



Functional Morpheme Under-realization and Compensatory Lengthening in Taizi Yemeni Arabic: A Stratal Perspective

الصرفم الوظيفي بين التلاشي والإطالة التعويضية في عربية تعز
من منظور طبقي

Mayada Nageeb Al-Maktary

Assistant Professor of Linguistics

Taiz University, Yemen

mayadanageeb@taiz.edu.ye

 <https://orcid.org/0000-0002-5193-778x>

Received: 10 June 2026

Accepted: 9 July 2026

الملخص (النسخة الخطية العربية)

تهدف هذه الدراسة إلى نمذجة الإبهام الصوتي المرتبط بالصرفم المؤنث في العربية اليمنية التعزية، وذلك في إطار نظرية الأمثلية الطبقية (Stratal Optimality Theory). وتتكون عينة الدراسة من 60 متحدثاً أصلياً باللهجة التعزية (تتراوح أعمارهم بين 15 و 65 عاماً) ممن عاشوا في مدينة تعز منذ ولادتهم. جُمعت البيانات الصوتية ميدانياً عبر مسارين: الملاحظة اللغوية والتسجيل الموجه. اعتمد المسار الأول على الملاحظة الصوتية المباشرة للمشاركين؛ لرصد نطق الصرفم المؤنث أثناء حديثهم العفوي في الجلسات الاجتماعية. في حين شمل المسار الثاني سبعة مشاركين سجلوا تجاربهم الشخصية لمدة لا تقل عن 10 دقائق في مكان هادئ. وأظهرت النتائج أن الإطالة التعويضية (Compensatory Lengthening) ليست عملية منفردة، بل هي إعادة تشكيل بنيوية ثنائية المراحل مدفوعة بالحفاظ المورائي (Moraic Conservation). ففي المستوى الصرفي (المورفولوجي)، يمنح قيد الوزن بالموقع (Weight-by-Position) مورا (μ) للصرفم المؤنث الصامت في ذيل المقطع، مما يخلق مقطعاً لفظياً ثنائي المورا (Bimoraic). أما في المستوى الصوتي (الفونولوجي)، فإن قيد الوسم t-CODA* يحفز حذف اللاحقة الصرفية المؤنثة في ذيل المقطع. وعلى نحو حاسم، يبقى الحيز الزمني صامداً في البنية العروضية لأن قيد الأولوية القصوى لمنع حذف الوحدات الوزنية ($\text{MAX}-\mu$) يحتل المرتبة الأعلى في التراتبية. وبناءً عليه، تتمدد الحركة الصائتة السابقة لتشغل المورا العائمة حفاظاً على الوزن العروضي للكلمة. وبذلك، تثبت الدراسة أن الحركات الطويلة الظاهرية السطحية ما هي إلا أثر عروضي يحفظ ذاكرة العلامة المحذوفة؛ مُعطيةً الأولوية للثبات الإيقاعي على حساب قيد الوفاء للمكونات القطعية الأصلية.

الكلمات المفتاحية: الإطالة التعويضية، النظرية الأمثلية الطبقية، العربية التعزية، النظرية المورائية، الإبهام الفونولوجي، الوزن العروضي.

Abstract (English Orthographic Version)

This study aims to provide a formal account of phonological opacity involving the feminine morpheme in Taizi Yemeni Arabic (TY Arabic), utilizing Stratal Optimality Theory (Stratal OT). The sample consists of 60 native Taizi speakers (aged 15–65) who have lived in Taiz city since birth. Data were collected via two methods: linguistic observation and guided recording. The first relied on direct observation of the participants to monitor the pronunciation of feminine marker during spontaneous speech in social gatherings, while the second involved seven participants who recorded their personal experiences for at least 10 minutes in a quiet setting. Findings shows that Compensatory Lengthening (CL) is not a singular process but a two-stage structural reconfiguration driven by moraic conservation. At morphological level, the Weight-by-Position (WBYP) principle assigns a mora (μ) to the feminine coda stop, creating a bimoraic syllable. At phonological level, the markedness constraint *t-CODA triggers the deletion of the word-final feminine suffix. Crucially, the timing slot survives because the constraint MAX- μ is top-ranked. The resulting orphan mora is filled by the preceding vowel to maintain prosodic weight. Accordingly, the study proves that surface long vowels function as a prosodic memory of the deleted marker, prioritizing rhythmic invariance over segmental faithfulness.

Keywords: Compensatory Lengthening (CL), Stratal Optimality Theory, Taizi Yemeni Arabic (TY Arabic), Moraic Theory, Phonological Opacity, Prosodic Weight.



1.1 Introduction

Language change is often perceived as a slow, historical drift, yet in the daily speech tongues, it manifests as dynamic and immediate restructuring. At the heart of this living mechanics lies the phenomenon of *Compensatory Lengthening* (CL). CL represents a significant phonological phenomenon observed across various languages. It involves deletion of a consonant, followed by a lengthening of an adjacent vowel to compensate for the loss. An important aspect of CL is its role in phonological evolution across different languages, which not only highlights the dynamic nature of language but also raises questions about the mechanisms driving these changes. It is particularly salient in diverse language families, where it influences syllable structures and stress patterns, thereby impacting the morphological and syntactic characteristics of languages. Notably, in the Bantu languages, CL has been associated with shifts in syllable boundaries and alterations in vowel quality, illustrating its far-reaching implications. Furthermore, the study of CL offers valuable insights into historical linguistics, revealing how phonetic shifts can drive language divergence and contribute to the emergence of dialectal variations (Komenda et al., 2013).

Accordingly, the implications of CL extend beyond phonological changes, as they can also influence sociolinguistic dynamics within communities. For example, regions where CL is prevalent may exhibit distinct dialectal features that not only reflect historical language contact but also contribute to identity formation among speakers. For example, Taizi Yemeni Arabic (TY Arabic)¹ is a distinct linguistic variety primarily spoken in Yemen.

¹ See the Appendix

This Taizi dialect has developed several distinctive phonological and morpho-phonological features (Al-Maktary, 2013, 2023; Al-Maktary & Smaoui, 2024; Smaoui & Al-Maktary, 2022). These features differentiate it from many other Arabic dialects and even from standard Arabic. Among its notable consonantal features, TY Arabic maintains the continued use of CL. Its manifestation presents a unique site for linguistic inquiry. Its occurrence is not merely a phonotactic consequence of coda attrition; rather, it is systematically constrained by the dialect's specific phonological or morpho-phonological architecture, depending on the environment and the type of the deleted sound, phoneme or morpheme.

Traditional *Parallel Optimality Theory* (Parallel OT) (Prince & Smolensky, 1993/2002) often struggles to account for this change because the reason for the lengthening a segment is absent from the surface form, a problem known as phonological opacity. To resolve this, this study employs *Stratal Optimality Theory* (Stratal OT) Kiparsky (2000, 2003). This framework suggests that the grammar operates in distinct stages, or 'strata', which retain information about the weight of the deleted segment from an earlier level of evaluation. In addition, this study uses *Moraic theory* to analyze how the timing unit (mora, μ) associated with the feminine /t/ is inherited by the preceding vowel. In this case, the introduction of a stratal hierarchy allows modeling the tension between markedness (the drive to delete the final feminine stop) and faithfulness (the drive to preserve the word's rhythmic duration). Hence, the primary objective of this study is to provide a formal Stratal OT account of the morpho-phonological interaction that triggers CL in TY Arabic, positing that CL is not an isolated phonological process but a mechanism sensitive to morphological boundaries. Specifically,

this study aims to demonstrate that the TY Arabic prioritizes prosodic invariance, ensuring that the beat of the word remains constant even as its segmental components shift. Interestingly, this study contributes to a broader understanding of how morphology and phonology negotiate the preservation of structural weight, offering new evidence for the mechanics of synchronic sound change in spoken Arabic.

1.2 Research Questions

The research questions for this study target the tension between the final functional feminine morpheme under-realization and the prosodic gain (the lengthening of the vowel). Accordingly, this study seeks to answer the following:

- i. Why does CL remain on the surface after the triggering suffix is deleted in TY Arabic?
- ii. What phonological and prosodic constraints trigger the under-realization of the final functional feminine suffix in TY Arabic?
- iii. How can Stratal OT formally model this two-stage interaction where classic Parallel OT fails?

2 Literature Review

This literature review explores the main concepts of CL, covering its definition, illustrative examples from its historical context, and key theories. It then identifies current challenges and debates, which ultimately leads to the research gap and the analytical framework used in this study.

2.1 CL in Historical Contexts

From a historical perspective, CL is not merely a random variation; rather, it is a testament to *linguistic economy*. It reflects the ongoing tension between the drive for articulatory simplification (via e.g. consonant loss) and the necessity of preserving semantic and rhythmic contrasts. It is evident in the Old English (Kobayashi & Skaer, n.d.), Middle English open syllable lengthening (MEOSL) (Minkova & Lefkowitz, 2021), Old French (Gess, 1998; Montaña, 2024), a Bantu language in Ekegusii (Komenda et al., 2013) and Samothraki Greek (SamG) (Topintzi, 2006b). For example, Minkova and Lefkowitz (2021) addressed the controversial aspect of MEOSL, specifically the variable results of lengthening in disyllabic (C)V.CVC stems, and to reframe MEOSL as a stem-level compensatory process (MECL). The study involved a full philological survey of recoverable monomorphemic input items and their reflexes in Present-day English (PDE). Data gathering involved re-examining empirical data to identify correlations between lengthening and the sonority of the medial consonant, and analyzing the interplay between that consonant and the second syllable's coda. The empirical findings were formalized using OT, including Maxent OT for probabilistic variations. Key findings include a previously unnoticed correlation between lengthening and the sonority of the medial consonant. Additionally, ME quantitative changes in disyllabic stem-form inputs can be accounted for by CL conditioned by schwa apocope and syncope. While (C)V.Cə inputs (e.g., 'name', 'nose', 'meat') show near-categorical lengthening, and (C)VRəC inputs (e.g., 'gannet', 'baron') show minimal lengthening, the (C)VTəR subset (e.g., 'copper', 'paper') exhibits variable lengthening.

2.2 CL Mechanisms

While CL serves to preserve the moraic weight of a syllable, its triggers are highly heterogeneous. Theoretically, these manifestations of CL can be categorized into three distinct frameworks:

2.2.1 Phonological Derivation

Phonological mechanism is a purely phonetic and phonological adjustment intended to maintain the syllable's original duration without being influenced by external grammar rules. This is often seen in languages where a consonant is deleted, and the preceding vowel compensates by lengthening, as described by Kavitskaya (2002). Kavitskaya's study analyzed the distinct behaviors of two types of CL in synchronic grammars: CL through consonant loss (CVC CL) and CL through vowel loss (CVCV CL). The materials for this linguistic analysis included examples from various languages, such as Lithuanian, Old Church Slavic, Serbo-Croatian, Komi (Ižma dialect), Slovak, Hungarian, Lama, and Czech, drawing on existing phonological literature and surveys. The key findings indicated that CVC CL, where the lost consonant is recoverable, is phonologically natural, exceptionless, and can be modeled as an optimization of syllable structure, often preserving moraic weight within a syllable. In contrast, CVCV CL, where the lost vowel is often unrecoverable, is typologically rarer and typically leads to non-optimal syllable structures, making its alternations less transparent and requiring morphological or lexical conditioning. The study concludes that the recoverability of the historical trigger is crucial for the phonological transparency and productivity of CL alternations.

In some languages, CL is linked to rhythmic patterns and the restructuring of syllables, as seen in the transformation of Proto-Slavic forms, where vowel lengthening is part of a broader prosodic change (Sukač, 2011). Sukač's study argued that CL of o-stems in West Slavic at the end of the Proto-Slavic period is not a single phenomenon but rather a cover term for several distinct processes. The study delved into the specific mechanisms involved, such as pretonic lengthening, resyllabification, and yer loss in *stolъ*-type forms (former APb); resyllabification, potential moraic coda acquisition, yer loss, and mora transfer in *bogъ*-type forms (former APc); and Kortlandt's lengthening rule, resyllabification, and yer loss in *klinъ*-type forms (former APa). The findings indicated that what was previously considered a singular CL event is, in fact, a complex interplay of various phonological changes.

CL has received a considerable share of scholarly attention in Arabic phonology, spanning both the standard and dialectal levels. At standard Arabic, Ben Slama (2016) posited an analysis driven by the *CODA constraint. The empirical data indicates that when the coda consonant is deleted, CL occurs as a repair strategy. Theoretically, this behavior is regulated by a hierarchy where *CODA is dominated by both the moraic WBYP and RIGHTMOST constraints, thereby enforcing the lengthening process. The structural interplay between these markedness and faithfulness constraints is formalized below:

- 1) WBYP, RIGHTMOST >> *CODA/n >> DEP_{IO-μ} >> NONFINAL, MAX_{IO-seg}

Within the domain of dialectal Arabic, Al-Maktary's (2023) study on contextual deletion in the Taizi dialect highlights that in certain environments

deletion triggers secondary phonological effects like CL. This is particularly evident in her analysis of the *Taa Marbuta* as a phoneme (termed 'Round-t'), where she explores cases such as:

2) Total deletion of round-t followed by CL

/alqarjah jaʕni:/	[alqarja: jaʕni:]	القرية يعني	The village I mean
/almadi:naħ	[almadi:na:	المدينة القديمة	the old city
alqadi:mah/	alqadi:m]		
/alqisʕah ʔinu:/	[alqisʕa: ʔinu:]	القصة إنو	the story was that
/qahwah wantti/	[qahwa: wantti]	قهوة وأنتِ	coffee and you were

Crucially, both Ben Slama's research on the standard level and Al-Maktary's work on the spoken dialect share a common conclusion: vowel lengthening serves as a vital mechanism to preserve syllable weight.

A phonological derivation can be caused by onset loss and stands apart from standard instances arising from coda loss. Alqahtani (2022) explored the phonological derivation behind CL in Standard Malay using Stratal OT. Specifically, the study sought to answer two questions: what the phonological derivation behind CL in Standard Malay is, and how this derivation can be accounted for using Stratal OT. The data was extracted from previous literature, including books, articles, and theses related to Standard Malay.

Additionally, consultations were conducted with several native Standard Malay speakers from Kuala Lumpur to verify the validity of the data. The data collection involved a review of existing literature and direct consultations with native speakers. This dual approach ensured a comprehensive understanding of the phonological phenomena being studied. Findings revealed that CL in Standard Malay primarily targets the stem-final /r/, which becomes moraic due to weight-by-position (WBP). The study concluded that the deletion of the moraic stem-final /r/ results in a floating mora, which is then linked to the preceding vowel, leading to vowel lengthening. This process exemplifies counterbleeding, where the CL interacts with WBP.

2.2.2 Phonology-Morphology Interference

This mechanism occurs when the lengthening is triggered by the interaction between sound rules (phonology) and word formation (morphology). In these cases, the loss of a segment often happens at the boundary where a prefix or suffix attaches to a root. The lengthening, a phonological reflex, serves as a trace of the missing piece of the word, helping to preserve the identity of the morpheme even after a sound has disappeared. In Ekegusii, a Bantu language, CL occurs as a result of morphological processes like prefixation, which alter phonetic environments and resolve hiatus situations (Komenda et al., 2013). Komenda's study primarily aimed to establish the processes of well-formed words in Ekegusii, describe vowels that undergo CL, and determine the morphological processes that trigger this lengthening. It also explored repair strategies for ill-formed vowel sequences (hiatus) and examined aspects of Autosegmental Phonology Theory. For materials, the researchers utilized the Ekegusii Bible (K.I.E, 2004), 'Tusome Lugha Yetu (Ekegusii)' (K.I.E, 1987), 'Amatera N'emegano (Ekegusii)'

(K.I.E, 1987), and 'Ekegusii for all Seasons' (Monari, 2000). Data gathering involved purposive sampling of four adult native speakers for verification and selection of texts, eliciting data in the form of 72 nominals and verbals, and audio-recording native speakers reading a wordlist created by consulting other studies. The key findings revealed that all seven basic Ekegusii vowels undergo CL when their phonetic environments are altered, primarily due to the morphological process of prefixation, which creates vowel sequences that are then resolved by lengthening. The study concludes that Ekegusii does not permit underlying hiatus situations, but they arise from prefixation, leading to resolution strategies like glide formation, vowel raising, and vowel deletion, which condition the occurrence of phonetic long vowels.

2.2.3 Phonology-Syntax Interface

This is a more complex mechanism where CL is influenced by the structure of a sentence (syntax). In certain languages, a sound might be deleted because of its position in a sentence or its proximity to a phrase boundary. The resulting lengthening acts as a prosodic marker, signaling to the listener that a grammatical element was once there, thereby linking the sound pattern directly to the sentence's arrangement. In Taiwanese Southern Min, CL is linked to syntactic structures, where the omission of a pronoun in a specific construction leads to lengthening, marked by a glottal stop (Chen, 2010). This study aimed to investigate the CL of the giving verb 'ho' in Taiwanese Southern Min (TSM), specifically focusing on the 'V1 ho (pro) V2' construction where the third-person pronoun is omitted. The research explored two main aspects: the motivation behind the occurrence of a glottal stop and its role as a boundary marker in the phonology-syntax interface. The study found that 'ho' undergoes CL when the pronoun is omitted in the 'V1 ho (pro)

V2' construction. This lengthening is realized by a glottal stop, which acts as a rest in melody. The study proposed that this CL functions as a boundary marker combined with a silent time slot within the phonology-syntax interface.

2.3 Research Gap

While the phenomenon of CL has been extensively documented in linguistic literature as a mechanism for preserving moraic weight across syllables, theoretical discourse has largely categorized its triggers into three distinct frameworks: Phonological Derivation, the Phonology-Morphology Interface, and the Phonology-Syntax Interface. Despite this well-established tripartite framework, there remains a significant empirical void concerning the realization of CL within the dialects of Yemen, specifically the TY Arabic. To date, the role of the Phonology-Morphology Interface as a potential trigger for CL in the TY Arabic remains entirely unexplored. Consequently, this study aims to bridge this gap by examining how morphophonological processes in the TY Arabic necessitate CL. Subsequent to defining the research gap, the focus shifts to the procurement of a methodological tool designed to process and analyze CL in TY Arabic data.

2. 4 Theoretical Implications

Recent studies have explored CL through different theoretical frameworks, revealing its complexity and variability. For example, in his Moraic theory, Hayes (1989) proposed a solution to the opacity problem of CL by referring to intermediate levels of representation. His argument was based on the fact that CL is inherently a process of mora preservation. His analysis is summarized in (3):

- 3) An input gets to be syllabified, followed simultaneously by the WBYP application.

The WBYP framework simulates input moraification based on the fact that mora-bearing ability is restricted to nuclei and codas. Under this framework, a coda deletion at any given syllabic position triggers the CL of a neighboring segment. Accordingly, Hayes' moraic constraint (1989) is defined as:

- 4) WEIGHT-BY-POSITION (WBYP):

Coda consonants are moraic.

Ben Slama (2016) and Al-Maktary (2023) agreed that WBYP introduces an appropriate solution for representing CL in Arabic.

In the re-evaluation of the data of Hayes (1989), Topintzi (2006b) described CL in Samothraki Greek (SamG) as 'position preservation through a mora' instead of 'mora conservation'. It used existing SamG data, mainly from Katsanis (1996), with additional insights from native speakers. Key findings revealed that SamG shows genuine CL after onset loss, especially with /r/-deletion lengthening the following vowel, thereby questioning traditional moraic assumptions. This pattern occurs predominantly word-initially and in complex onset clusters. The proposed model effectively explained this phenomenon without relying on input moraicity.

Benua (1995) tackled the issue of CL opacity by proposing a different mora-based constraint. Under this account, short vowels are stressed after a coda is deleted because they lengthen and become bimoraic through the application of STW:

- 5) STRESS-To-WEIGHT (STW):

If stressed, then heavy (Benua, 1995, p. 18).

Although STW incorporates moraic structure and effectively captures CL, it displays coda-sensitive stress. This indicates that CL is structurally conditioned by stress position, a behavior that diverges from Arabic, where CL is not constrained by stress.

CL raises questions about the universality of phonological rules, as some studies argue against the necessity of mora conservation for its occurrence (Gess, 1998). Gess refuted the claim made by de Chene & Anderson that CL depends on a pre-existing vowel length contrast in a language. The study demonstrated that CL can occur without such a contrast, using evidence from Old French to support this argument. Historical linguistic data was utilized, particularly focusing on Old French, to analyze the processes of consonant loss and CL. Poetic texts and glossaries from the 12th to the 16th centuries were examined to gather evidence regarding vowel length and syllable structure. A qualitative analysis was utilized. The data gathering involved a qualitative analysis of historical texts, including poetry and glossaries, to identify instances of vowel lengthening and consonant loss. The author also references previous studies and grammatical observations to support the analysis. The findings indicated that CL in Old French occurred alongside the loss of syllable-final consonants, specifically /s/ and /n/, without the necessity of a pre-existing vowel length distinction. This contradicts de Chene & Anderson's claims and suggests that CL is not inherently structure-preserving.

Building upon the identification of the present research gap, this study proceeds to establish the analytical framework necessary for examining the

collected data. After a comprehensive review of various phonological theories, it was determined that Optimality Theory (Prince & Smolensky, 1993/2002/ 2004) provides the most robust mechanism for interpreting the phonological-morphological interactions in the TY Arabic.

2.5 Optimality Theory

Optimality Theory (OT) is a linguistic model that shifted the focus from rules (how a sound changes step-by-step) to constraints (what the final output should look like). Introduced by Alan Prince and Paul Smolensky in 1993, it suggests that the 'surface form' of language is the result of resolving conflicts between competing requirements.

2.5.1 The Core Components of OT

OT operates like a *filter* system consisting of three main sub-processes:

- i. Generator (Gen): For any given input (the mental representation of a word), Gen generates an infinite list of potential output candidates. These candidates include the correct pronunciation, but also many *incorrect* or *illegal* versions.
- ii. Constraints (Con): This is the *criteria* of the language. In OT, constraints are a) universal (all languages have the same ones) and b) violable (they can be broken). The difference between languages (like English vs. Arabic) is simply c) ranking (how they rank these constraints).
- iii. Evaluator (Eval): Eval is the decision-maker. It takes the list of candidates from Gen and runs them through the ranked constraints. The candidate that violates the fewest high-ranking constraints is declared the *Optimal* candidate (the one people actually speak).

2.5.2 Families of Constraints

Constraints are always in conflict. To satisfy one, the researcher often has to break another. These universals are divided into two main families:

- i. **Markedness Constraints:** These constraints demand that the output be *natural* or easy to pronounce. They hate complexity. For example:
 - *NoCoda* (abbreviated *CODA): Syllables should not end in a consonant.
 - **V-Oral V-Nasal*: Don't put an oral vowel next to a nasal one.
- ii. **Faithfulness Constraints:** These constraints demand that the output remain *faithful* to the original input. They hate change.
 - *Max-IO*: Don't delete any segments from the input.
 - *Dep-IO* (Don't add/insert any new segments).

2.5.3 How OT Works: The Tableau

Tableau is a tool for working out the needed analysis, in which rankings are illustrated. The components of each Tableau are:

- i. **Input:** the underlying form (e.g., a word where a consonant is deleted).
- ii. **Constraints:** listed horizontally across the top from left (highest rank) to right (lowest rank).
- iii. **Candidates:** listed vertically down the left side.
- iv. **Asterisks (*):** mark a violation.
- v. **Exclamation point (!):** marks a *Fatal Violation* that eliminates a candidate.
- vi. **Pointing Finger (☞):** identifies the winner (the optimal form).

The rationale for selecting OT lies in its ability to handle conflicting linguistic requirements through a system of ranked, violable constraints rather than rigid serial rules. This constraint-based approach is particularly well-suited for analyzing CL, as it can effectively model how the dialect prioritizes the preservation of moraic weight over the faithfulness of segments during morphological operations.

However, CL highlights challenges in OT, such as opacity issue, particularly regarding input-output mappings and the role of onsets in lengthening (Al-Maktary, 2023; Alqahtani, 2022; Idsardi, 2000; Kleban, 2019; McCarthy, 1999, 2000; Smaoui & Al-Maktary, 2022; Topintzi, 2006a). Consequently, several models have emerged to address these limitations to introduce step-by-step derivational logic, such as Sympathy theory (McCarthy, 1999), Derivational Optimality Theory (DOT) proposed by Kiparsky (2000) and Rubach (1997, 2000a, 2000b), Stratal Optimality Theory (Stratal OT) Kiparsky (2000, 2003), Harmonic Serialism (HS) (McCarthy, 2000, 2002, 2010a, 2010b, 2016, 2018; Prince & Smolensky, 1993/2002/2004), and Optimality Theory with Candidate Chains (abbreviated OT-CC) (McCarthy, 2006). These models introduced by pioneering scholars to bridge the gap between parallelism and phonological derivations. Subsequently, a body of research has adopted these frameworks to analyze diverse languages and diachronic sound changes.

For example, Kleban (2019) applied Derivational Optimality Theory (DOT) to model sound changes in Middle or Early Modern English, providing a nuanced account of how CL unfolds through successive stages. Lee (2021) revisited classical analyses of CL in Middle English by adopting the

framework of HS. Lee proposed a serial account for coda consonant deletion and subsequent vowel lengthening, offering a more computationally transparent mapping than parallel OT. Montaña (2024) used the stratal phonological analysis in Old French to show that CL can be influenced by morphological and phonological interactions across different cycles, affecting stress and vowel quality. These diverse approaches collectively demonstrate that by relaxing the strict parallelism of classical OT, linguists can more accurately formalize the opaque and diachronic complexities of CL across various linguistic systems.

Thus, this review has synthesized existing literature on cross-linguistic variations in CL. It has highlighted a notable research gap concerning the role of the phonology-morphology interface as a potential trigger for CL in TY Arabic. Consequently, this study seeks to address this gap, offering new insights into the interplay between these two domains.

3 Methodology

This study employs a qualitative approach to investigate the morpho-phonological processes of CL within TY Arabic. The following section outlines the methodological framework used to collect and analyze linguistic data, detailing the speech materials, the participant selection criteria, data collection procedure and the analytical framework applied to interpret the findings.

3.1 Speech Materials

The speech materials for this study consisted of authentic TY Arabic spoken materials. The focus was specifically on the phonological behavior of

the feminine singular marker, the ‘open-t’ suffix (Taa Maftuha context). The corpus includes a variety of lexical items and phrasal structures to examine CL occurrences at the phonology-morphology interface. Regarding the linguistic variety analyzed, a crucial distinction must be made between the urban variety of Taiz city and the diverse rural sub-dialects spoken across the wider governorate. This study focuses exclusively on the urban variety of Taiz city. Due to continuous internal migration and prolonged dialect contact, the speech of long-term urban residents has undergone a process of dialect leveling, resulting in a relatively homogeneous urban koine.

3.2 Participants

The study involved 60 native TY Arabic speakers, ranging in age from 15 to 65 years. These participants were varied based on gender and educational background. The gender distribution consisted of 35 females and 25 males. In terms of education, the sample reflected three distinct levels: primary education only, secondary education, and university-level education. To ensure linguistic homogeneity and dialectal authenticity, all participants met the following criteria:

- i. They were born and raised in Taiz city, having acquired TY Arabic as their first tongue prior to any subsequent language acquisition.
- ii. They reported no history of speech, language, or hearing impairments that could affect their phonetic output.

3.3 Data Collection Procedure

The data collection process followed a two-phase approach, beginning with a preliminary pilot phase:

- i. The first track relied on direct observation of the participants during their spontaneous speech and everyday storytelling within natural social gatherings.
- ii. In the second track, a subset of seven participants was asked to record individual monologues. They were instructed to narrate a personal story or past experience lasting for a minimum of 10 minutes. These participants were strictly advised to record in highly quiet setting to minimize background noise and ensure maximum clarity.

3.4 Data Analyzing Framework

The collected data were analyzed within the framework of OT. This framework is particularly suited to this study as it allows for the examination of constraint ranking, specifically the tension between faithfulness and markedness constraints, that governs the realization of the feminine suffix and its subsequent effect on CL. This analysis identifies the hierarchical ranking of constraints and clarifies the phonological triggers and morphophonological interactions characteristic of the Taizi dialect under investigation.

In summary, the methodology outlined above provides a robust foundation for examining CL in TY Arabic. It ensures that the feminine singular marker behaviors observed in the Taizi participants are captured accurately and interpreted in line with OT principles.

4 Data Analysis

For an introductory purpose, the present discussion starts by highlighting two questions about the nature of the TY Arabic /t/ and its

functions: a) How is this sound articulated? b) Should this linguistic unit be classified as a phoneme, a morpheme, or both?

4.1 TY Arabic /t/

The Arabic T, represented by the letter (ت), is described as a voiceless alveolar plosive. In its production, the tip of the tongue touches the alveolar ridge, the airflow is completely blocked and then suddenly released, and the vocal cords do not vibrate during its production. There are two primary types of the letter T in Arabic script, each serving a different linguistic function: *Open 'T'* (taa Maftuhah, (ت)) and *Round 'T°'* (taa marbutah, (ة)).

- i. *Round 'T°'* only appears at the end of a word. It is the primary marker for the feminine gender (e.g., *Sayyarah* - Car). It denotes feminine nouns and adjectives. If one stops speaking at the word, it is pronounced as a soft /h/ or is silent. If one continues to the next word (or add a suffix), it transforms back into a clear /t/ sound.
- ii. *Open 'T'* is the standard letter used in roots, verbs, and masculine/plural nouns. It is always pronounced as a /t/ sound, regardless of whether one stop at the word or continue speaking. It has different grammatical functions:
 - **Verb Conjugation:** It is used as prefix or a suffix. As a prefix, an open 'T' at the beginning of a present-tense verb usually indicates 'she' or 'you (masculine singular)', (e.g., *Taktub* - She writes / You write). As a Suffix, an open 'T' at the end of a past-tense verb indicates the subject (e.g., *Katab-tu* - I wrote; *Katab-ta* - You wrote), a feminine marker (*Katab-at-* she wrote).

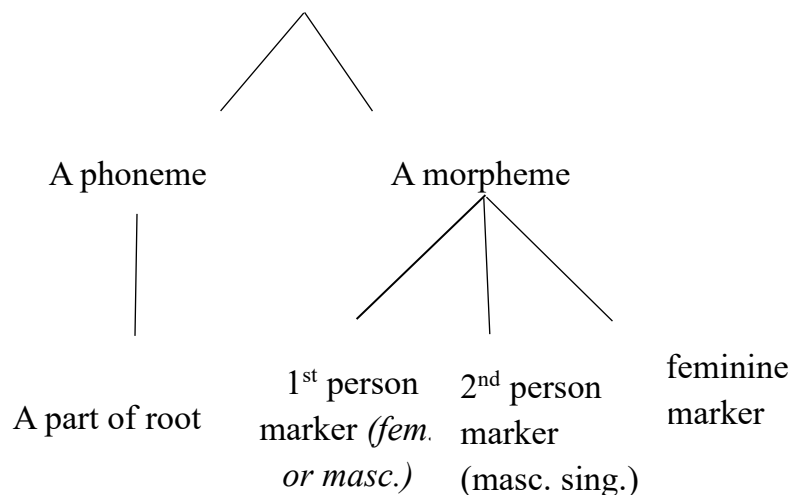
- Pluralization: The suffix -aat (ات) is used to create the ‘sound feminine plural’ (e.g., *Mu'allimaat* - Female teachers).

Thus, the possible functions of the open ‘T’ across word boundaries can be diagramed in Figure 1):

Figure 1.

The Possible Functions of TY Arabic open ‘T’ across Word Boundaries (Al-Maktary, 2023)

The TY Arabic Open ‘T’ Functions across Word



Focusing on the open ‘T’ as a letter, it changes its shape based on its position in a word. It is characterized by two dots placed horizontally above the base shape.

Table 1*Position and Glyphs of the letter T (ت)*

Position	Glyph	Example
Isolated	ت	ت (taa)
Initial	تـ	تُفاح (e.g., Tuffah - Apple)
Medial	ـتـ	كُتُب (e.g., Kutub - Books)
Final	ـت	بنت (e.g., Bint - Girl)

While Al-Maktary (2023) examined the segment *Taa* from a phonemic perspective, this study shifts the focus toward its morphemic functions. Specifically, it offers a Stratal OT account of the phenomenon of CL associated with the open *Taa*, particularly where it serves as an inflectional marker for femininity.

4.2 CL in TY Arabic

CL in TY Arabic is inextricably linked to the elision of the feminine marker (the open *Taa*). When the voiceless alveolar plosive /t/, which serves as the functional exponent of femininity, is deleted, the TY Arabic grammar prevents the total collapse of the moras associated with that syllable. Instead, the preceding short vowel undergoes lengthening to fill the vacuum left by the departing consonant. From a prosodic perspective, CL is not a random phonological occurrence; rather, it is a weight-preserving mechanism intended to maintain the moraic structure or the overall timing interval of a syllable following the loss of a segmental unit. To bridge the gap between theory and data, this section provides representative models of the targeted phenomenon.

It is worth noting that the entire dataset follows an identical systematic pattern: the deletion of the open *Taa* morpheme leading to CL. The interaction between the feminine marker and the resulting prosodic changes is effectively demonstrated through the following sets of examples in Table 2:

Table 2

Examples of CL in TY Arabic

Underlying representation	Surface Structure	Gloss
I. /qa:lat/	[qa:la:]	She said (قالت)
/galasat/	[galasa:]	She sat down. (جلست)
/nagaḥat/	[nagaḥa:]	She passed (نجحت)
/akalat/	[akala:]	She ate. (أكلت)
II. /ih'tarat wi ziṣilat wi ḥiniqat/ /ʕaragat adduka:n/	/[ih'tara: wi ziṣila: wi ḥiniqa:] /ʕaraga: adduka:n]	She got upset, angry, and offended. (إحترت وزعلت وحنقت) She went out to the grocery store. (خرجت الدكان)
/katabat alwa:geb/	[kataba: alwa:geb]	She did her homework. (كتبت الواجب)
/kalamat ga:ratha:/	[kalama: ga:ratha:]	She talked to her neighbor. (كلمت جارتها)

Note: Upon the deletion of the feminine suffix *-t* and the subsequent lengthening of the preceding vowel, for example, the word /qa:lat/ ('قالت', she said) is phonologically realized as [qa:la:] (قالا). It is crucial to emphasize that this orthographic representation does not

carry any morphosemantic properties of the dual marker (the dual *alif*); rather, it serves as a purely phonological representation capturing the structural reality of the utterance, independent of standard orthographic conventions.

Table 2 illustrates the under-realization of the feminine suffix morpheme, characterized by the phonological deletion of the alveolar stop /t/. *A Functional Morpheme Under-realization* refers to a phenomenon where a morpheme present in the underlying representation fails to surface as a distinct segment (phoneme), yet its structural presence is felt through secondary phonological effects. Therefore, the under-realization of the feminine suffix morpheme [t] triggers a compensatory mechanism to maintain the integrity of the syllable structure. This results in compensatory vowel lengthening, transforming the short vowel into a long one (e.g., from /qa:lat/ to [qa:la:]). Scientifically, this process illustrates a functional morpheme under-realization that maintains the timing tiers of the word, ensuring that the total prosodic weight remains constant even when the specific segment, the feminine marker, is phonologically suppressed.

4.3 Moraic Theory

Moraic Theory is a framework in phonology, was primarily developed by Bruce Hayes (1989) to describe and measure syllable weight. Instead of looking at a syllable as just a string of consonants and vowels, it treats the syllable as a collection of timing units called moras (symbolized by the Greek letter μ). In this theory, the weight of a syllable is determined by how many moras it contains. A mora is a unit of phonological weight:

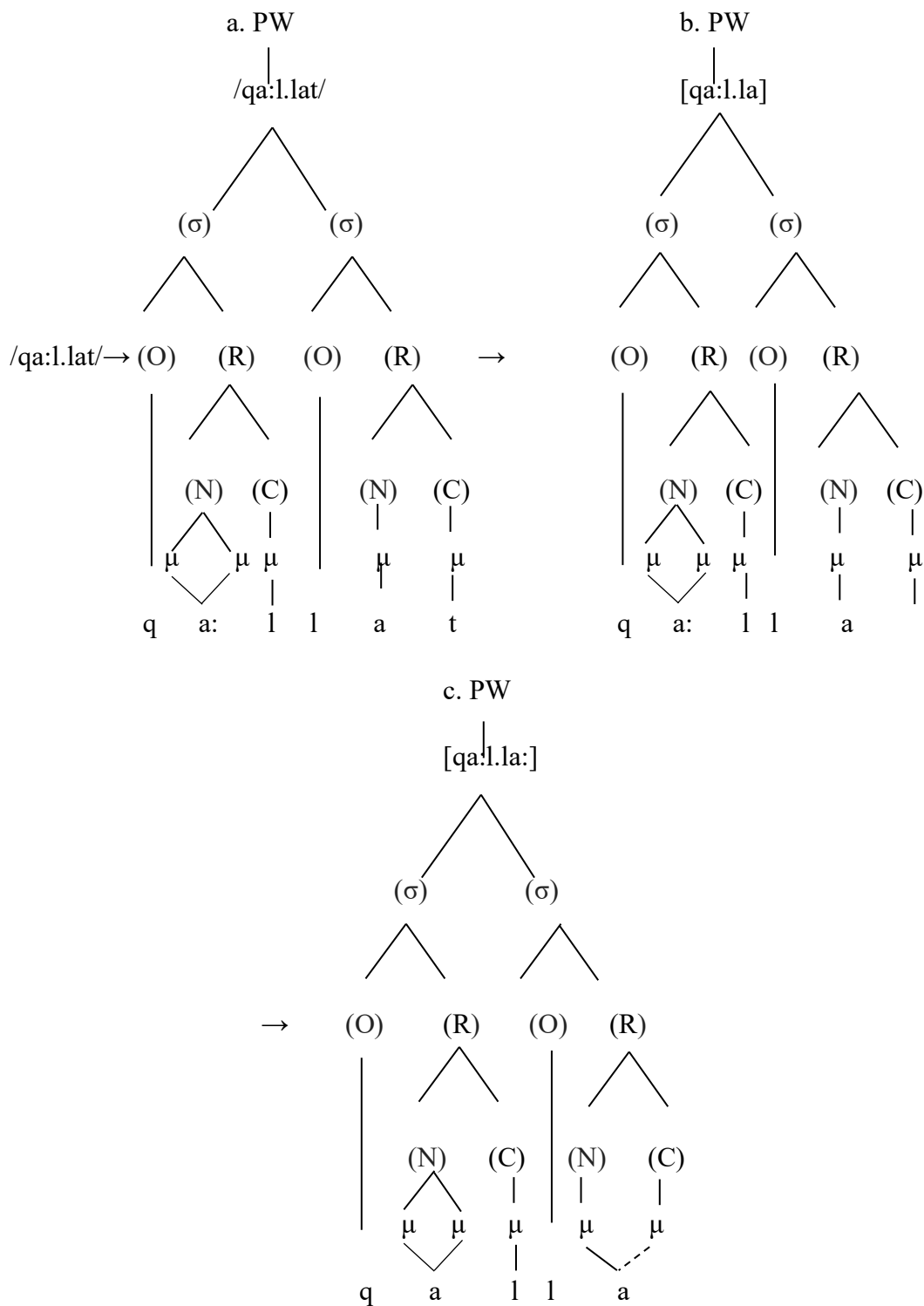
- 6) Deep and surface moraic status of vowels and consonants (Holt, 1997, pp. 24-25):

Short vowel	/V μ /	[V μ]
Long vowel	/V $\mu\mu$ /	[V $\mu\mu$]
Short consonant	/C/	[C] (onset only)
Short consonant	/C/	[C μ] (coda, if weight by position)
Geminate consonant	/C μ /	[C μ] (coda and onset)

According to 6), light syllable (monomoraic) contains one mora (μ). Heavy syllable (bimoraic) contains two moras ($\mu \mu$). Likewise, a short consonant is usually not associated with a single mora but may bear a mora if it occurs in syllable-final position (weight-by-position); geminate consonants are associated with a single mora in either coda or onset position. Following the moraic system, the generated long vowel in Figure 2 is assigned two moras (V $\mu\mu$):

Figure 2

A Moraic Representation of /qa:l.lat/.



Since the generated [la:] in [qal.la:] is moraic, it highlights the application of a universal constraint that assigns moras on codas. Throughout history, theories that have discussed moras on surface structure have built phonological analysis and developed certain concepts like:

- i. *WEIGHT-BY-POSITION (WBYP)* (Hayes, 1989) is the cornerstone of Moraic Theory. It explains how a consonant in the coda position (at the end of a syllable) can contribute to the *weight* of that syllable.
- ii. *STRESS-TO-WEIGHT (STW)* (Benua, 1995) STW looks at how stress *demands* weight.
- iii. POSCORR (Topintzi, 2006a) helps account for quantity-sensitive stress systems in which the presence of certain onset consonants affects stress placement and rhythmic patterns. It is a more recent and specialized constraint that challenges the traditional assumption that onsets (the beginnings of syllables) never contribute to syllable weight. In some languages, Topintzi argued that onsets can contribute to weight (the Moraic Onset idea).

Therefore, when examining CL, the process by which a segment is deleted and an adjacent segment (typically a vowel) lengthens to compensate, the most suitable analytical framework is moraic theory incorporating WBYP. Within the Stratal OT framework, the derivation of [qa:l.la:] is viewed as a two-level evaluation. Hence, what is Stratal OT, and how can CL be analyzed within this framework?

4.4 Stratal Optimality Theory (Stratal OT)

Stratal OT is a hybrid phonological framework that combines the constraint-based approach of standard OT with the sequential, level-ordered

structure of lexical phonology. It was developed primarily by Kiparsky (2000, 2003) to address the limitations of Classic OT, specifically its struggle to explain opacity and the chronological stages of word formation. Opacity occurs when the surface form of a language contains a phonological change that is not motivated by the visible phonetic environment.

Table 3

Key Architectural Differences Between Parallel and Stratal OT

Feature	Classic OT	Stratal OT
Processing	Parallel (all at once)	Serial (level by level)
Structure	Input → Output	Input → Stratum 1 → Stratum 2 → Output
Ranking	Fixed for the language	Can vary by stratum
Best For	Simplicity and universality	Explaining opacity and morphology

The choice of Stratal OT is strictly motivated by the morphophonological nature of the phenomenon under investigation, the deletion of the open *Taa* morpheme leading to CL. Stratal OT is favored over the other intermediate models, such as HS and OT-CC, for the following reasons:

- i. The phenomenon is triggered by the morpho-phonological interface, morpheme deletion at a particular structural level. Stratal OT naturally

accommodates this by segregating the grammar into distinct, morphologically-defined components (Stem, Word, and Phrase strata), where each stratum possesses its own constraint ranking. In contrast, standard HS and OT-CC operate within a single, parallel phonological component and lack a natural mechanism to restrict phonological operations based on distinct morphological domains or cyclic levels.

- ii. While HS evaluates derivations step-by-step through gradual, single-feature changes, it struggles to capture processes where a purely morphological deletion must co-occur simultaneously with a prosodic reassignment, CL, across distinct structural domains. Stratal OT handles this seamlessly because the output of the morphological stratum becomes the input to the word-level phonological stratum.
- iii. OT-CC introduces highly complex mechanisms, such as tracking whole historical chains of candidates and utilizing specialized constraints like *PRECEDENCE*. For a highly systematic, domain-specific morphophonological rule like the one analyzed here, Stratal OT provides a much more parsimonious and structurally intuitive account without inflating the grammatical machinery.

CL in TY Arabic serves as a manifestation of phonological opacity, specifically categorized as a counter-bleeding (over application) rather than counter-feeding (under application) relationship. This is because the vowel lengthening rule applies first, successfully saving the weight (mora) of the consonant /t/ before that consonant is removed from the string. If the rules were transparent (a bleeding relationship), the deletion would occur first, removing the coda and leaving no environment for lengthening to occur.

Therefore, CL is opaque because the lengthening outruns the deletion, leaving behind a long vowel as a structural trace of a segment that no longer exists on the surface.

Accordingly, Stratal OT operates on the principle that phonology happens in distinct stages (strata). Each stratum has its own set of ranked constraints. Instead of one giant leap from the underlying form (input) to the surface form (output), the process is broken down into typical levels. Within each stratum, the standard OT machinery is used. This includes Gen (Generator) and Eval (Evaluator):

- i. Input: The output of the previous stratum.
- ii. Gen: Creates a list of potential output candidates.
- iii. Eval: Uses a specific set of ranked constraints to pick the best candidate.
- iv. Output: Becomes the input for the next stratum.
- v. Constraint Ranking: Crucially, the ranking of constraints can change between strata. A constraint that is very important at the Stem level might be ignored at the Phrase level, allowing for the cyclic behavior seen in natural languages.

Thus, the main goal of Stratal OT is to fix the problem of phonological opacity. The grammar works in a series of steps (serialism). A rule can apply at Step A, and then Step B can change the sounds around it. This makes it easy to explain hidden patterns without needing the complicated Output-to-Output rules used in traditional OT. Recent studies have successfully employed this framework to capture complex lengthening processes. For example, Alqahtani (2022) investigated CL in Standard Malay, demonstrating that a Stratal OT

approach effectively accounts for the interaction between morphology and phonology. Montañó (2024) utilized Stratal OT to analyze specific phonological contexts in Old French, formalizing the patterns of vowel lengthening typically triggered by the deletion of coda /s/.

4.4.1 The Stratal Breakdown of /qa:l.lat/

In Stratal OT, CL is explained as a two-stage process where a) the feminine suffix /-t/ is deleted, b) the preceding vowel is lengthened (e.g., /qa:l.lat/ → [qa:l.la:]), c) and the weight of a deleted sound is preserved and handed off to a neighboring sound. It is often opaque, the reason for lengthening the second vowel in [qa:l.la:] is no longer visible on the surface. Stratal OT excels here because the phenomenon involves a clear interaction between morphological structure (suffixation) and phonological derivation (deletion and CL). Instead of everything happening at once, the theory looks at the word in different cycles (strata). Therefore, to provide a comprehensive Stratal OT account of opacity in the Arabic transition from the underlying representation /qa:l.lat/ to the surface realization [qa:l.la:], a dual-tableau framework is employed. This analysis formally distinguishes between Stratum 1 (Word Level), where moraic weight is assigned via Weight-by-Position (WBP), and Stratum 2 (Phonological Level), where the deletion of the segment and the subsequent preservation of its moraic weight are realized.

4.4.2 Relevant Constraints

The following constraints govern the mapping between input and output candidates:

i. MAX-C (McCarthy & Prince, 1995):

A faithfulness constraint requiring that every consonant in the input has a correspondent in the output (prohibits consonant deletion).

ii. Weight-by-Position (WBYP) (Hayes, 1989):

A structural markedness constraint requiring that coda consonants be associated with a mora (μ).

iii. MAX- μ (McCarthy, 1997):

A faithfulness constraint mandating that moras present in the input be preserved in the output (prohibits the deletion of weight units).

iv. DEP-C (McCarthy & Prince, 1995):

Every segment of S2 has a correspondent in S1 (S2 is “dependent on” S1).

v. DEP [μ] (McCarthy, 1997):

Assign a violation for each mora in the output that is not present in the input.

vi. *t-CODA:

A domain-specific markedness constraint prohibiting the feminine suffix /t/ from appearing in word-final position.

vii. *FLOAT (Samko, 2011, p. 29):

Assign a violation for each mora in the output that is not associated with a segment

- viii. Well-Formedness condition (WFC) (Goldsmith (1979) & Nespor and Vogel (1986) as cited in Sandell & Byrd, 2015):

Intersections between association lines are forbidden. Assign a single violation per intersecting pair.

The analysis proceeds through two distinct derivational stages:

i. **Stratum 1: Morphology Level (Establishing Weight)**

At this stage, the primary objective is the establishment of prosodic weight, so the grammar follows a principle called WBYP. The word is built with its full morphological structure first. Then, with the suffix /-at/ in /qa:l.lat/ recognized as a mora-bearing unit, the WBYP assigns a mora to the coda consonant:

Tableau 1

*Constraint Ranking at Stratum 1: WBYP >> *t-CODA >> MAX-C >> DEP-C >> DEP[μ]*

Input /qa:l.lat/	WBYP	*t-CODA	MAX-C	DEP-C	DEP[μ]
a. q ^μ a: ^{μμ} l ^μ . l ^μ a ^μ t ^μ		* !			
b. q ^μ a: ^{μμ} l ^μ . l ^μ a ^μ t	* !				
c. q ^μ a: ^{μμ} l ^μ . l ^μ a ^μ	* !		* !		
d. q ^μ a: ^{μμ} l ^μ . l ^μ a ^μ h ^μ			* !	* !	* !
e. qa:l.lat		* !			

Tableau 1 focuses on the interaction between coda constraints and the preservation of segment identity. Candidate 1(e), which is the faithful realization of the input (/qa:l.lat/ (Stem + Feminine marker)), is immediately rejected because it violates *t-CODA. The language finds it too heavy to pronounce /t/ in that position. However, simply deleting the /t/ creates a structural problem: the syllable loses a timing unit (mora). Therefore, Candidate 1(a) [q^μa:^{μμ} l^μ. l^μa^μt^μ] is the winner. Although it preserves all consonants (satisfying MAX-C), the grammar applies WBYP. It recognizes the segment /t/ at the end of the syllable and assigns it a mora (μ), effectively increasing the prosodic weight of the syllable, and creating a heavy syllable (2 moras). Hence, output of this level serves as the input for the subsequent level, carrying the moraic information forward. Candidate 1(b)

[q^μa:^{μμ} l^μ. l^μa^μt] fails to satisfy the higher-ranking constraint (WBYP) because it loses the timing wight (mora). Candidate 1(c) [q^μa:^{μμ} l^μ. l^μa^μ] deletes the /t/ (good) but also deletes the mora associated with the /t/ (fatal), violating the constraints WBYP, *t-CODA and MAX-C. Candidate 1(d) is also disqualified as it adds an additional segment with its mora [h^μ]. It violates both constraints DEP-C and DEP[μ]. Thus, this tableau sets the stage for deletion, but the repaired version must satisfy the weight requirements in the next step.

ii. Stratum 2: Phonological Level (The Deletion and lengthening Stage)

Now, the output from Level 1, where the final syllable consists of a short vowel (1μ) and a coda /t/ (1μ), enters a new environment. Phonological processes are applied, specifically deleting the suffix-final consonant while leaving the moraic structure remains preserved. Tableau 2 is more complex and represents a more refined prosodic analysis where moraic preservation is key:

Tableau 2

*Constraint Ranking at Stratum 2: WBYP >> MAX[μ] >> *t-CODA >> *FLOAT >> WFC >> MAX >> DEP [μ]*

Input :	WBYP	MAX[μ]	*t-CODA	*FLOAT	WFC	MAX-C	DEP[μ]
$q^{\mu}a^{\mu\mu}l^{\mu}l^{\mu}a^{\mu}t^{\mu}$							
a. $q^{\mu}a^{\mu\mu}l^{\mu}l^{\mu}a^{\mu\mu}$						*	
b. $q^{\mu}a^{\mu\mu\mu}l^{\mu}.l^{\mu}a^{\mu}$					*!		
c. $q^{\mu}a^{\mu\mu}l^{\mu}.l^{\mu}a^{(\mu)(\mu)}$				*!		*	
d. $q^{\mu}a^{\mu\mu}l^{\mu}.l^{\mu}a^{\mu\mu}t^{\mu}$			*!				*!
e. $q^{\mu}a^{\mu\mu}l^{\mu}.l^{\mu}a^{\mu}t^{\mu}$			*!				

Tableau 2 reveals that the conflict where the high-ranking constraint, *t-CODA, demands that the feminine /t/ be deleted. Candidate 2(e) [$q^{\mu}a^{\mu\mu}l^{\mu}.l^{\mu}a^{\mu}t^{\mu}$] keeps the /t/ to save the mora, but it fatally violates *t-CODA. however, the grammar at this level refuses to allow the /t/ to surface. Candidate 2(d) [$m^{\mu}a^{\mu\mu}s^{\mu}.l^{\mu}a^{\mu\mu}t^{\mu}$] adds a mora to the vowel before the coda /t/, violating the constraints *t-CODA and DEP[μ]. Candidate 2(c) [$m^{\mu}a^{\mu\mu}s^{\mu}.l^{\mu}a^{(\mu)(\mu)}$] losses its coda /t/ in the second syllable. However, a mora with no sound attached to it is unstable as grammar prohibits unassociated moraic structure. The mora in Candidate 2(c) remains *floating* (floating moras)!. It kept the weight unit but didn't attach it to the preceding vowel, leaving it floating in the structure, which is prosodically illegal. Therefore. it does not obey *FLOAT. To satisfy licensing requirements, the

empty mora must be licensed via segmental association; this typically triggers the rightward spreading of features from the preceding vowel to fill the vacant moraic weight conservation. The word still shrinks in timing as Candidate 2(b) $[q^{\mu}a^{\mu\mu} l^{\mu} l^{\mu} a^{\mu}]$ does not show that the syllable structure is prosodically legal. Accordingly, it fails to obey the constraint WFC. The solution is the preceding vowel identifies the empty mora. To satisfy the requirement of weight conservation, the empty mora re-associates with the nearest available sound, the vowel /a/. In other words, the features of the preceding vowel spread rightward into the vacant moraic place, resulting in the surface form $[q^{\mu}a^{\mu\mu} l^{\mu} l^{\mu} a^{\mu\mu}]$. Therefore, Candidate 2(a) (with long vowel) is the optimal winner. The /t/ cannot stay at the end of the word. So, *t-CODA outranks MAX-C, triggering the deletion of the suffix. Crucially, mora preservation is the most critical detail. While the segmental material (/t/) is deleted, it accepts a violation of the lower-ranked MAX-C to satisfy the higher priorities. Its associated mora (μ) is retained in the representation. It satisfies MAX- μ because it preserves the timing slot: the empty mora left by the /t/ is filled by the preceding vowel, creating the long vowel [a:]

7) Vowel(μ) + Consonant(μ) = Bimoraic Syllable($\mu\mu$)

8) Final Surface Form: $[q^{\mu}a^{\mu\mu} l^{\mu} l^{\mu} a^{\mu\mu}]$

4.5 Discussion

One of the most powerful aspects of Stratal OT result is that it works like a chain of intermediate inputs. The analysis of these two tableaux reveals how TY Arabic manages syllable weight when the feminine marker is deleted. The Tableaux (1,2) show how the decision-making process changes as the word moves through the grammar. The transition from the underlying

representation /qa:l.lat/ to the surface form [qa:l.la:] is not merely a segment-for-segment substitution, but a structural reconfiguration necessitated by the MAX- μ constraint. This Stratal OT achieves a step-by-step look without actually using old-fashioned rewrite rules like:

$$9) \text{ Voiceless alveolar plosive } /t/ \rightarrow / \emptyset, \left[\begin{array}{c} \text{Segment} \\ \# \end{array} \right]$$

Instead, the change is driven by evaluation. Each level has its own opinion on what the best output of the word is. At Stratum 1, the high ranking of MAX-C ensures the feminine /t/ is present, which triggers the WBYP constraint to create the extra weight (μ) to the coda /t/, establishing a heavy syllable ($\sigma\mu\mu$) as the optimal output. At Stratum 2, the optimal candidate is the one without the feminine /t/, but it is forced to respect the decisions made by Stratum 1 regarding weight. Therefore, the emergence of a high-ranking markedness constraint against *t-CODA forces the deletion of the feminine marker /t/. However, because MAX- μ , established by Stratum 1, remains top-ranked, the timing slot (mora) survives the segmental loss. The resulting orphan mora triggers a spreading operation where the preceding short vowel [a] associates with the vacant weight unit to satisfy syllabic well-formedness. This reveals that the feminine /t/ is preserved even after the consonant itself is deleted. The analysis proves that this language follows the *Law of Conservation of Morae*. The number of beats in the word must remain constant. When a consonant is sacrificed, the vowel must expand to take its place, ensuring the overall duration of the syllable remains unchanged.

Ultimately, this result confirms that the mental grammar in TY Arabic prioritizes the maintenance of rhythmic tempo over the preservation of specific feminine markers. It supports the idea that speakers have a two-

layered mental grammar. It explains why TY Arabic speakers (and speakers of other languages with CL (Alqahtani, 2022; Bijankhan, 2000; Chen, 2010; Gess, 1998; Hayes, 1989; i Vives, 1992; Kavitskaya, 2002; Kleban, 2019; Kobayashi & Skaer, n.d.; Komenda et al., 2013; Lee, 2021; Minkova & Lefkowitz, 2021; Montaña, 2024; Sadeghi, 2008; Song & Demuth, 2008; Sukač, 2011; Topintzi, 2007)) perceive the beat of the word as remaining constant, even when the segments themselves disappear.

5 Conclusion

This study aims to formally account for the opaque relationship between feminine suffix and compensatory vowel lengthening in TY Arabic within the Stratal OT framework. The findings provide a clear, constraint-based solution to phonological opacity, bridging the gap between abstract morphological representation and surface phonological realization. Theoretically, this study contributes to the broader field of generative phonology by providing empirical evidence that cyclic evaluations are essential for explaining CL. It also contributes to the broader cross-linguistic understanding of the interaction between morphological operations and phonological outputs. The presence of CL after the under realized feminine morpheme reinforces the theory that certain consonants possess abstract weight (moras) that the language strives to preserve, even when the segment itself is deleted. Practically, the sociolinguistic data confirms that these patterns remain robust among lifelong residents of Taiz across a broad age demographic (15–65). Since TY Arabic deletes the morpheme feminine /t/ and replaces it with length, learners of TY Arabic must be trained to recognize the vowel length as the feminine marker instead of the consonant.



Beyond the scope of CL, the TY Arabic is exceptionally rich in complex phonological phenomena that warrant deeper investigation. Future research should prioritize a comprehensive analysis of these features, moving toward a cross-linguistic comparative approach. Hence, researchers can contribute to the discovery of linguistic universals. Such studies would help determine whether the constraints identified in this Stratal OT account are restricted to a limited number of languages or reflect universal cognitive and formal principles shared across all human languages.

References

- Al-Maktary, M. N. (2013). *Regressive nasal place assimilation in English and Arabic: An optimality theory account* [Master thesis, Taiz University]. Available in the Centre Library, Taiz University, Taiz.
- Al-Maktary, M. N. (2023). *Contextual deletion in English and Arabic: An optimality theory account* [Doctoral thesis, Manouba University]. Available at Manouba University (Tunisia) and Taiz University (Yemen)
- Al-Maktary, M. N., & Smaoui, C. (2024). Taizi Yemeni Arabic /d/ across boundaries: Patterns and causes. In C. Smaoui, S. M. Abidi, & W. Chakroun. *ELT Without Boundaries: New Trends and Challenges*. L'imprimerie Officielle, Tunisie: Tunisia.
- Alqahtani, M. (2022). On the phonological derivation of compensatory lengthening in standard Malay: A Stratal Optimality theoretical approach. *International Journal of Language and Literary Studies*, 4(1), 96-112.
- https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=On+the

[+Phonological+Derivation+of+Compensatory+Lengthening+in+Standard+Malay%3A+A+Stratal+Optimality+Theoretical+Approach&btnG](#)

=

Ben Slama, N. (2016). *Mathahir an-naghamyah fi al-Arabyah al-fushah: Khasa'suha wa mu'lagtuha (Prosodic aspects in standard Arabic: Characteristics and treatments)*. Tunis: Mediterranean Publisher.

Benua, L. (1995). Identity effects in morphological truncation. In S. U. Beckman & L. Walsh (Eds.), *University of Massachusetts Occasional Papers in Linguistics 18: Papers in Optimality Theory*, Graduate Linguistic Student Association. Amherst, Massachusetts.

<https://rucore.libraries.rutgers.edu/rutgers-lib/41970/PDF/1/>

Bijankhan, M. (2000). Farsi vowel compensatory lengthening: an experimental approach. *INTERSPEECH*.

https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=Farsi+vowel+compensatory+lengthening%3A+an+experimental+approach.&btnG=

https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=Farsi+vowel+compensatory+lengthening%3A+an+experimental+approach.&btnG=

Chen, B.-C. (2010). Compensatory lengthening of “HO7(予)” in Taiwanese Southern Min. *USTWPL*, 6, 1-22.

http://ling.hss.nthu.edu.tw/USTWPL/doc/Volume%206/6-1.%20Chen_Bo-ching_.pdf

Gess, R. (1998). Compensatory lengthening and structure preservation revisited. *Phonology*, 15(3), 353-366.

<https://www.cambridge.org/core/journals/phonology/article/abs/compe>



[nsatory-lengthening-and-structure-preservation-revisited/470D6DEFC6E1D6179B848FA4135B29C3](https://linguistics.ucla.edu/people/hayes/papers/HayesCompensatoryLengthening1989.pdf)

Hayes, B. (1989). Compensatory lengthening in moraic phonology.

Linguistic Inquiry, 20(2), 253-306.

<https://linguistics.ucla.edu/people/hayes/papers/HayesCompensatoryLengthening1989.pdf>

Holt, D. E. (1997). *The role of the listener in the historical phonology of Spanish and Portuguese: An optimality theoretic account* [PhD dissertation, Georgetown University]. <http://roa.rutgers.edu/files/278-0898/278-0898-HOLT-6-0.PDF>

i Vives, P. P. (1992). Compensatory lengthening by vowel and consonant loss in early Friulian. *Catalan working papers in linguistics*, 2, 205-244.

https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=Compensatory+Lengthening+by+Vowel+and+Consonant+Loss+in+Early+Friulian&btnG=

Idsardi, W. J. (2000). Clarifying opacity. *The Linguistic Review*, 17, 337-350.
<https://doi.org/10.1515/tlir.2000.17.2-4.337>

Kavitskaya, D. (2002). Triggers and alternations in compensatory lengthening. *WCCFL 21: Proceedings of the 21st West Coast Conference on Formal Linguistics*. Cascadilla Press:

https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=%5C1.+Triggers+and+Alternations+in+Compensatory+Lengthening&btnG=
https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=%5C1.+Triggers+and+Alternations+in+Compensatory+Lengthening&btnG=

- Kiparsky, P. (2000). Opacity and cyclicity. *The Linguistic Review*, 17, 351–365.
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.206.1469&rep=rep1&type=pdf>
- Kiparsky, P. (2003). Syllables and moras in Arabic. *The syllable in optimality theory*, 147, 182.
<http://www.ai.mit.edu/projects/dm/featgeom/kiparsky03-arabicsyll.pdf>
- Kleban, G. (2019). Compensatory lengthening in OT and DOT: Loss of dorsal fricatives in middle or early modern English. *ANGLICA-An International Journal of English Studies*, 28(2), 47-61.
- Kobayashi, H., & Skaer, P. M. (n.d.). A reassessment of Old English compensatory lengthening.
https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=A+reassessment+of+Old+English+compensatory+lengthening&btnG=
- Komenda, S., Maroko, G. M., & Ndung'u, R. W. (2013). The morphophonemics of vowel compensatory lengthening in Ekegusii. *International Journal of Education and Research*, 1(9).
https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=The+Morphophonemics+of+Vowel+Compensatory+Lengthening+in+Ekegusi&btnG=
- Lee, S. (2021). Compensatory lengthening in Harmonic Serialism. *Linguistic Research*, 38(1), 99-121.
- McCarthy, J. J. (1997). Process-specific constraints in Optimality Theory. *Linguistic Inquiry*, 231-251.



https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=Process-specific+constraints+in+Optimality+Theory&btnG=

- McCarthy, J. J. (1999). Sympathy and phonological opacity. *Phonology*, 16(3), 331-399. <http://people.umass.edu/jjmccart/sympathy.pdf>
- McCarthy, J. J. (2000). Harmonic serialism and parallelism. *Proceedings of the North East Linguistics Society*, 40. https://scholarworks.umass.edu/linguist_faculty_pubs/40
- McCarthy, J. J. (2002). *A thematic guide to optimality theory*. Cambridge Cambridge University Press.
- McCarthy, J. J. (2006). Candidates and derivations in optimality theory. . *University of Massachusetts Amherst*. <http://roa.rutgers.edu/files/823-0506/823-MCCARTHY-0-0.PDF>
- McCarthy, J. J. (2010a). An introduction to harmonic serialism. *Language and Linguistics Compass*, 4(10), 1001-1018. https://works.bepress.com/john_j_mccarthy/103/
- McCarthy, J. J. (2010b). Perceptually grounded faithfulness in harmonic serialism. *Linguistic Inquiry*, 42(1), 171-183. http://works.bepress.com/john_j_mccarthy/104/
- McCarthy, J. J. (2016). The theory and practice of harmonic serialism. *University of Massachusetts - Amherst*. https://works.bepress.com/john_j_mccarthy/112/
- McCarthy, J. J. (2018). How to delete. https://works.bepress.com/john_j_mccarthy/114/
- McCarthy, J. J., & Prince, A. S. (1995). Faithfulness and reduplicative identity. Available in Rutgers Optimality Archive and Research Gate.

- Minkova, D., & Lefkowitz, M. (2021). Middle English open syllable lengthening (MEOSL) or Middle English compensatory lengthening (MECL)? *English Language & Linguistics*, 25(1), 155-180.
<https://www.cambridge.org/core/services/aop-cambridge-core/content/view/768AF7B76C904AC904C216E01891D544/S1360674319000522a.pdf/div-class-title-middle-english-open-syllable-lengthening-meosl-or-middle-english-compensatory-lengthening-mecl-div.pdf>
- Montaño, F. A. (2024). A Stratal phonological analysis of stem-level and word-level effects in Old French compensatory vowel lengthening upon coda/s/deletion. *Languages*, 9(5), 177.
https://www.researchgate.net/publication/380579889_A_Stratal_Phonological_Analysis_of_Stem-Level_and_Word-Level_Effects_in_Old_French_Compensatory_Vowel_Lengthening_upon_Coda_s_Deletion
- Prince, A., & Smolensky, P. (1993/2002). Optimality theory: Constraint interaction in generative grammar. *Manuscript, Rutgers University and University of Colorado, Boulder*. [ROA 537].
- Rubach, J. (1997). Extrasyllabic consonants in Polish: Derivational optimality theory. *Derivations and constraints in phonology*, 551-582.
- Rubach, J. (2000a). Backness switch in Russian. *Phonology*, 17(1), 39-64.
<http://www.ai.mit.edu/projects/dm/featgeom/rubach-backness-switch.pdf>
- Rubach, J. (2000b). Glide and glottal stop insertion in Slavic languages: A DOT analysis. *Linguistic Inquiry*, 31(2), 271-317.

Sadeghi, V. (2008). Compensatory lengthening in Persian: the timing of non-modal phonation. *ExLing*.

https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=Compensatory+lengthening+in+Persian%3A+the+timing+of+non-modal+phonation&btnG=

https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=Compensatory+lengthening+in+Persian%3A+the+timing+of+non-modal+phonation&btnG=

Samko, B. (2011). Compensatory lengthening in harmonic serialism.

Qualifying Paper, University of California, Santa Cruz, 1-47.

https://roa.rutgers.edu/content/article/files/1227_samko_1.pdf

Sandell, R., & Byrd, A. M. (2015). Extrametricality and non-local compensatory lengthening: The case of Szemerényi's law. *LSA Annual Meeting, Portland, Oregon*.

https://www.academia.edu/10119139/Extrametricality_and_Non_Local_Compensatory_Lengthening_The_Case_of_Szemere_nyis_Law

https://www.academia.edu/10119139/Extrametricality_and_Non_Local_Compensatory_Lengthening_The_Case_of_Szemere_nyis_Law

Smaoui, C., & Al-Maktary, M. N. (2022). Gradual limitation within Harmonic Serialism. *Les Annales de l'Institut Supérieur des Langues de Tunis (ISSN 0330-793X)*, 14, 39-48.

Song, J. Y., & Demuth, K. (2008). Compensatory vowel lengthening for omitted coda consonants: A phonetic investigation of children's early representations of prosodic words. *Language and speech*, 51(4), 385-402.



https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=Compensatory+vowel+lengthening+for+omitted+coda+consonants%3A+a+phonetic+investigation+of+children%27s+early+representations+of+prosodic+words.&btnG=

Sukač, R. (2011). Compensatory lengthening in West Slavic. *Zeitschrift für Slawistik*, 56(4), 417-445.

https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=Compensatory+lengthening+in+West+Slavic&btnG=

Topintzi, N. (2006a). *Moriac onset* [PhD dissertation, University of London]. <http://roa.rutgers.edu/files/848-0706/848-TOPINTZI-0-0.PDF>

Topintzi, N. (2006b). A (not so) paradoxical instance of compensatory lengthening: Samothraki Greek and theoretical implications. *Journal of Greek Linguistics*, 7(1), 71-119.

https://brill.com/view/journals/jgl/7/1/article-p71_4.pdf

Topintzi, N. (2007). Solving the Samothraki Greek compensatory lengthening puzzle. *Selected papers on theoretical and applied linguistics*, 17(1), 53-63.

https://scholar.google.com/scholar?hl=ar&as_sdt=0%2C5&q=Solving+the+Samothraki+Greek+compensatory+lengthening+puzzle&btnG=

Appendix

Figure A

Taiz location in Yemen.

Source: (Al-Maktary, 2023, p. 82)

