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ARABIC AND ENGLISH LOANWORD ADAPTATION IN KISWAHILI: A UNIFIED OPTIMALITY-THEORETIC ANALYSIS

Yasmeen Yaseen
The University of Taiz, Yemen

Abstract
This study investigates the phonological adaptation of Arabic and English loanwords in Kiswahili within the framework of Optimality Theory (OT). While previous research has examined loanwords from individual donor languages or focused on isolated repair strategies, this paper proposes a Unified Loanword Constraint Hierarchy (ULCH) to account for adaptation across multiple donor languages within a single grammar. Using a qualitative corpus-based approach with data drawn from dictionaries, broadcast media, online texts, and prior studies, the analysis shows that Arabic loanwords predominantly exhibit feature-driven adaptation (e.g., consonant substitution, neutralisation, and loss of pharyngeals), whereas English loanwords predominantly exhibit structure-driven adaptation (e.g., epenthesis, cluster simplification, coda repair, and prosodic adjustment). To explain these differences without positing separate grammars, the study introduces the Donor-Sensitive Constraint Activation (DSCA), whereby the phonological properties of each input determine which constraints become most consequential in selecting the optimal output within the same constraint system. The findings show that Kiswahili loanword adaptation follows a unified constraint-based system in which different input properties yield distinct adaptation patterns, offering a unified account of multilingual borrowing and contributing to research on loanword phonology, language contact, and theoretical economy.

Keywords: Kiswahili, Arabic, English, Optimality Theory, phonological adaptation.

1. INTRODUCTION

Loanword adaptation in Kiswahili has attracted considerable scholarly attention because of the language's long history of contact with Arabic and, more recently, English. Previous studies have examined the historical origins of borrowing, the phonological and morphological processes involved in lexical integration, and the theoretical mechanisms underlying loanword adaptation. While these studies have significantly advanced our understanding of how foreign lexical items are accommodated within Kiswahili, Arabic and English borrowings have often been examined separately, with studies adopting different descriptive and theoretical perspectives.

Research on Arabic loanwords in Kiswahili has consistently shown that borrowed forms undergo phonological adaptation to conform to Kiswahili phonotactic requirements. In a foundational book, Lodhi (2000) demonstrates the extensive Arabic influence on the Kiswahili lexicon resulting from long-standing contact through trade, religion, and coastal interaction. He shows that much of Kiswahili's religious, administrative, and scholarly vocabulary is of Arabic origin. As Lodhi (2000: 91) notes, "[...] Arabic had been the sole language of administration, commerce, diplomacy, education and liturgy in Muslim East Africa", thus underscoring the depth of Arabic's historical role in shaping Kiswahili.

However, the study focuses primarily on lexical influence rather than the systematic phonological mechanisms underlying loanword adaptation.

Similarly, Nurse & Hinnebusch (1993: 309) place Arabic borrowing within the wider history of the Sabaki languages, emphasising diachronic contact rather than phonological modelling. Their comparative method reconstructs proto-languages through shared vocabulary, sound correspondences, and grammatical innovations across Swahili, Comorian, Pokomo, Elwana, and Mijikenda, tracing how modern varieties diverged.

More specifically, phonological studies have documented the systematic adaptation of Arabic sounds that are absent or restricted in the Kiswahili phonological inventory. Akidah (2013: 4) observes that "[t]he process of borrowing words from Arabic into Kiswahili is accompanied by adaptation of the Arabic words into the Kiswahili phonological system". He further explains that consonants absent from the Kiswahili inventory—particularly pharyngeals, uvulars, and emphatics—are neutralised through substitution or deletion. These observations indicate that Arabic loanwords undergo modifications shaped by the recipient language's phonological requirements.

Complementing Akidah's (2013) observations, Mwita (2009: 48-55) identifies repair strategies such as vowel epenthesis, consonant substitution, and syllable restructuring in the adaptation of borrowed forms. For instance, Arabic *ḥukm* is realised as *hukumu*, involving vowel insertion that alters the syllable structure of the source form. Mwita's Optimality-Theoretic analysis links these repair processes to the interaction between faithfulness to the source form and Kiswahili's well-formedness requirements. As Mwita (2009: 51) explicitly writes: "The typical avoidance strategies that Kiswahili uses to repair the nonconforming syllables of the borrowed words are: (a) vowel epenthesis, (b) consonant deletion, (c) cluster tolerance, and (d) feature change".

More recently, Batais (2019) provides an Optimality-Theoretic analysis of Arabic loanword adaptation in Kiswahili and argues that markedness constraints play a central role in determining the phonological form of borrowed words. His analysis accounts for processes such as feature neutralisation and syllable repair in terms of the interaction between markedness and faithfulness. For example, vowel epenthesis may resolve consonant clusters, resulting in outputs that conform more closely to the phonological structure permitted in Kiswahili. Batais (2019: 1) reports that "[i]t has been found that word-final singleton and complex codas are never tolerated in Kiswahili; therefore, they are repaired via edge vowel epenthesis [...]". This raises a concern regarding the definition and scope of *CODACOND* in Batais's (2019) analysis. Although the constraint is intended to regulate permissible coda structures, its formulation does not clearly specify the status of complex medial codas. Consequently, the status of complex medial codas remains ambiguous, an issue that will be discussed further in the analysis section below.

In addition, Harvey (2014: 37) shows that epenthetic vowels in Swahili loanwords are conditioned by surrounding sounds: the letter <*i*> follows coronals, <*u*> follows labials, and <*a*> follows pharyngeals, while medial vowels often copy nearby vowels. He further demonstrates that English stress patterns may be neutralised in the adaptation of borrowed forms, with stress placement adjusted to conform to the prosodic patterns associated with Kiswahili, including a tendency towards penultimate stress. These

observations indicate that loanword adaptation involves both segmental and prosodic processes, with vowel selection conditioned by phonological context and stress placement contributing to the accommodation of English forms within Kiswahili phonology.

From a phonological perspective, Schadeberg (2009: 90) explains that Kiswahili strongly favours open CV syllable structures and restricts certain consonant clusters and complex codas, leading to the modification of English consonant clusters through processes such as vowel insertion and resyllabification. Examples such as *school → shule* and *stamp → stampu* illustrate these repair strategies. Schadeberg's analysis thus contributes to an understanding of loanword adaptation as a systematic process shaped by the phonological properties of the recipient language rather than as a set of arbitrary substitutions.

Within theoretical phonology, Optimality Theory has become an influential framework for explaining loanword adaptation. Yip (1993: 261) demonstrates that borrowed forms can be analysed through the interaction of markedness and faithfulness constraints, with outputs determined by constraint ranking rather than fixed rules. Building on this, Yip (2006:950) emphasises the relationship between perception and grammar; the adaptation of foreign sounds involves the mapping of non-native sounds onto native phonological categories before further phonological restructuring takes place.

Peperkamp & Dupoux (2003: 367) likewise highlight the perceptual basis of loanword adaptation, proposing that listeners initially map unfamiliar sounds onto categories available in their native phonological system. Similarly, Kang (2011: 2263), in a broader review of loanword phonology, further shows that adaptation reflects interacting factors, including phonological repair, perceptual mapping, production pressures, and integrated approaches to loanword processing. From this perspective, processes such as epenthesis and segmental substitution can be understood as systematic responses to conflicts between donor-language structures and the phonological requirements of the recipient language.

Uffmann (2006) provides further evidence for the role of constraint interaction in vowel epenthesis, showing that epenthesis may be preferred over deletion when it allows source material to be preserved while satisfying phonotactic requirements, noting that “vowel epenthesis is a noteworthy phonological feature […] languages which are characterised by restrictive constraints on syllable structure frequently epenthesize vowels to satisfy these constraints when borrowing words from a language which is more permissive with respect to syllable structure” (Uffmann 2006: 1080). His Optimality-Theoretic analysis relates epenthesis to the interaction of markedness, faithfulness, and vowel-related phonological processes. These theoretical accounts provide a foundation for analysing the phonological adaptation of English and Arabic loanwords in Kiswahili within a constraint-based framework.

Taken together, these studies indicate that Kiswahili loanword adaptation involves the accommodation of donor-language forms to the phonological requirements of the recipient language. However, much of the existing literature treats Arabic and English loanwords separately and focuses on particular adaptation processes or individual donor languages. Previous research has documented phenomena such as consonant substitution,

feature neutralisation, vowel epenthesis, coda repair, cluster simplification, and syllable restructuring, but these processes have generally been examined independently rather than within a comparative account of multiple donor languages. Consequently, the reviewed literature leaves a gap in explaining how different patterns of loanword adaptation can be related within a common constraint-based account of Kiswahili.

Under this approach, shared repair processes can be analysed through the same constraint system, while Donor-Sensitive Constraint Activation (DSCA) explains how the segmental, syllabic, and prosodic properties of each input determine which constraints become most consequential in selecting the optimal output. Thus, differences between Arabic and English loanwords are accounted for within a unified constraint system rather than through separate grammars.

To achieve the aims of the study, a unified Optimality-Theoretic approach is adopted to account for the phonological adaptation of Arabic and English loanwords in Kiswahili. The following section presents the analytical framework underpinning the analysis.

2. ANALYTICAL FRAMEWORK: THE UNIFIED LOANWORD CONSTRAINT HIERARCHY

The study adopts a unified Optimality-Theoretic framework to account for the phonological adaptation of Arabic and English loanwords in Kiswahili. It proposes the Unified Loanword Constraint Hierarchy (ULCH) as a common fixed hierarchy within which the datasets from the two donor languages are evaluated. The study further proposes the Donor-Sensitive Constraint Activation (DSCA) as a descriptive and explanatory component of the ULCH, referring to the differential relevance of constraints within the same fixed hierarchy when inputs with different phonological properties are evaluated.

It is important to note that DSCA does not involve the activation or deactivation of constraints, nor does it entail donor-specific reranking. Arabic and English loanwords are evaluated within the same fixed constraint hierarchy, and the constraints that constitute the ULCH remain part of the same Kiswahili grammatical system throughout the analysis. Thus, the proposal does not posit separate constraint rankings for Arabic and English, nor does it assume that Kiswahili changes its grammar according to the source language of a loanword. Rather, DSCA refers to the differential relevance of constraints within the same fixed ULCH when inputs with different phonological properties are evaluated. Because Arabic and English loanwords may introduce different types of phonological structures into Kiswahili, different constraints within the same hierarchy may become particularly consequential in determining the optimal output. For example, when an Arabic input contains a segment whose phonological features are incompatible with the Kiswahili system, constraints governing segmental markedness and feature realisation may play a more visible role in determining the repair. By contrast, when an English input contains a syllable structure, consonant cluster, or coda configuration that is disfavoured in Kiswahili, constraints regulating syllable structure may become more directly relevant to the observed repair. These differences do not indicate different grammars or different rankings; rather, they reflect the interaction between the same ranked constraints and inputs that contain different phonological properties.

In this sense, the term *activation* should not be interpreted as meaning that a constraint is grammatically switched on for one donor language and switched off for another. All constraints in the ULCH remain available to all evaluations. DSCA instead captures the fact that, depending on the phonological characteristics of a particular input, some constraints may have a more direct or observable effect on the choice of the optimal candidate than others. The same hierarchy therefore provides the grammatical basis for the evaluation of both Arabic and English loanwords, while the phonological composition of individual inputs determines which constraints become especially consequential in a given evaluation.

The use of a reduced set of constraints in individual tableaux is therefore a matter of analytical economy rather than a change in the underlying grammar. In principle, every tableau could display the complete ULCH. However, reproducing the entire hierarchy in every tableau would make the analysis unnecessarily long and obscure the specific constraint interactions responsible for each repair. Following the principle of analytical economy in Optimality Theory, the tableaux therefore display only the constraints that are directly relevant to the phonological contrast or repair under examination. The constraints shown in these reduced tableaux retain their relative ordering as established in the complete ULCH; no new ranking is introduced, and no constraint is reranked according to the donor language.

For example, if a subset of constraints is presented in a tableau as C1 >> C3 >> C6, this represents the corresponding portion of the complete ULCH rather than a separate ranking established specifically for that loanword or donor language. The omission of intervening or lower-ranked constraints from a particular tableau does not imply that those constraints are absent from the grammar or inactive in a grammatical sense. They are simply not required to demonstrate the particular contrast being illustrated. This approach allows the analysis to maintain a single unified hierarchy while avoiding unnecessary repetition and ensuring that each tableau focuses on the constraints that determine the relevant repair.

Accordingly, DSCA should be understood as describing differential constraint relevance within a single fixed ranking rather than donor-specific constraint reranking. The distinction between Arabic and English adaptation therefore arises from the interaction of different input structures with the same ULCH. Arabic and English loanwords may consequently exhibit different patterns of repair—such as feature modification, segmental substitution, deletion, cluster resolution, or other structural adjustments—without requiring separate grammatical systems. DSCA thus provides a way of characterising how the phonological properties of different inputs make particular constraints more consequential in the evaluation, while preserving the central claim of the ULCH: Arabic and English loanword adaptation can be analysed within a common Kiswahili constraint-based grammatical system.

3. METHODOLOGY

This study adopts a corpus-based qualitative phonological analysis within the framework of Optimality Theory (OT). The dataset consists of 140 attested loanwords (Arabic: 81;

English: 59) compiled from multiple complementary sources to capture both established and contemporary borrowing patterns. These items were drawn from scholarly studies and dictionaries documenting the historical influence of Arabic, from broadcast and media corpora representing naturally occurring spoken usage, and from online written discourse reflecting current borrowing trends.

The combination of sources allowed the dataset to capture both historical and contemporary borrowing patterns, while cross-checking across contexts enhanced the reliability of the loanword evidence. Each item was required to be clearly attested as a loanword in Kiswahili and widely recognised in usage. Words were excluded if they appeared only in isolated registers or lacked evidence of integration into Kiswahili phonology. All lexical items were manually extracted and verified across sources to ensure consistency. The analysis focuses exclusively on phonological adaptation, examining processes such as vowel epenthesis, consonant substitution, cluster simplification, assimilation, and prosodic restructuring. Within OT, these patterns are analysed in terms of interactions between markedness and faithfulness constraints in order to account for how Kiswahili well-formedness requirements shape the phonological realisation of borrowed forms.

4. DATA ANALYSIS

This analysis first examines Arabic loanwords and then English loanwords. It covers the relevant phonological processes in Kiswahili, followed by the analysis of Arabic and English loanwords with particular attention to the phonological processes involved in their adaptation. Before examining the adaptation of Arabic and English loanwords, it is necessary to outline the relevant phonological processes and structural preferences of Kiswahili. These processes provide the phonological basis against which the adaptation of borrowed forms can be evaluated. The following subsection therefore discusses the principal phonological patterns that characterise Kiswahili, particularly vowel epenthesis, vowel harmony, consonant cluster avoidance, and nasal assimilation, which are relevant to the subsequent analysis of loanword adaptation.

4.1 The relevant phonological processes in Kiswahili

Kiswahili phonology strongly favours unmarked syllable structures and simple phonotactics. Marked structures are typically repaired to conform to the preferred CV syllable pattern, providing the basis for loanword adaptation. One of the most common repair strategies is vowel epenthesis, which eliminates complex consonant clusters and closed syllables while preserving open syllable structure (Iribe Mwangi 2008: 243). In Optimality Theory, this pattern reflects the dominance of ONSET over DEP-IO, as the grammar prioritises well-formed syllables despite vowel insertion. Another important process is vowel harmony, which operates mainly in verbal morphology. Although Kiswahili is not a fully harmonic language, vowels within verb roots and suffixes often harmonise, promoting phonological uniformity. This tendency can be analysed as the dominance of *AGREE(V)* over *IDENT(V)* (Iribe Mwangi 2008: 209). These phonological preferences also

shape loanword adaptation. Borrowed words with syllable structures that violate Kiswahili phonotactics are systematically repaired through vowel epenthesis. For example, *school → shule*, *station →steshini*, and *class → darasa* illustrate how illicit consonant clusters are resolved to satisfy *ONSET, NOCODA,* and the preferred CV syllable structure, and as Iribe Mwangi (2008: 243) notes, "[v]owel insertion is a more dominant process in Standard Kiswahili borrowed words […] it realises the open syllable structure throughout the word".

Another important process is nasal assimilation, whereby a nasal assimilates to the place of articulation of a following consonant, as in *mbaya* 'bad'. From an Optimality Theory perspective, this process reflects the dominance of *AGREE(Place)* over *IDENT(Nasal),* promoting place agreement between adjacent segments (Massamba et al. 2004: 96). Collectively, epenthesis, vowel harmony, consonant cluster avoidance, and nasal assimilation show that Kiswahili prioritises phonological well-formedness through the interaction of markedness constraints (*ONSET, NOCODA, AGREE(V), AGREE(Place)* over faithfulness constraints *(DEP-IO, IDENT)*. These native phonological preferences underpin loanword adaptation, with Arabic borrowings predominantly exhibiting feature-driven repairs and English borrowings predominantly exhibiting structure-driven repairs, although both types of repair may occur in either group. These patterns motivate the proposed Unified Loanword Constraint Hierarchy (ULCH) and the principle of Donor-Sensitive Constraint Activation (DSCA), which accounts for the differential relevance of constraints within the same fixed hierarchy as inputs with different phonological properties are evaluated.

4.2 Arabic loanwords

4.2.1 Non-native feature adaptation in Arabic loanwords

The first pattern observed in the Arabic loanword data is the systematic adaptation of consonants that carry phonological features absent from the native Kiswahili inventory. Arabic contains several segment types, including pharyngeals, uvulars, emphatics, and geminates, which have no direct equivalents in Kiswahili. Consequently, these segments pose challenges for the recipient language and frequently trigger repair strategies during borrowing. Kiswahili consistently resolves such mismatches through feature simplification, segment deletion, and syllable restructuring, while preserving as much of the original lexical form as possible. These adaptation patterns are illustrated by the Arabic loanwords presented in Table (1).

Table 1: Illustration of feature adaptation of Arabic loanwords in Kiswahili

	Arabic word	Arabic pronunciation	Adapted Kiswahili pronunciation	Kiswahili Spelling	Gloss
1.	*ḥaqq*	/ħaqː/	/ha.ki/	*haki*	'truth, right'
2.	*suuq*	/suːq/	/so.ko/	*soko*	'market'
3.	*qahwa*	/qah.wa/	/ka.ha.wa/	*kahawa*	'coffee'
4.	*kitāb*	/ki.taːb/	/ki.ta.bu/	*kitabu*	'book'
5.	*ṣābūn*	/sˤaː.buːn/	/sa.bu.ni/	*sabuni*	'soap'

6.	*shidda*	/ʃid.da/	/ʃi.da/	*shida*	‘problem, difficulty’
7.	*qaṭṭ*	/qatˤː/	/ka.tu/	*katu*	‘never’
8.	*ṣallā*	/sˤal.laː/	/sa.li/	*sali*	‘pray’

The primary phonological challenge presented by these Arabic loanwords is the presence of consonantal features that are absent from the native Kiswahili inventory. Pharyngeals such as /ʕ/are deleted, uvulars like /q/ are replaced by less marked velar counterparts, emphatic consonants lose their secondary articulations, and geminates are simplified. Thus, *ḥaqq* → *haki* illustrates uvular adaptation and geminate simplification. Similarly, *qahwa* → *kahawa* and *ṣābūn* → *sabuni* show the neutralisation of uvular and emphatic features, respectively. Collectively, these patterns indicate that Kiswahili systematically eliminates marked consonantal features while preserving the borrowed form’s lexical identity.

The markedness constraint ***NON-NATIVE FEATURES (*NNF)*** penalises output segments containing phonological features not permitted in the native Kiswahili inventory, while ****GEMINATE (*GEM)*** penalises geminate consonants absent from the Kiswahili phonological system. These constraints dominate faithfulness constraints, forcing the elimination of pharyngeals, uvulars, emphatics, and geminates. ***IDENT-IO(place) (IDENT-P***) maintains faithfulness by preserving the place of articulation of corresponding input and output segments, while ***IDENT-IO(feature) (IDENT-F)*** may be violated when marked feature specifications change. Similarly, ***MAX-IO (MAX),*** which militates against the deletion of input segments, is violated when preserving those segments would incur violations of higher-ranked markedness constraints, and *DEP-IO* (DEP) penalises vowel insertion. The resulting ranking is as follows: ****NNF, *GEM ≫ MAX ≫ IDENT-F ≫ IDENT-P ≫ DEP.***

Tableau 1 illustrates the ranking above, which evaluates competing phonological representations for the adaptation of /ħaqq/ as /haki/.

Tableau 1[1]: /ħaqː**/→ /ha.ki/**

Candidates	*NNF	*GEM	MAX	IDENT-F	IDENT-P	DEP
(a) /ħaqq/	*!	*!				
(b) /haq/	*!		*	*		
(c) /haqi/	*!		*	*		*
☞(d) /ha.ki/			*	*	*	*

[1] In Optimality Theory, the term *tableau* refers to the display used to evaluate competing output candidates against a set of ranked constraints, whereas *table* is used here to present linguistic data and their corresponding forms.

Candidate(d) /ha.ki/ emerges as the optimal candidate because it satisfies the high-ranked constraints **NNF* and **GEM* by adapting the pharyngeal /ħ/ to /h/, replacing the uvular /q/ with /k/, and simplifying the geminate. These repairs incur violations of *MAX* through the deletion of one input /q/, *IDENT-F* through the change from /ħ/ to /h/, and *IDENT-P* through the change from /q/ to /k/. *DEP* is violated by the insertion of final /i/. These adaptations eliminate marked phonological properties that are incompatible with the target language's phonological system. Although the optimal candidate incurs faithfulness violations through consonant substitution and geminate simplification, these violations are tolerated because the relevant markedness constraints take priority over faithfulness. The analysis therefore illustrates how markedness-driven adaptation can override the preservation of donor-language features, yielding a form that conforms more closely to Kiswahili phonological patterns while retaining sufficient similarity to the source word for lexical recognition. In particular, uvulars and pharyngeals are regularly adapted to sounds available in Kiswahili, while emphatic consonants lose their secondary articulatory features. The adaptations identified in the present data support these observations and show a tendency to eliminate marked consonantal features.

4.2.2 Syllable structure repair (with conditional codas) in Arabic loanwords

Arabic loanwords in Kiswahili may undergo syllable-structure repair to conform to the language's phonological constraints, particularly those governing permissible coda consonants. The following data in Table (2) illustrate these adaptation patterns.

Table 2: Syllable structure repair of Arabic loanwords in Kiswahili

	Arabic word	Arabic pronunciation	Adapted Kiswahili pronunciation	Kiswahili Spelling	Gloss
1.	*daftar*	/daf.tar/	/daf.ta.ri/	*daftari*	'notebook, register'
2.	*tafsīr*	/taf.siːr/	/taf.si.ri/	*tafsiri*	'interpretation,
3.	*ḥabl*	/ħabl/	/ha.bu.li/	*habuli*	'rope'
4.	*sulṭān*	/sul.tˤaːn/	/su.lta.ni/	*sultani*	'sultan, ruler'
5.	*ḥukm*	/ħukm/	/hu.ku.mu/	*hukumu*	'judgment, ruling'
6.	*waqt*	/waqt/	/wa.ka.ti/	*wakati*	'time'
7.	*fikr*	/fikr/	/fi.ki.ri/	*fikiri*	'thought'
8.	*dhikr*	/ðikr/	/ði.ki.ri/	*dhikiri*	'remembrance'
9.	*dhanb*	/ðanb/	/ðam.bi/	*dhambi*	'sin'
10.	*sharṭ*	/ʃartˤ/	/ʃar.ti/	*sharti*	'condition'
11.	*nafs*	/nafs/	/naf.si/	*nafsi*	'self, soul'
12.	*dars*	/dars/	/da.ra.sa/	*darasa*	'lesson, study'

The second major adaptation pattern involves repairing syllable structures. Unlike Arabic, which permits codas and consonant clusters, Kiswahili strongly favours open CV syllables and avoids complex consonant clusters. The data illustrate that Kiswahili consistently employs vowel epenthesis as its primary repair strategy. Consonant clusters are broken up through vowel insertion, as seen in /ðikr/ → /ði.ki.ri/, /fikr/ → /fi.ki.ri/, /ħukm/ →

/hu.ku.mu/, and /ħabl/ → /ha.bu.li/. In each case, the borrowed form was reshaped to conform to the native Kiswahili CV syllable template. However, the data show that Kiswahili does not eliminate all codas in borrowed words. Other forms, including /taf.siːr/ → /taf.si.ri/, /daf.tar/→ /daf.ta.ri/, /ðanb/→ /ðam.bi/, /sul.tˤaːn/ → /sul.ta.ni/, /nafs/→ /naf.si/ and /ḥabl/ → /ha.bu.li/ retain medial codas, demonstrating that the adaptation process does not uniformly impose an entirely open-syllable structure.

From an Optimality Theory perspective, these adaptations are driven primarily by the markedness constraints N*OCOD*A and *COMPLEX*. In the present analysis, these constraints are represented more specifically by ***NOCODA# (NC#)***, which prohibits word-final codas, and ***COMPLEX (CMPX)*****,** which penalises complex consonant structures in the relevant syllabic positions. However, these constraints cannot fully account for the variation observed in Kiswahili loanword adaptation, since structurally different clusters may undergo different adaptation strategies, while some medial codas are retained. Batais's (2019) *CODACOND*, which permits singleton codas in word-initial syllables, provides a useful starting point for explaining coda retention in forms such as *tafsiri* /taf.si.ri/, *daftari* /daf.ta.ri/, and *nafsi* /naf.si/. Nevertheless, the patterns examined here require a more differentiated account of the conditions under which medial codas are retained. For example, the cluster /qt/ in Arabic *waqt* is repaired in Kiswahili *wakati* /wa.ka.ti/, whereas /ft/ in *daftari* is retained across a syllable boundary. The adaptation of /ħabl/ → /ha.bu.li/ likewise illustrates cluster repair, while /ðanb/ → /ðam.bi/ demonstrates nasal place assimilation alongside coda retention.

Building on Batais's (2019) analysis of syllabic adaptation in Kiswahili loanwords, the present study proposes three constraints to account for medial singleton codas licensing in the data examined here. The first constraint, ***Medial Coda Condition on Plosive Onsets (MCC-pl)***, accounts for medial codas preceding plosive onsets across a syllable boundary. This pattern is illustrated by *daftari* /daf.ta.ri/, in which /f/ occupies coda position and /t/ occupies the onset of the following syllable. By contrast, the plosive cluster in *waqt* does not meet this condition and undergoes repair in *wakati* /wa.ka.ti/. The second constraint, ***Medial Coda Condition on Fricative Onsets (MCC-FR)***, accounts for medial singleton codas preceding fricative onsets in the relevant data. In particular, the sequences /fs/ and /sf/ are permitted across a syllable boundary. For example, *tafsiri* /taf.si.ri/ and *nafsi* /naf.si/ retain /f/ as a coda before /s/, rather than resolving the sequence through epenthesis or deletion. These cases indicate that medial coda licensing is not restricted to environments involving a plosive onset. The third constraint, ***Medial Coda Condition on NASAL+CONSONANT(MCC-NC)***, proposes that a nasal coda N1 is licensed before a consonant onset C2, without assimilation. This pattern is illustrated by the Arabic loanword *insani* /in.sa.ni/, in which /n/ is retained as the coda of the first syllable before the fricative onset /s/. Unlike *insani*, the Arabic loanword *dhambi* /ðam.bi/ 'sin', illustrates place assimilation: the input nasal /n/ is realised as /m/ before the bilabial plosive /b/. This assimilation is captured by ***AGREE(PLACE) (AGR-P***), which requires the relevant adjacent consonants to agree in place of articulation. *MCC-NC* accounts for licensing the nasal coda, whereas *AGR-P* accounts for place assimilation. This pattern can be considered alongside the preference for onset-based consonant sequences

in Kiswahili. In native words such as *mtu* /m̩.tu/ 'person', *mti* /m̩.ti/ 'tree', and *mkate* /m̩.ka.te/ 'bread', a syllabic nasal precedes a plosive onset across a syllable boundary. Although these examples do not demonstrate coda retention, they illustrate a broader pattern of consonant sequencing across syllables, which the loanword data extend by permitting nasal codas before a range of onset consonants. Thus, *MCC-PL*, the *MCC-FR*, and the *MCC-NC* capture three proposed structural environments for medial coda licensing, rather than treating coda retention as purely positional. Clusters outside these environments may undergo vowel epenthesis, consonant deletion, or other restructuring. Coda retention and cluster repair are therefore analysed as complementary, context-dependent outcomes of the interaction between phonotactic well-formedness and faithfulness to source-language segments. The constraints capture the proposed conditions on medial coda retention, word-final repair, and place assimilation, while *MAX-IO* and *DEP-IO* regulate deletion and insertion, respectively. The ranking becomes: ***NNF* ≫ *GEM* ≫ MCC-(PL**, *FR, NC)* **≫ NC# ≫ CMPX*≫ MAX≫ *IDENT-F* ≫ *IDENT-P*≫ DEP.**[2] The constraints, highlighted in bold, are applied to the Arabic loanword /daf.tar/→/daf.ta.ri/ in Tableau (2).

Tableau 2: /daf.tar/ → /daf.ta.ri/

Candidates	MCC-PL	NC#	CMPX	AGR-P	MAX	DEP
a. /da.fa.ta/					*	*!
☞ b. /daf.ta.ri/						*
c. /daf.tar/		*!				
d. /daft.ri/	*					*
e. /da.ftar/		*!	*			

Candidate (b), /daf.ta.ri/, is selected because it retains /f/ as a medial coda before the plosive onset /t/, satisfying *MCC-PL*, and repairs the word-final coda through the insertion of /i/. Candidate (a) incurs two *DEP* violations because it inserts two vowels. Candidate (c) violates *NC#* by retaining word-final /r/. Candidate (d), /daft.ri/, has a complex coda /ft/followed by /r/ in the onset and violates *MCC-PL*. Candidate (e) also violates *NC#* and *CMPX*.

The ranking, including *AGR-P*, which accounts for place assimilation, becomes: ***NNF* ≫ *GEM* ≫ MCC-(*PL, FR, **NC)** ≫ NC# ≫ CMPX ≫ AGR-P ≫ MAX≫ *IDENT-F* ≫ IDENT-P≫ DEP.** The constraints, highlighted in bold, are applied to the Arabic loanword /ðanb/→ /ðam.bi/ in Tableau (3).

[2] The full constraint ranking is presented in each section to maintain the consistency of the proposed *Unified Loanword Constraint Hierarchy (ULCH)* throughout the analysis. However, only the constraints highlighted in bold are directly relevant to the candidates in each tableau.

Tableau 3: /ðanb / → /ðam.bi/

Candidates	MCC-NC	NC#	CMPX	AGR-P	MAX	IDENT-P	DEP
☞ a. /ðam.bi/						*	*
b. /ðan.bi/				*!			*
c. /ðab.ni/	*!			*			*
d. /ða.nbi/			*!				*
e. /ðan/		*!			*		

Candidate (a) is selected because it retains the medial nasal coda and satisfies *AGR-P* through the agreement in place between /m/ and the following /b/. The change from input /n/ to output /m/ incurs a violation *of IDENT-P*, while the final vowel /i/ incurs a *DEP* violation. Candidate (b), /ðan.bi/, preserves the input nasal but violates *AGR-P* because /n/ and /b/ differ in place of articulation. Candidate (c), /ðab.ni/, violates *MCC-NC* and incurs *DEP* violation. Candidate (d), /ða.nbi/, contains a complex onset /nb/ and violates *CMPX and DEP*. Candidate (e), /ðan/, deletes /b/ and retains a word-final coda, violating *MAX* and *NC#.*

4.2.3 Deletion vs. preservation of structure in Arabic loanwords

The adaptation of Arabic loanwords into Kiswahili involves the selective deletion of segments that are incompatible with the recipient language's phonological system, alongside the preservation of segments that can be accommodated within Kiswahili phonotactics. The data in Table (3) illustrate this contrast.

Table 3: Deletion vs. preservation of structure of Arabic loanwords in Kiswahili

	Arabic word	Arabic pronunciation	Adapted Kiswahili pronunciation	Kiswahili Spelling	Gloss
1.	*ʕadl*	/ʕadl/	/a.di.li/	*adili*	'justice'
2.	*ṣubḥ*	/sˤubħ/	/a.su.bu.hi/	*asubuhi*	'morning'
3.	*ʕaql*	/ʕaql/	/a.ki.li/	*akili*	'intellect, reason'
4.	*ʕāfiya*	/ʕaːfija/	/a.fja/	*afya*	'health'
5.	*dawāʔ*	/da.waːʔ/	/da.wa/	*dawa*	'medicine'
6.	*sharīʕah*	/ʃa.riː.ʕah/	/ʃa.ri.a/	*sharia*	'law'
7.	*ʔimām*	/ʔi.maːm/	/i.ma.mu/	*imamu*	'imam'
8.	*ʔāmāna*	/ʔaː.maː.na/	/a.mi.ni/	*amini*	'believe'
9.	*ʕakrab*	/ʕaq.rab/	/ak.ra.bu/	*akrabu*	'scorpion'
10.	*ʔal-ʕaṣr*	/ʔal.ʕasˤr/	/a.la.si.ri/	*alasiri*	'late afternoon'

The data demonstrate that Arabic loanwords frequently contain pharyngeals, emphatics, uvulars, and marked coda consonants that are incompatible with Kiswahili phonotactics.

However, Kiswahili does not delete problematic segments. Instead, it attempts to preserve as much lexical material as possible while repairing the structures that violate native phonological constraints. The data illustrate the loss of Arabic pharyngeal and glottal consonants, the adaptation of certain consonants, and vowel insertion to repair consonant sequences. This pattern is evident in forms such as /ʕaql/ → /a.ki.li/, where the pharyngeal consonant is deleted because it cannot be accommodated in the Kiswahili consonant inventory. At the same time, the remaining consonants are preserved and integrated into well-formed CV syllables through vowel epenthesis. Similarly, /ʔal.ʕasˤr/→ /a.la.si.ri/ shows the deletion of /ʔ/ and /ʕ/, the adaptation of /sˤ/ to /s/, and vowel insertion. It highlights the importance of a marked coda, incompatible with Kiswahili syllable structure. These forms undergo repair through segmental deletion, epenthesis, feature neutralisation, and syllable restructuring, producing outputs that conform to native phonotactic requirements while remaining recognisably related to the source forms. The data also include vowel shortening, as illustrated by /ʔi.maːm/→ /i.ma.mu/. To account for this pattern, the analysis introduces the markedness constraint ***LONG-V***, which penalises long vowels in the output. This constraint is ranked above *IDENT-F*, allowing the avoidance of long vowels to take precedence over the preservation of input vowel length.

The interaction between markedness and faithfulness provides a framework for accounting for these patterns. **NNF* penalises the retention of segments or features excluded by the adopted analysis of the Kiswahili sound system. *NC#* prohibits consonants in word-final coda position, while *CMPX* penalises consonant clusters. The faithfulness constraints regulate the extent of input–output modification: *MAX* penalises the deletion of input segments, *IDENT-F* penalises changes in segmental features, and *IDENT-P* penalises changes in place of articulation. *DEP* penalises the insertion of output segments. The additional constraint **LONG-V* penalises output long vowels and is placed below *MAX* but above *IDENT-F*. Under the proposed ranking, **NNF* and *NC#* dominate *MAX*, allowing the avoidance of prohibited non-native material and word-final codas to take precedence over the preservation of every input segment. Meanwhile, *MAX* dominates *DEP*, favouring the preservation of input segments over insertion when higher-ranked constraints do not determine the outcome. The ranking of **LONG-V* above *MAX* and *IDENT-F* prioritises the avoidance of long vowels and permits input-segment deletion and vowel shortening when required by higher-ranked constraints. The lower ranking of *IDENT-F* and *IDENT-P* also allows changes in segmental features and place of articulation to satisfy higher-ranked constraints. The analysis therefore treats adaptation not as unrestricted deletion but as a constrained process that balances conformity to Kiswahili phonology with the preservation of the source word's segmental and lexical identity. The ranking becomes: ****NNF*** *≫ *GEM* ***≫*** *MCC-(PL, FR, NC)* ***≫ NC#*** *≫* ***CMPX≫ *LONG-V*** *≫* AGR-P***≫ MAX≫*** *IDENT-F ≫ IDENT-P ≫ DEP*. The constraints, highlighted in bold, are applied to the Arabic loanword /ʃa.riː.ʕah/ as /ʃa.ri.a/in Tableau (4).

Tableau 4: /ʃa.riː.ʕah/ → /ʃa.ri.a/

Candidates	*NNF	NC#	CMPX	*LONG-V	MAX
a. /ʃa.riː.ʕah/	*!			*!	
b. /ʃa.ri.ʕa/	*!				*
☞ c. /ʃa.ri.a/					*
d. /ʃa.riː.a/				*!	*
e. /ʃa.ri/					***!

The tableau illustrates the competition between deletion and preservation of input structure in the adaptation of Arabic /ʃa.riː.ʕa/ as /ʃa.ri.a/. Candidate (a) preserves the input segments but violates **NNF* because it retains the pharyngeal /ʕ/, as well as **LONG-V* because it retains /iː/. Candidate (b) shortens the long vowel but retains /ʕ/, violating **NNF*. Candidate (d) deletes /ʕ/ but retains the long vowel, violating **LONG-V.* Candidate (e), /ʃa.ri/, deletes the last syllable, which contains three sounds, violating *MAX*. The optimal candidate (c) balances phonological well-formedness and input faithfulness. It removes the non-native pharyngeal consonant while shortening the long vowel, preserving the remaining vowel sequence. Thus, the selected output illustrates selective deletion and vowel shortening rather than complete preservation or excessive deletion of input structure. The tableau balances phonological well-formedness and input faithfulness.

4.2.4 Pharyngeal deletion and associated vowel adaptation in Arabic loanwords

This section examines the adaptation of Arabic guttural consonants in Kiswahili, focusing on the relationship between guttural deletion, the treatment of adjacent vowels, and epenthesis. The data include pharyngeal consonants, such as /ʕ/, as well as the glottal stop /ʔ/. Although these sounds belong to different articulatory categories, their adaptation provides an opportunity to investigate whether consonant deletion is accompanied by changes in the surrounding vowel structure or whether vowels may be retained independently of the deleted consonant. The following data in Table (4) illustrate this adaptation pattern.

Table 4: Guttural deletion in Arabic loanwords in Kiswahili

	Arabic word	Arabic pronunciation	Adapted Kiswahili pronunciation	Kiswahili Spelling	Gloss
1.	*ʕibārah*	/**ʕi**.baːrah/	/**i**.ba.ra/	*ibara*	‘expression, phrase’
2.	*ʕibādah*	/**ʕi**.baː.dah/	/**i**.ba.da/	*ibada*	‘worship’
3.	*ʕaqīdah*	/**ʕa.**qiː.dah/	/**a**.ki.da/	*akida*	‘creed, belief’
4.	*ʕamal*	/**ʕa**.mal/	/**a**.ma.li/	*amali*	‘work, deed’
5.	*ʕazīz*	/**ʕa**.ziːz/	/**a**.zi.zi/	*azizi*	‘dear, beloved’

6.	*ʕumr*	/**ʕu**mr/	/**u**m.ri/	*umri*	‘life, age’

The examples demonstrate that guttural deletion does not produce a uniform pattern of vowel adaptation. In *ibara* and *ibada*, the initial highlighted pharyngeal /ʕ/ is absent from the Kiswahili forms, while the following vowel highlighted /i/ remains. A similar relationship is observed in *akida* and *amali*, where the initial /ʕ/ is absent but the initial highlighted vowel /a/ is retained. The form *imamu* provides a parallel example involving the glottal stop /ʔ/: the initial consonant is absent from the adapted form, whereas the following vowel /i/ is preserved. These examples support the hypothesis that deleting a guttural consonant need not delete its adjacent vowel.

To capture this relationship more explicitly, the present study proposes the constraint ***MAX-V(GUTTURAL) MAX-V(G)***, which requires input vowels adjacent to guttural consonants to have corresponding output vowels. Unlike general *MAX-V(G),* which militates against vowel deletion irrespective of phonological environment, *MAX-V(G)* specifically targets vowel preservation in the input environments under investigation. The constraint preserves input vowels adjacent to guttural consonants. Preservation here refers to retention of the vowel segment, not necessarily preservation of all its features. Thus, a vowel may remain in the output even if its length or quality changes. The proposed constraint captures the observed asymmetry between the deletion of a guttural consonant and the retention of its adjacent vowel.

However, vowel retention should not be interpreted as evidence that the vowel remains unchanged in every environment. In *amini*, for example, the Arabic form /ʔaː.maː.na/ corresponds to /a.mi.ni/ in Kiswahili. Although the initial vowel /a/ is retained after the deletion of /ʔ/, other vowel correspondences involve changes in vowel quality. Similarly, the adaptation of long vowels may involve shortening. These patterns indicate that consonant deletion, vowel preservation, vowel shortening, and vowel-quality modification must be evaluated separately rather than treated as a single process. *MAX-V(G)* accounts only for the retention of the relevant vowel segment; additional faithfulness constraints are needed to evaluate changes in vowel length and quality.

Epenthesis constitutes another independent aspect of the adaptation. In *amali*, the vowel in the adapted forms helps resolve consonant sequences that are not maintained in the same configuration as in the Arabic source forms. The additional vowel structure should therefore be analysed as a repair of the consonant sequence, rather than as a necessary consequence of deleting /ʕ/. The same analytical distinction applies to other loanwords in which consonant loss and vowel insertion occur within the same form: their co-occurrence does not, by itself, establish that one process directly causes the other.

Within Optimality Theory, these patterns can be examined through the interaction of markedness and faithfulness constraints. The high ranking of **NNF* can motivate the avoidance of consonants that are not licensed in the recipient language, while *MAX* penalizes the deletion of input segments. The relative ranking of these constraints can therefore account for the loss of a source consonant when avoiding a non-native feature takes priority over preserving that consonant. Constraints governing syllable structure can independently motivate the restructuring of consonant sequences, whereas *DEP-IO*

penalizes vowel insertion. The ranking of *DEP* relative to the relevant markedness constraints determines whether epenthesis is permitted to repair an illicit structure.
The proposed *MAX-V(G)* constraint adds a more specific dimension to this interaction. The constraint does not itself explain why the guttural is deleted, why a long vowel shortens, or why one vowel quality changes into another. These outcomes must be evaluated through the interaction of *MAX-V(G)* with **NNF, MAX-IO*, the relevant vowel-faithfulness constraints, and the constraints governing syllable structure and epenthesis. The ranking becomes: ****NNF*** ≫ **GEM* ≫ *MCC-(PL, FR, NC* ≫ ***NC#*** ≫ *CMPX* ≫ ****LONG-V*** ≫ ***MAX-V(G)*** ≫ AGR-P ≫ ***MAX*** ≫ ***IDENT-F*** ≫ ***IDENT-P*** ≫ *DEP.* The constraints, highlighted in bold, are applied to the Arabic loanword /ʕa.qː.dah/ → /a.ki.da/ in Tableau (5).

Tableau 5: /ʕa.qː.dah/ → /a.ki.da/

Candidates	*NNF	NC#	*LONG-V	MAX-V(G)	MAX	IDENT-F	IDENT-P
a. /ʕa.qiː.dah/	*!	*	*				
b. /a.qiː.dah/	*!	*	*		*		
c. /a.kiː.da/			*!		**		*
d. /i.ki.da/				*!	***	*	*
☞ e. /a.ki.da/					**	*	*

Candidate (e) is selected as the optimal output because it deletes the non-native pharyngeal /ʕ/, preserves the adjacent vowel /a/, adapts /q/ to /k/, and shortens /iː/. The proposed *MAX-V(G)* is satisfied because the input vowel /a/ adjacent to /ʕ/ is retained in the output. In contrast, candidate (d), /i.ki.da/, fails to preserve this vowel, violating the proposed constraint. Thus, *MAX-V(G)* captures the asymmetry between guttural deletion and adjacent-vowel preservation, while other constraints account for consonant adaptation and vowel shortening.

Overall, the findings show that Kiswahili preserves lexical identity whenever possible but systematically prioritises phonological well-formedness. Within the Unified Loanword Constraint Hierarchy (ULCH) and under Donor-Sensitive Constraint Activation (DSCA), Arabic borrowings are therefore integrated through a combination of deletion, feature neutralisation, and epenthesis, producing outputs that conform to the native phonotactic system while remaining recognisably linked to their source forms. While Arabic loanwords primarily challenge Kiswahili through non-native consonantal features and marked codas, English borrowings present a different set of phonological problems, particularly consonant clusters, stress patterns, and complex syllable structures.

4.3 English loanwords

Unlike Arabic loanwords, which primarily challenge Kiswahili through non-native consonantal features such as pharyngeals, uvulars, emphatics, and geminates, English

loanwords present a different phonological profile. The major difficulties arise from complex consonant clusters, codas, stress patterns, and vowel sequences that conflict with Kiswahili phonotactic requirements. Kiswahili systematically repairs these structures through vowel epenthesis and syllable restructuring rather than eliminating non-native consonantal features.

Previous studies provide useful insights but remain limited in scope. Many rely on small datasets or focus narrowly on single phenomena such as coda repair, without integrating these processes into a comprehensive constraint hierarchy. A recurring weakness is the tendency to overemphasise deletion as the default repair strategy, despite clear evidence that Kiswahili overwhelmingly prefers epenthesis to preserve input *club* → *klabu*). Furthermore, most accounts neglect the comparative dimension and treat English loanwords in isolation, without considering how adaptation patterns relate to those found in Arabic loanwords. Finally, several studies remain descriptive rather than theoretical, offering lists of repairs without embedding them in an explicit Optimality-Theoretic framework supported by tableaux and constraint interaction.

The analysis develops a Unified Loanword Constraint Hierarchy (ULCH) that integrates structural, segmental, and prosodic constraints into a single explanatory framework, revealing how multiple repair strategies interact within one system. By demonstrating that vowel epenthesis consistently outranks deletion as a repair mechanism, the analysis provides further evidence for Kiswahili's strong preference for open CV syllable structure. The English loanword analysis continues the constraint hierarchy established in the Arabic section. The constraints identified through Arabic loanword adaptation serve as the initial ranking for the English analysis. The English tableaux then examine whether this hierarchy adequately accounts for English loanwords or whether additional constraints are required. This stepwise analysis allows the Unified Loanword Constraint Hierarchy (ULCH) to be developed progressively, with each donor language contributing evidence for refining the hierarchy while maintaining a single recipient-language grammar.

4.3.1 Non-native feature adaptation in English loanwords

English loanwords in Kiswahili may contain consonants, vowel contrasts, and syllable structures that are absent from or restricted in the recipient language. Their adaptation may involve consonant substitution, vowel-quality adjustment, vowel-length reduction, and vowel epenthesis. These processes reflect the interaction between the phonological properties of the English source forms and the segmental and syllabic patterns of Kiswahili. The following data in Table (5) illustrate how non-native features are adapted in borrowed words.

Table 5: Non-native feature adaptation of English loanwords in Kiswahili

	English word	English pronunciation	Adapted Kiswahili pronunciation	Kiswahili Spelling	Gloss
1.	*shirt*	/ʃɜːt/	/ʃa.ti/	*shati*	'shirt'
2.	*television*	/ˈtɛ.ləˌvɪʒ.ən/	/te.le.vi.ʃe.ni/	*televisheni*	'television'
3.	*jacket*	/ˈʤæk.ɪt/	/ʤa.ke.ti/	*jaketi*	'jacket'

4.	*coffee*	/ˈkɒfi/	/ko.fi/	*kofi*	‘coffee’
5.	*hammer*	/ˈhæmə/	/ha.ma/	*hama*	‘hammer’
6.	*tennis*	/ˈtɛnɪs/	/te.ni.si/	*tenisi*	‘tennis’
7.	*garage*	/ˈgær.ɑːʒ/	/ge.re.dʒi/	*gereji*	‘garage’

The data illustrate two major areas of adaptation: consonantal features and vowel contrasts. At the consonantal level, /ˈgær.ɑːʒ/ → /ge.re.dʒi/ illustrates the replacement of the voiced postalveolar fricative /ʒ/ with the voiced postalveolar affricate /dʒ/. Although the two segments share a broad place of articulation, they differ in manner: /ʒ/ is a fricative, whereas /dʒ/ is an affricate. This substitution can therefore be analysed as a feature change rather than a change in primary place of articulation. Similarly, /ˈtɛ.ləˌvɪʒ.ən/ → /te.le.vi.ʃe.ni/ shows the adaptation of /ʒ/ to /ʃ/. This change involves a difference in voicing, while both segments are fricatives. The two examples suggest that the adaptation of /ʒ/ is not uniform across lexical items.

The adaptation of English postalveolar consonants in the data shows that English /ʃ/ is generally retained as /ʃ/ in Kiswahili, as illustrated by /ˈsteɪ.ʃən/ → *stesheni* /ste.ʃe.ni/ and *shirt* /ʃɜːt/ → *shati* /ʃa.ti/. The data also show that English /ʒ/ may be adapted as /ʃ/, as in /ˈtɛ.ləˌvɪʒ.ən/ → *televisheni* /te.le.vi.ʃe.ni/, or as /dʒ/, as in /ˈgær.ɑːʒ/ → /ge.re.dʒi/. These examples indicate that /ʒ/ does not have a uniform adaptation outcome in the dataset. Although /ʒ/ becomes /ʃ/ in *television*, where it precedes /ən/, the retention of /ʃ/ in *shirt* shows that the presence of /ən/ is not a necessary condition for /ʃ/ to occur in the Kiswahili output. The contrast between *television* and *garage* may suggest an effect of phonological position or surrounding segments.

Vowel adaptation is also prominent in the dataset. Standard Kiswahili is generally described as having a five-vowel system, /i, e, a, o, u/, whereas English distinguishes additional vowel qualities, including /æ/, /ʌ/, /ɜː/, /ɒ/, /ɪ/, and /ə/. These English contrasts do not map directly onto the five-vowel Kiswahili system and may consequently be replaced by vowel categories available in the recipient language. In *garage* → *gereji*, the source vowels /æ/ and /ɑː/ correspond to /e/ in /ge.re.dʒi/. In *hammer*, /æ/ is adapted as /a/ in /ha.ma/, while /ɜː/ in *shirt* is represented by /a/ in /ʃa.ti/. In *coffee*, /ɒ/ corresponds to /o/ in /ko.fi/. In *jacket*, the source vowels /æ/ and /ɪ/ correspond to /a/ and /e/ in /dʒa.ke.ti/. These examples illustrate vowel substitution and neutralisation of source-language contrasts, rather than a single automatic mapping between English and Kiswahili vowels.

Vowel epenthesis provides a further means of accommodating source forms to Kiswahili phonotactics. In *shirt* → *shati* and *jacket* → *jaketi*, a vowel occurs after a consonant that would otherwise be word-final in the English source form. The adapted forms therefore avoid retaining the source word-final consonant in the same position. The final /i/ in /ˈgær.ɑːʒ/ → /ge.re.dʒi/ similarly follows the adapted consonant /dʒ/, producing the open final syllable /dʒi/. These examples are consistent with a preference for open syllables in Kiswahili, although this preference should not be interpreted as evidence that all medial codas are prohibited.

The patterns can be analysed within the Unified Loanword Constraint Hierarchy (ULCH), which distinguishes markedness constraints governing output well-formedness from faithfulness constraints regulating the preservation of source-language segments and features. The constraint **NNF* penalises segments or feature specifications that are absent from or restricted in the Kiswahili variety represented by the data. Its application must therefore be defined with reference to that variety; it should not imply that every sound occurring in English but not in the core Kiswahili inventory is categorically excluded from all Kiswahili varieties. In *garage*, **NNF* motivates the replacement of /ʒ/ with /dʒ/, while *IDENT-F* evaluates the resulting feature difference. *IDENT-P* can remain satisfied if it is defined specifically in terms of consonantal place of articulation. The vowel substitutions, reduction of vowel length, and insertion of final /i/ require separate evaluation through the relevant faithfulness and markedness constraints. The ranking becomes*: ***NNF*** ≫ **GEM* ≫ *MCC-(PL, FR, NC)* ≫ ***NC#*** ≫ *CMPX* ≫ ****LONG-V*** ≫ *MAX-V(G)* ≫ AGR-P ≫ ***MAX*** ≫ ***IDENT-F*** ≫ ***IDENT-P*** ≫ ***DEP***. The constraints, highlighted in bold, apply to the English loanword /gær.ɑːʒ/ as /ga.ra.dʒi/ in Tableau (6).

Tableau 6: (/gær.ɑːʒ/→/ge.re.dʒi/)

candidates	*NNF	NC#	CMPX	*LONG-V	MAX	IDENT-F	IDENT-P	DEP
a. /gær.ɑːʒ/	*!	*!		*!				
b. /ge.reː.dʒi/				*!		***		*
☞ c. /ge.re.dʒi/						***		*
d. /ge.re.ʒi/	*!					**		*
e. /gredʒ/		*!	*		*	**		*

Candidate (a), /gær.ɑːʒ/, preserves the input but violates **NNF* if /ʒ/ is classified as a non-native or prohibited segment in the Kiswahili variety under analysis. It also violates *NC#* because the word ends in a consonant and *LONG-V because it contains /ɑː/. Candidate (b), /ge.reː.dʒi/, avoids the word-final coda but violates **LONG-V* because it retains a long vowel in the output. Candidate (d), /ge.re.ʒi/, incurs a fatal violation of **NNF* under the same assumption that /ʒ/ is prohibited, although its vowel adaptation and final /i/ insertion resemble those of the optimal candidate. Candidate (e), /gredʒ/, violates *NC#* because it ends in a consonant, violates *CMPX* because it starts with a cluster and violates both *IDENT-F* and *DEP*. Candidate (c), /ge.re.dʒi/, is selected as optimal because it avoids the higher-ranked violations of **NNF, NC#,* and **LONG-V*. Although it incurs *IDENT-F* violations through vowel-quality changes and the adaptation of /ʒ/ to /dʒ/, as well as a *DEP* violation through final /i/ insertion, these lower-ranked violations are tolerated to satisfy the higher-ranked markedness constraints. The tableau illustrates the central claim of the ULCH: loanword adaptation need not preserve every source-language segment or feature when doing so conflicts with higher-ranked requirements on

the output. In *garage → gereji*, consonant substitution, vowel adaptation, and final-vowel insertion jointly produce the attested Kiswahili form. The analysis therefore treats adaptation as the outcome of interactions among markedness, segmental faithfulness, and syllable-structure requirements rather than as the effect of a single constraint.

4.3.2 Syllable structure repair in English loanwords

English loanwords in Kiswahili frequently contain syllable structures that violate native phonotactic constraints, particularly consonant clusters and closed syllables. Since Kiswahili strongly prefers open syllables, these illicit structures are repaired through epenthesis and resyllabification. However, Kiswahili does not eliminate all consonant clusters or medial codas; rather, the adaptation patterns indicate that the acceptability of a consonant sequence depends partly on its syllabic position and the conditions governing coda licensing. Table (6) illustrates these patterns.

Table 6: Syllable structure repair of English loanwords in Kiswahili

	English word	English pronunciation	Adapted Kiswahili pronunciation	Kiswahili Spelling	Gloss
1.	*book*	/bʊk/	/bu.ku/	*buku*	‘book’
2.	*bus*	/bʌs/	/ba.si/	*basi*	‘bus’
3.	*club*	/klʌb/	/kla.bu/	*klabu*	‘club’
4.	*ticket*	/ˈtɪkɪt/	/ti.ki.ti/	*tikiti*	‘ticket’
5.	*jeans*	/dʒiːnz/	/dʒin.zi/	*jinsi*	‘jeans’
6.	*biscuit*	/ˈbɪs.kɪt/	/bis.ku.ti/	*biskuti*	‘biscuit’
7.	*lift*	/lɪft/	/lif.ti/	*lifti*	‘lift’
8.	*bank*	/bæŋk/	/beŋ.ki/	*benki*	‘bank’

The forms in Table 6 demonstrate that different loanwords undergo different types of repair. In /bʊk/ → /bu.ku/, a final vowel is inserted after /k/, eliminating the word-final coda. Similarly, /bʌs/→/ba.si/ and /ˈtɪ.kɪt/→/ti.ki.ti/ illustrate the insertion of vowels to avoid word-final consonants. In contrast, /klʌb/→/kla.bu/ retains the complex onset /kl/ while repairing the final coda through vowel insertion. The forms /dʒin.zi/, /bis.ku.ti/, and /lif.ti/ also retain medial codas before the onset of the following syllable. These examples show that the relevant generalisation is not the complete elimination of consonant clusters or codas, but the licensing of particular consonant sequences in specific syllabic positions.

Other forms retain consonants in medial coda position. In /dʒiːnz/ → /dʒin.zi/, the input sequence /nz/ is realised across a syllable boundary: /n/ occupies the coda of the first syllable, while /z/ begins the second syllable. In /lif.ti/, the source consonants /l/, /f/, and /t/ are preserved, and the final vowel /i/ accommodates the word to Kiswahili phonological patterns. Importantly, the medial sequence /lif.t/ in /lif.ti/ remains intact across the syllable boundary: /f/ functions as the coda of the first syllable, and /t/ as the onset of the second. Thus, the presence of a medial coda in the adapted form shows that Kiswahili loanword adaptation does not necessarily eliminate every coda or repair every

consonant sequence by deleting segments. In /beŋ.ki/, the nasal /ŋ/ is retained as a medial coda before /k/. These examples indicate that the relevant generalisation is not the categorical elimination of codas, but the licensing of particular consonants and sequences in specific syllabic positions. The adaptation of /dʒiːnz/ is particularly relevant to the interaction between syllable structure and input–output faithfulness. The input contains adjacent consonants /n/ and /z/, whereas the adapted form places an inserted vowel /i/ between them. ***CONTIGUITY-IO(CONTIG*)** can capture this disruption of input adjacency: although the consonants remain in their original order, they are no longer adjacent in the output.

Taken together, the data support an analysis in which syllable-structure markedness interacts with input–output faithfulness. Word-final consonants are frequently repaired through vowel epenthesis, while certain medial codas are retained. The proposed MCC constraint accounts for the language-specific conditions governing medial coda licensing, while *CONTIG* can capture the loss of adjacency associated with epenthesis. The resulting analysis avoids treating Kiswahili phonotactics as requiring every syllable to have a simple CV structure. The relevant ranking is therefore*: *NNF≫ *GEM≫* ***MCC-(****PL, FR,* ***NC)*** *≫* ***NC#*** *≫* ***CMPX≫ *LONG-V≫*** *MAX-V(G)≫* ***CONTIG≫*** AGR-P***≫ MAX ≫ IDENT-F ≫*** *IDENT-P* ***≫ DEP***. The constraints, highlighted in bold, apply to the English loanword /dʒiːnz/ as /dʒin.zi/ in Tableau (7).

Tableau 7: /dʒiːnz/→/dʒin.zi/

Candidates	*MCC-(NC)*	NC#	*CMPX*	**LONG-V*	CONTIG	*MAX*	IDENT-F	DEP
a. /dʒiːnz/		*!		*!				
b. /dʒiː.ni.zi/				*!	*			**
☞ c. /dʒin.zi/							*	*
d. /dʒi.nzi/			*				*	*
e. /dʒiz.ni/	*	*!			**		*	*

The optimal candidate /dʒin.zi/ preserves the consonants /dʒ/, /n/, and /z/ in their original order. It shortens /iː/ to /i/ and inserts a final /i/, yielding the two syllables /dʒin.zi/. The /n/ is retained as a medial coda, while /z/ becomes the onset of the following syllable. Crucially, *CONT* is not violated by the winning candidate: the input-adjacent consonants /n/ and /z/ remain adjacent in the output. The inserted vowel occurs after /z/, not between /n/ and /z/. Candidate (b) and candidate (e) violate *CONT* because consonants do not remain adjacent in the output. The ranking favours candidate (c) because it avoids the higher-ranked violations associated with a long vowel and a word-final coda, while preserving all input consonants. Its vowel shortening incurs an *IDENT-F* violation, and its inserted final vowel incurs a DEP violation, both of which are tolerated under the proposed ranking.

4.3.3 Deletion vs preservation of structure in English loanwords

English loanwords in Kiswahili exhibit systematic variation between deletion and preservation strategies when resolving phonotactic violations. Complex consonant sequences and marked syllable structures are either reduced through segment deletion or preserved through restructuring. Consider the data in Table (7).

Table 7: Deletion vs preservation of structure of English loanwords in Kiswahili

	English word	English pronunciation	Adapted Kiswahili pronunciation	Kiswahili spelling	Gloss
1.	*school*	/skuːl/	/ʃu.le/	*Shule*	'school'
2.	*shirt*	/ʃɜːt/	/ʃa.ti/	*shati*	'shirt'
3.	*wire*	/waɪə(r)/	/wa.ja/	*waya*	'wire'
4.	*screw*	/skruː/	/su.ku.ru.bu/	*sukurubu*	'screw'
5.	*pencil*	/ˈpen.səl/	/pen.se.li/	*penseli*	'pencil'

The data demonstrate two competing repair strategies in English loanword adaptation: deletion and preservation through restructuring. In /skuːl/→/ʃu.le/, the source consonant sequence /sk/ is not preserved in its original form. The source /k/ has no direct correspondent in the output, while /s/ is realised as /ʃ/. The source vowel /uː/ is adapted as /u/, and the final lateral /l/ is retained as the onset of the second syllable rather than as a word-final coda. The insertion incurs a violation of *DEP*, which penalises the insertion of an output segment, and may disrupt input–output adjacency, making *CONTIG* relevant. However, preserving the relative order of the consonants does not itself violate ***LINEARITY-IO(LIN)***, which penalises changes in the relative ordering of corresponding input segments. The form thus illustrates how consonantal material can be retained while its syllabic organisation is substantially altered. The output therefore involves both segmental modification and syllabic restructuring. The absence of /k/ can be analysed as a violation of *MAX*, which penalises the deletion of input segments, whereas the change from /s/ to /ʃ/ incurs a violation of *IDENT-F,* which penalises changes in the features of corresponding segments. The adaptation cannot be explained by vowel epenthesis alone because the source consonants undergo additional changes. Similarly, /ʃɜːt/→/ʃa.ti/ and /waɪə(r)/→/wa.ja/ illustrate adaptations in which a source segment may lack a correspondent in the output. In /ʃa.ti/, the English /r/ is absent, while the vowel is adapted and the final /t/ is followed by an inserted vowel, producing two open syllables. In /wa.ja/, the source /r/ is absent if the relevant input pronunciation contains a consonantal /r/. These examples therefore provide potential evidence for *MAX* violations, although the analysis must be based on the specific English pronunciations used as inputs.

Taken together, these examples demonstrate that deletion, substitution, epenthesis, and resyllabification are distinct, although potentially interacting, strategies in English loanword adaptation. These interactions therefore suggest that Kiswahili does not apply a single, uniform repair strategy to English loanwords. Rather, the outputs reflect interactions between structural well-formedness and input faithfulness, involving the following constraints: **NNF*≫ **GEM* ≫ ***MCC*** ≫ ***NC#*** ≫ ***CMPX*** ≫ ***LONG-V*** ≫ *MAX-V(G)* ≫

***CONT* ≫ *LIN* ≫ *AGR-P*≫ *MAX* ≫ *IDENT-F* ≫ *IDENT-P* ≫ *DEP*.** The constraints, highlighted in bold, apply to the English loanword /skuːl/ as /ʃu.le/ in Tableau (8):

Tableau 8: /skuːl/ → /ʃu.le/

Candidates	MCC(PL)	NC#	CMPX	*LONG-V	CONT	LIN	MAX	IDENT-F	IDENT-P	DEP
a. /skuːl/		*!	*!	*!						
b. /suk.le/	*				*					**
☞ c. /ʃu.le/							*		*	*
d. /ʃu.ku.le/					*				*	**
e. /su.lek/					*!	*!				*

The adaptation of English school /skuːl/ to Kiswahili shule /ʃu.le/ illustrates the interaction between markedness and faithfulness constraints in the proposed ULCH. Candidate (a), /skuːl/, violates **NC#* because it retains a word-final consonant, as well as **CMPX* and **LONG-V* because it contains the complex onset /sk/ and the long vowel /uː/. The high ranking of **NC#* rules out this candidate. Candidate (b), /suk.le/, violates **MCC(PL)* because /k/ occurs in a medial coda, while the inserted vowel disrupts the adjacency of the input correspondents /s/ and /k/, resulting in a violation of *CONT* under the adopted definition. Candidate (e), /su.lek/, also violates **NC#* because it ends in /k/ and violates *LIN* because the relative order of the input consonants /k/ and /l/ is reversed. The attested candidate (c), /ʃu.le/, avoids these marked structures by deleting /k/, changing /s/ to /ʃ/, and adding final /e/. It therefore violates *MAX*, *IDENT-P,* and *DEP*, respectively. Candidate (d), /ʃu.ku.le/, preserves /k/ but inserts a vowel between the output correspondents of the adjacent input segments /s/ and /k/, incurring a *CONT* violation; it also incurs two *DEP* violations for the inserted vowels.

Earlier studies (e.g. Batais 2019: 86) describe cluster simplification as phonological reduction, often implying deletion as the primary strategy. For example, *school → shule* is interpreted as simplification without distinguishing whether deletion or restructuring is responsible. However, these accounts do not explain why deletion is not consistently applied where full segmental preservation is maintained through epenthesis and syllable restructuring. The present analysis addresses this limitation by showing that *CONT* outranks *MAX*, leading to preference for structural preservation over segment deletion. This explains why Kiswahili often retains input segments while restructuring syllables instead of deleting material. This finding reflects DSCA within the ULCH: in English loans, structural constraints such as *CMPX*, *NC#*, and *MCC* are activated, ensuring syllable well-formedness while allowing preservation through restructuring.

4.3.4 Sonority sequencing, vowel epenthesis and consonant-cluster adaptation in English loanwords

English loanwords in Kiswahili illustrate how the language adapts donor-language forms while maintaining its own phonological requirements. In particular, consonant clusters may be retained when their internal ordering is compatible with Kiswahili phonotactics, while vowel adaptation and epenthesis accommodate differences in syllable structure. ***The Sonority Sequencing Principle (SSP***) is relevant to this process because it regulates the relative sonority of consonants within complex syllable margins. Rather than requiring the elimination of every consonant cluster, *SSP* favours outputs in which the consonants follow the appropriate sonority pattern. Consider the data in Table (8).

Table 8: Sonority sequencing and cluster adaptation of English loanwords in Kiswahili

	English word	English pronunciation	Adapted Kiswahili pronunciation	Kiswahili spelling	Gloss
1.	*train*	/treɪn/	/tre.ni/	*treni*	‘train’
2.	*brake*	/breɪk/	/bre.ki/	*breki*	‘brake’
3.	*clinic*	/ˈklɪn.ɪk/	/kli.ni.ki/	*kliniki*	‘clinic’
4.	*screen*	/skriːn/	/skri.ni/	*skrini*	‘screen’
5.	*speaker*	/ˈspiː.kə/	/spi.ka/	*spika*	‘speaker’
6.	*printer*	/ˈprɪn.tə/	/prin.ta/	*printa*	‘printer’

The data illustrate how English consonant clusters are maintained in Kiswahili loanword adaptation when their ordering is compatible with the *Sonority Sequencing Principle (SSP)*. The constraint *SSP* regulates sonority sequencing within complex syllable margins, requiring sonority to rise towards the nucleus in onset clusters and to fall away from the nucleus in coda clusters. Unlike *COMP*, which penalises complex syllable margins, *SSP* evaluates the internal sonority relations between consonants within those margins. Consequently, a cluster may be retained when its sonority profile satisfies the principle, even if other aspects of the donor form undergo adaptation. In the Unified Loanword Constraint Hierarchy (ULCH), the *SSP* expresses a phonotactic requirement that can be applied consistently to loanwords from different donor languages. Its inclusion therefore allows the analysis to distinguish between adaptations motivated by sonority sequencing and those arising from other constraints, including restrictions on complex syllable margins, coda structure, non-native features, and segmental faithfulness. The constraint does not necessarily trigger a change in every loanword; its role is to evaluate whether the resulting form conforms to the relevant sonority requirements.

The examples /treɪn/ → /tre.ni/, /breɪk/ → /bre.ki/, and /glɑːs/ → /gla.si/ demonstrate the preservation of rising-sonority onset clusters /tr/, /br/, and /gl/, respectively. In these clusters, the first consonant is a stop, while the second is a rhotic or lateral, resulting in an increase in sonority towards the vowel nucleus. The same pattern occurs in /ˈklɪn.ɪk/ → /kli.ni.ki/ and /ˈprɪn.tə/ → /prin.ta/, where the onset clusters /kl/ and /pr/ retain their expected sonority ordering. The adaptation /skriːn/ → /skri.ni/ further illustrates the preservation of a complex onset. Although /skr/ contains

the initial sibilant /s/, a cluster type that requires special consideration in sonority-based analyses, the sequence /kr/ exhibits rising sonority from the stop /k/ to the rhotic /r/. Similarly, /ˈspiː.kə/ → /spi.ka/ retains the /sp/ sequence. Because /s/+stop clusters do not follow the simple rising-sonority pattern assumed for ordinary onset clusters, this example should be distinguished from the more straightforward cases represented by /tr/, /br/, /gl/, /kl/, and /pr/. The examples indicate that Kiswahili loanword adaptation does not necessarily require deletion or reordering of consonants in complex onsets. Instead, clusters may be preserved while other aspects of the donor word, including vowel quality and syllable structure, are adapted to the phonological patterns of Kiswahili. Within the Unified Loanword Constraint Hierarchy (ULCH), the *SSP* evaluates the sonority relationships within consonant clusters, while other constraints account for additional adaptations. The data therefore illustrate the relevance of the *SSP* to the analysis of English loans and support its inclusion in a unified constraint system intended to account for loanword adaptation across different donor languages. The relevant ranking is therefore: **NNF*≫ **GEM*≫ ***MCC-(****PL, FR,* ***NC)*** ≫ ***NC#*** ≫ ***CMPX*≫ **LONG-V*≫** *MAX-V(G)*≫ ***CONTIG*≫ *LIN*≫** AGR-P≫ ***SSP*≫ *MAX*** ≫ ***IDENT-F*** ≫ *IDENT-P* ≫ ***DEP***. The highlighted constraints apply to Tableau (9).

Tableau 9: /treɪn/ → /tre.ni/

Candidates	MCC(NC)	NC#	CMPX	*LONG-V	CONT	LIN	SSP	MAX	IDENT-F	DEP
a. ☞ /tre.ni/								*	*	**
b. /ter.ni/	*!				*			*		**
c. /treɪn/		*!	*	*					*	
d. /te.re.ni/					*!	*		*	*	***
e. /te.rni/			*		*	*	*	*	*	**

Candidate (a), /tre.ni/, is the optimal output, corresponding to Kiswahili /tre.ni. It preserves the initial cluster /tr/, whose sonority rises from the stop /t/ to the rhotic /r/, satisfying SSP. The output adapts the English vowel sequence and final consonant structure to the Kiswahili form through vowel insertion, while preserving the input consonants. Candidate (b), /te.ni/, deletes /r/ from the input cluster, violating *MAX*. Candidate (c), /treɪn/, retains the English form, including its final coda /n/ and long vowel or diphthong representation, violating *NC#, CMPX*, and *LONG-V* as defined in your hierarchy. Candidate (d), /te.re.ni/, removes /r/ from the original onset cluster and resyllabifies it, incurring violations of *CONT* and *LIN* because the input sequence and its structural relations are not preserved. Candidate (e), /te.rni/, produces a medial consonant sequence that violates the relevant coda and sonority restrictions. The selection of /tre.ni/ illustrates how the ranking favours an output that preserves the consonants and the acceptable sonority

profile of the onset while adapting the vowel and syllable structure. *SSP* evaluates sonority sequencing, *CMPX* evaluates complex margins, and *MAX, IDENT-F, IDENT-P,* and *DEP* regulate input–output faithfulness.

4.3.5 Stress and prosodic adaptation in English loanwords

English loanwords in Kiswahili undergo prosodic adaptation, particularly through the replacement of English stress patterns with the predictable penultimate-syllable stress characteristic of Kiswahili. Rather than eliminating stress, Kiswahili reorganises stress according to its own prosodic system. The constraint, ***ALIGN-STRESS/TROCHEE (ALIGN-S/T)*** evaluates whether stress placement conforms to the expected Kiswahili prosodic pattern, whereby stress falls on the penultimate syllable. In the analysis below, this constraint evaluates the stress placement of each candidate against the target-language pattern. This adaptation can be analysed through the interaction of ***ALIGN-S/T*** and stress-faithfulness constraints, alongside constraints governing syllable structure and segmental adaptation. Prosodic constraints dominate, ensuring that stress is not preserved in any lexical adaptation. Consider the data in Table (9).

Table 9: Stress and prosodic adaptation of English loanwords in Kiswahili

	English word	English pronunciation	Adapted Kiswahili pronunciation	Kiswahili spelling	Gloss
1.	*television*	/ˈtɛlɪˌvɪʒən/	/te.le.vi.ˈʃe.ni/	*televisheni*	‘television’
2.	*station*	/ˈsteɪ.ʃən/	/ste.ˈʃe.ni/	*stesheni*	‘station’
3.	*professor*	/prəˈfɛs.ər/	/pro.ˈfe.sa/	*profesa*	‘professor’
4.	*seminar*	/ˈsɛm.ɪ.nɑːr/	/se.mi.ˈna.ri/	*seminari*	‘seminar’

The data illustrate the adaptation of English loanwords to Kiswahili’s predictable stress pattern. In /ˈtɛlɪˌvɪʒən/→ /te.le.vi.ˈʃe.ni/, the adapted form has penultimate stress, unlike the initial primary stress of the English source. Similarly, /ˈsteɪ.ʃən/→ /ste.ˈʃe.ni/ places stress on the penultimate syllable, while /prəˈfɛs.ər/→ /pro.ˈfe.sa/and /ˈsɛm.ɪ.nɑːr/→ /se.mi.ˈna.ri/ also exhibit penultimate stress. These examples show that English stress placement is not necessarily preserved during borrowing; instead, stress is reassigned in accordance with Kiswahili prosody. The pattern supports an analysis in which prosodic well-formedness takes precedence over faithfulness to the source language’s stress placement. The relevant ranking is*: ***NNF*** *≫* ***ALIGN-S/T*** *≫ *GEM* ***≫ MCC-(****PL, FR,* ***NC)*** *≫* ***NC#*** *≫ CMPX* ***≫*** **LONG-V≫ MAX-V(G)* ***≫*** *CONTIG≫ LIN* ***≫****SSP* ***≫***AGR-P ***≫*** *MAX* ***≫ IDENT-F*** *≫* ***IDENT-P*** *≫* ***DEP****.* The highlighted constraints apply to Tableau (10).

Tableau 10: /ˈtɛlɪˌvɪʒən/ → /te.le.vi.ˈʃe.ni/

Candidates	*NNF	ALIGN-S/T	MCC-(NC)	NC#	IDENT-F	IDENT-P	DEP
a. /ˈte.le.vi.ʃe.ni/		*!			*		*
b. ☞ /te.le.vi.ˈʃe.ni/					*		*
c. /ˈtɛlɪ.vɪ.ʒən/	*!	*		*			
d. /te.ˈle.vɪʒ.ni/	*!	*	*		*	*	*
e. /te.le.ˈvi.ʃe.ni/		*!			*		*

The optimal candidate, /te.le.vi.ˈʃe.ni/, is selected because it satisfies *ALIGN-S/T* by placing stress on the penultimate syllable, consistent with the expected Kiswahili stress pattern. Candidates (a) and (e) have the same segmental structure as the optimal output but place stress on the first and third syllables, respectively, and therefore violate *ALIGN-S/T*. Candidate (d), violates **NNF* by retaining /ʒ/, *ALIGN-S/T* through non-penultimate stress, and relevant syllable-structure constraints because of the medial consonant sequence /ʒn/. The English candidate (c), /ˈtɛ.lɪ.vɪ.ʒən/, retains the source-language stress pattern and ends in the consonant /n/, violating *ALIGN-S/T* and *NC#*. It also retains /ʒ/, which is treated as a non-native segment under **NNF.* The adapted candidates incur *DEP* and *IDENT-F* violations because the adaptation changes segmental features, including the substitution of /ʒ/ with /ʃ/ and changes in vowel quality. Candidate (b) consequently emerges as optimal because it satisfies the higher-ranked stress constraint while preserving the adapted segmental structure.

Compared with earlier accounts of stress adaptation in Kiswahili loanwords, which often treated stress modification as a syllable restructuring, the present analysis highlights the role of prosodic constraints in shaping loanword adaptation. In English loans, constraints such as *ALIGN-S/T* interact with syllable-structure constraints to enforce the expected Kiswahili stress pattern. Stress adaptation is therefore not merely incidental but reflects the interaction and relative ranking of prosodic and faithfulness constraints within Optimality Theory. This pattern illustrates the Donor-Sensitive Constraint Activation (DSCA) component of the ULCH: **structural and prosodic constraints are particularly relevant to the adaptation of English loans, whereas feature-based constraints play a more prominent role in Arabic loans**. Nevertheless, both patterns are accounted for within the same constraint hierarchy, suggesting that Kiswahili employs a unified phonological system whose constraint interactions respond to the distinct phonological properties of different donor languages.

4.4 In summary: A comparative analysis of Arabic and English loanword adaptation

The distinction between Feature-Driven Adaptation and Structure-Driven Adaptation characterises the predominant patterns of phonological repair observed in Arabic and English loanwords in Kiswahili. It does not imply that feature-based processes occur exclusively in Arabic loans or that structural processes are restricted to English loans. Rather, the distinction identifies the principal phonological pressures motivating adaptation in each donor-language group. Arabic loanwords predominantly activate constraints targeting marked segmental features, whereas English loanwords more frequently activate constraints targeting syllable structure and prosodic organisation. Nevertheless, both groups may exhibit multiple types of repair because the optimal output must satisfy the interacting constraints of the same Kiswahili phonological grammar.

In Arabic loanwords, feature-driven adaptation is particularly evident when consonants contain phonological properties that are absent from or restricted in Kiswahili. Constraints such as **NNF* and *AGR-P* can motivate the neutralisation or substitution of marked consonantal features. However, the adaptation of Arabic loans is not limited to segmental modification. Arabic inputs may also undergo syllable restructuring, vowel epenthesis, or the repair of illicit coda configurations. For example, Arabic /daf.tar/ is adapted as /daf.ta.ri/. This form retains the medial coda /f/ while adding a final vowel to accommodate the source form within Kiswahili phonological patterns. Similarly, /muʕallim/ → /mwalimu/ involves changes to the segmental and syllabic organisation of the source word. These examples demonstrate that Arabic loanword adaptation can involve structural repair alongside feature-based modification. The classification as feature-driven therefore reflects the prominence of segmental-feature constraints in the Arabic analysis, rather than the absence of syllable-structure processes.

English loanwords predominantly illustrate structure-driven adaptation because English permits consonant clusters, closed syllables, and stress patterns that may conflict with Kiswahili phonotactic and prosodic preferences. Constraints such as *CMPX*, *MCC*, *SSP*, *NC#*, and *ALIGN-S/T* are consequently important in accounting for processes such as epenthesis, cluster simplification, resyllabification, and stress reassignment. For example, English *school* /skuːl/ is adapted as Kiswahili *shule* /ʃu.le/, involving both the modification of source segments and the restructuring of the syllable pattern. Likewise, *station* /ˈsteɪʃən/ is adapted as *stesheni* /ste.ˈʃe.ni/, involving vowel adaptation, the addition of a final vowel, and adjustment to the expected Kiswahili stress pattern. These examples show that English adaptation is not exclusively structural: segmental substitutions and vowel-quality changes also occur. Its classification as structure-driven instead reflects the prominence of constraints addressing syllable structure and prosodic well-formedness in the relevant analyses.

This comparison supports the principle of Donor-Sensitive Constraint Activation (DSCA) within the Unified Loanword Constraint Hierarchy (ULCH). The same constraint system evaluates inputs from both donor languages, but the phonological properties of each input determine which constraints are most consequential in selecting the optimal candidate. In Arabic loans, constraints targeting marked consonantal features may be decisive, while

in English loans, constraints governing clusters, codas, syllable structure, and stress may be more prominent. This difference in constraint activation does not require separate grammars or imply that constraints relevant to one donor language are inactive in the other. Instead, DSCA captures differences in the relative importance of constraints across the two input types within a unified Optimality-Theoretic framework. The distinction between Feature-Driven Adaptation and Structure-Driven Adaptation represents a difference in the predominant patterns of phonological repair rather than an absolute division between the two donor-language groups. Arabic loanwords predominantly exhibit feature-based repair, particularly the neutralisation or substitution of marked consonantal features, although they may also undergo syllable restructuring and vowel epenthesis, as illustrated by /daftar/ → /daf.ta.ri/. English loanwords, by contrast, predominantly exhibit structural and prosodic repair, including epenthesis, cluster simplification, and stress reassignment, although segmental substitution and deletion may also occur, as illustrated by /skuːl/ → /ʃu.le/. These overlapping processes demonstrate that feature-driven and structure-driven adaptation are complementary analytical tendencies rather than mutually exclusive categories. Under Donor-Sensitive Constraint Activation (DSCA), both donor-language groups are evaluated by the same Unified Loanword Constraint Hierarchy (ULCH), but the phonological properties of each input determine which constraints are most consequential in selecting the optimal output.

Figure (1) illustrates how the ULCH accounts for both donor-language groups within a unified Optimality-Theoretic framework. Arabic loanwords predominantly exhibit feature-driven adaptation, whereas English loanwords predominantly exhibit structure-driven and prosodic adaptation. These tendencies are not exclusive: either group may undergo both segmental and structural repair. DSCA captures these differences by explaining the varying prominence of constraints according to the input's phonological properties.

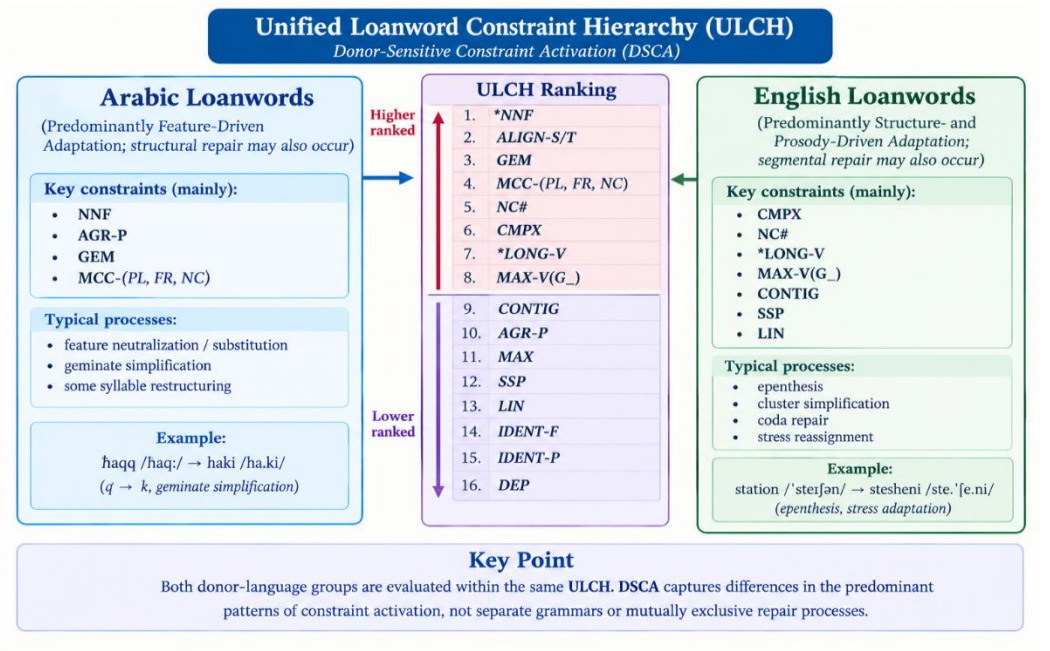


Figure 1. Unified Loanword Constraint Hierarchy (ULCH) illustrating Donor-Sensitive Constraint Activation (DSCA) in Kiswahili loanword adaptation.

As shown in Figure 1, the ULCH accounts for Arabic and English loanword adaptation within a single ranked system. DSCA explains why Arabic loans predominantly undergo feature-based repair, while English loans more frequently involve syllable-structural and prosodic adjustments. These patterns motivate the Feature-Driven versus Structure-Driven Adaptation framework while allowing for overlap between segmental and structural processes within a single phonological grammar.

5. CONCLUSION

This study investigated the phonological adaptation of Arabic and English loanwords in Kiswahili within the framework of Optimality Theory. The analysis shows that the two datasets can be accounted for within a common constraint-based grammatical system, represented in this study as the Unified Loanword Constraint Hierarchy (ULCH). Rather than requiring separate phonological mechanisms or rankings for different donor languages, the findings indicate that the same inventory and ranking of markedness and faithfulness constraints can account for the principal adaptation patterns. Differences between the two datasets arise from the distinct phonological properties of their inputs and the constraints that become relevant in evaluating them.

The Arabic data exhibit a predominantly feature-driven pattern of adaptation. Pharyngeals, uvulars, emphatics, and other marked consonantal properties are frequently adapted through feature neutralisation and consonant substitution, with comparatively greater preservation of source syllable structure. The English data, by contrast, show a

stronger tendency towards structural and prosodic repair, including vowel epenthesis, cluster simplification, coda repair, and prosodic restructuring. These findings position Arabic and English along the proposed Feature-Driven–Structure-Driven Adaptation continuum, with Arabic tending more strongly towards feature modification and English towards structural and prosodic repair. The continuum captures differences in the relative prominence of adaptation strategies without treating the two donor languages as categorically distinct systems.

The analysis further shows that markedness constraints generally outrank faithfulness constraints, reflecting the priority given to Kiswahili phonological well-formedness over complete preservation of source forms. The proposed ULCH brings together segmental, structural, and prosodic constraints within a single fixed ranking:
ALIGN-S/T, **NNF*, **GEM*, *MCC-(PL, FR, NC)*, *NC#*, *CMPX*, *LONG-V*, *MAX-V(G)*≫ *CONTIG*≫ LIN≫ *AGR-P*≫ *MAX*≫ *IDENT-F*≫ *IDENT-P*≫ *DEP*.

Within the present dataset, this ranking accounts for the principal adaptation processes identified in the analysis. The ULCH is therefore proposed as a common constraint-based framework rather than as evidence that Arabic and English loanwords undergo identical repairs. A further contribution of the study is the proposed Donor-Sensitive Constraint Activation (DSCA) account, which captures the differential relevance of constraints within the same fixed hierarchy when inputs with distinct phonological properties are evaluated. Thus, Arabic and English loanwords may exhibit different adaptation outcomes without requiring donor-specific reranking or changes to the underlying Kiswahili grammar. DSCA consequently accounts for donor-sensitive adaptation within a common grammatical system.

Overall, the study contributes to research on loanword phonology, language contact, and Optimality Theory by providing a comparative account of Arabic and English loanword adaptation in Kiswahili. The ULCH provides the proposed common analytical framework; DSCA describes the differential relevance of constraints within the same fixed ranking in response to different input structures; and the Feature-Driven–Structure-Driven Adaptation continuum captures the observed variation in the relative prominence of feature-based and structural repairs. Together, these proposals provide a unified account of the observed adaptation patterns and offer a basis for further investigation of loanword adaptation in Kiswahili and other multilingual contact settings.

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APPENDICES: ENGLISH AND ARABIC LOANWORDS DATASET

Appendix 1: Arabic loanwords in Kiswahili

No.	Kiswahili	Arabic (source form)	English gloss
1.	*kitabu*	*kitaab*	book
2.	*kalamu*	*qalam*	pen
3.	*daftari*	*daftar*	notebook
4.	*waraka*	*waraqah*	document
5.	*habari*	*khabar*	news
6.	*taaluma*	*taʕallum*	education
7.	*tafsiri*	*tafsiir*	interpretation
8.	*kalima*	*kalima*	word
9.	*lugha*	*lugha*	language
10.	*maana*	*maʕna*	meaning
11.	*hakika*	*ḥaqiiqa*	truth
12.	*batili*	*baaṭil*	falsehood
13.	*jibu*	*Jawaab*	answer
14.	*swali*	*suʔaal*	question
15.	*hali*	*ḥaal*	condition
16.	*wakati*	*waqt*	time
17.	*ajali*	*ʔajal*	destiny
18.	*amani*	*amaan*	peace
19.	*usalama*	*salaama*	safety
20.	*shida*	*shidda*	difficulty
21.	*faraja*	*faraj*	relief
22.	*saburi*	*ṣabr*	patience
23.	*rama*	*raḥma*	mercy
24.	*adhabu*	*ʕadhaab*	punishment
25.	*dhambi*	*dhanb*	sin
26.	*riziki*	*rizq*	provision
27.	*baraka*	*baraka*	blessing
28.	*dini*	*diin*	religion
29.	*imani*	*iimaan*	faith
30.	*nabii*	*nabiyy*	prophet
31.	*sheha*	*shaykh*	local leader

No.	Kiswahili	Arabic (source form)	English gloss
32.	*kadhi*	*qaadii*	religious judge
33.	*hakimu*	*ḥaakim*	civil judge
34.	*hukumu*	*ḥukm*	judgement
35.	*kanuni*	*qaanuun*	law
36.	*sharia*	*shariiʕa*	law
37.	*adabu*	*adab*	manners
38.	*dunia*	*dunyaa*	world
39.	*akhira*	*aakhirah*	afterlife
40.	*elimu*	*ʕilm*	knowledge
41.	*fikiri*	*fikra*	thought
42.	*hekima*	*ḥikma*	wisdom
43.	*akili*	*ʕaql*	intellect
44.	*nia*	*niyyah*	intention
45.	*biashara*	*shara*	Trade/to buy
46.	*fedha*	*fiḍḍa*	money
47.	*dhahabu*	*dhahab*	gold
48.	*ujira*	*ʔujrah*	wage
49.	*amali*	*ʕamal*	work
50.	*waziri*	*waziir*	minister
51.	*rais*	*raʔiis*	president
52.	*jeshi*	*Jaysh*	army
53.	*harbi*	*ḥarb*	war
54.	*afya*	*ʕaafiya*	health
55.	*maradhi*	*maraḍ*	illness
56.	*dawa*	*dawaaʔ*	medicine
57.	*tabibu*	*ṭabiib*	doctor
58.	*darasa*	*dars*	lesson
59.	*taliba*	*ṭaalib*	student
60.	*mwalimu*	*muʕallim*	teacher
61.	*shahada*	*shahaada*	cert
62.	*tafsiri*	*fassara*	interpret
63.	*amini*	*ʔaamana*	believe
64.	*hukumu*	*ḥakama*	judge

No.	Kiswahili	Arabic (source form)	English gloss
65.	*shukuru*	*shakara*	thank
66.	*Kabila*	*qabila*	tribe
67.	*katu*	*qaṭṭu*	Refuse/never
68.	*safiri*	*saafara*	travel
69.	*jaribu*	*jarraba*	try
70.	*hesabu*	*ḥasiba*	calculate
71.	*sali*	*ṣallaa*	pray
72.	*dua*	*duʕaa*	supplicate
73.	*fasiri*	*fassara*	explain
74.	*amuru*	*ʔamara*	command
75.	*manaa*	*manaaʕah*	Immunity/protect ion
76.	*hifadhi*	*ḥafiðʿa*	preserve
77.	*badili*	*baddala*	change
78.	*suluhu*	*ʔaṣlaḥa*	correct
79.	*asubuhi*	*ṣubḥ*	morning
80.	*fahamu*	*fahima*	comprehend

Appendix 2: English loanwords in Kiswahili

No.	Kiswahili	English (source form)	Meaning
1.	*hospitali*	*hospital*	hospital
2.	*kliniki*	*clinic*	clinic
3.	*televisheni*	*television*	television
4.	*intaneti*	*internet*	internet
5.	*basi*	*bus*	bus
6.	*treni*	*train*	train
7.	*injini*	*engine*	engine
8.	*lifti*	*lift*	lift
9.	*skrini*	*screen*	screen
10.	*spika*	*speaker*	speaker
11.	*penseli*	*pencil*	pencil
12.	*programu*	*programme/program*	programme/program
13.	*maikrofoni*	*microphone*	microphone
14.	*projekta*	*projector*	projector
15.	*blogu*	*blog*	blog
16.	*akaunti*	*account*	account
17.	*skana*	*scanner*	scanner
18.	*modemu*	*modem*	modem
19.	*rauta*	*router*	router
20.	*benki*	*bank*	bank
21.	*meneja*	*manager*	manager
22.	*daktari*	*doctor*	doctor
23.	*nesi*	*nurse*	nurse
24.	*polisi*	*police*	police
25.	*ofisa*	*officer*	officer
26.	*ripoti*	*report*	report
27.	*digrii*	*degree*	degree
28.	*filamu*	*film*	film
29.	*tiketi*	*ticket*	ticket
30.	*hoteli*	*hotel*	hotel
31.	*menyu*	*menu*	menu
32.	*keki*	*cake*	cake

No.	Kiswahili	English (source form)	Meaning
33.	*chokoleti*	*chocolate*	chocolate
34.	*biskuti*	*biscuit*	biscuit
35.	*sandwichi*	*sandwich*	sandwich
36.	*kompyuta*	*computer*	computer

Author's email address: yasmin.yaseennew@gmail.com