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An Application of Optimality Theory (OT) on Syllable Structure within Reduplication in Hausa Spoken in Kano

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ABSTRACT : *This paper discusses the process of word formation with reference to the types and functions of reduplication in one of the dialects of Hausa which is spoken in Kano, Nigeria. The study investigated the interaction of syllable structures and syllable weight of Hausa, showing the phonological interactions that occur within the morphological process of reduplication using Optimality Theory (OT). The OT analysis demonstrates that syllable structure and weight are important in selecting the optimal reduplication candidate. Specifically, structures like CVCC are not permitted in the reduplicant because they are not permissible forms in Hausa syllable structures. Additionally, the analysis reveals that in total reduplication, the reduplicant is usually a disyllabic foot, whereas in partial reduplication, it is a monosyllabic foot. These findings may shed light on a new facet of OT and its role of interpreting reduplication in Hausa. Hence, this study offers a new window to phonologists who are interested in OT and to explore further issues of Hausa in light of OT.*

KEYWORDS: Hausa, reduplication, Optimality Theory (OT), syllable structure, syllable weight, foot

INTRODUCTION

Hausa is one of the major languages that have more first language speakers than any other language in sub-Saharan Africa. It belongs to the Chadic branch of Afro-asiatic languages with about 50 million people speaking the language in Nigeria, Niger, Cameroon, Togo and Ghana. The majority of its speakers live in northern Nigeria and in the southern areas of the neighbouring Republic of Niger (Jaggar 2001: 1, Caron 2013: 1). In Nigeria, Hausa is one of the major languages spoken alongside Yoruba and Igbo; it is a language spoken in the northern states of Nigeria. It serves as a first language to millions of people (Jaggar 2001: 1, Schlippe, Djomgang, Vu, Ochs and Schultz 2012: 1). In addition, it serves as a lingua franca used in the Northern states of Nigeria. Hausa which is spoken in Nigeria has quite a number of dialects. However, many researchers (e.g. Greenberg 1941, Schuh and Yalwa 1993, Jaggar 2001, Caron 2013) recognise the dialect spoken in Kano as the standard form as it is used for broadcasting and publications.

Different linguistic issues of Hausa have been studied for many decades (e.g. Greenberg 1941, Parsons 1955, 1960, Newman 1973, 1984, 1986, Schuh 1974, Newman and Jaggar 1983, Schuh and Yalwa 1993, Jaggar 2001). However, to the best of our knowledge, none of these studies has tackled the interaction of phonological factors with those of morphology using Optimality Theory (OT) as an analytical framework, especially in relation to reduplication. Hence, this paper aims at investigating this interaction using OT in order to examine the syllable structures and weight in Hausa, specifically in reduplication. Also, it investigates the extent to which Hausa's syllable structure and syllable weight affect the selection of the reduplicant in both total and partial reduplication. The following section provides an overview of some key concepts pertaining to the phonology of Hausa.

Key Concepts

Hausa Phonemes

Speech sounds are contrasted in order to illustrate the distinctness of a sound, namely, whether it is a consonant or a vowel. These distinct sounds are called phonemes. Davenport and Hannahs (2010: 116) describe a phoneme as "the abstract underlying unit" of the sound system of a language. Hausa has a vast number of phonemes; the sound system of Hausa consists of twenty seven consonants, ten monophthongs and two diphthongs as illustrated by Schuh and Yalwa (1993: 78). The phonemes of Hausa as described in Hoffman and Schachter in Dunstan (1969: 74-77) and Schuh and Yalwa (1993: 78) are presented in appendix 1 and 2 with examples.

Syllable Structures of Hausa

Hausa has three permissible and possible syllable structures as identified by most researchers (e.g. Jaggar 2001 and Caron 2013). Jaggar (2001: 23) states that all the syllable structures of Hausa are consonant initial, examples of these structures are as follows:

CV	**ma.ce** [**ma.tʃe**]	'woman'	**ci.ki** [**tʃi.ki**]	'inside'
CVC	**rum.far** [**rum.faɽ**]	'the stall'	**has.ken** [**has.keŋ**]	'the light'
CVV	**yaa.roo** [**ja:.ɽo:**]	'boy'	**ai.ki** [**ʔai.ki**]	'work'

Kager (1999: 95-96) describes some languages that have a different dimension of complexity of syllable margin that is, although onsets and codas are allowed, they must be simple. Put differently, complex onsets and codas are not permitted. Therefore, only one consonant can be found in the onset and coda of a syllable. Hausa is one of these languages which do not allow a CC or CCC syllable structures i.e. consonant cluster. Jaggar (2001: 34) concurs that English loanwords that have consonant clusters are resolved by the epenthesis of a vowel e.g. 'plank' – [**fi.lan.ki**], 'brake' – [**bur.ki**], 'bench'- [**ben.tʃi**], and 'plot' (of land) – [**fu.lo.ti**].

Syllable Weight

The distinction between syllable weights is a very important factor in Hausa's syllable structure, especially in the study of reduplication. Jaggar (2001: 24) identifies the interaction of syllable weight and morphological processes indicating that the weight of the initial syllable determines the choice of the affix (i.e. either the prefix or suffix). In his discussion on the universality of syllable weight, Kager (1999: 147) states that while short vowels are characterized by only one mora, long vowels are characterised by two moras. According to Hayes (1989: 254), a mora represents a well-known contrast between light and heavy syllables and counts as a phonological position. Therefore, universally, CV syllables are considered light (monomoraic), while CVV syllables are considered heavy (bimoraic). As for CVC syllables, the weight depends on whether its coda consonant is moriac or not.

This notion is also favoured by Clements (1983: 12), who describes syllable weight in terms of the nucleus, stating that a simple (non-branching) nucleus V makes up a light syllable, whereas a complex (branching) nucleus VV or CV makes up the heavy syllable. Caron (2013: 4) posits that Hausa syllable structures according to their weight are as follows:

CV - Light
CVV - Heavy
CVC - Heavy

Some researchers have studied other aspects of the interface between the syllable weight and reduplication on the one hand and other linguistic properties on the other, e.g. the tonal interaction between syllable weight with tone (Jaggar 2001: 25), reduplication with tone (Newman 1989a: 1) and tone with affixation (Newman1986: 1). However, this study focuses mainly on the interaction of reduplication with syllable structure and weight in light of OT.

Reduplication

Reduplication is defined by Bauer (2003: 31) as "a morphological process of word formation that involves identity, whereby the root or stem of a word, or part of it is repeated". In other words,

reduplication is used in inflections to convey a grammatical function, such as plurality and intensification. In derivation, it is used to create new words. In order words, reduplication is often used when a speaker adopts a tone more "expressive" or "figurative" than ordinary speech and is also often, but not exclusively, iconic in meaning. McCarthy and Prince (1995: 1) recognise it as a matter of identity, where the reduplicant copies the base, they explain that perfect identity cannot, however, always be achieved. A clear and simple morphological definition of reduplication is offered by Kager (1999: 194), he defines it as "a kind of affixation, both in its morphosyntactic contribution (it forms morphological categories such as plurals) and in its linear position with respect to the stem (preceding it as a prefix or following it as a suffix)". Looking at the phonological perspective, he says that reduplication has a special property, in that, the reduplicative affix is unspecified for segmental content but is copied from reduplicated stem. Therefore, reduplication involves phonological identity between the reduplicant and the adjoining base (Kager ibid).

Furthermore, McCarthy and Prince (cited in Kager 1999: 202) define a reduplicant as a "string of segments that is the phonological realization of some reduplicative morpheme RED, which is phonologically empty". On the other hand, the base is defined as "the output string of segments to which the reduplicant is attached more specifically". In other words, the preceding string is for reduplicative suffixes and the following string of segments is for prefixal reduplication. In their discussion on the phonology of reduplication, Inkelas and Zoll (2005: 18-20) discuss the phonological issues in reduplication, in particular, the kind of reduplicative construction necessary for the development of what is phonologically possible. They indicate that reduplicative phonology does not always favour one copy (the base) against the other copy (the reduplicant). Instead, both of them are modified differently in certain constructions. According to the duo, phonological modifications in reduplication result from the interface of three cophonologies, where cophonology means the mother node i.e. "the output" and the daughter nodes i.e. "the inputs". An example of this can be found in Hausa's pluractionals, where the first stem reduces to its initial CVC string and the other one remains as it is. Also, gemination occurs in the final C of the base initial consonant. This can be seen in the following examples:

	Base		Reduplicate	
(1)	**ƙira**	'call'	**ƙiƙ-ƙira**	'call repeatedly'
(2)	**buga**	'beat'	**bub-buga**	'beat severally'
(3)	**ka:wo**	'bring'	**kak-ka:wo**	'bring continuously'

While discussing phonological copying in Hausa, Inkelas and Zoll (2005: 21) note that the duplication of the consonant is phonologically driven by the need for a syllable onset. Because phonological copying is at work, they posit that this will be resolved in autosegmantal phonology by spreading a consonant to the onset position, and in OT using the ONSET constraint, which forces the insertion of a consonant that agrees to the features of a nearby consonant. They indicate that phonological copying is different from morphological copying in the sense that it serves a phonological purpose, namely, it is phonologically proximal. This means that it involves single phonological segments and it is driven by phonological identity imperative. On the other hand, morphological copying serves a morphological purpose, it is not necessarily phonologically proximal, it involves morphological constituents and it is not driven by phonological identity imperative (Inkelas and Zoll 2005: 197).

Types of reduplication cross-linguistically

According to Bauer (2003: 30) and Booij (2005: 36), reduplication occurs either totally or partially. Total reduplication occurs when the entire base is reduplicated, making the reduplicant and the base totally identical, whereas partial reduplication occurs when only a part of the word is reduplicated and added at the beginning or end of a base as an affix. Although its level of linguistic productivity varies, reduplication occurs in a wide range of languages and language groups. Below are some examples (as cited in Bauer 2003: 31):

Afrikaans

(4)	**amper**	'nearly'	**amper.amper**	'very nearly'

(5) **dik** 'thick' **dik.dik** 'very thick'

Jordanian Arabic (JA)[1]

(6) **kθiir** 'much' **kθiir-kθiir** 'very much'

(7) **ʃwai** 'little' **ʃwai-ʃwai** 'very slowly'

English[2]

(8) **Bye** **bye-bye**

(9) **No** **no-no**

(10) **Softly** **softly-softly** 'doing things slowly and carefully'

Japanese

(11) **jawah** 'fire' **jəjawah** 'to warm oneself by the fire'

(12) **tamu** 'guest' **tətamu** ' to visit'

Reduplication has a corresponding connection with other morphological processes. For instance, Fabb (2001: 69) states that total reduplication is sometimes considered a compounding process. However, this paper focuses on reduplication in Hausa in light of OT. The connection between compounding and reduplication needs further investigation.

Reduplication types and functions in Hausa

Hausa exhibits both total and partial reduplication, which are added either as a prefix or as a suffix as can be seen in the following examples:

2.4.2.1 Partial reduplication

	Base		Reduplicate	
(13)	**kawo** [**ka.wo**]	'bring'	**ka-kawo** [**ka-ka.wo**]	'keep bringing'
(14)	**yanka** [**jaŋ.ka**]	'cut'	**yan-yanka** [**jaŋ-jaŋ.ka**]	'cut severally'
(15)	**tsaguwa** [**tsa.gu.wa**]	'rip'	**tsa-tsaguwa** [**tstsa.gu.wa**]	'rip severally'

2.4.2.2 Total reduplication

	Base		Reduplicate	
(16)	**Gaari** [**ga:.ri**]	'powder'	**gaa.ri-gaa.ri** [**ga:ri-ga:ri**]	'powdery'
(17)	**ruwa** [**ru.wa**]	'water'	**ru.wa-ru.wa** [**ru.wa-ru.wa**]	'watery'
(18)	**tsami** [**tsa.mi**]	'sour'	**tsa.mi-tsa.mi** [**tsa.mi-tsa.mi**]	'sourly'

Reduplication performs several functions in Hausa. Below are some of these functions, which are discussed in Newman (1989b), Jaggar (2001) and Inkelas and Zoll (2005):

I. Plural formation: some plurals are formed by copying the base-final consonant, this process involves reduplication of a syllable or the entire word as in the following examples:

a) Copying the onset consonant of the final syllable as follows:

	Base	Plural	
(19)	**buk.ka** [**buk.ka:**]	**buk.ko.ki** [**buk.ko.ki**]	'grass hut'
(20)	**ƙo.fa** [**k'o:.fa:**]	**ƙo.fo.fi** [**k'o:.fo:.fi**]	'door'

b) Reduplicating and infixing the antepenultimate –CVC- part of the final two syllables to the suffixed plural form itself. The initial C of the infix is the final C of the base. This can be illustrated in the following examples:

	Base	Plural	
(21)	**cu.ta** [**ʧu.ta**]	**cu.tut.tu.ka** [**ʧu.tut.tu.ka**]	'illness/disease'
(22)	**ga.wa** [**ga.wa**]	**ga.waw.wa.ki**[**ga.waw.wa.ki**]	'corpse'

c) Pluractional (intensive) verbs: reduplicating the two right-most syllables of a verb with the deletion of the final vowel of the stem to indicate multiple, iterative, frequentative, distributive, or extensive actions of a verb. Below are some examples:

	Base	Reduplicate	
(23)	**yagalaa** [**jagala:**]	**ya.gal-ga.la** [**ja.gal.ga.la**]	'tear in pieces'
(24)	**kucinaa /kutʃina:/**	**kucicinaa** [**kutʃitʃina**]	'cut in pieces'

[1] The examples are based on the second author's intuition as a native speaker of Arabic.

[2] English examples are cited based on the authors' knowledge of English.

II. Adjectives: some adjectives are formed by reduplication, this can be seen in the following examples:

a) Denominal adjectives: single concrete nouns can be totally reduplicated and the vowel in the final syllable shortened to derive adjectives with the meaning characterised by the source noun as follows:

	Base		Adjective		
(25)	**gari**	[**ga:.ri:**]	**gari-gari**	[**ga:ri-ga:ri**]	'powdery'
(26)	**ruwa**[**ru.wa:**]		**ruwa-ruwa**	[**ru.wa.ru.wa**]	'watery'
(27)	**yashi** [**ja.ʃi:**]		**yashi-yashi**	[**ja.ʃi-ja.ʃi**]	'sandy'

b) Reduplicated ('x-ish') adjectives: these are simple and derived adjectives that are formed by total reduplication. These adjectives have the equivalent of the English "x-ish" examples where "x" stands for the adjective as follows:

	Base		Adjective		
(28)	**baƙi**	[**ba.k'i**]	**baƙi-baƙi**	[**ba.k'i-ba.k'i**]	'blackish'
(29)	**danye**[**ɗaŋ.je**]		**danye-danye**	[**ɗaŋ.je-ɗaŋ.je**]	'rawish'
(30)	**babba** [**bab.ba**]		**babba-babba**	[**bab.ba-bab.ba**]	'biggish'

III. Adverbs: some adverbs reduplicate in order to intensify or detensify the adverbial meaning of adverbs. This can be seen in the following examples:

a) Intensification by vowel gemination and rhoticization of coda in the reduplicated output as follows:

Gemination

	Base		Reduplicate	
(31)	**nsafe** [**sa.fe**] 'morning'		**sassafe** [**sas.sa.fe**]	'very early in the morning'

Rhoticization

	Base		Reduplicate	
(32)	**kusa** [**ku.sa**]	'close'	**kur-ku.sa** [**kuɽ-ku.sa**]	'very close'

b) Detensification: this process takes place when the basic meaning may be densified by total reduplication as follows:

	Base		Reduplicate	
(33)	**baya** [**ba:.ja**] 'behind/back'		**baya-baya** [**ba.ja-ba.ja**]	'slightly behind'

On the basis of the previous discussion, it can be observed that Hausa exhibits both total and partial reduplication, which mainly occur via attaching prefixes or suffixes to the base. The following section focuses on the OT analysis of reduplication and syllable structures interaction in Hausa.

METHODOLOGY

In order to describe an optimal account of reduplication in Hausa, OT constraints for prefixal total and partial reduplication and their analysis need to be fully explained. Both markedness and faithfulness constraints are used in OT analysis. For total reduplication analysis, the output examined is RED-[**ru.wa:**] 'water' and for partial reduplication, the output is RED-[**jaŋ.ka**] 'cut'.

According to McCarthy and Prince (1995: 16), there are three ways of constraining the shape of the reduplicant in standard OT; these constraints include MAX constraint family, DEP constraint family and IDENT constraint family. The first family MAX has a general schema, namely, every segment of S_1 (base or input) has a correspondent in S_2 (reduplicant or output). Specifically, MAX-BR requires every segment of the base to have a correspondent in the reduplicant (for total reduplication), just like MAX-IO which requires every segment of the input to have a correspondent in the output (no phonological deletion). The second family DEP generally requires that every segment of S_2 to have a correspondent in S_1 (S_2 is dependent on S_1). Specifically, DEP-BR requires that every segment of the reduplicant to have a correspondent in the base (prohibits fixed default segmentism in the reduplicant) just like DEP-IO, where every segment in the output has a correspondent in the input (prohibits phonological epenthesis).

The third family is the IDENT (F), which generally states that let X be a segment in S_1 and Y be any correspondent of X in S_2. If X is [ɤF] then Y is [ɤF] (correspondent segments are identical in feature F). Specifically, IDENT-BR (F) requires that the reduplicant correspondents of a base [ɤF] segments are also [ɤF], just like IDENT-IO (F), which requires that the output correspondents of an input [ɤF] segments are also [ɤF].

To sum up, the faithfulness constraints are as follows:

- MAX-BR: this is the identity constraint, which states that every element of the base must re-occur in the reduplicant. This applies to total reduplication.
- DEP-BR: this constraint states that segments in the reduplicant must have correspondents in the base.
- IDENT BR [F]: this constraint deals with the featural identity between the correspondents in the base and the reduplicants.

DATA ANALYSIS AND DISCUSSION

The first part of the analysis focuses on total reduplication. A conflict two between constraints is examined in the analysis of the output RED-[ru.wa:]. The reduplication of this base does not allow for a heavy syllable to be reduplicated. For the analysis, a faithfulness constraint MAX-BR, which is an identity constraint and a markedness constraint ANCHOR (used in Kager 1999), which allows the left (right) element of the reduplicant to correspond with the left (right) peripheral element of the base, thereby allowing the reduplicant to align to the left (right) edge of the base, is used and ranked such that ANCHOR dominates MAX-BR. The following Tableau provides an analysis for total reduplication of [**ru.wa:**] 'water'.

Total Reduplication of [ru.wa:] 'water'

Tableau 1 ANCHOR >> MAX-BR

RED- /ru.wa:/	ANCHOR	MAX-BR
→a. **ru.wa**-ru.wa		*
b. ru.wa-**ru**	*!	*

In Tableau 1 candidate (a) violates MAX-BR since it changed the long vowel to a short one. Thus, it caused a violation of identity but it satisfies ANCHOR. Candidate (b), on the other hand, violates both MAX-BR and ANCHOR as it aligns to the right by making the RED a suffix instead of a prefix. Although none of them is perfect, candidate (a) is selected as the optimal candidate because it has a violation of a lower ranked constraint while candidate (b) is not because it violates a highly ranked constraint. This calls for the introduction of a new constraint DEP-BR, which dominates the maximizing constraint MAX-BR. This can be seen in Tableau 2.

Tableau 2 ANCHOR >> DEP-BR >> MAX-BR

RED-/ru.wa:/	ANCHOR	DEP-BR	MAX-BR
→a. **ru.wa**-ru.wa			*
b. ru.wa-**ru**	*!		*
c. ru.wa-**ru.wa.wa**	*!	*	*

In Tableau 2, candidate (a) is still the winning candidate since it violates only the lowest ranked constraints compared to candidate (c), which violates the newly introduced faithful constraint by the epenthesis of a syllable and aligning to the right instead of the left. Furthermore, it violates the highly ranked markedness constraint. Hence, the latter is not selected as the optimal candidate. Hausa has no complex syllables in either onset or coda positions of words. Therefore, a new markedness constraint

*COMPLEX (used in Kager 1999), which prohibits the occurrence of a complex onset or coda, dominates the faithfulness constraints DEP-BR and MAX-BR. This is illustrated in Tableau 3.

Tableau 3 ANCHOR >> *COMPLEX >> DEP-BR >> MAX-BR

RED-/ru.wa:/	ANCHOR	*COMPLEX	DEP-BR	MAX-BR
→ a. **ru.wa**-ru.wa				*
b. ru.wa-**ru**	*!			*
c. ru.wa.-**ru.wa.wa**	*!		*	*
d. **tru.wa**-ru.wa		*!	*	*

In Tableau 3, candidate (c) has a fatal violation as it has a consonant cluster, which is a contrary form to the base. In particular, it violates the new constraint *COMPLEX, which does not allow complex onsets or codas. Therefore, candidate (a) is selected as the optimal candidate.

Another constraint that causes a change of identity in the features of the input is necessary, so that the same features in the input should be identical to the ones in the output. The constraint IDENT-BR (F) does not allow for this change, thus, it dominates MAX-BR.

Tableau 4 ANCHOR >> *COMPLEX >> DEP-BR >> IDENT BR(F) >> MAX-BR

RED-/ru.wa:/	ANCHOR	*COMPLEX	DEP-BR	IDENT BR(F)	MAX-BR
a.→ **ru.wa**-ru.wa				*	*
b. ru.wa-**ru**	*!		*	*	*
c.ru.wa **ru.wa.wa**	*!		*	*	*
d. **tru.wa**-ru.wa		*!	*	*	*
e. **tru.wai**-ru.wa		*!	*	*	*

In Tableau 4, it can be seen that candidate (e) violates the new constraint, which states that the features of the reduplicant must be identical with those of the base. It also violates all the faithfulness constraints. Although the winning candidate (a) also violates the new constraint IDENT BR (F), it is lower ranked by all the other candidates, which allows it to maintain its winning status.

The reduplicant in Hausa's total reduplication is not usually a monosyllabic foot. The data in this analysis has a disyllabic foot and the reduplication rule allows for a constraint, which states that the reduplicant must be a disyllabic foot RED-$FT_{\sigma\sigma}$. In the following Tableau, this constraint dominates ANCHOR and MAX-BR.

Tableau 5 RED-FT$_{\sigma\sigma}$ >>ANCHOR >>*COMPLEX>>DEP-BR>>IDENT-R>>MAX-BR

RED-/ru.wa:/	RED-FT$_{\sigma\sigma}$	ANCHOR	*COMPLEX	DEP-BR	IDENT-BR(F)	MAX-BR
→a. **ru.wa**-ru.wa					*	*
b. ru.wa-**ru**	*!	*!		*	*	*
c.ru.wa-**ru.wa.wa**		*!		*	*	*
d. **tru.wa**- ru.wa			*!	*	*	*
e. **tru.wai**-ru.wa			*!	*	*	*
f. **wa**-ru.wa	*!			*	*	*

Candidate (f) violates the constraint RED-FT$_{\sigma\sigma}$ because it has a monosyllabic foot, which infringes on the new constraint. It is a fatal violation since it violates a highly ranked constraint.
In a nutshell, the most important aspect of the previous analysis is that in Hausa's total reduplication, syllable weight and foot are seen to be important in selecting the reduplicant. The reduplicant in total reduplication is always a light syllable with a disyllabic foot. The next section sheds light on partial reduplication in Hausa.

Partial Reduplication of [jaŋ.ka] 'cut'
The same constraints used for the analysis of total reduplication are re-used for the partial reduplication analysis. The word [**jaŋ.ka**] uses a prefix reduplication whereby the initial syllable is reduplicated. To account for this, the optimal candidate (a) in Tableau 6 has fewer violations of faithfulness constraints MAX-BR and DEP-BR, which are dominated by *COMPLEX.

Tableau 6 *COMPLEX >> DEP-BR >> MAX-BR

RED- /jaŋ.ka/	*COMPLEX	DEP-BR	MAX-BR
→a. **jaŋ**-jaŋ.ka			*
b. **ʔjaŋ**-jaŋ.ka	*!	*	*

The losing candidate (b) has more violations of the constraints in Tableau 6. Specifically, it violates the higher ranked markedness constraint *COMPLEX, that does not permit complex onsets and codas compared to the optimal candidate (a), that has only one violation of the least ranked constraint MAX-BR, which does not permit the input to delete any segment from the base. In keeping the reduplicant leftmost of the base, a new markedness constraint ANCHOR shows this action as it is ranked higher than MAX-BR in Tableau 7.

Tableau 7 ANCHOR >> *COMPLEX >> DEP-BR >> MAX-BR

RED- /jaŋ.ka/	ANCHOR	*COMPLEX	DEP-BR	MAX-BR
→a. **jaŋ**-jaŋ.ka				*
b. **ʔjaŋ**-jaŋ.ka		*!	*	*
c. jaŋ.ka- **jaŋ**	*!			*

In Tableau 7, the new candidate (c) violates the constraint ANCHOR by suffixing the reduplicant to the right-most instead of keeping it to the left-most of the base. This is a fatal violation of a highly ranked constraint, which makes candidate (a) the optimal candidate.

Considering the syllable weight in Hausa syllable structure, in which, CVV is a heavy syllable and CV, CVC are light syllables, and because the reduplicant is a CVC light monomoraic syllable, the constraint that is used in ranking it is of Wight-By-Position, focusing on the position of the monomoraic coda consonant. The Total reduplication constraint RED-FTσσ is modified as RED-FTσ (light) for the partial reduplication and is ranked higher than MAX-BR. This can be seen in Tableau 8.

Tableau 8 RED-FTσ (light) >> ANCHOR >> *COMPLEX >>DEP-BR >>MAX-BR

RED- /jaŋ.ka/	RED-FT σ (light)	ANCHOR	*COMPLEX	DEP-BR	MAX-BR
a. **jaŋ**-jaŋ.ka					*
b. **ʔjaŋ**-jaŋ.ka			*!	*	*
c. jaŋ.ka- **jaŋ**		*!			*
d. **jaŋk**-jaŋ.ka	*!		*!	*	*

Candidate (d) violates the high ranking constraint RED-FTσ (light) in Tableau 8 by making the reduplicant a CVCC heavy bimoraic syllable. Hence, it has a heavy syllable in the coda position, which is not a permissible syllable structure in Hausa. To maintain the identity of the output in the input, the identity constraint IDENT-BR is used. It is lower ranked than RED-FTσ (light) but equally ranked with MAX-BR. This is shown in Tableau 9.

Tableau 9 RED-FTσ (light) >>ANCHOR >>*COMPLEX >>DEP-BR >>IDENT-BR >>MAX-BR

RED- **/jaŋ.ka/**	RED-FT (light)	ANCHOR	*COMPLEX	DEP-BR	IDENT-BR	MAX-BR
→ a. **jaŋ**-jaŋ.ka					*	*
b. **ʔjaŋ**-jaŋ.ka			*!	*	*	*
c. jaŋ.ka- **jaŋ**		*!			*	*
d. **jaŋk**-jaŋ.ka	*!		*!	*	*	*
e. **jiŋk**-jaŋ.ka	*!		*!	*	*	*

The new faithful identity constraint IDENT-BR ranks equally with the low ranked constraint MAX-BR in Tableau 9 and it favours the optimal candidate. All the candidates including the optimal one violate this constraint; the new candidate (e) could not beat the optimal candidate because it has a fatal violation of a higher ranked constraint.

In summary, the analyses of the partial reduplication also show the importance of syllable weight and foot in the reduplicant. Unlike total reduplication where a disyllabic foot is the reduplicant, the opposite is the case in partial reduplication where the reduplicant is a monosyllabic foot and the syllable weight is a heavy syllable.

CONCLUSION

To sum up, this paper shows that Hausa has primarily two types of reduplication, total and partial, which serve different functions ranging from the formation of some plurals, pluractionals verbs, denominal adjectives, "X-ish" adjectives, detensification and intensification of adverbs. Also, Hausa has primarily three syllable types which consist of light (CV) and heavy (CVV and CVC) structures. The OT analysis reveals that syllable structure and weight are important in selecting the optimal reduplication candidate, where structures like CVCC or CCV are not permitted in the reduplicant since they are not permissible forms in Hausa's syllable structures. Light syllables are more preferred in the reduplicant in total reduplication, whereas heavy syllables are preferred in partial reduplication.

In addition, the reduplicant in total reduplication is usually a disyllabic foot, whereas in partial redulplication, it is a monosyllabic foot. It is important to note that the analysis of total and partial reduplication used in this paper could be applied to other reduplicated words. Therefore, the same constraints may be used to analyse other reduplicated words in Hausa. This paper may help phonologists to understand the mechanisms by which reduplication operates in Hausa in light of OT and to explore other issues of Hausa in light of OT. Additionally, it may be used for pedagogical purposes. For future studies, an OT analysis is recommended to explain the phonological interaction with other morphological processes, such as reduplication in other languages e.g. Arabic.

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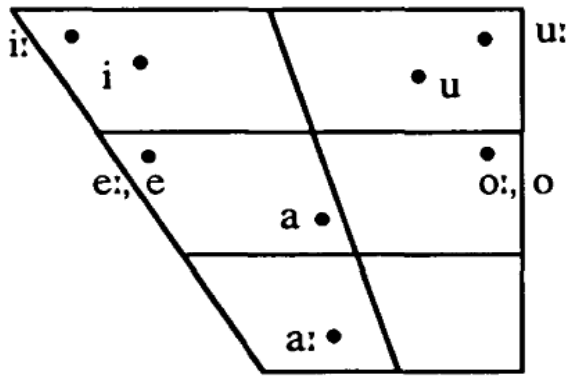
Appendix 1

Hausa consonants

	Bilabial	Alveolar	Post-Alveolar	Palatal	Palatalized Velar	Velar	Labialized Velar	Glottal
Plosive & Affricate	b	t d	tʃ dʒ		k^j g^j	k g	k^w g^w	ʔ
Implosive & Ejective Stops & Affricate	ɓ	ts' ɗ	(tʃ')	$ʔ^j$	k^j'	k'	k^w'	
Nasal	m	n						
Fricative	ɸ	s z	ʃ					h
Tap/Trill		r ɾ						
Approximant	w			j				
Lateral Approximant		l						

Vowels



Appendix 2

Bilabial

/b/	[ba:.ba:]	'father'
/ɓ/	[ɓe.ra]	'rat'
/m/	[ma:.ʃi]	'spare'

Labio-dantal

/f/	[fa.ʃi:]	'rob'

Palatalized labial

/fj/	[fja.ɗe]	'rape'

Alveolar

/t/	[ta.kar.da]	'book'
/d/	[do.ki]	'horse'
/ɗ/	[ɗa.ki]	'room'
/s/	[sa.bo]	'new'
/z/	[za.ki]	'lion'
/n/	[na:.ma:]	'meat'
/r/	[ra:.mi]	'hole'
/l/	[le:.ma:]	'umbrella'

Retroflex

/ɽ/	[ɽa.wa:]	'dance'

Palato-alveolar

/ʃ/	[ʃa:.nu]	'cow'
/tʃ/	[tʃo:.ka.li]	'spoon'
/dʒ/	[dʒa:.go:.ra:]	'guide'

Palatal

/j/ -	[ja:.ro;]	'boy'

Palatalised velar

/kj/	[kjaŋ.wa]	'cat'
/gj/	[gja:.ra:]	'repair'
/kʼj/	[kʼja:.le:]	'ignore'

Velar

/k/	[ka.re:]	'dog'
/g/	[go:.na]	'farm'
/kʼ/	[kʼai.fi]	'sharp'

Labialised-velar

/kʷ/	[kʷa.le.kʷa.le]	'canoe'
/gʷ/	[gʷa:ŋ.gʷa.ni]	'tin'
/kʼʷ/	[kʷʼa:.ɽa]	'shea-nuts'
/w/	[waŋ.ki]	'wash'

Glottal

/ʔ/	[ʔau.re]	'marriage'
/h/	[han.nu]	'hand'

Vowels

/i:/	[kʲʼi:.ɽa]	'forgoing'
/e:/	[kʲʼe:.ɽa]	'to forge'
/a:/	[kʼa:.ra]	'to increase'
/o:/	[kʷo:.ɽa]	'to chase'
/u:/	[kʷu:.ɽa]	'dust'
/i/	[kʲʼi.ɽa]	'calling'
/e/	[ta.ɽe]	'together'
/a/	[ka.ɽa]	'stalk'
/o/	[gʷo:.ro]	'kola nut'
/u/	[kʷu:.ɽa]	'to stare'

/**ai**/ [**kai**] 'head'
/**au**/ [**hau**] 'to climb'