AN OPTIMALITY THEORY ANALYSIS OF NŊWƐ SYLLABLE STRUCTURE

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Introduction

In the early forms of generative phonology, the syllable played no role (Clements and Keyser, 1983). Syllables are often considered as the phonological "building blocks" of words. They can influence the rhythm of a language, its prosody, its poetic meter, or its stress pattern. It is also considered "the smallest unit of speech that normally occurs in isolation, consisting of either a vowel alone (as in the pronunciation of the pronoun oar, ore, awe, I, eye, air, heir, err, our, hour, or, ah, etc.) or a combination of vowels and consonants (as in the pronunciation in, of so, it, two, four, salt, road, etc.)". Some consonants can be pronounced alone and may or may not be regarded as syllables (syllabic nasals in most African languages), but they normally accompany vowels, which tend to occupy the central position in a syllable.

According to Clements and Keyser (1983), the primary set of core syllable types, cross linguistically contain the following sequences:

(1) a. V (Some languages allow V-initial syllables e.g. V or VC).
   b. CV (Every language allows CV syllables i.e. no language bans C-initial syllable and on the other hand, no language equally bans V-final syllables.
   c. CVC (Some languages allow final consonants e.g. VC or CVC). It is worth noting here that these are patterns of output syllable inventories but not restrictions on both morpheme and input shapes.

Languages of the world have preferred syllable structures. Traditional work on internal structure of the syllable has arrived at the conclusion that the syllable is a phonological constituent which consists of zero or more consonants followed by a vowel and ending with a shorter string of zero or more consonants. The importance of these three spans has long been recognized and various names have been given to sub-parts of the syllable. They are generally referred to as the onset, the nucleus and the coda respectively as in the Nŋwɛ example below where the major parts of the syllable are indicated.

(2)
```
        σ
       / \
      O   R
      |   / \
      |  N   C
      |  |   |
      X  X   X
      |  |   |
      ŋ  á   ŋ    'bell'
```

The syllable is the prosodic category organising segments in sequences according to their sonority values. Each syllable has a sonority peak (nucleus), usually a vowel, possibly surrounded on both sides by margin segments of lower sonority, usually consonants (onset and coda), (Kager, 1999: 91). To obtain sensible words, the different pertinent, distinctive, invented, and organised elements have to be combined.

The main objective of this paper is to investigate the potentiality of Optimality Theory (OT) and to see whether one can depend on it to generate syllable structures cross linguistically and apply that general perspective on a particular language like Nŋwɛ. Consequently, this study is divided into four sections. The first section of this paper contains an introduction and a general presentation of OT, taking into account its components (Lexicon, Generator and Evaluator) and also the constraints (Faithfulness and Markedness). The second section involves a presentation of the syllable, the syllable structure constraints and the ranking of these syllable structure constraints in the language. The third section on its part is concerned with the application of OT to the analyses of the syllable structures in the language. In this regard therefore, syllable constraints are applied using some Nŋwɛ data. Finally, the fourth section summarises the paper presenting the findings of the work.

General presentation of optimality theory

Linguistics, just like every other science, has known successive developments in the course of its evaluation to the extensive fieldwork and fine-grained analysis of data from languages of different families. From this large body of research a broad picture emerges of 'unity in variety': core properties of grammar (with respect to sub-system of sounds, words, phrases and meaning) in a set of universal properties. Grammars of individual languages draw their basic options from these limited sets, which many researchers identify as universal grammar (UG). Each language, thus, reflects in a particular way the structure of its specific characteristics.

OT, which was developed by Prince and Smolensky in 1993 presents a very different view of phonological studies and is now also used in the study of syntax and language acquisition. It is a Constraint-Based Approach as opposed to the Derivational Approach inaugurated by Chomsky and Halle (1968) in the Sound Pattern of English (SPE). The derivational approach normally takes the form "X becomes Y in the context of Z" (X→Y/-Z).

According to McCarthy (2002) "Optimality Theory is the circulation of grammatical well-formedness which is accomplished by the optimalization of a set of constraints on structures and on input-output disparity, instead of through serial application of rule subject and filtering constraints." The fundamental ideas of optimality theory are, firstly, that there are no rules; everything is done by constraints. Secondly, that all constraints are allowed to be violated. It is not the violation as such that fails a candidate's output but the ranking. If one constraint is more important, and more highly ranked than another, then any candidate that violates that one is rejected and the remaining candidate may be acceptable even if it goes on to violate the lower ranked constraints.

In optimality theory markedness is built into grammar in the form of universal output constraints, which directly state marked or unmarked patterns. In optimality theoretical terms, constraints are violable. The Violation of a constraint is not a direct cause of ungrammaticality, nor, the absolute satisfaction of all constraints is what depicts the optimal candidate. Constraints are intrinsically in conflict, and every logical possible output of any grammar will necessarily violate at least some constraints. Languages differ in their ranking of these constraints. Each violation of a constraint is avoidable, yet the violation of a higher ranked constraint is avoided more forcefully than the violation of a lower ranked one.

At the heart of OT lies the idea that language in general and every grammar in particular is a system of conflicting forces. These forces are embodied by several constraints, each of which makes a requirement about some aspects of the grammatical output forms. While constraints are universal, the ranking is not; differences in ranking are the source of cross-linguistic variation. For a given input, the grammar generates and later evaluates a set of output candidates, from which the optimal candidate is selected, which is the actual output. Evaluation takes place by ranking the constraints starting with the higher ranked before moving to the lower ranked ones, each of which will eliminate some candidate’s output, until a point where only one output survives.

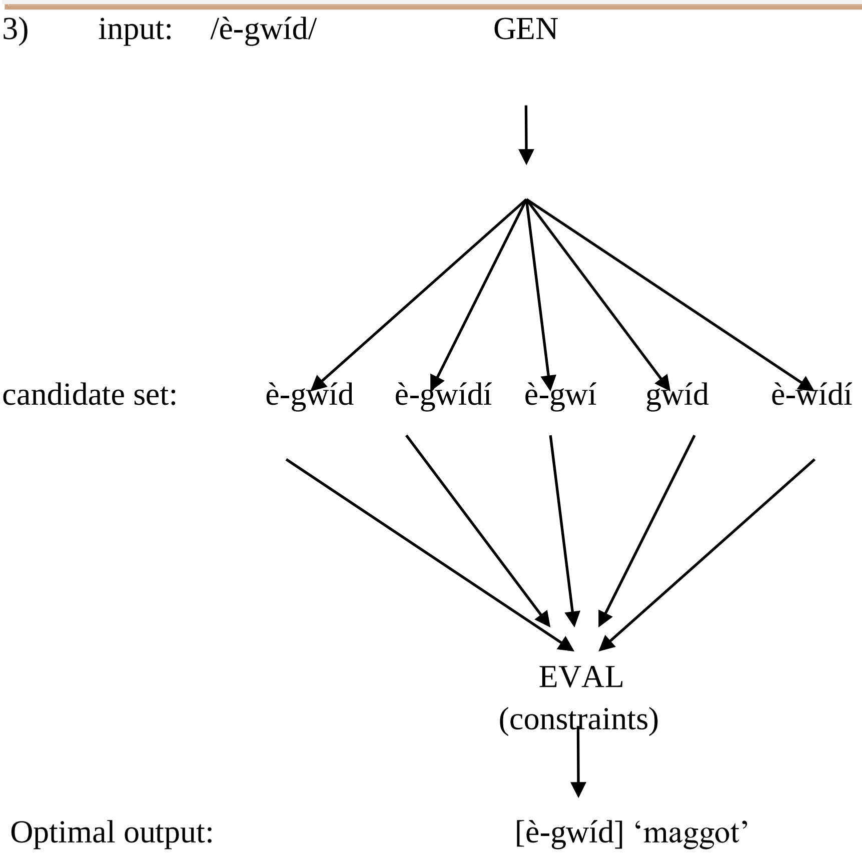
The optimal output candidate is one which is harmonic with respect to the set of ranked constraints, that is the one that violates the least constraint(s). Harmony is a kind of relative well-formedness condition taking into account the severity of the violation of individual constraints as determined by their hierarchical ranking. OT allows ranking of variation present in human languages and it also constraints that which is not possible in some languages.

Components of optimality theory grammar

LEXICON: Contains lexical underlying forms of morphemes, which form the input.
GENERATOR: Generates output candidates for some inputs**,** and submits them to the evaluator.

EVALUATOR: Evaluates the different candidates that have been generated by the generator and selects the optimal candidate. The roles of GEN, EVAL, and CON are illustrated schematically below using the Nŋwɛ word: /è-gwíd/ ‘maggot’.

3)



From the diagram above, we see that /è-gwíd/ 'pepper,' is used as the input. From the input, the GEN creates many candidates, namely, /è-gwíd/, /è-gwídí/, /è-gwí/, /gwíd/ and even /è-wídí/. Note that GEN can create many more candidates from this input other than the ones mentioned. EVAL on its part uses the different constraints (Faithfulness – Universal constraints- and Markedness- language specific-) to select the optimal candidate. This theory is different from the others because it shows that constraints are conflicting and the primary action in OT is comparative.

Constraints in OT

McCarthy (2002) identifies two main constraint types: faithfulness and markedness, some of which are used in this paper.

<u>Faithfulness constraints</u>

Faithfulness constraints ban disparity between input and output forms as follows:

a) **MAX-IO:** Input segments must have output correspondents ('No deletion').

b) **DEP-IO:** Output segments must have input correspondents ('No epenthesis).

They require that output forms preserve the properties of their basic (lexical) forms, expecting some kind of similarity between the output and its input.

Markedness constraints

Markedness constraints are language specific. They require that output forms meet some criterion of structural well-formedness. They take the form of prohibitions of marked phonological structures. Examples of markedness constraints relevant to Nŋwɛ are:

a. Vowels must not be nasal.
b. Syllables must not have codas.
c. Syllables must have onset.
d. Complex onsets are not allowed.
e. Complex codas are not allowed.

The relevant syllable markedness constraints in Nŋwɛ used in this paper are presented below. According to Kager (1999) syllable constraints take the following format:

a)	**ONSET**	*[V	('Syllables must have onsets.')
b)	**NO-CODA**	*C]	('Syllables are open.')
c)	***COMPLEX^{ONS}**	*[CC	('Onsets are simple')
d)	***COMPLEX^{COD}**	*CC]	('Codas are simple')

Nŋwɛ syllable structure constraints

The ranking of Nŋwɛ syllable structure constraints

The basic syllable structure constraints, MAX, DEP, ONSET, and NO-CODA, are ranked here in dominance order suitable for Nŋwɛ. Two points which are crucial here are: whether onsets are required and/or whether codas are forbidden. Also, if either is, how is that enforced? The answer to these questions will determine the ranking of markedness constraints with respect to their faithfulness counterparts. Attention will be paid first to the question that is related to Onset and Codas. Not all the syllable types in the language have an onset, which means that onset is optional in Nŋwɛ. This goes to illustrate the fact that ONSET is dominated by the faithfulness constraints. This relation of dominance is represented as DEP>>MAX>>ONSET.

On the other hand, not all the syllable types in the language have codas, pointing to the fact that codas are optional in the language thus, not forbidden. This and in accordance with what has been discussed, results in ranking NO-CODA lower than the faithfulness constraints as follows: DEP>>MAX>>NO-CODA

This means that the relative order of the markedness constraints on the one hand and the faithfulness constraint on the other in Nŋwɛ shows that the faithfulness constraints dominate the markedness ones and this can be represented in as DEP>>MAX>>ONSET>>NO-CODA.

It is necessary to examine this ranking to see whether it succeeds in determining the true output if it were to evaluate particular inputs. First, I take as the input CVC and try to examine the best candidate as shown in the analysis in the following table (a table on which constraints are ranked horizontally in a descending ranking from left to right, and output candidates are ranked vertically in a random order. The cells on the different tables contain violation marks **'*'** incurred by each candidate for the constraint heading the column and the optimal candidate is marked by the index ☞.The dotted lines separating two constraints indicate that the two constraints have no particular ranking i.e., either of the two can be ranked first (Kager, 1999: 3).

In this table markedness constraints are ranked over faithfulness constraints.

(4) Input: /CVC / ⟶ output: *[CV]

/CVC/	ONSET	NO-CODA	DEP	MAX
a) CVC		*!		
b) CV.C**V**			*	
c) ☞ CV				*

Table 1

It is shown in the table that ranking markedness constraints over faithfulness constraints results in the wrong output. Candidate (c) which is the CV syllable type emerges as the optimal candidate whereas (a) is supposed to be the optimal candidate. If faithfulness constraints are ranked over markedness constraints we will have the right output.

(5) Input: /CVC / ⟶ output: [CVC]

/CVC/	DEP	MAX	ONSET	NO-CODA
a) ☞ CVC				*
b) CV.C**V**	*!			
c) CV		*!		

Table 2

In the table, the constraints are ranked in a reverse order and the correct output is obtained. Obviously, the postulated ranking of constraints is successful in determining the true output of the input CVC, since candidate (a) emerges as the optimal candidate.

Nŋwɛ syllable structures

Nŋwɛ canonical syllable types include V, CV, CVC, and N while the derived canonical syllable structures are CGV, NCV, NCVC, NCCV, and NCGV. Other syllable types can be seen to occur in a combinatory manner in the language.

An observation about the syllable types in this language is that not all the syllables begin with a consonant, which means that onset is optional in the language; therefore there are ‘onsetless syllables’.

Analysis of Nŋwɛ syllable structures

The V syllable structure

Here, the ONSET constraint is ranked with respect to faithfulness constraints in order to determine whether onsets are required or not. On the other hand, faithfulness constraints are ranked with respect to each other so as to show the ONSET requirement in Nŋwɛ. To do so, let me take the input /V/ and evaluate a set of three candidates, each of which exhibits a single violation of one of the four constraints in question, against different constraint hierarchies showing the possible relative ranking.

a) V violates ONSET
b) (V) violates DEP
c) Vv violates MAX

When V is taken as the optimal candidate, it means that the constraints, which are violated by V, must appear very low in the constraint hierarchy related to the syllable structure. Therefore, in order to get the optimal candidate /V/ in Nŋwɛ, faithfulness dominates markedness. This means that constraints under faithfulness dominate those on markedness to get the optimal candidate in this language as said above. Consider the example and table below.

(6) /óÎ/ 'mother'
/m̀/ 'yes'

Markedness constraints will still be ranked over faithfulness constraints here so that we see whether the optimal output will be derived.

Input: /óÎ/ 'mother' ⟶ output: * [bóÎ]

/óÎ/	NO-CODA	ONSET	DEP	MAX
a) óÎ		*!		
b) ☞ **bóÎ**			*	
c) óÎg	*!	*	*	

Table 3

Input: /óÎ/ 'mother' ⟶ output: [óÎ]

/óÎ/	DEP	MAX	NO-CODA	ONSET
a) ☞ óÎ				*
b) **bóÎ**	*!			
c) óÎ**g**	*!		*	*

Table 4

Considering tables 3 and 4, the correct ranking would be to have faithfulness constraints outrank markedness constraints as earlier seen above in the CVC analysis in tables 1 and 2. This is so because if the ranking is reversed, candidate (b) will emerge as the optimal candidate being a CV structure and not a V structure which is the input. It is realised that onset is not required therefore making it possible for ONSET and NO-CODA to be lowly ranked, permitting DEP and MAX to dominate them in order to get the optimal output. Therefore, the constraints are ranked in the order DEP>>MAX>>NO- CODA>>ONSET.

The V syllable type can combine with other syllable types to form words in the language. Therefore, I consider the constraints and the ranking that derive these combinations as follows:

V.CV combination

In this combination the first syllable contains a vowel and the second is made up of both an onset and a nucleus. Consider the examples and table below.

(7) à.bè ‘profit’
è.fȏ ‘father’
à.bo[illegible] ‘hand’
è.sā ‘market’
à.lí ‘blood’

input: /à.bè / ‘profit’ ⟶ output: [à.bè]

/ à.bè/	DEP	MAX	ONSET	NO-CODA
a) ☞ à. bè			*	
b) à.bè**t**	*!		*	*
c) à.b		*!	*	

Table 5

It is assumed in this paper that the right ordering for the constraints would be faithfulness over markedness because if the reverse is taken as seen in the first and third tables above, the wrong output is gotten. There would be no need for the comparison of the ranking of the constraints since the right output is already obtained. Therefore, in table (5), the GEN produces candidates from the input which violate ONSET and NOCODA. This does not disqualify all the candidates, since these are the lower/lowest ranked constraints in the language. Candidate (a) is the optimal candidate and this is due to the fact that it satisfies the highest ranked constraint thereby violating the lowest ranked constraints as seen above. On the other hand candidates (b) and (c) violate DEP and MAX which are the two highly ranked constraints thereby disqualifying them.

The V.CVC combination

A similar ranking hierarchy will be used at this point to see if it derives this syllable structure present in the language. Examples are given below.

(8) è.sáŋ ‘broom’
è.lùʔ ‘honey’
a.[illegible]tɛ́m ‘hut’
ā.fɛ́m ‘breeze’
è.bùʔ ‘mushroom’

input: / è.lùʔ / ‘honey’ ⟶ output: [è.lùʔ]

/ è.lùʔ/	DEP	MAX	ONSET	NO-CODA
a) lè.lùʔ	*!			*
☞b) è.lùʔ			*	*
c) è.lù		*!	*	

Table 6

The optimal candidate (b) satisfies all the faithfulness constraints and equally violates all the markedness ones, which are lowly ranked. Here the constraint hierarchy is maintained since it is what is used in Nŋwɛ. When it comes to determining the optimal candidates in syllable structures, stating the right ranking of the constraints is important and needs to be handled with great care because the wrong ranking change will give priority to the wrong candidate and violate the correct syllable structures of the language. Consider another combination under the V syllable type, which is an open one.

<u>The V.CV.CV combination</u>

This is also a complex syllable structure combination and it is mostly present in trisyllabic words, which are numerous in Nŋwɛ verbs. The centre syllable is closed but the beginning and the final syllables are open. Examples are given below.

(9) a.ɱdì.dì 'chin'
à.kő.rô 'waist'
à.ʒô.gő 'afternoon'
à.lá.kù 'foot'
è.kì.bì 'plum'

/input: / a.ɱdì.dìɱ/ 'chin' ⟶ output: [a.ɱdì.dìɱ]

/ a.ɱdì.dìɱ/	DEP	MAX	NO-CODA	ONSET
a) a.ɱdì.dìɱʔ	*!		*	*
b) a.ɱdì.d		*!		*
☞ c) a.ɱdì.dì				*

Table 7

In the table above, candidates (a) and (b) are eliminated because they violate the top-most ranked constraints DEP and MAX. These two candidates violate them in order to satisfy the lower constraints ONSET and NO-CODA, and this is not accepted in Nŋwɛ, since onsets and codas are optional elements in the language, leaving candidate (c) to emerge as the winner.

Interestingly, one would expect to have the V.CVC.CV syllable type in Nŋwɛ. However, this is not the case because, VCV combination can only syllabify to V.CV and not VC.V and the CVCV combination can also only syllabify to CV.CV and never CVC.V.

The V.CV.CVC combination

The V.CV.CVC combination in Nŋwɛ is made up of three different canonical syllable structures which are V, CV and CVC which have already been discussed above. The analysis of this syllable combination combines the three different syllable structures in the language. Examples include the following.

(10) à.té.sék ‘mat’
à.kí.mɔ̋k ‘charcoal’
à.té.tȁŋ ‘Irish potatoes’

input: /à.té.tȁŋ/ ‘Irish potatoes’ ⟶ output: [à.té.tȁŋ]

/à.té.tȁŋ/	DEP	MAX	ONSET	NO-CODA
☞ a) à.té.tȁŋ			*	*
b) à.té.tȁŋ.**é**	*!		**	*
c) à.té.ta		*	**	

Table 8

From the table above it is realised that candidate (a) is the optimal candidate because it violates the least ranked constraints. The first syllables do not have onsets and do not have codas. Nothing is inserted or deleted from the syllables i.e., input is exactly like output. Candidate (b) violates DEP once and violates ONSET and NO-CODA twice because of the vowel /é/ which is inserted to create a new syllable. Candidate (c) on its part violates MAX and ONSET but doesn’t violate NO-CODA because the second and third syllables do not have codas.

The CV syllable structure

This is the syllable type which is considered to be universal. No language prohibits the CV syllable structure, thus no language prohibits onsets or require codas. This means that these languages have ‘Onsetful syllables’, open syllables, and may allow codas. Hence, languages have optional consonant initial syllables but never ban them and optional vowel final ones but never require them.

Apparently, there are two operations according to Clements and Keyser (1983) which are responsible for producing the three less natural core syllables from the most natural one, CV. The first involves the deletion of the initial consonant of the CV syllable type to have a V, or it can as well be considered as being the first of the two steps towards producing VC. The second one involves adding a final consonant to the CV syllable type to have CVC. This predicts the different operations to be used to get the CV structure in Nŋwɛ. Consider the data and table below.

(11) ŋó ‘snake
ŋó⬆ ‘sun’
be✍ ‘pick’
teà ‘not’
tʃě ‘urinate

input: / tʃě ✍/ ‘urinate’ ⟶ output: [tʃě]

/ tʃě/	DEP	MAX	ONSET	NO-CODA
☞ a) tʃě				
b) tʃě**b**	*!			*
c) ě		*		

Table 9

The CV syllable structure is universally optimal because it doesn't violate any of the syllable structure constraints. No alternative analysis, therefore, can be more adequate than what is presented. The basic CV syllable theory constraints are: ONSET, NO-CODA, NUC (nucleus), *COMPLEX, DEP, MAX etc. This is obviously due to the simple fact that this syllable type doesn't violate any of the universal constraints. There are other syllable combinations, which fall under this syllable type, and they are presented below.

<u>The CV.CV combination</u>

It is a combination with no coda and it has its nucleus in the final positions of each of the syllables and an onset. This is therefore analysed as shown below.

(12) le⮉fó⮉ 'eight'
t💧ő̆ʔő̆ 'tomorrow'
be⮉ró✍ 'nose'
lɛ́dá 'write'
óŋ⮉á 'suck'

input: / lɛ́dá/ 'write' ⟶ output: [lɛ́dá]

/ lɛ́dá /	DEP	MAX	ONSET	NO-CODA
a) lɛ́.á		*!	*	
☞ b) lɛ́dá				
c) lɛ́d.áp	*!		*	* *

Table 10

In table (10) above, the optimal candidate (b) satisfies all the constraints, thereby evolving as the optimal candidate, while, candidate (a) violates MAX and ONSET due to the deletion of the consonant /t/ in the onset position of the second syllable. The last candidate violates DEP, ONSET and NO-CODA due to the transfer of the consonant /d/ from the onset position of the second syllable to the coda position of the first syllable, thereby, leaving the second syllable with no onset. It also violates NO-CODA twice because of /t/ and /p/ at the coda positions of the two syllables.

<u>The CV.CVC combination</u>

This combination is mostly present in disyllabic and polysyllabic words in the language. Consider the examples and the analysis in the table below.

(13) lèkēŋ 'pot'
bèvéd 'oil'
bɛ́bɛ́g 'lizard'
lèlēʔ 'yam'

lèfók 'indian bamboo'

input: /lèkēŋ/ 'pot' ⟶ output: [lèkēŋ]

/lèkēŋ/	DEP	MAX	ONSET	NO-CODA
a) lè.kē		*!		
b) lès.kēŋ	*!			**
☞ c) lèkēŋ				*

Table 11

In table (11) above the first candidate violates MAX because of the deletion of the consonant /ŋ/ at the coda position of the second syllable. Candidate (b) is eliminated due to its violation of DEP and NO-CODA despite the fact that it satisfies the highly ranked MAX constraints. The optimal candidate is (c) because it violates the lowest ranked constraint.

<u>The CV.CV.CV combination</u>

With the CV.CV.CV combination, it is realised that no matter the length of the syllable, it is still an open syllable. It is also universally optimal despite the fact that it has three different syllables which are all CV. The analysis of this structure is similar to that of the CV.CV syllable structure in table (11) above. This is because they have certain characteristics in common. These characteristics include the following: They are open, hence, have no codas and they all have onsets. It is worth noting that this syllable type is so rare in the language. Examples include the following.

(14) le⬆to⬆ŋe⬆ 'ear'
lègó⬆dʒô 'now'
lèbró⬆ʔeà 'nine'
bèɳa⬆róà 'sand'
ŋáʔásé 'bend down'

input: /bèɳa⬆róà/ 'sand' ⟶ output: [bèɳa⬆róà]

/bèɳa⬆róà/	DEP	MAX	ONSET	NO-CODA
☞ a) bè.ɳa.⬆róà				
b) bè.ɳa.⬆róàp	*!			*
c) bèɳ.a.⬆róà			*	*

Table 12

From the table above it is realised that candidate (a) is the optimal candidate because it doesn't violate any of the constraints. All the syllables have onsets and do not have codas. Nothing is inserted or deleted from the syllables i.e., input is exactly like output. Candidate (b) violates DEP and NO-CODA because of the consonant /p/ which is inserted in the coda position of the last syllable. Candidate (c) on its part violates ONSET and NO-CODA because the second syllable doesn't have an onset and the first syllable has a coda.

The CVC syllable structure

The focus here is to determine whether it is banned or optional. To do this, I have to take the input /CVC/ and evaluate it with a set of three candidates and see their exhibition of the violation of the constraints. Consider the analysis below.

a) CVC violates NO-CODA
b) CV.CV violates DEP
c) CV.(C) violates MAX

It is realised in this case that CVC which is the optimal candidate violates NO-CODA and satisfies ONSET. Therefore, since it is the optimal candidate, the constraint violated by it must appear very low in the constraint hierarchy as follows: DEP>> MAX>>NO-CODA. Therefore, the constraint hierarchy that is to be used is DEP>>MAX>>ONSET>>NO-CODA.

Again when both faithfulness constraints are highly ranked on the table, the candidate representing the very same input is designated the winner, even if such a candidate violates the other constraints, which in this case are the markedness constraints. See the data and table below.

(15) tóŋ 'basket'
bŭk 'our'
luàŋ 'hot'
zuàŋ 'dry'
ŋaàŋ 'bell'

input: [luàŋ] 'hot' ⟶ /su⬤✍/ output: [luàŋ]

/luàŋ/	DEP	MAX	ONSET	NO-CODA
a) luà		*		
b) luà.ŋ★⬤	*!			
☞ c) luàŋ				*

Table 13

When the same line of argument as that above is pursued, an inevitable conclusion is arrived at, i.e., DEP>>MAX>>Onset>> NO-CODA so, candidate (c) wins. Therefore, codas in Nŋwɛ are optional. It is also realised that if codas would have outranked the pairs of markedness constraints, then codas would have been forbidden in the language and the banning would have been reinforced by either deletion or epenthesis that is being decided on by the relative ranking of DEP and MAX. The banning of codas is not a functional element in Nŋwɛ due to the fact that they are optional, not forbidden characteristics.

This syllable type doesn't really have combinations with other syllable types. It has a few words with CVC.CVC and CVC.CV combinations.

Analysis of some derived syllable structures

The derived syllable types in the language result from the modification of the canonical syllable types as a result of some phonological processes such as devocalization and prenasalization or both. It is worth noting here that the focus of this paper is not to discuss these phonological rules but to handle these derived syllable structures using Optimality Theory. Looking at the syllables that are derived here, it can be observed that some of them contain complex onsets which means that complex onset is optional in Nŋwɛ. This goes to illustrate the fact that *COMLPEX (onsets and codas are simple) is dominated by the faithfulness constraints. A structural well-formedness constraint is needed to capture the margin of complexity of these syllable types since they are made up of more than one consonant in the same environment. This relation of dominance can be represented as follows: DEP>>MAX>>ONSET>>NO-CODA>> *COMLPEX.

From the above ranking, it is seen that *COMLPEX is the least ranked of all the constraints; therefore, all the other higher ranked constraints take precedence over this constraint. Worthy of note is the fact that all the markedness constraints here can be interchanged but we shall still have the same result. Some of the derived syllable structures will be analysed here.

<u>CGV syllable structure</u>

This syllable type is made up of a consonant, a glide and a vowel. Glides are considered as consonants in this work since they occur on the consonant chart of the language. This syllable type exists mostly with verbs in the language. Examples include the following.

(16)	/fie/	[fjə́]	'give'
	/kui/	[kwí]	'receive'
	/dió/	[djő]	'say'
	/zió /	[zjő]	'plant'
	/gui/	[gwĭ]	'laugh'

input: /kui/ 'receive' ⟶ output: [kwí]

/ kui/	DEP	MAX	ONSET	NO-CODA	*COMLPEX
☞ a) kwí					*
b) kwít	*!			*	*
c) kw		*!			*

Table 14

From the table above, the optimal candidate is (a) because it violates only *COMLPEX which is the least ranked of all the constraints. Candidate (b) violates *COMLPEX, DEP and NO-CODA because /t/ is added in the final position of the syllable thereby violating a no addition constraint, as well as codaless and simple codas constraints. Candidate (c) on its part violates both *COMLPEX and MAX because the final vowel /í/ is deleted and the candidate is made up of two consonants.

NCV syllable structure

Examples include the following:

(17) ǹʒì 'sheep'
m̀bú 'dog'
m̀bɛ́ 'flute'
ǹtá 'thigh'
ǹtɛ́ 'five'

input: /Ntɛ́/ 'koki beans' ⟶ output: [ǹtɛ́]

/ǹtɛ́/	DEP	MAX	ONSET	NO-CODA
a) tɛ́		*!		
b) ǹ.tɛ́**p**	*!			*
☞ c) ǹ.tɛ́				

Table 15

From the table above it is realised that candidate (c) is the optimal candidate because it doesn't violate any of the constraints. The two syllables have onsets and do not have codas. Nothing is inserted or deleted from the syllables i.e., input is exactly like output. Candidate (b) violates DEP and NO-CODA because of the consonant /p/ which is inserted in the coda position of the last syllable. Candidate (a) on its part violates only MAX because of the deletion of the syllabic nasal. Worthy of note is the fact that *COMLPEX constraint is not necessary in the table above since there are no complex onsets or codas.

NCCV syllable structure

Examples include the following.

(18) ŋ̀krɔ̋ 'handle'
ǹtrɛ̆ 'distance'
ǹdrɔ̋ 'dress'
ǹkrʊ̄ 'monkey'
ŋ̀krʊ̀ 'rope'

input: /ŋ̀krɔ̋/ 'handle' ⟶ output: [ŋ̀krɔ̋]

/ŋ̀krɔ̋/	DEP	MAX	ONSET	NO-CODA	*COMLPEX
a) ŋ̀krɔ̋**p**	*!			*	***
☞ b) ŋ̀krɔ̋					***
c) ŋ̀kr		*!			***

Table 16

In table (16) above, candidate (b) emerges as the optimal candidate because it violates the least ranked constraint *COMPLEX. Candidate (a) violates DEP, NO-CODA and *COMLPEX. This is seen in the insertion of the consonant /p/ which violates DEP and forms the coda of the second syllable. Candidate (c) violates MAX, and *COMLPEX which equally disqualifies it to become the optimal candidate.

NCGV syllable structure

Examples include the following:

(19) /ŋ̀kuɔ̋/ [ŋ̀kwɔ̋] 'gun'
/ǹziɔ̋/ [ǹzjɔ̋] 'palm nut'
/ǹʒiɔ̋/ [ǹʒjɔ̋] 'mirror
/ ŋ̀guí/ [ŋ̀gwí] 'wife'
/m̀biə̀/ [m̀bjə̀] 'cricket'

[m̀bjə̀] 'cricket'

input: /Nbjə̀/ ⟶ output: [m̀bjə̀]

/m̀bjə̀/	DEP	MAX	ONSET	NO-CODA	*COMLPEX
☞ a) m̀.bjə̀					*
b) m̀.bjə̀**k**	*!			*	*
c) m̀.bə̀		*!			

Table 17

From the table above, the optimal candidate is (a) even though it violates *COMPLEX. Candidate (b) violates DEP, NO-CODA and *COMPLEX because a /k/ sound is added in the final position of the syllable thereby violating a no insertion constraint and a codaless constraint. Candidate (c) on its part violates MAX because the consonant /w/ is deleted creating a simple onset.

Conclusion

In conclusion, it can be said that OT shows high potentiality in serving as a theory for the analysis of the syllable structure of Nŋwɛ. Throughout this paper, attention has been on a set of more general issues in OT as far as the syllable is concerned. It has been shown that syllable-dependent processes like any other phonological processes, involve interactions of 'markedness and faithfulness constraints. A change (deletion, insertion) is made at the cost of some faithfulness constraint, but only to avoid the violation of higher ranked constraints.

When a look is given to the 17 tables of this paper, it is realised that all the candidates (a), (b), and (c) emerge as the optimal candidate at different times and different tables in the analyses. This is due to the manner in which the selected candidates are arranged and also due to the ranking of the constraints. It is therefore due to this ranking that the following are suggested as the constraint ranking orders for Nŋwɛ syllable structure.

(A) DEP>>MAX>>ONSET, (B) DEP>>MAX>>NO-CODA, (C) DEP>>MAX>>ONSET>>NO-CODA (D) DEP>>MAX>>NO-CODA>>ONSET and finally; (E) DEP>>MAX>>ONSET>>NO-CODA>> *COMLPEX.

Since GEN generates all logically possible candidates for a given input, OT grammar needs no rewrite rules to map inputs onto outputs. The evaluation of these candidate analyses is the function of the evaluator, the component of ranked constraints. It has equally been noticed in this study that candidates generated by the generator must not look exactly like the input in order to arrive at the optimal output as illustrated in the last five tables.

The discussions in this paper reveal that in Nŋwɛ just like other languages, faithfulness constraints outrank the language specific counterparts as far as the syllable structures are concerned.

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