Broken plurals and syllable sequence restrictions in Iraqw

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1 *Introduction*

Iraqw, a Southern Cushitic language spoken in Northern Tanzania, has a rich system of plural formation of nouns. Two of these plural formations are "broken" plurals in that they involve infixation. The actual form these broken plurals take and the sort of stems they apply to, is related to the sequence structure restrictions of noun stems in general. In this paper I present the relevant facts of the plural formation in general (section 2), of broken plural formation in particular (section 3) and their related non-broken plural suffixes (section 4). I show that the broken plural formation is comparable and related to the broken plural formation in a related language, Burunge, (section 5) and that the metrical conditioning is confirmed by tests with nonsense words (section 6). In section 7 I show that the metrical conditioning is in fact a reflex of what is a possible stem form in general and finally, in section 8, I discuss some problems involving an optimal analysis of the phenomenon.

2 *Iraqw plural formation*

Number in Iraqw is of a derivational nature. There are many different number suffixes, twelve different plural suffixes, four singulative suffixes and two collective suffixes that can be either singular or plural. The plural is derived from a singular base as in (1), or the singular is derived from a plural base, as in (2), or the plural base takes

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another, derived plural form, as in (3), or the singular base takes another, derived singular form, as in (4), or there is only one form, singular and plural, as in (5)[1].

(1) *buura* (f) 'beer'; plural: *buur-(a)du* (n) 'various beer parties'

(2) *bariis* (m) 'first-born (PL)'; singular: *bariis-moo* (m) 'first-born (SG)'

(3) *ts'uu(n)qaa* (n), (PL) 'saliva, blessing': *ts'unqar-eeri* (f), (PL) 'saliva at different places'

(4) *ts'uunk-áy* (m), (SG) 'dung': *ts'uunki* (f), (SG) 'one piece of dung'

(5) *tɬ'uw-ay* (m), (SG or PL) 'rain', from *tɬ'uuw* (v) 'rain'

For other nouns all forms contain number suffixes. A derived singular can have its own derived plural. The plural suffix replaces the singular suffix. A sequence of productive number suffixes does not occur.

(6) *saqaan* (m), PL 'earrings'; *saqaan-mo* (m), SG 'one earring', *saqan-ma?* (n) 'several earrings'

(7) *?aar-uuso?o* (f) 'prophetess', *?aar-uusmoo* (m) 'prophet', *?aar-uusee* (f) 'prophets (male or female)', derived from the verb *?ar* 'see'

A single noun stem can take several number suffixes, plural or singulative suffixes, or both.

(8) *gits'o* (f), SG 'grass'; *gits'-iingw* (m), PL 'grasses'; *gits'iimi* (f), SG 'one plant of grass'; *gits'-ito?o* (f), SG 'a small piece of grass'

There are recurrent series of derivations. Singulatives in *-amo* often undergo a plural formation in *-ama?*, e.g. *saqaan* 'earring(s)' → *saqaanmo* 'one earring' → *saqaanma?* 'earrings'. This practice eases the memorisation of singular-plural pairs. Collectives in *-ay* tend to have singulatives in *-i*, collectives in *-angw* tend to have plurals in *-aawee*, etc.

The choice of which plural suffix to use for a certain noun is lexically determined. That is to say, it is not predictable on the basis of form or meaning of the noun. This does not mean that the distribution of plural suffixes is random. To some extent the choice of the plural suffix can be related to the gender of the singular and to the suffix of the singular. Each number suffix has its own gender: (m), (f), or (n). Gender is nearly always different between singular and plural. This is a common feature of Cushitic languages. All number suffixes with neuter gender are plural. There are no masculine suffixes among the plural suffixes, but the collective suffixes are masculine. Note that there are nouns of neuter gender with singular reference, such as *ħayso* (n) 'tail', and masculine nouns with plural reference, such as *daaqaay* (m) 'boys'. The gender of the base form is a factor in the choice of the plural suffix. Masculine and feminine base forms take plural suffixes from different sets. This is not true for singulative suffixes. When suffixes are attached to the base form, the final vowel of the stem is nearly always deleted.

[1] ħ indicates a voiceless pharyngeal fricative; ʕ its voiced counter-part; ? indicates a glottal stop; ɬ a voiceless lateral fricative; ts' and tɬ' are ejective affricates, the latter with lateral release.

Table 1: Iraqw number suffixes

collective suffixes:
-*aay* MASC
quruntɬ'i (f) 'gourd', PL: *quruntɬ'-ʔáy* (m)
seeʔ-aay (m) 'dog', PL: *seeʔ-aawee* (f)
-*angw* MASC
balaangw (m) SG/PL 'harvest', SG: *bal-aali* 'ear of grain'
dir-aangw (m) 'lion', PL: *dir-eeri* (n)

plural suffixes with a masculine base noun
-*ee* FEM
fura (m) 'toothbrush', PL: *fur-ee* (f)
ʔaal-it-moo 'heir', PL: *ʔaal-it-ee* (f)
-*aawee* FEM
filá (m) 'aardvark', PL: *filaawee* (f)
pohám (m) 'baboon', PL: *pohamaawee* (f)
-*maʔ* NEUT
warqa-moo (m) 'piece of cloth', PL: *warqamaʔ* (n)
-*ʔi* NEUT
ʕaymu (m) 'word', PL: *ʕam(i)ʔi* (n)
-*eeri* NEUT
<*ee*>_*i* NEUT

plural suffixes with a feminine base noun
-*a* FEM
ħooki (f) 'pigeon', PL: *ħooka* (f)
manoongi (f) 'grass for cattle', PL: *manoonga* (f)
-*o* FEM
ʔarwi (f) 'banana', PL: *ʔarwo* (f)
hibaambi (f) spider, PL: *hibaambo* (f)
-*du* NEUT
tɬ'anka (f) 'bridge', PL: *tɬ'ankadu* (n)
bakoora (f) 'walking stick', PL: *bakoor(a)du* (n)
-*u* NEUT
loohi (f) 'path', PL: *lohu* (n)
baha (f) 'hyena', PL: *bahu* (n)
-*aʔ* NEUT
yaaʔee (f) 'leg', PL: *yaʔaʔ* (n)
-*o* NEUT
fala (f) 'hide', PL: *falo* (n)
-*eemo* NEUT
<*ee*>_*o* NEUT

singulative suffixes
-*mo* MASC
ʔaga (m) 'cannibals', SG: *ʔagamo* (m)
meeħa (f) cattle tick, SG: *meeħamo* (m)
-*itoʔo* FEM
ʕayo (f) 'flower', SG: *ʕaytoʔo* (f)
ilwa (n) 'milk', SG: *ilwatoʔo* (f) 'drop of milk'
-*oʔo* FEM
ʔaaruusee (f) 'prophets', SG: *ʔaarusoʔo* (f) prophetess
-*i* FEM
ʔombás (m) 'kind of grass', SG: *ʔombaasi* (f)

3 *Iraqw broken plurals*

Iraqw has two plural formations involving infixation. Both require the infixation of a long vowel *ee* before the last consonant of the stem. In addition, *i* or *o*, replaces the stem final vowel. Both broken plural formations, <*ee*>_*o* and <*ee*>_*i*, are relatively rare. Table 2 contains a full list of examples.

Table 2: Nouns with broken plurals

SG	PL	meaning
digma (m)	*digeemi* (n)	boundary, border
duʔuma (m)	*duʔeemi* (n)	leopard
fuq(u)no (m)	*fuqeeni* (n)	fingernail
garmo (m)	*gareemi* (n)	tree sp.
ħutɬ'mo (m)	*ħutɬ'eemi* (n)	small belt
kurmo (m)	*kureemi* (n)	hoe
ʔuh(u)mo (m)	*ʔuheemi* (n)	pillar (in house)
xaarmo (m)	*xaareemi* (n)	horn, tusk, maize cob
diq(a)ma (f)	*diqeemi* (n)	fence for cattle
durmi (f)	*dureemi* (n)	stomach
kwaal-oʔo (f)	*kwaʔeeli* (n)	widow
wakri (f)	*wakeeri* (n)	chin
ʕaysani (f1)	*ʕayseeno* (n)	lie, slander
ʕantani (f1)	*ʕanteeno* (n)	anthill
barsi (f)	*bareeso* (n)	bundle of grass
gaʕawi (f)	*gaʕeewo* (n)	milk calabash
halmi (f)	*haleemo* (n)	branch
maħ(a)ti (f)	*maħeeto* (n)	shadow
map(a)ri (f)	*mapeero* (n)	ditch
naʕani (f)	*naʕeeno* (n)	penis
qatni (f)	*qateeno* (n)	bed

qawri (f)	*qaweero* (n)	baby
tɬ'aʕafi (f)	*tɬ'aʕeefo* (n)	kitchen
tɬ'aħasa (f)	*tɬ'aħeeso* (n)	rain pool
ts'its'ini (f)	*ts'its'eeno* (n)	tip, point
qawtani (f)	*qawteeno* (n)	grazing land
wakri (f)	*wakeero* (n)	chin
baʔasa (m)	*baʔeeso* (n)	bushbuck
darma (m)	*dareemo* (n)	wilderness
ħafta (m)	*ħafeeto* (n)	mat
naʕáɬ (m)	*naʕeeło* (n)	gums, palate
marʔafmo (m)	*marʔeefo* (n)	relative
ts'aʕat-mo (m)	*ts'aʕeeto* (n)	calf
mugúl (m)	*mugeelo* (n)	collar bone
darqafi (m)	*darqeefo* (n)	scale

4 *The suffixes -eeri and -eemo*

The plural suffixes *-eeri* and *-eemo* are of special interest to us. They resemble the broken plurals in several respects. All render the noun neuter. The plural formation *<ee>_i* shows a preference for masculine singulars, as does *-eeri*, while *<ee>_o* combines with feminine singulars, just like *-eemo*. The most important observation is that the resulting plurals are very similar in shape. Table 3 contains all nouns with these plural suffixes.

Table 3: Nouns with *-eemo* or *-eeri*

ʕuru (m)	*ʕureeri* (n)	force
ħampa (m)	*ħampeeri* (n)	wing
tiʔita (m)	*tiʔiteeri* (n)	Ficus thoningii
ʕuntɬ'a (m)	*ʕuntɬ'eeri* (n)	cheek
ħam-angw (m)	*ħameeri* (n)	leather strips
łaara (m)	*łaareeri* (n)	armpit
gurungura (m)	*gurungureeri* (n)	knee
ʕar-mo (m)	*ʕareeri* (n)	lump; calf of leg
lama (f1)	*lameemo* (n)	lie
dangi (f)	*dangeemo* (n)	twins
kanki (f)	*kankeemo* (n)	corner
tɬ'awi (f1)	*tɬ'abeemo* (n)	lake
naanú (m)	*naaneemo* (n)	side dish
łanú (m)	*łaneemo* (n)	python
danda (m)	*dandeemo* (n)	back
ʔaya (m)	*ʔayeemo* (n)	land
gayu (m)	*gayeemo* (n)	other side

ʕaaru (m)	*ʕareemo* (n)	breakfast
ʔatu (m)	*ʔateemo* (n)	brain
kintu (m)	*kinteemo* (n)	bush
xad-ay (m)	*xadeemo* (n)	place of worship

The plural nouns with a broken plural *<ee>_o* and those with the suffix *-eemo* are all trisyllabic. The second syllable contains the long *ee*, the final vowel is *o*. The first syllable is either open, or "closed" by a semi-vowel, a (homorganic) nasal or r[2]. The same statements are valid for the plurals containing *<ee>_i* or *-eeri*. In addition we can observe that the last consonant of the plurals in *<ee>_i* is a sonorant, as is the consonant of the suffix *-eeri*. The fact that broken plurals are based on stems with a closed first syllable and that nouns with an open first syllable take a disyllabic suffix that yields the same shape as a resultant plural noun shows that broken plurals are related to the syllabic structure of the word. Thus *<ee>_o* and *-eemo* are two components of one and the same plural formation while their complementary distribution is determined by the syllabic content of the base. Similarly for *<ee>_i* and *-eeri*.

5 *Parallels in Burunge*

Such a relationship between broken plurals and syllabic structure is confirmed if we look at a similar phenomena in Burunge, a related language, and if we study the plurals of nonsense words. Kiessling (1994:52-54) states that the Burunge broken plural *<ee>_i* is used with three-radical stems and the last stem consonant is a nasal or a liquid. Both *<ee>_i* and *-eeri* render the nouns neuter and combine with masculine singulars in Burunge. The broken plurals of Iraqw and Burunge have a common origin: In Iraqw *kwaʔeeli* (n) is the plural of *kwal-oʔo* 'widow', in Burunge the same form is the plural of *kwaʔal-ay* 'poor person'; *yaʕeeto* 'sandals' is common to both languages, based on *yaʕati* (f) in Iraqw and *yaʕata* (f) in Burunge.

6 *Parallels in psycholinguistic tests*

In several tests[3] involving the plural of nonsense words I got a few broken plurals despite the fact that broken plural formations are rare in the language. I also obtained a few instances of the suffix *-eeri*. These cases, presented in tables 3 and 4, are in concordance with the generalisations made above about the resultant shape of the

[2] Exceptional long nouns are *gurungureeri* 'knees', which contains a reduplicated stem, and *tiʔiteeri* 'fig tree species (pl)'. A glottal stop between two identical vowels varies with a long vowel.

[3] These tests were conducted with a limited number of adults. Several strategies were used. Some words were presented with no meaning, others with vague meanings such as "this is a sort of insect that you might not have heard of before". Such tests are often conducted with children and pictures are used in order to convince them that the words are real. I didn't observe any problems among my subjects to provide the plural of non-existing words, nor to discuss the best plural(s) among a number of possibilities presented to them. As a word of caution for the interpretation of the results I must point out that these kind of tests are developed for a more regular type of morphology than Iraqw plural formation.

plural, with the exception that the first syllable of a plural word in *-eeri* is sometimes closed, especially when the next consonant is a sonorant.

Table 4: Plurals of nonsense words

ʕagno	*ʕageeno*
xutno	*xuteeno*
burmi	*bureemo*
ɬikma	*ɬikeemi*
dakri	*dakeeri*

Table 5: The suffix *-eeri* with nonsense words

tiqri	*tiqreeri*
wagla	*wagleeri*
sigma	*sigmeeri*
giga	*gigeeri*
xito (f)	*xiteeri*
ts'ari	*ts'areeri*
dib-angw	*dibeeri*
tɬ'ara	*tɬ'areeri*

Iraqw broken plurals are rare and they are lexically indexed. The use of a particular plural formation is not predictable. There are disyllabic plural suffixes that result in the same syllabic pattern of plural nouns. This can also be observed in a related language and in plurals of nonsense words. In order to understand the relation between broken plurals and syllabic structure we will now turn to the syllabic structure of words in general.

7 *Syllabic structure of words in general*

Iraqw nouns can contain maximally five syllables. For example, the singulative of *boreg* 'a type of beans' is *boregito?o*; the singulative of *langalanga* 'a type of sorghum' is not *langalangito?o*, which would be six syllables, but *langito?o*. The minimum shape of a noun is one heavy syllable, for example *muu* 'people'. Many nouns are disyllabic of the type CV(V)CV. For longer nouns there are some restrictions in possible patterns. If we disregard reduplications, compounds and number suffixes, the trisyllabic noun stems fall into the following categories - consonant final stems are considered to have an extra syllable, and epenthetic vowels are counted as a syllable too:

Table 6: Possible "trisyllabic" noun stems

1. CVVCVC stems, first syllable contains long *ee* or *oo* and second syllable a high-toned *á* (three cases only):

   poohám 'baboon'
   dee?ár 'root'
   koo?án 'five'

2. CVC(v)CV stems, the first syllable has stress and contains a short *i*, *u*, or *a*.

   diq(a)ma 'cattle fence'

3. CV(C)CVVCV stems, the second syllable has stress and contains a long *ee*, *oo*, or *aa* (or a high toned short vowel of the same quality) and the first syllable contains a short *i*, *u*, or *a*.

   ʔumaali 'hedgehog'
   tawér 'wild dogs', SG: *taweer-mo*

4. CVCVCV stems, the last syllable has a high tone (realised on the number suffix if present) and all vowels are identical.

   quruntɬ'-áy 'water gourd'

In the example *tawér* under type 3 we can see that a short vowel with a high tone correlates with a long stressed vowel with a low tone if a suffix is added. Noun stems of type 2 are similar in shape to derived nouns that have undergone a syllable reduction rule that applies to any combination of morphemes: Short vowels are deleted if both the preceding and the following open syllables contain a short vowel, thus creating an iambic foot, for example *karama-u* 'castrated animal-PL' becomes *karmu* and *gawid-en* 'difficult-PL' becomes *gawden*.

Loan words are not always completely adjusted to one of these four types. The word *borég* 'a type of beans' (loan from Datooga) is a case in point. But the word for 'hospital' is adjusted to fall into type 3, *siptaali*, presumably from English or German through Swahili.

The singulars of broken plurals fall into type 2. Their plurals fall into type 3. As a group, all plural nouns containing a suffix *-eeri*, *-eemo*, *<ee>_i* or *<ee>_o*, fall into group 3. In order to obey the restrictions of type 3 trisyllabic stems take infixation (broken plurals) and disyllabic stems suffixation. Thus broken plurals are related to possible stem forms.

8 *Towards an optimal analysis*

An analysis of the broken plurals should ideally capture the following generalisations:

- The set of plural formations, *<ee>_i*, *-eeri*, *<ee>_o*, *-eemo*, all result in words of a similar shape.
- This shape is one of a limited set of possible shapes for trisyllabic stems.
- This shape involves an open first syllable and an accented second syllable. Disregarding the low vowel, vowels in the second syllable are lower in vowel height; i.e. the sequence is high-mid (or mid-low).
- The consonant *r* in the suffix *-eeri*, being a typical sonorant, is in accordance with the fact that nouns taking the *<ee>_i* plural have a final consonant that is a sonorant.

The crucial factor in this list of generalisations is how to capture the link between stem structure in general and the shape of the broken plural. For a similar problem, Stewart (1983:122-24) proposed to extend the operational domain of well-formedness conditions to the word in order to eliminate the unwanted double formulation of vowel harmony, as a sequence restriction constraint and as a phonological rule. He needed Automatic Adjustment rules linked to the well-formedness conditions to state how well-formedness conditions are met and violations avoided when morphemes combine to a word. In the framework of optimality theory, violations of the conditions are simply allowed and the conditions are ranked to evaluate the optimal analysis. In our case, a condition on the syllable sequence structure would be ranked higher than the condition that disallows infixes and therefore broken plurals arise, obeying the higher ranked condition, violating the lower ranked one, see McCarthy and Prince (1993).

Nouns that are marked to take the plural formation *eeSi*, where *S* stand for a sonorant, or *eeCo*, will result in type 3 nouns of Table 5, i.e. having the shape CV(C)CVVCV because of the stressed *ee* in the penultimate syllable. Thus we have *ʕura-eeSi* → *ʕureeri* 'ashes' and *digma-eeSi* → *digeemi* 'boundaries'. The first syllable of the plurals is open. There are however the following cases to accomodate:

Table 7: Type 3 nouns with a semi-open first syllable (The dollar sign marks the syllable boundary)

dan$d-eemo	backs
ʕan$t<ee>no	anthills
dar$q<ee>f-o	scales
ʕay$s<ee>n-o	slanders

Other such cases are *ħampeeri* 'wings', *marʔeefo* 'relatives', *qawteeno* 'grazing lands', and *ʕanteeno* 'anthills'. The first syllable contains a vowel followed by a glide, or a vowel followed by a *r* or the nasal part of a homorganic nasal-oral stop cluster. Nouns containing a first syllable that is closed by the nasal part of a homorganic nasal-oral stop cluster do not take infixation. Note that Iraqw speakers make a clear syllable boundary between the nasal and the stop when asked to syllabify these words. Iraqw differs from the neighbouring Bantu languages in this respect. Thus, the nasal is part of the first syllable and, in a way, behaves like a vowel. Newman (1972:315-16) observed something similar for Hausa plurals in *aa_ee* for which the second part of a diphthong and the syllable final *n* behave as vocalic and not as consonantal elements. We can adjust the syllable sequence condition in the following way: If the stress is on the second syllable, the first syllable is open where "open" includes vowel-glide, vowel-*r*, vowel-nasal[4].

Nouns such as *digma* are marked to take the *eeSi* plural formation. Nouns taking this plural formation have a sonorant as the last consonant. In order to obey the syllable sequence condition, the stressed *ee* is inserted between the *g* and the

[4] There is one example in the plurals of nonsense words, *sigmeeri*, that despite its stressed *ee* in the second syllable violates the syllable sequence condition since the first syllable is not "open".

m violating the continuity constraint. A noun like *ʕuru* which is marked for the same plural *eeSi* does not violate the syllable sequence condition if it is suffixed to the base. Since there is no consonant available and the final consonant has to be a sonorant, the default sonorant *r* is inserted, resulting in *ʕureeri*. A word like *darqafi* is marked to take the plural *eemo* and obeys the syllable sequence condition under the wide definition of "open" and thus results in *darqeefo*, while *danda*, marked for *eemo*, obeys the same wide definition of openness.

The plural formations under discussion have in common that they include a stressed *ee* and therefore fall into type 3 nouns of table 5. There are two other number formatives that contain a stressed syllable, the plural suffix *-aawee* and the rare singulative *-aaCi*, where C is a reduplication of the last consonant. Both obey the syllable structure condition without resulting in infixation. Other suffixes result in patterns such as CVCV or CVCCV.

Conclusion: Iraqw broken plurals are "broken" in order to be in line with the general shape of nouns that have a stressed second syllable. The constraint expressing this shape states that the preceding syllable is open. The rhyme of such an open syllable may include diphthongs, the nasal part of a homorganic nasal-stop cluster and an *r*. A framework of optimality theory can account for the broken plurals and capture the generalisation of their relation to sequence restrictions of stems if this constraint dominates the general contiguity constraint.

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