Arabic Broken Plurals
Revisited

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Abstract

The paper deals with allomorphy in broken plurals. The main issues discussed are the following: why does a particular singular have many plural forms with different templates: is it a synchronic or diachronic phenomenon? How can this be represented in the mental lexicon? What kind of relations can be established between different plural forms related to a particular singular? How to explain the diversity of the internalized (infixed) long vowels in broken plural templates: aa,uu,ii? To my knowledge this phenomenon was not dealt with. In the paper, some approaches from different perspectives will be presented and discussed ((McCarthy 1982, McCarthy and Prince (1990)), Hammond (1988), Ratcliffe (1998)), and another approach will be suggested to handle the diversity of broken plurals in Arabic.[1]

[1] This paper is originally a conference communication at the Mediterranean Morphology Meeting (MMM6), University of Patras, Ithaca, Greece, September 2007.

Introduction

The plural in Arabic is formed by suffixation and infixation: suffixation consists of adding a suffix to the singular stem forming the sound plural called by the grammatical tradition <the sain plural> where the form of the singular is not altered. Plural suffixes are: uu (nominative), ii (accusative or genitive). Infixation consists of altering the CV-skeleton of the singular form and its vocalism. This is called <broken plural>.

Describing the system of Arabic Broken Plurals is one of the most challenging tasks to Morphological Theory. The data is so varied that it is difficult to handle it in one strong theoretical model. This data is of two kinds: The first is the 'unpredictable' plurals which are mainly related to triliteral singulars. These forms must be known or heard to be derived, so they are called jumuuʕ samaaʕiyyat. The predictable plurals are those related to singular forms of quadriliteral or quinqueliteral roots. These are called jumuuʕ qiyaasiyyat "the regular plurals".

The feeling of discomfort gets stronger when it comes to deal with Arabic Broken Plurals in modern linguistic theory: Hammond (1988: 253) says that" there are approximately thirty different kinds, only a few of which are predictable." Ratcliffe (1998:68) indicates rightly that most theories are built on the assumption that randomness and irregularity are at the heart of the system.

This paper deals with the phenomenon of allomorphy in Arabic Broken Plurals: why can a particular singular have many plural forms with different templates? What kind of relation can be established between different plural forms related to a particular singular? How to explain the diversity of the internalized (infixed) long vowels in plural templates?

To my knowledge this phenomenon was not dealt with. I also argue that broken plurals are predictable, and their derivation is governed by the same rules which govern the derivation of the predictable plurals.

Part (1) of the paper is a short review of the theoretical framework. In part (2) some analyses are reviewed briefly: Infixation, templatic transfer. Part (3) will focus on the approach I suggest handling allomorphy in Arabic Broken plurals and the formation of the main plurals.

1. Theoretical framework

In Arabic and Semitic Languages words are formed by the association of many components to the CV-skeleton. The different components are represented on different tiers (McCarthy 1979, 1981). Each component is a morpheme bearing a particular meaning to the whole form:

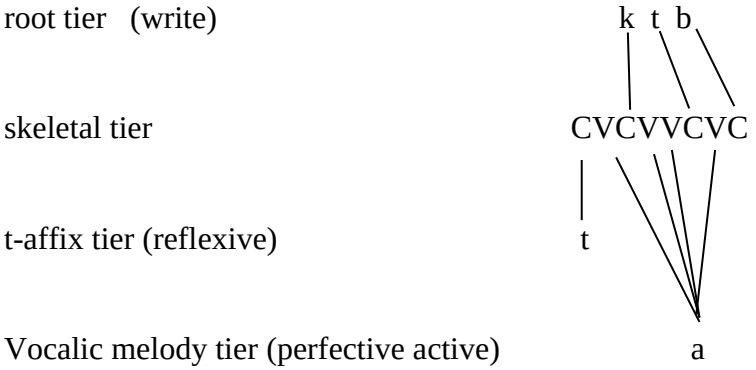
The CV-skeleton is represented as a string of elements C and V indicating the slots (-syll., +syll.) where the elements of the other tiers are anchored as autosegments. It is also conceived as composed of uniform units Xs (Levin 1985) and lately as mora-levels (McCarthy and Prince 1986).

The vocalic melody is a set of vowels V bearing the grammatical meaning proper to the morphological form. Each element is associated to the corresponding V-slot(s) in the template.

The root is a set of consonants C, composed of three, four or five consonants bearing the lexical meaning. Each element of the root is associated to the skeleton at the corresponding C-slot(s). Some other morphemes are composed solely by C bearing grammatical meaning (reflexive, causative, etc.).

The association is ruled by some principles which ensure the well-formedness of the word: every CV-slot is associated to one element at least and every element of the melody is associated to the appropriate C or V-slot. Association is runned in a one-to-one fashion without crossing lines.

The underlying representation of takaatab < write to each other, past> is the following:



2. Arabic Broken Plurals

In this section some of the analysis dealing with Arabic Broken Plurals are presented briefly.

2.1. Infixation:

Analyzing the data presented in (1):

(1)	a.	maktab	makaatib	< office>
	b.	jaħmariš	jaħaamir	< old lazy woman)
	c.	jaamuus	jawaamiis	< buffalo>
	d.	jundab	janaadib	< locust>

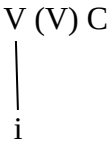
McCarthy (1982) suggests that the derivation of the plural is governed by the following rules:

(2)- infixation rule: __ → VV/ (_ __ / plural

(3)- vowel melody: a i

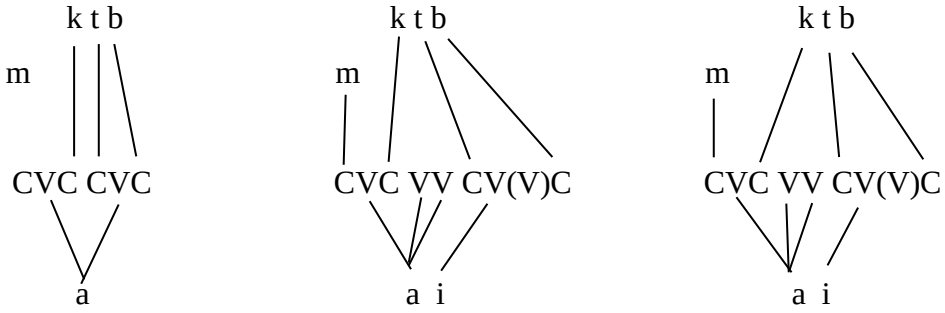
(4) - Plural Template Filter : (CVCVVCV(V)C) (Plural)

(5)- The vowel i is associated to the rightmost V-slot of the template, then other associations apply:



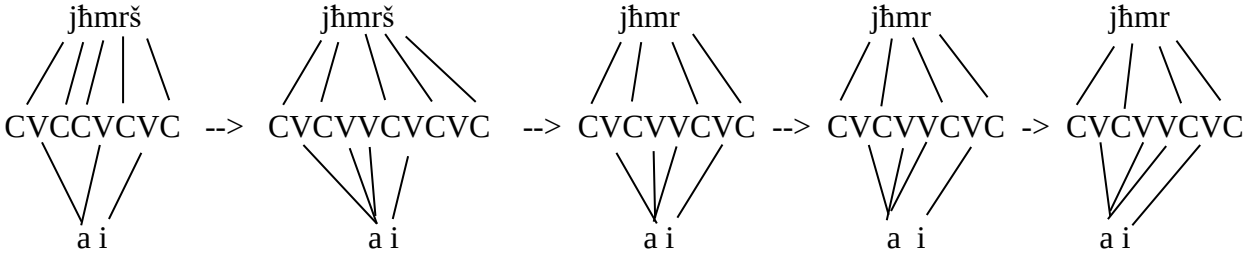
The derivation begins by infixing VV after the first syllable (rule 2), then the resulting skeleton is checked by the Plural Template Filter and the vowel i is associated to the rightmost V-slot in the template. The other elements of the different tiers are associated to the template one-to-one from left to right. This gives the derivation of makaatib <offices> shown in (6):

(6)



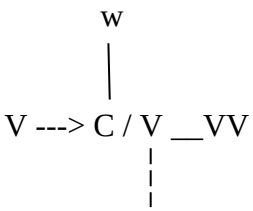
The derivation of the plural jaħaamir (1-b) undergoes the steps of infixation (rule 2) and the plural vowel melody (rule3) but is runned out at the third step (Plural Template Filter) since there are consonants more than it is allowed in the plural template. McCarthy, then, resolves the problem by introducing the rule of truncation which truncates the final VC as shown in (7):

(7)



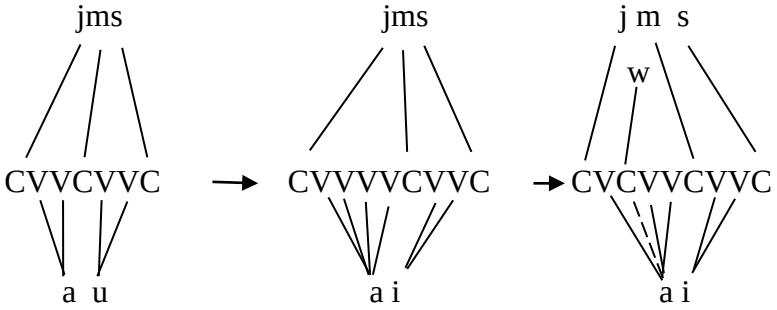
The derivation of the plural jawaamiis (1-d) goes through infixation, the plural template is met, and then another rule applies converting the second V-slot to a C-slot where w is inserted by the w-insertion rule (8):

(8)



The derivation of jawaamiis is shown in (9):

(9)

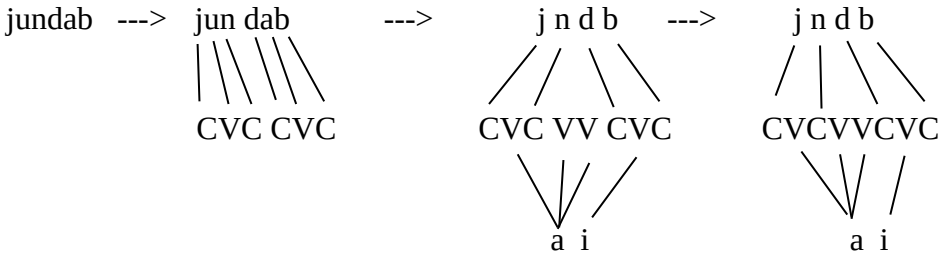


2.2. The processual account

McCarthy and Prince (1987) propose a processual account for Broken Plurals in three steps: at the first step, the singular is reparsed into a sequence of two moras and a remainder containing everything else in the word. The minimal word given by the reparsing is mapped, at the second step, from left to right to a template composed of a light syllable followed by a heavy one (CV CVV). At the third step, the result of the mapping is concatenated with the remainder.

The derivation of janaadib (1-d) is shown in (10):

(10)



McCarthy and Prince (1990a,1990b) suggest that plurals and diminutives are formed by suffixation of the initial heavy syllable. This phenomenon is governed by the principle of prosodic circumscription which makes suffixation applying to a prosodically delimited substring within the morphological category, yielding some sort of infix (McCarthy, 1993):

<CVX>Cvx ---> <CVCVX> Cvx

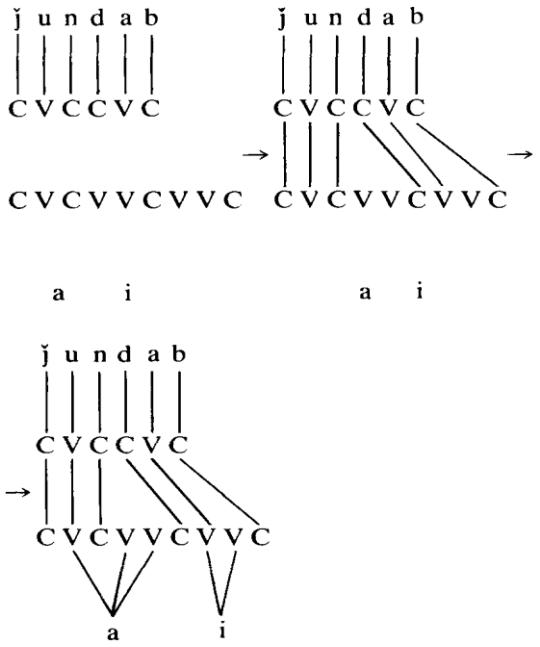
Hammond (1988 p 246 and 259) states that there are many problems with McCarthy's analysis: The length of the final vowel in the plural depends on vowel length in the corresponding singular: maktab/makaatib (office), miftaaħ/mafaatiiħ (key). This can not be handled in terms of a standard template. The consonant which spreads in the singular spreads also in the plural: the third consonant of šʔb in šuʔbuub /šaʔaabiib (shower of rain) and the second of nwr in nuwwaar/nawaawir (white flowers). The condition of w-insertion in the plural is the existence of a long vowel in the first syllable of the corresponding singular: jaamuus/jawaamiis (buffalo).

2.3. Templatic transfer

Hammond (1988) suggests another analysis of Broken Plurals in term of reduplication and transfer following Marantz (1982) and Clements (1985). He admits the plural template and the plural melody defined by McCarthy and assumes that the plural template acquires its melody via transfer instead of direct association as McCarthy does.

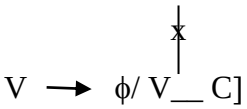
The derivation of the plural janaadiib (1.d) is shown in (11):

(11)



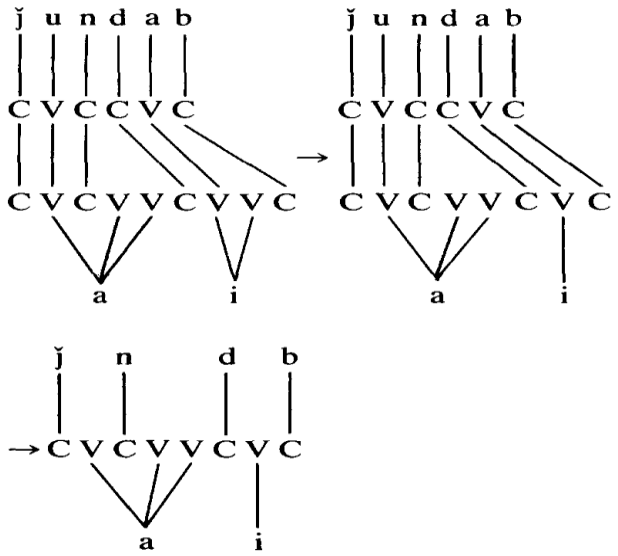
The association between the two templates is driven by the singular template. The derivation considers each C or V of the stem from left to right and looks for the leftmost C or V of the paraffix with which it can associate. The association between the plural template and the plural vowel melody follows the mapping principle supplemented by the rule (5). Hammond adds a supplementary rule (12) which applies before transfer takes place, deleting the last V in the plural template which has not been associated to the singular template:

(12)



This gives the derivation in (13):

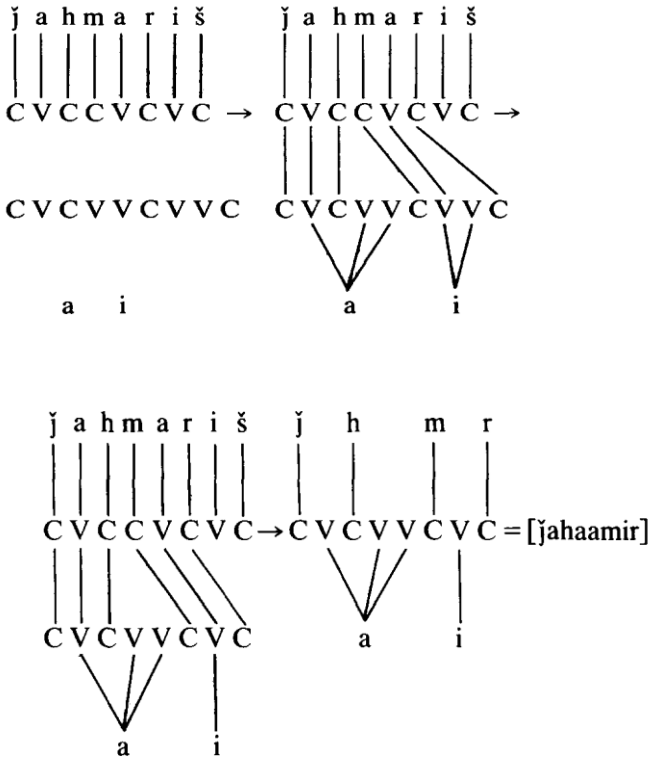
(13)



Transfer can deal with truncation in some broken plurals as following:

The two templates are associated, and the plural melody is associated directly with the plural template. Rule (12) applies, and truncation follows automatically as a result of the length of the plural template as shown in (14):

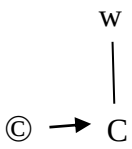
(14)



The problem of w-insertion is dealt with as being a consequence of the existence of an unspecified C-slot in the plural template. The derivation of xawaatim (signet ring) for example,

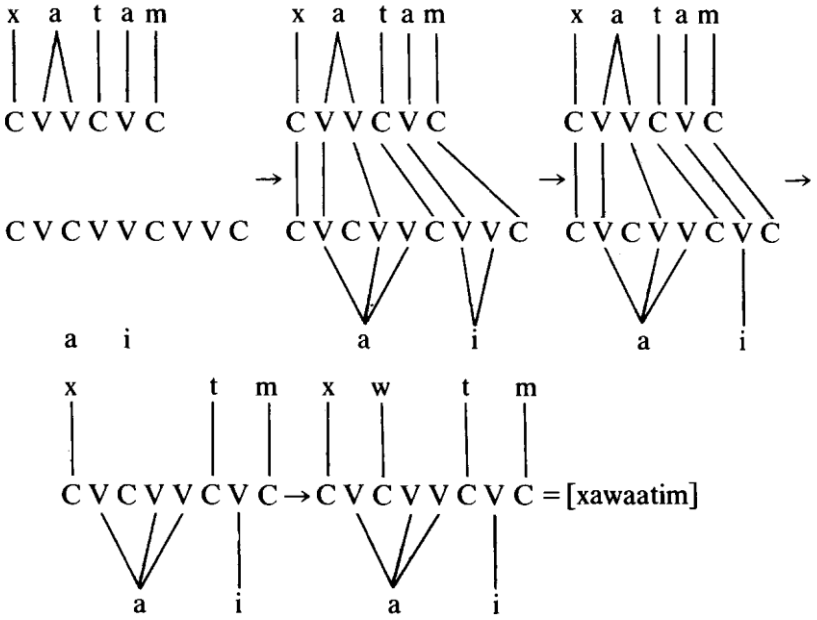
goes through association of the plural melody to the plural template, then the rule (12) applies leaving an unspecified C-slot which is filled by w by the rule (15):

(15)



The derivation of xawaatim is the following:

(16)



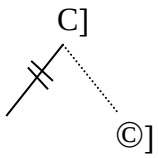
Hammond's analysis deals also with plurals of feminine nouns in CVCVVC. The data he worked on was the following:

(17)	jaziir(at)	jazaaʔir	<island>
	saħaab(at)	saħaaʔib	<cloud>
	šimaal	šamaaʔil	<left hand>
	ʕajuuz	ajaaʔiz	<old woman>

He considers that these forms pose a twofold problem: the singular form contains too few consonants to satisfy the plural template by one-to-one association. In this case spreading or the application of the rule (15) are expected but a glottal stop fills the empty C-slot. The other aspect of the problem is the filled C-slot: the rightmost C-slot is the expected one to be filled but it is the

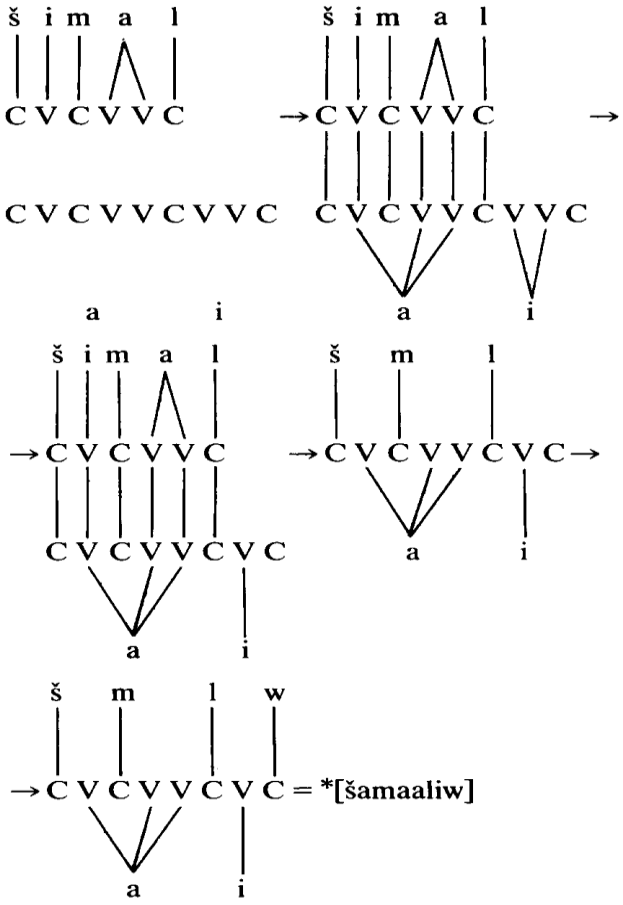
penultimate which is filled instead. To resolve the problem, he suggests the rule (18) which reassociates the third root consonant to a final unassociated slot:

(18)



Rule (18) applies before rule (15) giving *šamaawil and an independent rule turns w into ʔ after aa giving šamaaʔil as following (Hammond; 1988 p. 265):

(19)



3. Arabic Broken Plurals revisited

The models presented in the last section concentrate their analysis on the predictable broken plurals, in terms of infixation or templatic transfer and avoid the unpredictable plurals. So they do not resolve many problems related to the whole system of Arabic Broken Plurals: This task can be achieved by driving out the general principles governing the derivation of the plural in general which is related to the nature of the morphological system in Arabic and by considering the particular rules of derivation in the subsets of plurals.

In this section we will present the basic principles and rules that govern the derivation of plurals in Arabic, starting with plurals of triliteral singulars. Our analysis will be based on the data of attested sets of plurals related to two singulars taken as samples. And then we will deal with some other issues related to plurals in general and discuss some of McCarthy's explanations and some of the Hammond's results.

3.1. Are Broken Plurals broken?

It is well known that one triliteral singular in Arabic may have many broken plural forms: allomorphy. The focus of this paper is to try to understand why this kind of situation exists.

Consider the following data:

(20)

	singular	plural		singular	plural
a.	ʕabd	1- ʔaʕbud	b.	ðakar	1- ðukuur
	<slave>	2- ʕabiid		<male>	2- ðukuurat
		3- ʕibdaan			3- ðikaar
		4- ʕubdaan			4- ʔaðkaar
		5- ʕibiddaan			5- ðikaarat
		6- ʔaʕaabid			6- ðukraan
		7- ʕibiddaa			7- ðakarat
		8- ʕibiddaaʔ			8- ðikarat
		9- ʕibaad			

In the data presented in (20) we have two singular forms 20-a and 20-b. Each one of them has a long list of attested plurals related to it. At the first look at one of those two lists, it seems that there is no relation between these varied forms. But if we proceed to sort out the forms sharing some features the phenomenon becomes clear. Is it possible to go back with these forms to one, from which the others are derived?

One of many ways is the sain plural which is derived by a simple concatenation of the singular form and a plural morpheme. We have in the data above:

Both singulars ʕabd and ðakar are suffixed by the plural morpheme <aan> found in some other lexicalized broken plurals like ɣizlaan <gazels>, ɣirbaan <crows>, ṣibyaan <children> etc. Three of nine plural forms related to ʕabd have this suffix:

ʕabd ʕibd+aan

ʕubd+aan

ʕibidd +aan

One of eight plural forms related to ðakar also has the suffix <aan>:

ðakar ðukr+aan

Let us consider this step the first one in deriving the plural: the suffixation step which is governed by the general rule of plural derivation. This step is a theoretical assumption based on the data.

If we examine the vowel melody contained within the broken forms in the data in (20) and sort out the melody <aa>, we find the following forms where the infixed <aa> corresponds to the suffixed <aa>:

ʕabd	ʕibdaan	ʕibaad
ðakar	ðukraan	ðikaar

For the singular ʕabd it is easy to see the correspondence between ʕibaad and ʕibdaan. The suffixed long vowel <aa> in ʕibdaan is at the infix position, after the first closed syllable, changing the template of the sain plural to a broken one. The same is true for the plural ðikaar compared to ðukraan.

However, there are other plural forms in (20) containing a long vowel <uu> as in ðukuur, ðukuurat (20 b-1 and b-2). Others contain a long vowel <ii> as in _ʕabiid (20 a-2). These plural forms with an infixed long vowel do not have a corresponding plural with the same vowel suffixed, attested in the data. But many lexicalized broken plurals are attested with a suffix <uun> like ʔarḍuun <lands>, sinuun <years> etc and the long vowel <ii> is suffixed to the singular to derive the external plural bearing the accusative or the genitive, like *musaafiriin* <voyager, masculin, plural, acc./gen.>.

The existence of the long vowel <ii> at the infix position in ʕabiid is an argument to attest that this broken plural form may have been suffixed by <iin> to give *ʕabdiin and this suffix was infixed to give the attested ʕabiid. This fact may be confirmed by analogy to ʕibdaan/ʕibaad which are attested.

3.1.1. Suffixation

To handle the diversity of broken plurals in Arabic, we have to deal with that phenomenon in synchrony and in diachrony. Formalizing the first is not easy without considering the second. Understanding the second may help us to understand the first.

We assume that the class of plural forms called broken plurals were derived by suffixation. Since suffixation is a concatenative operation, it may be considered as a simple morphological process, thus a primary one. All broken plurals forms are supposed to be derived by it.

The suffixation hypothesis is necessary to also explain the diversity of the infixed long vowels in broken plural forms in general and in those related to one singular form. This helps us to handle forms like ʕibaad, ʕabiid related to the singular ʕabd or forms like ðikaar, ðukuur related to ðakar. Ratcliffe (1998,218) proposed correctly that the principal productive derivational process in the internal morphology of Proto-Semitic was the one producing a derivative with an initial light-heavy syllable pattern from a base form. He considered that difference in vocalization between derived forms is related to the difference of meanings expressed by the verbal and nominal forms. This is true for verbal and nominal forms in general. But it can not explain the diversity of broken plural forms related to one singular, based on difference in vocalization, since the only meaning shared by these forms is plurality. Even the distinction drawn by the Arab Grammarians between the plural of paucity and the plural of multiplicity is an arbitrary distinction and it can not resolve the problem.

If suffixation is the primary step, then we may posit that the suffixed forms are the source of broken plurals derivation based on infixation. Plural suffixes are three: <aa>, < uu>, <ii>.

The suffixation hypothesis is built on two aspects: The lexicalized plurals bearing the plurality suffixes. To this set belong some plurals presented in (20). In fact, Corriente (1971) considers that plural forms in CiCCaan and CuCCaan are remnants of old plural suffix. The second aspect is the correspondence between the suffixed forms and the infixed forms in vocalic material: the suffixed vowel is the same as the infixed one in quality and length.

The hypothesis of the primary suffixation may help us reconstruct the tree of the diverse plural forms related to one singular as we will see below, and this way we can handle the diversity of broken plurals and explain the different rules governing their formation:

(21) Plural Suffixation Rule (PSR)

The singular form is suffixed by a plural morpheme: VV

__ → VV/ CVC(V)CVC#___) plural

V → a /u /i

When automatically applied, PSR derives three plural forms from one singular :

ʕabd ʕibdaan / *ʕabduun/ *ʕabdiin

ðakar ðukraan/*ðukruun/*ðakriin

These plural forms, regardless the fact that they are attested or not, are the primary plural forms from which the attested broken plurals are derived by infixation.

3.1.2 infixation

Infixation, like suffixation, has a diachronic aspect and a synchronic one. In diachrony we posit that its development is related to a systematic change in morphological derivation in the history of Arabic guided by the principle of exploiting to the maximum the capacities of the internal vocalic melody in morphological derivation. Murtonen (1964) considers that broken plurals are the result of internalization of the long vowel of the sound plural suffix. The internalized long vowels <aa>, <uu> are the original feminine and masculine plural endings in proto-semitic. Infixation is related to the stress distribution in the syllabic structure of the word in Arabic, so the suffixed long vowel is attracted in a kind of migration to the stressed syllable. In synchrony, infixation works as a rule deriving broken plurals. Here we meet McCarthy in his elaboration of that rule, however we consider that infixation is the result of moving the suffix vocalic material to the infix position by rule (22):

(22) Plural Infixation Rule (PIR):
Infix ViVi after the first CVC of the template:
CVC (V)C#ViVi) plural ---> CVCViViC) plural

The PIR applies regarding the singular template whether the target V-slot is empty or full. If it is empty PIR applies directly. If the V-slot is full then it has to be emptied by deleting the vowel occupying it, by the vowel deletion rule (23). This rule applies on short vowels only:

(23) Vowel deletion rule (V-del):
V---> _/CVC__C#ViVi) plural

After rule (22) applies the consonantal material of the nominal suffix <n> is deleted since it has no syllabic nucleus and no C-slot to be associated to.

At this point, two obligatory rules governing all broken plurals derivation are established: PSR and PIR. Those two rules may apply recursively and in this way the plurals of plurals and some rare plurals may be handled as shown in (25).

Let us review the data presented in (20) starting with those plurals derived by the two obligatory rules. In (24), the different steps of plural derivation are presented with the rules governing them in our assumption. Attested plurals are in bold letters:

(24)

a.

	PSR		PIR	
ʕabd	⟶	ʕibdaan	⟶	ʕibaad
		*ʕabdiin		ʕabiid

b.

	PSR		V-del		PIR	
ðakar	→	*ðikaraan	→	*ðikraan	→	ðikaar
		*ðukaraan	→	ðukraan		

After PIR applies, a new situation is created concerning the vocalic harmony (VH) between vowels in the template, and the semantic relations between templates in the morphological system in Arabic. Vowel harmony system is well known in Arabic Morphology so we will be interested only in the aspects related to our matter here.

The infixed long vowel does not disturb the vocalic harmony in the template and it does not create an interference between morphological forms, so nothing happens and the form derived by PIR is used as it is expressing plurality: ʕabiid, ʕibaad and ðikaar in (24).

If the application of PIR creates a situation of morphological interference and/or does not meet the conditions of vocalic harmony, then change occurs to preserve the harmony and/or to avoid interference. Changes occur on the vocalic component since vowel quality, in Arabic Morphology, is the basic mean to make the distinction between the different morphological and lexical categories:

- The infixed long vowel spreads to the preceding V-slot: The plural *ðakuur has the following template: CaCuuC which bears the meaning of intensity , habit or skill in the action expressed by the root, like kaðuub <lier, intensity, frequent> (big lier). If this template is kept as it is the meaning of plurality would be hidden, then the long vowel u spreads into the preceding syllable giving the attested form ðukuur which is a regular broken plural template:

ðakar	*ðakruun	*ðakuur	ðukuur <male>
ʔasad	*ʔasduun	*ʔasuud	ʔusuud < lion>
namir	*namruun	*namuur	numuur <tiger>

- t-suffixation (t-suf): The morpheme t in Arabic is polysemic. It is used as a morpheme of feminine (kabiir+at <big, sing. fem.>), as an intensifier (ʕallaam+at <know, sing. masc. Intensity >), as a partitive where it indicates the individual of the generic (naħl <bee, generic> / naħl+at <bee, one individual>) and in abstract nouns. It may occur in plurals meaning intensity in plurality: we have in (20) some pairs of plurals corresponding in the template with a difference in the t-suffix: ðukuur/ðukuurat, ðikaar/ðikaarat.

- V-shortening (VS): Some pairs of plurals in the data (20) show similarity in the template and in the vocalic and consonantal elements and differ in the length of the second vowel (the infixed long

vowel). This may be explained by the V-shortening rule: ðikaarat/ðikarat. Other samples of pairs of plurals are attested in Arabic like: numuur/numur <tiger>, nuyuub/nuyub <tooth, fang>.

- Metathesis (met) between the vowel and the consonant in the first syllable occurs without changing the vocalic material and makes a spontaneous glottal stop emerge at the onset of *VC at the beginning of the word. The shape VC is prohibited in Arabic phonology:

*ðakaar	ʔaðkaar	<male>
*qalaam	ʔaqlaam	<pencil>
*faraax	ʔafraax	<young of a bird>

In (20) we have three forms: ʕibiddaan, ʕibiddaa, ʕibiddaʔ. These plurals are rare in Arabic and may be considered as forms of special use in poetry for example. But we have to explain how their derivation is possible. In our view these plurals are secondary broken plurals. A simple broken plural form like ʕabiid would undergo the PSR with the suffix material <aan> to give *ʕabiidaan. PIR is blocked because of the absence of an available V-slot in the template, V-deletion is blocked too because the vowel in the second syllable is long. Vowel harmony would make the second vowel spread to the first syllable giving the attested *ʕibiidaan. This form would undergo the V-shortening (V-s) of the second long vowel accompanied by a compensatory gemination (CG) of the third root consonant giving the attested ʕibiddaan. the n-deletion rule applies to give _ibiddaa and this form in turn would undergo the ʔ-suffixation (ʔ-suf) to give _ʕibiddaaʔ :

(25)

PSR	VH	VS+CG	n-del	ʔ-suf

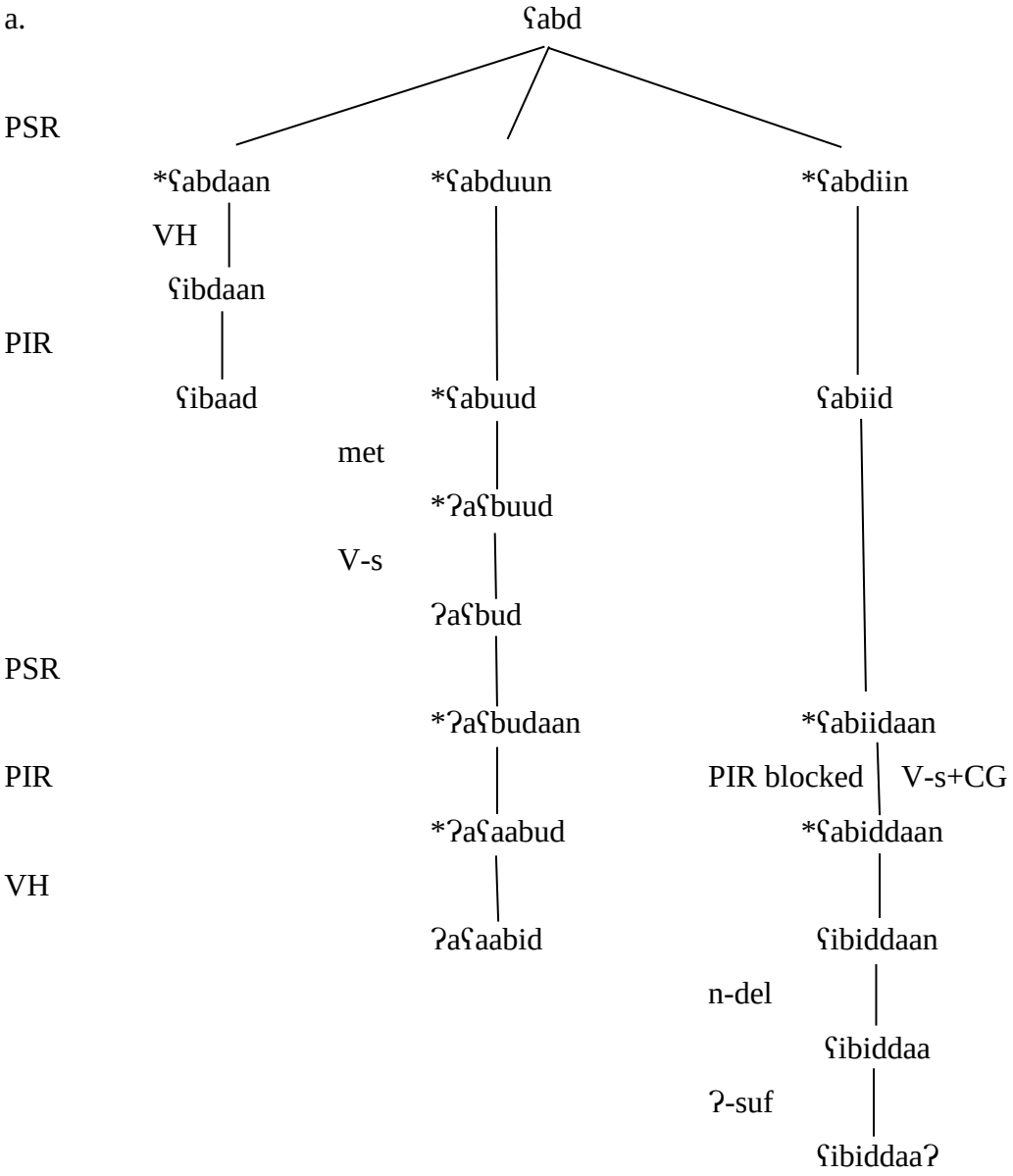
ʕabiid → *ʕabiidaan → *ʕibiidaan → ʕibiddaan → ʕibiddaa → ʕibiddaaʔ

At this point we can proceed to establish the < genealogical> tree of the different plurals related to one singular. In the tree (26) there are different <generations> represented by layers corresponding to the output of different rules. Some forms may never have been attested but they are a necessary step to explain the attested forms: it is a kind of an ancestor who vanished, and he gave his genes to the following generation. We are doing a kind of reconstruction of the different derivational phases which gave a wide variety of plural forms departing from one singular. We think that the same processes take place in the derivation of the Masadr <name of action>: In fact, there are many different masdars related to one triliteral verb, so they are considered, like the plurals of the triliteral singulars, as irregular and unpredictable.

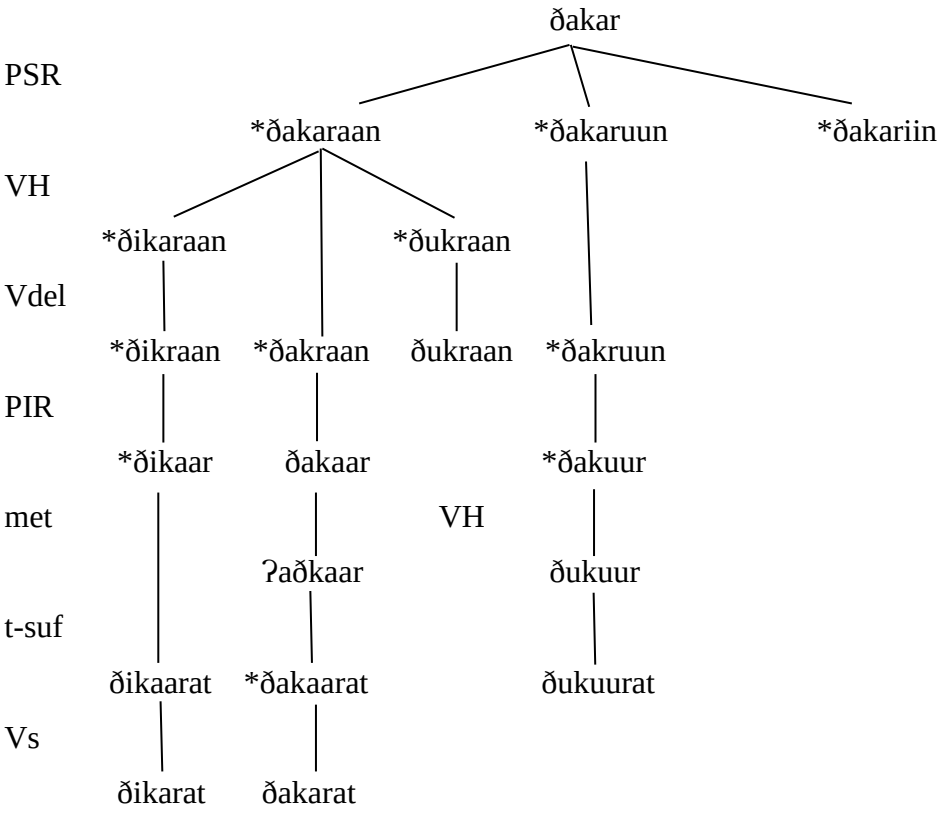
In (26), general rules are represented to the left. Each one of these rules govern its correspondent level by taking the form derived at the preceding level as an input and the following level as an output. Rules with limited scope are to the left at the inner parts of the tree:

(26)

a.



b.



3.2. Broken Plurals of the singular of CV(V)CV(V)C

Singular forms with an inner long vowel examined in this section will be a set of three subgroups: singulars with a long vowel in the first syllable CVVCVC, (27.a), singulars with a long vowel in the second syllable CVCVVC (27.b), singulars with long vowels in each syllable CVVCVVC (27.c):

(27)

a.	xaatam	xawaatiim/xawaatim	< signet ring>
b.	ʕajuuz	ʕajaaʔiz	< old woman>
	šamaal	šamaaʔil	< north, left hand>
	jaziirat	jazaaʔir	<island>
c.	jaamuus	jawaamiis	<buffalo>

McCarthy considers that the derivation of the plural jawaamiis (27.c) goes through infixation, the plural template is met, but this operation yields a sequence of four V-slots. Then applies the rule converting the second V-slot to a C-slot where w is inserted following the rule (8) as shown in (9) above. Hammond argues that the w-insertion is a consequence of the presence of an unspecified C-

slot in the plural template. The derivation of xawaatim for example goes through association of the two templates and the association of the plural melody, then rule (12) applies leaving an unspecified C-slot which is filled by w by the rule (15) as shown in (16) above. The same argument is adopted by Idrissi (1997) where he considers that w is a default consonant which fills in the empty C-slot. Ratcliffe (1998,97-99) considers that w and ʔ which appear in some plurals of singulars of the form CVVCV(V)C "are not part of the underlying form but result from morphological and phonological processes. The template has one more C-position than there are consonants in the input. This C-position is filled by a default consonant, the quality of which is determined by the environment". The analysis of plurals with an inner default consonant w do not give strong arguments to explain the presence of w in the plurals: what is the origin of w in these plurals? Is w the only default consonant used in plurals? What about the glide y which behaves like w in Arabic in many aspects? The solution is neither in the situation created by the plural long vowel infixation, nor in the situation created by the unspecified V-slot. It is in the underlying form of the singular. We argue that w exists before any rule of plural derivation applies on singulars.

It is well known that in Arabic Phonology a long vowel has the value of a short vowel and a glide (w/y). So VV can be converted to VG and VG can be converted to VV, following the systematic binary correspondences between vowels and gildes: u-w, i-y, a-w/y. This phenomenon is governed by conversion rules. These rules are sensitive to the lexical category of the form and to the semantic relevance:

(28) Vowel-Glide conversion rules (V-G Cr):

1.	aa	aw	*yawjal	yaajal	< to be frightened>
	wa		*yuqwal	yuqaal	< it is said >
	ay		yaynaʕu	yaanaʕu	< come to maturity>
	ya		*yubyaʕu	yubaaʕu	< it is sold>
2.	uu	uw	*nuwr	nuur	< day light>
	wu		*yaqwulu	yaquulu	< he says>
3.	ii	iy	*liyn	liin	< softness>
	yi		*yabyiʕu	yabiiʕu	< he sells>

If this is correct and attested, then we can suppose that the long vowel in the singular form is converted to a short vowel and a glide. This phenomenon is still productive in Modern Arabic: the word < computer> is translated as <ħaasuub>, the plural is ħawaasiib <computers> and the

operation of computing/computation is ħawsabat which is related to the verb ħawsab < to compute>. The w is not in the root ħsb < calculate>, it is somewhere in the template of <ħaasuub> to which the plural <ħawaasiib> is related. Adopting the glide-vowel conversion rules is a way to ensure the economy of rules in derivation since there is no need for a special rule of w-insertion.

So the first long vowel in the singular form is converted to its correspondent short vowel and glide before plural derivation rules apply: Jaamuus is converted to *jawmuus , then PSR applies yielding *jawmuusaan on which PIR applies to give *jawaamuus and the VH rule change uu to ii giving the attested jawaamiis. These steps are the same for the plural derivation of the singular with a glide like kawkab -kawaakib <star> or baydaq-bayaadiq <pawn>:

	PSR		PIR		VH	
kawkab	→	*kawkabaan	→	*kawaakab	→	kawaakib
baydaq		*baydaqaan		*bayaadaq		bayaadiq
jaamuus - *jawmuus		*jawmuusaan		*jawaamuus	→	jawaamiis

The same rules govern the derivation of plurals from feminine nouns (27.b), where the long vowel in the singular is converted to its corresponding short vowel and glide. PSR and PIR apply and the glide is converted to a glottal stop after a long vowel aa:

V-G	PSR	PIR	VH	G-ʔ
ʕajuuz →	*ʕajwuz →	*ʕajwuzaan →	*ʕajaawuz →	*ʕajaawiz→ ʕajaaʔiz

V-G	PSR	PIR	G-ʔ
Jaziir(at) →	*Jazyir →	*jazyiraan →	jazaayir → jazaaʔir

The analysis based on vowel-glide conversion shows that both of the glides w and y are part of the underlying structure. Considering w the unique default consonant may be arbitrary and needs to be revised (McCarthy and Prince (1995,345) and followed by Idrissi (1997).

Hammond's analysis of the plural šamaaʔil (27.b) in the templatic transfer frame was problematic and even complicated. He mentioned two problems with this sample: The singular šimaal contains too few consonants to satisfy the plural template by one-to-one association. In this case spreading of one consonant of the root šml or the application of the rule (15) are expected, but a glottal stop fills in the empty C-slot. the other problem is related to the position of the filled C-slot: the C-slot which is expected to be filled is the rightmost one, but the one filled is the penultimate.

The word šimaal has many variants attested in Arabic:

šamaal - šamuul - šamʔal - šaʔmal - šamal - šaml

Two of these variants have a glottal stop. The question is to consider this fact in the singular form before dealing with it in the plural. Vowel-glide conversion may be the way to explain this

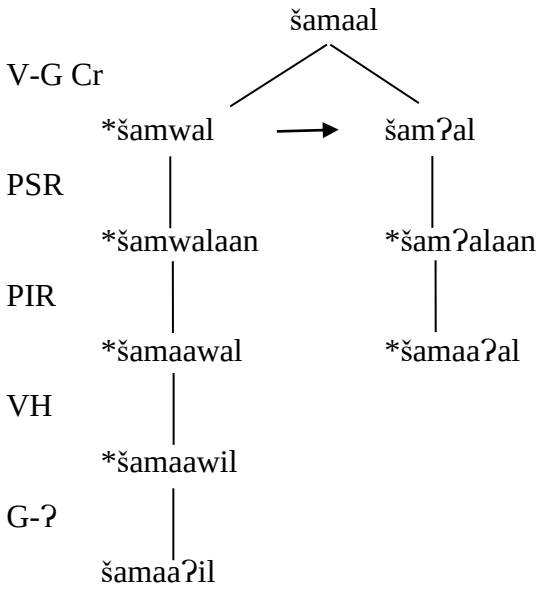
phenomenon: assuming that all these variants are linked to the root šml, we can establish the relation between the form with a long vowel šamaal and the one with a glottal stop šamʔal through the vowel-glide conversion. A simple vowel can not be converted to a glottal stop, only glides do. Then, the underlying form of šamaal is *šamwal. Plural formation does not work directly on the root component, it has to deal with the singular form first. šaʔmal is related to šamʔal through metatheis:

šamaal ---> *šamwal---> šamʔal---> šaʔmal.

Deriving the plural from the singular of the form CVCVVC through the vowel-glide conversion CVCw/yVC is supported by the data from the singular forms where this phenomenon works.

The derivation of šamaaʔil in our analysis would be the following where two paths converge at the output:

(29)



In our account there is no need for a specific rule of w-infixation (McCarthy) nor for a special rule of reassociation (Hammond).

Ratcliffe considers that plurals of singulars of the form CVVCVVC are derived by w-insertion (qaanuun/qawaaniin <law> or by internal reduplication of the second consonant (diibaaj-dabaabiij <brocades>). In his view plurals of this type show allomorphic (non-distinctive) alternation between reduplication and default consonant insertion as strategies for filling the empty C-positions in templates. He mentions that this alternation is common in Semitic and Afroasiatic, although in Classical Arabic the reduplicative option is employed only here.

The question is how to explain the allomorphy between reduplication and default consonant? If in Classical Arabic, those two strategies are productive in plural derivation, can this mean that they are employed to derive allomorphic plurals from one particular singular?

Reduplication in plurals is corresponding to reduplication in singulars: The reduplicated consonant and its position in the template (kuttaab/kataatiib <coranic school>, kullaab/kalaaliib <pincer>). However, there are singulars which do not show reduplication although their plural does: diibaaj/dabaabiij, diinaar/danaaniir. There might be a step between plural and singular where reduplication happens: The underlying form of diinar is *dinnaar and the underlying form of diibaaj is *dibbaaj. The reduplication rule would follow the vowel-glide conversion (28-3): ii---> iy, and it converts the sequence <C1 iy C2> to <C1i C2C2>:

(30)

iy--->iC2/ #C1___ C2VVC3 singular

Rule (30) is one of the most productive phonological rules in Arabic verbal and nominal derivation related to roots with an initial glide in the form VIII (wfq - ʔittafaq/ʔittifaaq < agree/agreement>).

The derivation of the plural *danaanir* would be the following:

V-GCr	Red.	PSR	PIR	VH
diinaar →	*diynaar →	*dinnaar →	*dinnaaraan →	*dinaanaar → danaaniir

Dealing with derivation in general and plural derivation in particular, needs basically to establish the relation between plural and singular the right way to insure the right analysis. If two forms (plural/singular) are linked mistakenly the analysis would be weak or false: Ratcliffe (1998,99) mentions that there are three-consonant singular nouns for which the four-consonant plural is imposed in an unexpected way. He concludes that derivation in this case is idiosyncratic. The samples he analysed was ħadiiθ/ʔaħaadiiθ <prophetic tradition>, ʕaruuḍ/ʔaʕaariiḍ <poetic meter>. The initial glottal stop is added to fill in the first C-position of the plural template. However, the corresponding singular form to the plural is not the one presented in Ratcliffe's analysis:

The corresponding singular may be reached in our analysis departing from the plural form: ʔaħaadiiθ and ʔaʕaariiʕḍ are assumed to be derived by infixation of aa by the rule PIR. This rule needs a template having an available V-position where the infixed aa should land. So, the singular should be starting by a closed syllable: ʔaħ in the case of ʔaħaadiiθ and ʔa in the case of ʔaʕaariiḍ. In Arabic there exist a singular ʔuħduuθat corresponding to ʔaħaadiiθ and ʔiʕriiḍ corresponding to

ʔaʕaariidˀ. If we start from these singulars, the corresponding plurals would not be problematic and their derivation is governed by the regular rules: the glottal stop is part of the singular, and it has its position in the plural too.

3.3 Broken Plurals of the singular of CV(C)CV(C)CVC

The plurals in (31) have the same template CaCaaCiC. They have fewer segments (root consonants, derivational morphemes) compared to the singular forms. The problem in the literature dealing with broken plurals is how to predict this fact and how to explain the absence of these segments?

(31)

a. jaħmariš	jaħaamir	<old lazy woman>
b. farazdaq	faraazid / faraaziq	<piece of meat>
c. mustaxrij	maxaarij	<extractor >
d. muħranjim	maħaarij	<to be hesitating>

In both of McCarthy’s and Hammond's accounts, this phenomenon is dealt with by truncation. Truncation is applied to the last segments in the template. It works for words similar to (31.a) but can not handle the other words in (31) where the missing segments are not in the last position in the template: in faraaziq (31.b), the penultimate consonantal root is truncated, and the derivational morphemes like <st> in (31.c) and <n> in (31.d). Following the models adopting truncation, the plurals derived would be unpredicted or unacceptable:

farazdaq	faraazid	predicted and attested.
	faraaziq	unpredicted but attested.
mustaxrij	*masaatix	double truncation and unacceptable.
muħranjim	*maħaarin	double truncation and unacceptable.

This fact suggests that truncation applies before plural derivation. The plural template is one but the rules deriving it are different regarding the templates of the singular. We suggest that singular forms of the type presented in (31) undergo the deletion of specific segments before plural derivation rules apply. Consonantal root segments are deleted in singulars related to quinqueliteral roots by the rule (32):

(32) Consonant deletion rule (CDR):

delete the last VC in the singular template where C is the fifth consonantal root:

VC) ⟶ __/ C1VC2C3VC4_ _) singular

This rule handles the derivation of jaħaamir from jaħmariš. The last VC truncated, *jaħmar would undergo PSR to give *jaħmaraan, PIR will yield *jaħaamar and VH rule applies giving the attested jaħaamir. The rule (32) has a wide scope represented in singulars related to quinqueliteral roots. However, it may have a rare counterexample: The plural faraaziq is attested as a variant of faraazid. This must be explained: why the penultimate CV is deleted instead of the last VC. This fact may be related to the nature of the loan word <farazdaq>.

Truncation applying on singular templates before going through plural derivation is confirmed by plurals of the type (31-c, d). These singulars are derived forms related to triliteral and quadriliteral roots. They undergo the deletion of the derivational morphemes which are common to the verbal forms and nominal derived forms. This kind of rule is sensitive to the morpho-lexical category: since pluralization is typically nominal then nominal derivational morphemes have to be saved along the process of plural derivation:

(33)

Morpheme(s) deletion rule (MDR):

delete the verbal-nominal derivational morphemes in the singulars of five C-slots or more :

__(verb-nom.) ⟶ __/ singular (Root: 3 and more /C-slots :5 and more)

The plural maxaarij in (31.c) is derived as following:

	MDR		PSR		PIR		VH	
mustaxrij	⟶	muxrij	⟶	*muxrijaan	⟶	*muxaarij	⟶	maxaarij

In the plural maħaarij both rules MDR and CDR apply. The input of CDR is the output of MDR:

	MDR		CDR		PSR		PIR		VH	
muħranjim	⟶	*muħrajim	⟶	muħraj	⟶	*muħrajaan	⟶	muħaaraj	⟶	maħaarij

4. Conclusion

Making the plural derivation in Arabic a two stepped operation has an empirical consequence and a theoretical one. The first is a prederivational step where some rules apply to prepare the singular form to have the conditions required by plural derivation. In this way abnormal forms are avoided, and the economy of rules is guaranteed. The second is the proper derivational step which includes the different rules governing plural derivation. All broken plurals are predictable.

In our analysis, many theoretical and formal issues find their answer:

The plurals called broken are issued from the sain plurals through suffixation which is considered as a primary strategy in expressing plurality. Suffixation is a primary simple concatenative operation. Broken plurals are the result of shifting from suffixation to infixation in diachrony.

The diversity of broken plural forms related to one particular singular is a superficial phenomenon. All these forms are related to one suffixed form which may be lexicalized (attested) or hypothetical elaborated through analogy to the attested one. The different plurals related to one singular may be represented in a tree-structure with many different layers.

The diversity of vowel melodies in one set of broken plurals related to one singular, in particular, and in broken plural templates in general is related to the variety of the suffixed long vowels to derive sain plurals. The vowels which are suffixed to derive sain plurals are those which are infixed to derive broken plurals. The long vowel moved from the suffix position to the infix position must be long because it is the plural morpheme. It may undergo shortening by special rules deriving variants of broken plurals with a short vowel from broken plurals with an infixed long vowel.

The plural vocalic melody in Arabic is fixed by the rules governing vowel harmony and the distinction between templates in the morphological system.

The w/y insertion is not a formal operation in our analysis. It is part of the underlying morphophonological structure. It is governed by the rules of vowel-glide conversion in Arabic.

Our analysis demonstrated that adopting the notion of predictability as a criterion in studying broken plurals, does not make sense. If some forms are considered as unpredictable, then we have to elaborate the rules governing their derivation through the data. This way we can built the appropriate system of rules to avoid unpredictability.

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