

# Optimality Analysis of Consonant Clusters Repair Strategies among Nigerian Speakers of English

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## Abstract

This research investigates how L1 phonotactic constraints affect English consonant clusters in 40 Nigerian undergraduates (20 males, 20 females) at the University of Africa, Toru-Orua. Subjects' L1s (Izon, Yoruba, Edo, and Urhoho) belong to the Niger-Congo family and favor open (CV) syllables, disallowing complex codas. Data from pronunciation tasks were phonetically transcribed and acoustically analysed via Praat. Analysis revealed three repair strategies—simplification, reduction, and full realisation—with simplification most frequent. Based on Optimality Theory, these processes reflect systematic constraint interactions where markedness dominates faithfulness, yielding the ranking \*COMPLEX»MAX»IDENT»DEP. Crucially, local re-rankings showed onsets favor simplification while codas tolerate reduction. These findings provide empirical evidence for constraint reranking in interlanguage grammars, demonstrating how L1 phonotactic pressures shape Nigerian English phonology. The study underscores OT's relevance in explaining phonological variations exhibited by bilingual students.

**Keywords:** Optimality theory, L2 speakers, consonant clusters, constraints, phonotactics, pronunciation

## Introduction

Production of consonant clusters is one of the main weaknesses which longtime learners of English as second language (L2) find most challenging. Clusters of consonants (two or more consonants in the initial or final position of a syllable) are a noticeable characteristic of English phonology but can usually be missing or severely limited in most native African languages. The learning of complex consonant clusters involves enormous articulation and phonological adaptation in the example of Nigerian speakers, where first languages (L1s) are mostly open syllable (CV) languages, such as Izon, Yoruba, Edo, and Urhobo (Adedimeji and Akinola, 2021). Lack of these clusters in the L1 syllable inventory limits the ability of the learners to reproduce the English phonotactics correctly resulting to the common simplifications or omissions in speech. Knowledge of these cluster repair patterns is crucial to theoretical phonology and second-language acquisition (SLA). In the phonological perspective, consonant clusters provide an empirical test base of theories of constraint interaction and markedness (Prince and Smolensky, 1993). Pedagogically, cluster production has a direct influence on intelligibility, especially in academic and professional communication where simplified or reduced articulations can act as a barrier to clarity and fluency (Eckman, 2008). Though an increasing literature has investigated the Nigerian language phonological transfer to English (Gut, 2008; Udofot, 2011), most of the studies have concentrated more on the segmental substitutions, vowel qualities, or general phonotactic violations, as opposed to the constraint mechanisms specifically involved in realising clusters. Moreover, the current works in the field of Nigerian English phonology are more likely to follow descriptive or pedagogic methodologies (e.g., error analysis, interference studies), which can be rather insufficient to understand the theoretical basis that might explain why some cluster repairs are more common than others (Usman and Kagu, 2021).

Moreover, while Optimality Theory (OT) has been widely applied in studies of L2 phonology in other linguistic contexts—such as Arabic, Japanese, or Spanish learners of English (Broselow, Chen, & Wang, 1998; Hancin-Bhatt, 2000)—its application to Nigerian English remains limited (Bello & Gafar, 2018; Usman & Kagu, 2021). Little attention has been paid to how learners' interlanguage grammars reflect constraint reranking between markedness and faithfulness. In particular, little is known about the way the phonotactic limitations of the Niger-Congo languages limit the repair strategies of learners in the English cluster production.

These gaps indicate the necessity of a theoretically based phonological study that links L1 phonotactics, repair strategies, and constraints hierarchies in the OT framework. This paper fills in these gaps as it examines consonant cluster repair mechanisms of the Nigerian L2 learners of the English language in the context of the Optimality Theory. The study was conducted using the data of forty undergraduates (20 males, 20 females) at the University of Africa, whose L1s are Izon, Yoruba, Edo and Urhobo to explore the effects of L1 phonotactic restrictions on the realisation of English clusters and how learners can solve phonological conflicts between the markedness and faithfulness constraints.

The study seeks to answer the following question:

***What constraint hierarchies best account for the variation among learners' outputs of consonant clusters in English pronunciation?***

By integrating acoustic and perceptual analyses with OT-based constraint evaluation, this research advances the theoretical understanding of interlanguage phonology in Nigerian English. It demonstrates how L2 speakers reranked universal constraints to accommodate the phonotactic pressures of their native languages. The findings are expected to contribute to the refinement of phonological models of L2 acquisition and to the ongoing description of Nigerian English within the global English varieties framework.

## Literature Review

L1 phonotactic restrictions tend to continue among learners in the second language phonology and affect the acquisition of the structures in the second language (Eckman, 2008). As Broselow (1992) and Archibald (1998, 2021) observe, to address unattested L2 structures, learners utilise repair strategies that make L2 inputs consistent with L1 syllable templates. In this way, cluster simplification, and vowel epenthesis (vowel insertion) are not accidental errors but predetermined reactions of the phonological grammar of the learner to markedness pressures. This view holds the notion that interlanguage phonology follows a set of rules and is limited by the general laws like those embodied by Optimality Theory (Prince and Smolensky, 1993)

Numerous studies have examined how L2 speakers modify consonant clusters that are illicit in their native phonologies. Broselow and Finer (1991) demonstrated that learners of the English language whose L1s do not permit complex onsets often introduce vowels to subdivide clusters (e.g., /play/ [pule]). Equally, Carlisle (1991) noted that Spanish and Japanese English learners tend to downstep final clusters by eliminating one of the members (such as /desk/ [des]) (Kang and Lee, 2020). According to Gut (2008) and Udofot (2010), in the African contexts, simplification is uniform in both onset and coda clusters among Nigerian speakers of English in terms of the open-syllable nature of the native languages. Emenanjo (2015) and Akinjobi (2010) also added that Yoruba and Edo English speakers use deletion and vowel insertion together to solve phonotactic conflicts, which presents the ongoing L1 phonology impact on even competent speakers. According to Soneye and Oladunjoye, (2015), non-native speakers of English frequently employ strategies to simplify or declusterise consonant clusters, primarily utilising epenthesis and deletion (consonant removal). Studies of L2 varieties, including Hausa English (Bello and Gafar, 2018; Usman and Kagu, 2021) and Ghanaian English (Huber, 2004), indicate that the nature of the repair strategy applied (either deletion,

epenthesis or metathesis) can be determined by the location and complexity of the cluster, and the degree of exposure to native-like input. These studies highlight the phonological rather than purely pedagogical nature of cluster modification, situating it within the framework of universal grammar and constraint interaction.

The application of Optimality Theory (OT) to second-language data has provided new insights into how constraint hierarchies evolve during language learning. Hancin-Bhatt (2000) demonstrated that interlanguage grammars are governed by reranking processes whereby markedness constraints from the L1 initially dominate, leading to non-target forms that gradually shift toward target-like outputs as learners demote these constraints. Broselow, Chen, and Wang (1998) applied OT to explain cluster modification in L2 acquisition, showing that the relative ranking of \*COMPLEX}, MAX-IO, and DEP-IO determines whether learners delete or insert segments. Davidson (2006) similarly found that Korean learners' epenthetic patterns could be modeled as optimal outputs under a constraint hierarchy favouring syllable well-formedness over faithfulness. These works all established that L2 phonological patterns are not arbitrary but mirror internal grammatical structures under the influence of universal constraints and language-specific rankings. OT therefore offers a common platform of comparison of inter language systems among different linguistic backgrounds.

Within Nigerian English, the influence of native phonotactic restrictions on cluster realisation is well established. Jibril (1982), Eka (1985), and Gut (2008) observe that Nigerian English speakers often break consonant clusters with vowel insertion or reduce them through deletion. Udofot (2010) attributes this to the predominance of open syllables in Nigerian languages, where \*COMPLEX is highly ranked and MAX-IO is typically violated in cluster contexts. The systematic simplification tendencies are observed in studies devoted to Yoruba, Izon, and Edo English phonology (Akinjobi, 2010; Emenanjo, 2015; Tamunobelega, 2020) with some different approaches. Yorubas speakers have the tendency of adding a vowel to

maintain the sonority sequencing, but the Izon and Urhobo speakers prefer deleting the segments. These interlingual variations indicate different constraint rankings even within Nigerian English, suggesting that interlanguage grammars are not homogeneous but shaped by specific L1 structures. The present study builds upon these findings by offering a systematic OT analysis of UAT undergraduates' cluster repair strategies. It builds upon the previous studies by providing a comparison of male and female productions, investigating the interplay between social and articulatory aspects and phonological constraint hierarchies.

The current literature has determined the Nigerian learners often simplify or limit English clusters because of the L1 influence, yet not many studies have examined such trends in a formal theoretical framework (Bello and Gafar, 2018; Usman and Kagu, 2021). In addition, although the majority of the earlier research reports common tendencies throughout the varieties of Nigerian English, little has been done regarding the inter-speaker variation and its contribution to establish constraint interactions. This work thus represents a fundamental gap by taking the Optimality Theory to empirically predict the patterns of repair among UAT undergraduates in terms of hierarchies of constraints, which would best describe their behaviours and outputs. Combining the phonological theory with the empirical analysis of acoustics, it can be added to the current debate on the formation of interlanguage grammar and the L2 phonotactic adaptation dynamics.

## **Theoretical framework**

### **Optimality Theory (OT)**

The constraint based model of phonological grammar is provided by Optimality Theory (OT) proposed by Prince and Smolensky (1993) and extended by McCarthy and Prince (1995). OT, in contrast to rule-based phonology, which presupposes ordered derivations, assumes that surface forms (outputs) arise through the interaction and ranking of universal constraints, which provide an assessment of candidate realisations of an input. The optimal output is not a solution

that meets all the constraints but a solution that meets the hierarchy of the ranked constraints of a given language in the best way possible.

The main point is that languages have the same universal set of constraints but the order in which these constraints occur varies in the different languages leading to variation across languages. This approach therefore includes both the universality (constraints shared) and variability (rankings which are language-specific), which makes it especially useful in studying the phonology of a second language where interlanguage systems exhibit mixed constraint hierarchies based on both L1 and L2 grammars.

Basically, there are three basic elements:

- **GEN (Generator):** Produces all possible candidate outputs from a given input.
- **CON (Constraint set):** Contains universal constraints that evaluate the candidates.
- **Eval (Evaluator):** Selects the optimal candidate based on the specific constraint ranking.

### **Constraints Typology and Interaction**

OT distinguishes between two main types of constraints:

1. **Faithfulness Constraints**, which demand similarity between input and output.
  - **MAX-IO:** Do not delete input segments. (Every segment in the input must have a correspondent in the output.)
  - **DEP-IO:** Do not insert new segments. (Every output segment must have a correspondent in the input.)
  - **IDENT(Feature):** Preserve the phonological features of segments (e.g., voicing, place, or manner).
2. **Markedness Constraints**, which restrict the occurrence of certain structures in surface representations.
  - **\*COMPLEX:** Penalises complex onsets or codas (i.e., consonant clusters).

- **ONSET:** Requires syllables to begin with consonants.
- **NOCODA:** Prohibits consonant codas.

This study adopts Optimality Theory as its explanatory framework because it captures the interaction between universal constraints and learner-specific rankings that result in systematic variations in cluster production. By analysing learners' outputs through OT tableaux, the study identifies the dominant constraint hierarchies underlying observed patterns of simplification, reduction, and faithful realisation.

### **Methodology**

This study adopts a mixed-methods design that integrates phonetic observation and theoretical modeling to investigate how Nigerian second-language (L2) speakers of English repair complex consonant clusters. The study is situated within the framework of Optimality Theory (OT) (Prince & Smolensky, 1993/2004), allowing for a formal evaluation of learners' repair outputs against competing constraints. The design combines experimental phonological analysis (elicitation, transcription, and acoustic verification) with qualitative interpretation of constraint interactions. The goal is to explain *why* certain repairs—simplification, reduction, or full realisation—emerge as optimal within the learners' interlanguage grammar, rather than merely describing *how often* they occur.

The study involved forty undergraduate (20 men and 20 women) students of the Faculty of Arts and Education, the University of Africa, Toru-Orua (UAT). All subjects were native speakers of Niger-Congo languages, that is, Izon, Yoruba, Edo, and Urhobo, both of which mainly display open syllable (CV) structures and prohibit complex consonant clusters. The sample size was equal in terms of same sex participants and all ages (17-21 years). Everyone had been taught English as a second language (L2) in formal school and had been exposed to the English used by Nigerians (their native form). None of the participants reported hearing or speech disorders.

As the primary elicitation device, a sentence list with ten focused English lexical items that had challenging onset and coda clusters (e.g., strengths, twelfths, grasped, frisked, shrinks, structure) was created. These words were chosen because of their great phonotactic complexity and frequency of occurrence in the previous works (e.g., Broselow and Finer, 1991; Udofot, 2010). The participants were asked to read the words independently and in carrier phrases (e.g., Say \_\_\_ again). The recordings were recorded in a silent setting with the TASCAM DR-05X recorder, and analysed acoustically with Praat software (Boersma and Weenink, 2024). Two trained linguists transcribed the recordings phonetically, which provided reliability, and disagreements were settled by consensus.

The inter-transcriber agreement was used to ensure reliability and obtain an inter-transcriber agreement of 91% consistency in the transcription, meaning a high degree of reliability to the original recordings. Phonetic accuracy was also supported by acoustic verification.

The theoretical validity of the OT modeling was established by testing constraint rankings against multiple lexical contexts and confirming that the same hierarchies consistently predicted optimal outputs across tokens. Informed consent was obtained before data collection was done. Moreover, all the recordings were anonymised, and the participation was voluntary. In conclusion, the methodology combines empirical phonetic analysis and formal OT modeling so that it explains the way the Nigerian L2 speakers of the English language repair the phonotactically complex clusters. The study aims to shed some light on the grammar of interlanguage phonology, by comparing observed data with theoretical constraint hierarchies, the gap between surface patterns of pronunciation and constraint systems underlying those patterns.

**Table 1: Demographic Data**

<b>Respondent ID</b>	<b>Age</b>	<b>State</b>	<b>Gender</b>
1	18	Bayelsa	Male
2	20	Bayelsa	Female
3	19	Bayelsa	Male
4	17	Bayelsa	Female
5	21	Bayelsa	Male
6	20	Delta	Female
7	19	Delta	Male
8	21	Delta	Female
9	18	Delta	Male
10	19	Edo	Female
11	20	Ogun	Male
12	20	Bayelsa	Male
13	19	Bayelsa	Female
14	21	Bayelsa	Male
15	17	Delta	Female
16	19	Delta	Male
17	20	Delta	Female
18	21	Delta	Male
19	18	Delta	Female
20	19	Delta	Male
21	20	Edo	Female
22	18	Edo	Male
23	21	Ogun	Female
24	20	Ogun	Male
25	19	Bayelsa	Male
26	21	Bayelsa	Female
27	18	Bayelsa	Male
28	20	Bayelsa	Female
29	21	Bayelsa	Male

30	19	Bayelsa	Female
31	17	Bayelsa	Male
32	18	Bayelsa	Female
33	20	Bayelsa	Male
34	19	Bayelsa	Female
35	21	Bayelsa	Male
36	20	Delta	Female
37	19	Delta	Male
38	18	Delta	Female
39	20	Delta	Male
40	21	Delta	Female

**Table 2: Summary of Respondent Characteristics**

Total Respondents	40
Age Range	17 to 21 years
States Represented:	
Bayelsa State	30 respondents
Delta State	6 respondents
Edo State	2 respondents
Ogun State	2 respondents

**Table 3: Words for Articulation**

Words	Words
1. Strengths	6. Flinched
2. Twelfths	7. Shrink
3. Sphinx	8. Structure
4. Grasped	9. Texts
5. Frisked	10. Asked

## Data Analysis

**Table 4: Pronunciation Realisation of Consonant Clusters**

Word	Full Realisation	Reduction	Simplification	Full Realisation
1. Strengths	/streŋkθs/ (CCCVCCCC)	/strents/ (CCCVCCC)	/strenkts/ (CCCVCCCC)	/streŋkθs/ (CCCVCCCC)
2. Twelfths	/twɛlfθs/ (CCVCCCC)	/twɛlfs/ (CCVCCC)	/twɛlfts/ (CVCCCC)	Twɛlfθs/ (CCVCCCC)
3. Sphinx	/sfɪŋks/ (CCVCCC)	/sfɪns/ (CCVCC)	/sfɪnks/ (CCVCCC)	/sfɪŋks/ (CCVCCC)
4. Grasped	/græpsɪt/ (CCVCCCC)	/græpsɪ / (CCVCCC)	/græpsɪd/ (CCVCCCC)	)græpsɪt/ (CCVCCCC)
5. Frisked	/frɪskt/ (CCVCCC)	/frɪsd/ (CCVCC)	/frɪskd/ (CCVCCC)	/frɪskt/ (CCVCCC)
6. Flinched	/flɪntʃt/ (CCVCCC)	/flɪnʃ/ (CCVCC)	/flɪntʃd/ (CCVCCC)	/flɪntʃt/ (CCVCCC)
7. Shrinks	/ʃrɪŋks/ (CCVCC)	/ʃrɪns/ (CCVCC)	/ʃrɪnks/ (CCVCC)	/ʃrɪŋks/ (CCVCC)
8. Structure	/strʌktʃə/ (CCCVCCV)	/strʊʃə/ (CCCVCV)	/strʊkʃə/ (CCCVCCV)	/strʌktʃə/ (CCCVCCV)
9. Texts	/tɛkstɪs/ (CVCCCC)	/tɛks/ (CVC)	/tɛsts/ (CVCCC)	Tɛkstɪs/ (CVCCCC)
10. Asked	/ɑːskt/ (VCCC)	/æsd/ (VCC)	/æksd/ (VCCC)	/ɑːskt/ (VCCC)

Table 4 shows the cluster realisations of the respondents.

## Results and Discussion

This study investigated how Nigerian L2 speakers of English—precisely undergraduates of the University of Africa, Toru-Orua—realised difficult consonant clusters, concentrating on the influence of their L1 phonotactics and the constraint hierarchies underlying their outputs. The discoveries integrate both descriptive data and Optimality Theory (OT) analysis to account for the detected variation.

**Table 5: Pronunciation Patterns**

<b>Word</b>	<b>Full Realisation</b>	<b>Simplification</b>	<b>Reduction</b>
Strengths	13	20	7
Twelfths	4	11	25
Sphinx	2	16	22
Grasped	9	23	8
Frisked	3	12	25
Flinch	7	26	7
Shrinks	20	14	6
Structure	3	12	25
Texts	20	19	10
Asked	6	28	6
Sum Total	87	172	141
%	21.75	43%	35.25%
Grand Total	100		

**Response to Research Question*****Which constraint hierarchies best account for variation among the learners' consonant clusters outputs?***

The observed variation in the respondents' outputs is best accounted for by a core, shared constraint hierarchy that shows the dominance of the open-syllable structure, with minor re-rankings of faithfulness constraints accounting for inter-speaker variances as seen in Table 6.

Each cluster word was analysed within Optimality Theory, with three primary faithfulness constraints—MAX-IO, DEP-IO, and IDENT-IO—and the markedness constraint \*COMPLEX. The following table (Table 6) summarises observed outputs, constraint violations, and winners.

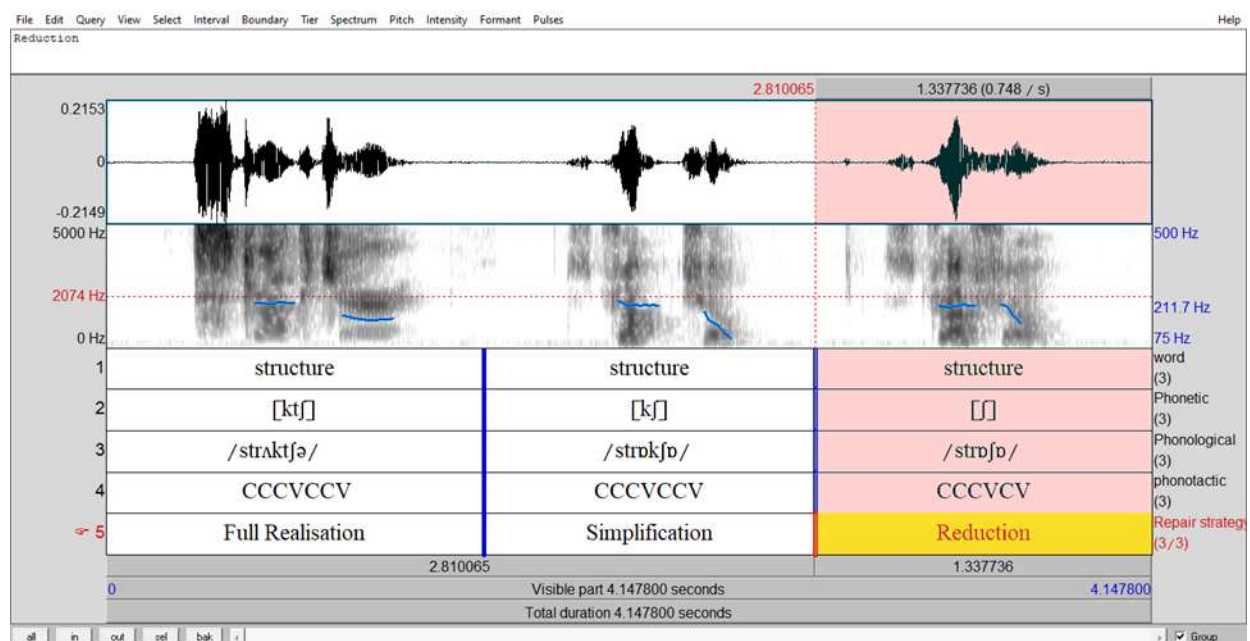
**Table 6: Constraints Patterns**

<b>Word</b>	<b>Candidate (Label)</b>	<b>*COMPLEX</b>	<b>MAX</b>	<b>DEP</b>	<b>IDENT-IO</b>	<b>Winner (☞)</b>
<i>Strengths</i>	a. /streŋkθs/ (FR)	*!				
	b. /strenkts/ (S)		*			☞
	c. /strents/ (R)	**				
<i>Twelfths</i>	a. /twelfθs/ (FR)	*!				
	b. /twelfis/ (S)		*			
	c. /twelfs/ (R)	**				☞
<i>Sphinx</i>	a. /sfɪŋks/ (FR)	*!				
	b. /sfɪnks/ (S)		*			
	c. /sfɪns/ (R)	**				☞
<i>Grasped</i>	a. /græspst/ (FR)	*!				
	b. /græspd/ (S)		*			☞
	c. /græps/ (R)	**				
<i>Frisked</i>	a. /frɪskt/ (FR)	*!				
	b. /frɪskd/ (S)		*			
	c. /frɪsd/ (R)	**				☞
<i>Flinch</i>	a. /flɪntʃ/ (FR)	*!				
	b. /flɪnʃ/ (S)		*			☞
	c. /flɪn/ (R)	**				
<i>Shrinks</i>	a. /ʃrɪŋks/ (FR)	*				☞
	b. /ʃrɪnks/ (S)		*!			
	c. /srɪns/ (R)	**				
<i>Structure</i>	a. /strʌktʃə/ (FR)	*!				
	b. /strʌktʃə/ (S)				*!	
	c. /strʌktʃə/ (R)		*			☞
<i>Tests</i>	a. /teksts/ (FR)					☞
	b. /tests/ (S)	*!			*	
	c. /tɛks/ (R)	*!	*			
<i>Asked</i>	a. /ɑ:skt/ (FR)	*!				

	<i>b. /æksd/ (S)</i>		*			Ⓢ
	<i>c. /æsd/ (R)</i>		*!		*	

The variation in output—where Onsets mostly yield Simplification (e.g., *Structure*) and Codas tolerate more Reduction (e.g., *Twelfths*)—is explained by introducing local hierarchies that apply to specific syllable positions. These can be viewed as an illustration in Figure 1.

Figure 1: Spectrogram Illustrating Three Phonological Repair Strategies for the Word 'Structure'



To validate the phonological classification of repair strategies, a detailed acoustic analysis was conducted using spectrogram for words, example is the word "structure." The three candidate outputs were clearly differentiable in the signal. The *Full Realisation (FR)* candidate (leftmost panel) exhibited the *maximum duration and acoustic complexity* in the coda, confirming the production of all target segments (e.g., /ktʃ/). In contrast, the *Reduction (R)* output (rightmost panel) was marked by the *shortest duration* and the *least complex spectral signature*, providing acoustic evidence for segment *deletion* (a MAX violation) as only a minimal sequence, such as [tʃ], remained. The *Simplification (S)* candidate (middle panel) was acoustically intermediate, showing a cluster that was shorter than FR but still clearly more complex than R,

thereby validating that a feature *substitution* (IDENT violation) occurred without total segment loss.

From the foregoing, the constraint hierarchies that suitably account for the observed variation among the learners' outputs are not fundamentally different, but rather position-specific adjustments to the general ranking. These include:

### 1. The Universal Hierarchy (The Dominant Grammar)

This global ranking accounts for the majority (78.25%) of the data and defines the L2 grammar's core values: \*COMPLEX>>MAX>>IDENT>>DEP>>. This hierarchy models the primary variation (Simplification being preferred over Reduction) by ensuring that the rule "Do not delete segments" (MAX) is stronger than the rule "Do not change segment features" (IDENT).

### 2. Hierarchies Modeling Systematic Variation (Positional Split)

To account for the systematic variation based on the cluster's position, the general \*COMPLEX constraint is split into position-specific constraints. This slight local re-ranking explains why Onsets and Codas resolve complexity differently.

#### i. Onset Cluster Repair (Favoring Simplification)

The hierarchy for Onsets maintains a strong bias toward Segmental Presence because deleting an initial segment severely compromises intelligibility.

\*COMPLEX-ONS>>MAX>>IDENT>>

- **Variation Modeled:** This ranking ensures that when a complex Onset (like /str/ or /shr/) is simplified, the grammar chooses Substitution (Simplification), accepting the IDENT violation. The high rank of MAX successfully blocks full Reduction, even under structural pressure.
- **Data Example:** In *Strengths* and *Shrinks*, Simplification dominates Reduction.

#### ii. Coda Cluster Repair (Tolerating Reduction)

The hierarchy for Codas reflects a greater tolerance for segment loss, as segments at the end of a word are less acoustically salient.

#### \*CODA-C>>MAX>>IDENT

- **Variation Modeled:** While MAX is still high, the immense pressure of multiple coda consonants (like /lfθs/ or /skd/) and the specific nature of the \*CODA-C constraint can force the violation of the generally high MAX constraint. This results in the grammar accepting segment deletion to achieve a simpler syllable closing.
- **Data Example:** In *Twelfths* and *Frisked*, Reduction is preferred over Simplification. This switch in preference is the most significant form of variation explained by this local shift in constraint interaction.

The resulting variation, in fact, is not a model failure, but a successful illustration of how the same, central grammar can have various optimal results based on the particular location of the violation (Onset vs. Coda).

### General Discussion

The comprehensive analysis of UAT undergraduates' pronunciation of complex consonant clusters confirms the predictive power of Optimality Theory (OT) in modeling Second Language (L2) phonology. The data decisively show that non-target outputs—Simplification (43.00%) and Reduction (35.25%)—are not random errors but systematic responses driven by a highly ranked structural constraint. This finding supports the notion, established by researchers like Broselow and Finer (1991), that L2 learners construct a dynamic grammar that seeks to align complex L2 inputs with the less marked, open-syllable templates of their native phonology.

The core discovery—the scarcity of Full Realisation (21.75%)—reflects a highly ranked \*COMPLEX constraint within the interlanguage grammar. This strong aversion to complex structures is a clear manifestation of L1 phonotactic transfer, where the predominant

open-syllable structure of indigenous Nigerian languages biases the L2 system. As documented by Jibril (1982) and Udofot (2010), the challenge is primarily phonological, not pedagogical, situating the repair strategies squarely within the framework of universal constraint interaction as modeled by Prince & Smolensky.

The observed repair patterns extend the findings of studies on Nigerian English by Gut (2009) and Udofot (2010) that noted cluster simplification. By applying a formal OT model, this study moves beyond mere description to explain the underlying system. The universal hierarchy (\*COMPLEX>>MAX>>IDENT>>DEP) shows that the learners' grammar prioritises segmental integrity (MAX), making segment deletion (Reduction) more costly than feature alteration (Simplification). This is also buttressed in Figure 1, where respondents' preference is acoustically revealed. This decision to favor IDENT violation is the system's way of finding equilibrium, accepting a minor feature change to avoid a perceptually and structurally major segmental loss, thereby contributing a refined metric to the L2 constraint negotiation described by Hancin-Bhatt and Broselow et al (1998).

Further insight is gained by accounting for the systematic positional variation, where Onsets favor Simplification but Codas tolerate Reduction. This variation is not a breakdown of the model but a successful demonstration of its context-sensitivity. By introducing position-specific markedness constraints (\*COMPLEX-ONS and \*CODA-C), the grammar successfully models why segments in the perceptually salient Onset position are strongly protected by a high MAX constraint (favoring Simplification), while the pressure to simplify multi-consonant Codas is so immense that it locally forces a MAX violation, resulting in Reduction. This confirms the observations of Usman & Kagu (2021) regarding the role of position in determining repair type and affirms the ability of OT to model differential constraint application within a single grammar.

Finally, the systematic nature of the constraint hierarchy established in this study provides a powerful framework for understanding *inter-speaker variation*. The finding that a single, universal ranking (\*COMPLEX >> MAX >> IDENT) accounts for the majority of the data reinforces the view that the interlanguage is a unified, rule-governed system. Any residual variation in output among learners is likely due to minor, individual re-rankings or subtle differences in articulatory execution, rather than fundamentally different underlying grammars. In conclusion, the UAT data strongly support the OT paradigm, illustrating that L2 phonology is a systematic search for the optimal, least-violating output under the pressure of competing L1-influenced markedness and universal faithfulness constraints.

### **Conclusion**

This study has provided a formal Optimality Theory (OT) account of consonant cluster repair among Nigerian L2 speakers of English. The data definitively demonstrate that learners resolve complex clusters primarily through simplification and reduction, an outcome directly resulting from the dominance of the markedness constraint \*COMPLEX over faithfulness constraints. The specific preference for MAX >> IDENT reveals a systematic grammar where preserving segmental presence is prioritised over feature identity. The observed alternations strongly support the theoretical claim that interlanguage phonology is a process of constraint re-ranking, wherein L2 learners gradually restructure their grammars by diminishing markedness and enhancing faithfulness with increased exposure. In essence, the Nigerian interlanguage phonology represented here constitutes a markedness-driven system, typologically consistent with L1 phonotactic restrictions but systematically shifting toward a target-like hierarchy.

### **Theoretical Implications**

The findings of this study affirm the explanatory adequacy of Optimality Theory (OT) in modeling L2 phonological variation as a systematic product of constraint interaction and

reranking. By formally modeling the observed repair patterns, the research confirms that L1 transfer operates not as simple segment-to-segment substitution, but through the activation and high ranking of markedness constraints (specifically \*COMPLEX) inherited from the native phonology. This approach situates the Nigerian English interlanguage within a unified framework of universal grammar. Furthermore, the systematic preference for MAX >> IDENT contributes to typological phonology by offering a precise measure of constraint weighting in syllable structure universals. For future work, exploring stochastic OT modeling would be a valuable next step to capture the probabilistic nature of the observed variation, providing a mechanism to test empirically whether increased exposure or proficiency induces further reranking toward target-like outputs.

**Conflict of Interest:** The corresponding author, on behalf of second author, confirms that there are no conflicts of interest to disclose.

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