stem III</u>	<u>derived noun</u>	<u>rad. cons</u>	<u>gloss</u>
b $\underline{r}$ i		b $\underline{r}$ i	<b>ab<math>\underline{r}</math>ay</b>	b $\underline{r}$ y	'to cut a piece'
d $\underline{r}$ i		d $\underline{r}$ i	<b>ad<math>\underline{r}</math>ay</b>	d $\underline{r}$ y	'to hit one's finger'
δ $\underline{n}$ i		δ $\underline{n}$ i	<b>aδ<math>\underline{n}</math>ay</b>	δ $\underline{n}$ y	'to be fat'
n $\underline{d}$ i		n $\underline{d}$ i	<b>an<math>\underline{d}</math>ay</b>	n $\underline{d}$ y	'to set a trap'

(3.42)

Verb type  $C_1@C_2C_2i$  / i alt. -> noun:  $aC_1@C_2C_2i$   
 $C_1aC_2i$  / i alt.  $aC_1aC_2i$ 

<u>stem I</u>	<u>verb</u>	<u>stem III</u>	<u>derived noun</u>	<u>rad. cons</u>	<u>gloss</u>
R@ $\underline{t}$ t $\underline{t}$ i		R@ $\underline{t}$ t $\underline{a}$	aR@ $\underline{t}$ t $\underline{t}$ i	R $\underline{t}$	'to muffle up'
b@ $\underline{r}$ r $\underline{r}$ i		b@ $\underline{r}$ r $\underline{a}$	ab@ $\underline{r}$ r $\underline{r}$ i	b $\underline{r}$	'to take no further interest in'
n $\underline{a}$ d $\underline{i}$		n $\underline{u}$ d $\underline{a}$	an $\underline{a}$ d $\underline{i}$	n $\underline{d}$	'to look for'
\$ $\underline{a}$ l $\underline{i}$		\$ $\underline{u}$ l $\underline{a}$	a\$ $\underline{a}$ l $\underline{i}$	\$ $\underline{l}$	'to roam'

(3.43)

Verb type  $C_1C_1@C_2$  -> noun:  $tuC_1C_1C_2a$   
 $C_1C_1i$  / i non alt. -> noun:  $tuC_1C_1ya$ 

	<u>verb</u>	<u>stem III</u>	<u>derived noun</u>	<u>rad. cons</u>	<u>gloss</u>
a.	bb@ $\underline{R}$	bb@ $\underline{R}$	t $\underline{u}$ bb $\underline{R}$ a	b $\underline{R}$	'to dive'
	\$ $\underline{\$}$ @ $\underline{g}$	\$ $\underline{\$}$ @ $\underline{g}$	t $\underline{u}$ \$ $\underline{\$}$ g $\underline{a}$	\$ $\underline{g}$	'to slip'
b.	b $\underline{b}$ i	b $\underline{b}$ i	t $\underline{u}$ b $\underline{b}$ y $\underline{a}$	b $\underline{y}$	'to pinch'
	k $\underline{k}$ i	k $\underline{k}$ i	t $\underline{u}$ k $\underline{k}$ y $\underline{a}$	k $\underline{y}$	'to take part'

(3.44)

Verb type  $aC_1@C_2$  → noun:  $aC_1aC_2$ ,  $aC_1C_1uC_2$   
 $aC_1i / i$  non alt. → noun:  $aC_1ay$ ,  $aC_1C_1uy$

	<u>verb</u>		<u>derived noun</u>	<u>rad. cons</u>	<u>gloss</u>
	<u>stem I</u>	<u>stem III</u>			
a.	ag <sup>w</sup> @m	ug@m	ag <sup>w</sup> am	g <sup>w</sup> m	'to draw'
	ad@f	ud@f	adduf	df	'to go down'
b.	aç <sup>w</sup> i	uçi	aç <sup>w</sup> ay	ç <sup>w</sup> y	'to wake up'
	ali	uli	alluy	ly	'to go up'
	ani	uni	annuy	ny	'to delouse'

(3.45)

– Representations

'If [a] glide is not followed by a phonetic vowel in the nuclear position, then it occupies that nuclear position'.  
 (Guerssel XX) (3.46)

(a)

CV<sub>1</sub>CV<sub>2</sub>C<sub>3</sub>V<sub>3</sub>  
 | | †  
 C<sub>1</sub> C<sub>2</sub> I  
 \* C<sub>1</sub>C<sub>2</sub>@y

(b) PG

—  
 ↓ |  
 CV<sub>1</sub>CV<sub>2</sub>C<sub>3</sub>V<sub>3</sub>  
 | | \ /  
 C<sub>1</sub> C<sub>2</sub> I  
 C<sub>1</sub>C<sub>2</sub>i

(3.47)

(a) Verb type bri, ÆBRY.

CV<sub>1</sub>CV<sub>2</sub>CV  
 | | V  
 b r I  
 [bri]

(b) Verb type aç<sup>w</sup>i, Æç<sup>w</sup>Y.

a  
 ^  
 CVCVCVCV  
 | V  
 ç<sup>w</sup> I  
 [aç<sup>w</sup>i]

(3.48)

– Apophonic derivations

IMPERFECTIVE

PERFECTIVE (positive pret.)

—→  
*apophony*

(a)

CVCVCV  
 | | V  
 b r I  
 [bri]

CVCVCV  
 | | V  
 b r I  
 [bri]

(b)

—→  
*apophony*

a  
 / \  
 CVCVCVCV  
 | V  
 ç<sup>w</sup> I  
 [aç<sup>w</sup>i]

↓ ↓  
 u i  
 / \  
 CVCVCVCV  
 | V  
 ç I  
 [uçi]

(3.49)

(b) - 'Hollow' verbs

$\tilde{A}\check{\text{c}}\text{YL}$  verb stem I:  $\check{\text{c}}\text{il}$  stem III:  $\check{\text{c}}\text{il}$  'to measure' (intr. & tr.)  
variant stem I:  $\check{\text{c}}@\text{yy}@l$  stem III:  $\check{\text{c}}@\text{yy}@l$  'to measure' (tr.)  
 (3.50)

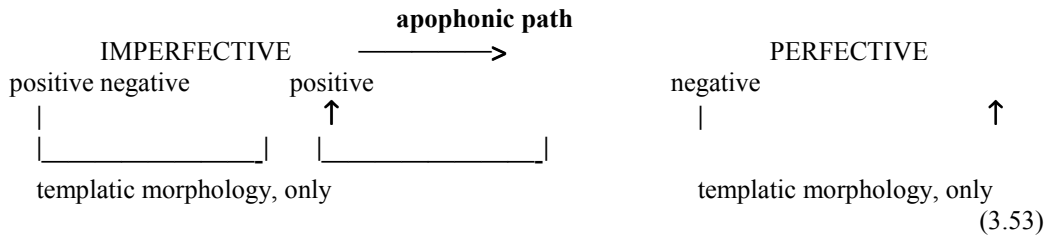
(a) IMPERFECTIVE → (b) PERFECTIVE (+ pret.)  
 $\text{CVC}_2\text{VCV}_3$   $\text{CVC}_2\text{VCV}_3$   
 $\begin{array}{|c|} \hline \backslash / \\ \hline \end{array}$   $\begin{array}{|c|} \hline \text{i} \\ \backslash / \\ \hline \end{array}$   
 $\check{\text{c}} \quad \text{I} \quad \text{l}$   $\check{\text{c}} \quad \text{I} \quad \text{l}$   
 $[\check{\text{c}}\text{il}]$   $[\check{\text{c}}\text{il}]$   
 (3.51)

(c) - Glide W: opacity

<u>rad.</u> <u>cons.</u>	<u>loan</u> <u>&lt; ar</u>	<u>verb</u>		<u>variant</u>		status of [u]	
		stem I	stem III	stem I	stem III		
Hn \$d	<u>H</u> NN \$DD	Hun \$udd	Hun \$udd	does not exist does not exist		vocalic melody	'to pity so' 'to bind'
$\check{\delta}\text{wl}$ Hw\$	<u>T</u> WL	$\check{\delta}\text{ul}$ hu\$\$	$\check{\delta}\text{ul}$ hu\$\$	$\check{\delta}@\text{bb}^w@l$ h@bb <sup>w</sup> @\$	$\check{\delta}@\text{bb}^w@l$ h@bb <sup>w</sup> @\$	radical glide	'to be long' 'to shake'

(3.52)

8. Conclusion



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## The internal structure of the determiner in Beja

### Content:

Different role of AP.

Form of correspondence between the grammatical features and their phonological exponents.

Data and analysis from Bendjaballah 1999.

### 1. Introduction

	singular		plural	
	subject	non subject	subject	non subject
masculine	u: -	o: -	a: -	e: -
feminine	tu: -	to: -	ta: -	te: -

(5.1)

(i) **u:-me:k e:a** "the donkey came"  
 detMsS-donkey come, 3ms past

vs. me:k e:a "a donkey came"  
 donkey come, 3ms past

(ii) **wu:-yo: o:-ra:w deb-i\$-iya** "the bull made the other fall"  
 detMsS-bull detMs\*S-other fall-caus-3ms past

**to:-fna i-hayt** "he took the spear"  
 detFs\*S-spear take, 3ms past

**e:-mana tam-ya** "he ate the viscera"  
 detMp\*S-viscera eat-3ms past

(5.2)

### Aims

— Identify the phonological exponents of the grammatical features expressed on the determiner in Beja.

— More generally: explore the nature of the correspondence between the grammatical features and their phonological exponents.

The grammatical features have access to the internal phonological structure of the segments: a grammatical feature may have as phonological exponent an object that is not phonetically interpreted in isolation but is realized in composition with another phonological object.

(5.3)

A form of correspondence between the gramm. features and their phonological exponents:

(i) the grammatical features, i.e. the primitives of the grammatical matrixes, are realized by the primitives of the phonological representations.

(ii) correspondence between the type of grammatical feature and the type of phonological primitive. (5.4)

### 2. Ingredients

3 types of phonological primitives: (a) the element, primitive of the segmental level  
 (b) the CV unit, primitive of the skeletal level  
 (c) the association line

(5.5)

Grammatical features: (a) gender feature: masc., fem.  
 (b) number feature: sing., plur.  
 (c) case feature: subject, non subject  
 (d) definiteness feature: determiner is definite

(5.6)

	phonetic exponent	internal structure of the segments		gramm. features
		cons.	voc.	
a.	[u:]	∅	U	<M, sg, S, def>
b.	[o:]	∅	A.U	<M, sg, nonS, def>
c.	[a:]	∅	A	<M, pl, S, def>
d.	[e:]	∅	A.I	<M, pl, nonS, def>
e.	[tu:]	t	U	<F, sg, S, def>
f.	[to:]	t	A.U	<F, sg, nonS, def>
g.	[ta:]	t	A	<F, pl, S, def>
h.	[te:]	t	A.I	<F, pl, nonS, def>

(5.7)

### 3. Analysis

- (a) the gender, number and case features: inherited from another syntactic node - concord.  
 (b) the "definite" feature: not inherited. (5.8)

The phonological exponent of the feature "definite" is the support that makes it possible for the inherited features to be realized. (5.9)

Definite = CV (5.10)

Gender: M = ∅      F = t (5.11)

	singular		plural	
	subject	non-subject	subject	non-subject
phonetic realization	[u:]	[o:]	[a:]	[e:]
phonological structure	U	A.U	A	A.I

(5.12)

The phonological complexity characteristic of non-subject forms is not lexical, rather it reflects out morphological complexity. More precisely, each of the 2 elements present in non-subject forms is the phonological exponent of one grammatical feature. (5.13)

Number	Sg = A	Pl = I
Case	S = non-association of the exponent of the number feature	non-S = association of the exponent of the number feature

(5.14)

<u>Sg</u>		<u>Pl</u>	
1	a-ktib	1	ni-ktib
2m	ti-ktib-a	2c	te-ktib-na
2f	ti-ktib-i		
3m	i-ktib	3c	e-ktib-na
3f	ti-ktib		

(5.15)

	<u>Sg</u>	<u>Pl</u>	<u>gloss</u>
• Berber: <i>Kabyle Berber</i>	argaz	irgaz@n	"man"
• Chadic: - Hausa	ak <sup>w</sup> @rsi	ik <sup>w</sup> @rsiy@n	"seat"
	kaazaa	kaaZii	"frog"
	faaraa	faarii	"grasshoper"
- Pa'a	taka	taki	"arrow"
	\$ila	\$ili	"axe"

(5.16)

Grammatical category	Phonological identity of the gramm. features	
Gender	M = Ø	F = t
Number	Sg = A	Pl = I
"Case"	S = non-assoc. of num	non-S = assoc. of num
Definite	CV	

(5.17)

	<u>Sg</u>			<u>Pl</u>		
	<u>S</u>	<u>nonS</u>		<u>S</u>	<u>nonS</u>	
— gnr —	Ø	Ø		Ø	Ø	
— def+?? —	CVCV	CVCV	CVCV	CVCV		
	V	V		V	V	
??	U	U		A	A	
— case —						
— num —	A	A		I	I	
	[u:]	[o:]		[a:]	[e:]	

(5.18)

#### 4. Why an additional element

##### (a) - Proposal

In Beja, the grammatical oppositions expressed on the Det must be phonetically readable.

(5.19)

Add the apophonic output of the element present in the representation.

(5.20)

##### (b) - The gramm. oppositions are phonetically readable => application of AP

Given (5.18) and (5.20), could the additional elements be other elements?

	<u>Sg</u>		<u>Pl</u>			<u>Sg</u>		<u>Pl</u>		
	<u>S</u>	<u>nonS</u>	<u>S</u>	<u>nonS</u>		<u>S</u>	<u>nonS</u>	<u>S</u>	<u>nonS</u>	
1)	x	z	y	t	2e)	x	z	y	z	
2a)	x	x	y	z	3a)	x	x	y	x	
2b)	x	y	y	z	3b)	x	x	y	y	
2c)	x	z	y	x	3c)	x	y	y	x	
2d)	x	z	y	y	3d)	x	y	y	y	

where

(i)  $x \neq y, x \neq A.z, x \neq I.t, y \neq A.z, y \neq I.t$  and  $A.z \neq I.t$

(ii)  $x \neq \emptyset$  and  $y \neq \emptyset$

(5.21)

Configuration	x	Ø	y	Ø	where (x, y)	{I, A, U} <sup>2</sup> ,	x ≠ y				
additional elements	elements of the det				phonetic realization						
I	Ø	A	Ø	I	A	A	I	[i]	[a]	[a]	[i]
I	Ø	U	Ø	I	A	U	I	[i]	[a]	[u]	[i]
A	Ø	I	Ø	A	A	I	I	[a]	[a]	[i]	[i]
A	Ø	U	Ø	A	A	U	I	[a]	[a]	[u]	[i]
U	Ø	I	Ø	U	A	I	I	[u]	[a]	[i]	[i]
U	Ø	A	Ø	U	A	A	I	[u]	[a]	[a]	[i]

(5.22)

Configuration	x	x	y	y	where	(x, y)	{I, A, U} <sup>2</sup> ,	x ≠ y				
additional elements					elements of the det				phonetic realization			
I	I	A	A	I	A.I	A	A.I		[i]	[e]	[a]	[e]
I	I	U	U	I	A.I	U	I		[i]	[e]	[u]	[i]
A	A	I	I	A	A	I	I		[a]	[a]	[i]	[i]
A	A	U	U	A	A	U	I		[a]	[a]	[u]	[i]
U	U	I	I	U	A.U	I	I		[u]	[o]	[i]	[i]
U	U	A	A	U	A.U	A	A.I		[u]	[o]	[a]	[e]

(5.23)

### 5. What has to be lexicalized

#### Gender: + F = t

- Binary opposition, "feminine" is marked => opposition "+ F vs. - F".
- Expressed by "sthg vs. nothing".
- Lexicalise the exponent of + F only.

(5.24)

#### Number: + Pl = I

- x, x', y and y' 4 elts, where (x', y') is the apophonic output of (x, y).

DetM		<u>Sg</u>		<u>Pl</u>	
		<u>S</u>	<u>nonS</u>	<u>S</u>	<u>nonS</u>
— gnr —		∅	∅	∅	∅
— num —		x	x	y	y
— case —					
— def —		CV	CV	CV	CV
apo. der.	x'		x'	y'	y'

We need: (x, y) ∈ {∅, I, A, U}<sup>2</sup>

ii. x' ≠ x.x', x.x' ≠ y', x.x' ≠ y.y', y' ≠ y.y', x' ≠ y', x' ≠ y.y'

- Conditions on (x, y):
- x' ≠ x.x' => x ≠ ∅
  - y' ≠ y.y' => y ≠ ∅
  - x' ≠ y' => x ≠ y

=> (x, y) ∈ {I, A, U}<sup>2</sup> & x ≠ y

(5.25)

- possibilities = {(A, I), (I, A), (A, U), (A, U), (I, U), (U, I)}

(a) (sg, pl) = (A, I)

(b) (sg, pl) = (A, U)

	<u>Sg</u>	<u>Pl</u>	<u>Sg</u>	<u>Pl</u>	
	<u>S</u>	<u>nonS</u>	<u>S</u>	<u>nonS</u>	<u>S</u> <u>nonS</u>
— gnr —	∅	∅	∅	∅	∅
— num —	A	A	I	I	A
— case —					U
— def —	CV	CV	CV	CV	CV
	U	U	A	A	U
	[u]	[o]	[a]	[e]	[u]

(c) (sg, pl) = (I, U)

	<u>Sg</u>		<u>Pl</u>	
	<u>S</u>	<u>nonS</u>	<u>S</u>	<u>nonS</u>
— gnr —	∅	∅	∅	∅
— num —	I	I	U	U
— case —				
— def —	CV	CV	CV	CV
	A	A	U	U
	[a]	[e]	[u]	[u]

(5.26)

If Beja lexicalizes +Pl = A, then it is impossible to derive the exponent of -Pl.

If Beja lexicalizes +Pl = I, then AP predicts the exponent of -Pl to be A. (5.27)

**Do not associate the exponent of the copy of the number feature of the noun when it is phonetically readable on the verb.** (5.28)

**Definite:** Support necessary to the realization of the num/gnr features. (5.29)

### Summary

1. The three grammatical oppositions expressed on the determiner (gender, number and case) must be unambiguously phonetically readable.
2.
  - a. Definite = Support necessary to the realization of the gnder and number features.
  - b. Gender = Mark + F
  - c. Nb = Mark + Pl
  - d. Do not associate the exponent of the copy of the number feature of the noun when it is phonetically readable on the verb.
3. AP : ∅ -> I -> A -> U -> U (5.30)

### 6. Conclusion

- The existence of morphemes that consist exclusively in a tone or an element is recognized in autosegmental phonology. I propose that the third phonological primitive, the skeletal unit (CV in my framework), also may be the phonological exponent of a grammatical feature (ie the skeleton has an autonomous morphological activity).

- CV as exponent of the feature which is not inherited via concord.

=> further research: whether such a correspondence may be extended, that is: to precise how the differences between the various types of phonological primitives correspond to differences between the various types of grammatical primitives.

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## Apophony theory and template organisation in Semitic

### Content:

Apophony theory makes predictions on the organization of Semitic templates.

- the template set is organized.
- a precise relationship between templates: derivation.
- the role of the lexicon is reduced: a template may be derived from another one.

Data and analysis from Ségéral 1995, 2000.

### 1. Introduction

(Arabic)	CaCaCa	kataba	"he wrote"		
		CuCiCa	kutiba	"it has be written"	
		CaCCaCa	kattaba	"he caused to write"	
		CiCaaCun	kitaabun	"book (nom.)"	
		maCCaCun	maktabun	"office (nom.)"	(6.1)

(Gz)	√qtl	<i>Perfective:</i>	CäCäC- qätäl-	<i>Imperfective:</i>	-CØCïC-      * -CØCäC- -qØtïl-      * -qØtäl-
	√lbs	<i>Perfective:</i>	CäCØC- läbØs-	<i>Imperfective:</i>	* -CØCïC-      -CØCäC- * -lØbis--lØbäs- (6.2)

*vocalization*

*derivational relationship between templates*

traditional view:	lexical	no prediction	
apophonic view:	derived	prediction	(6.3)

### 2. Construction of the model

#### (a) - The Apophonic Path

Ø -> I -> A -> U -> U (6.4)

#### (b) - The "butterfly"

<i>possible deriv.</i>	<i>apophonic deriv.</i>	<i>possible deriv.</i>	<i>apophonic deriv.</i>
qatal > qutul	yes	qutul > qatal	*
qatal > qØtil	*	qØtil > qatal	*
qatal > qatil	*	qatil > qatal	yes
qutul > qØtil	*	qØtil > qutul	*
qutul > qatil	*	qatil > qutul	*
qØtil > qatil	*	qatil > qØtil	*

(6.5)

qatal	qatil	qatul	qatØl
qital	qitil	qitul	qitØl
qatal	qutil	qutul	qutØl
qØtal	qØtil	qØtul	qØtØl

(6.6)

<p>(a)</p> <p>q Ø t Ø l</p> <p>q i t i l</p> <p>q a t a l</p> <p>q u t u l</p> <p>V1 &amp; V2:</p> <p>Ø -&gt; i -&gt; a -&gt; u</p>	<p>(b)</p> <p>q i t Ø l</p> <p>q a t i l</p> <p>q u t a l</p> <p>q u t u l</p> <p>V1: i -&gt; a -&gt; u -&gt; u</p> <p>V2: Ø -&gt; i -&gt; a -&gt; u</p> <p>V2: i -&gt; a -&gt; u -&gt; u</p>	<p>(c)</p> <p>q Ø t i l</p> <p>q i t a l</p> <p>q a t u l</p> <p>q u t u l</p> <p>V1: Ø -&gt; i -&gt; a -&gt; u</p> <p>(6.7)</p>
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<p>(a)</p> <p>q a t Ø l</p> <p>q u t i l</p> <p>q u t a l</p> <p>q u t u l</p> <p>V1: a -&gt; u -&gt; u -&gt; u</p> <p>V2: Ø -&gt; i -&gt; a -&gt; u</p>	<p>(b)</p> <p>q Ø t a l</p> <p>q i t u l</p> <p>q a t u l</p> <p>q u t u l</p> <p>V1: Ø -&gt; i -&gt; a -&gt; u</p> <p>V2: a -&gt; u -&gt; u -&gt; u</p>	<p>(6.8)</p>
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<p>(a)</p> <p>q u t Ø l</p> <p>q u t i l</p> <p>q u t a l</p> <p>q u t u l</p> <p>V1: u -&gt; u -&gt; u -&gt; u</p> <p>V2: Ø -&gt; i -&gt; a -&gt; u</p>	<p>(b)</p> <p>q Ø t u l</p> <p>q i t u l</p> <p>q a t u l</p> <p>q u t u l</p> <p>V1: Ø -&gt; i -&gt; a -&gt; u</p> <p>V2: u -&gt; u -&gt; u -&gt; u</p>	<p>(6.9)</p>
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qutØl	qatØl	qitØl	qØtØl	qØtil	qØtal	qØtul
\	q qutil	q qatil	q qitil	q qital	q qitul	/
	\	q qatal	q qatal	q qatul	/	
		\	q qutul	/		

(6.10)

— Properties of the "butterfly"

(i) Chirality

*Hypothesis:* one of the "wing" of the butterfly is the image of the set of nominal templates and the other "wing" is the image of verbal templates. (6.11)

(ii) Apophonic relation between "primary" forms.

*Hypothesis:* qØtØl is an abstract form with two instances: qØtØl and qØtØl. Primary forms are derived via apophony (horizontally and vertically). (6.12)

		qutØl					
		qatØl	->	qutil			
		qitØl	->	qatil	->	qatal	
√qtl <	qØtØl			qitul	->	qatal	->
	qØtØl					qutul	
		qØtil	->	qital	->	qatul	
		qØtal	->	qitul			
		qØtul					
<i>lexicon</i>		primary		secondary <i>morphology</i>			(6.13)

(iii) Derivational scheme: sec. forms are organized according to the butterfly. (6.14)

### 3. Predictions of the model: Akkadian templates

#### (a) - Chirality

— General observation

*Basic nominal templates:*

Akkadian: pirs, pars, purs  
 Arabic: fi'l, fa'l; fu'l  
 Hebrew: sipr-, malk-, boqr-  
 Ethiopian: q#l, qätl

*Basic verbal templates:*

Akkadian: -pqid-, -\$bat-, -rpud-  
 Arabic: labis-, katab-, kabur-  
 Hebrew: kaabed, qaaTal, qaaTon  
 Ethiopian: CäCØCä, qätäl-

**are of the "left" type: CVCØC      are of the "right" type: CØCVC      (6.15)**

— Consider the Akkadian verbal system.

LOOK AT PAGE 6, PLEASE



Two domains: D1 on the left of R2: prosodic morphology,  
 D2 on the right of R2: no prosodic morphology. (6.17)

The vowel in D1 is A or Ø.  
 The vowel in D2 is an apophonic vowel. (6.18)

D1	D2
- R1 ... V1 ... A	R2 V2 R3 -   apophonic V

prosodic morphology: yes -  
 apophonic morphology: - yes (6.19)

— Consider the Akkadian nominal system.

pars 1	pirs 2	purs 3	paras 4	paris 5	parus 6	
paraas 7	pariis 8	paruus 9	piraas 10	puraas 11	puriis 12	puruus 13
paaris 14						

(6.20)

Long vowel always in D2, V2 = Ø, aa.  
 The vowel in V1 is an apophonic vowel. (6.21)

D1	D2
- R1 ... V1   apophonic V	R2 V2 ... R3 - A

prosodic morphology: - yes  
 apophonic morphology: yes - (6.22)

The verbal system is the mirror image of the nominal system. (6.23)

**(b) - Derivational relationships between primary forms**

I   preterite	->	A   present	->	U   stative	(6.24)
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pr̄is "transitives, moment. act" intransitive vbs of motion state verbs	pr̄as transitives	pr̄us intransitives	(6.25)
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pirs root-nouns birku 'knee' action noun ziqtu 'piqûre'	pars root-nouns kalbu 'dog' concrete noun rakbu 'cavalier' nukurtu 'hostility'	purs root-nouns uznu 'ear' abstract noun	(6.26)
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I   action noun	=>	A   concrete noun	=>	U   abstract noun	(6.27)
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**(c) - Derivational algorithm (secondary forms)**

purØs	parØs	pirØs	pØrØs	pØris	pØras	pØrus
\	┘	┘	┘	┘	┘	/
	<b>puriis</b>	<b>pariis</b>	piris	<b>piraas</b>	pirus	
		┘	┘	┘	/	
		<b>puraas</b>	<b>paraas</b>	<b>paruus</b>		
		\	┘	/		
			<b>puruus</b>			

(6.28)

Summary: prediction on a formal basis

- 4 derivations:

a- (pirØs) -&gt; pariis -&gt; puraas -&gt; puruus

b- (parØs or purØs) -&gt; puriis

c- (pØrAA) =&gt; pirAAs =&gt; parAAs =&gt; purAAs

d- (pArØs) =&gt; pAriis =&gt; pAraas =&gt; pAruus

- 2 values for homophonous forms:

parAAs / pAraas, puraas / purAAs, pariis / pAriis

c	pirAAs	parAAs	purAAs	<i>root nouns</i>
d	pAriis <i>subst G-infinitive</i>	pAraas <i>G-infinitive</i>	pAruus <i>G-part passive poet</i>	
a	pariis <i>adj substantive</i>	puraas <i>adj substantive pers/obj</i>	puruus <i>concrete noun (objects)</i>	
b	puriis <i>diminutive, pejorative</i>	puraas	puruus	(6.29)

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