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Demystifying Diphthong Adaptation Patterns within English Loanwords in Iraqi Arabic: An Optimality-Theoretic Analysis

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ABSTRACT

This paper aimed to provide an explanatory account of the phonological adaptation patterns of diphthongs within English loanwords in Iraqi Arabic (IA). The Optimality-Theoretic framework was employed to identify the phonological constraints imposed on 346 English loanwords in IA and then examine the interaction and ranking of those constraints. Results revealed that five phonological constraints were involved in adapting English diphthongs into IA: four faithfulness constraints and one markedness constraint. The undominated ranking of the markedness constraint NoDIPH explained the complete lack of diphthongs in IA output forms. The unique importance of the distance between a diphthong's two elements in determining its adaptation to IA and the high ranking of the faithfulness constraint UNIFORMITY in adapting wide diphthongs explain the atypical tendency of IA output forms to maintain the two-element feature of wide GB diphthongs /aɪ/, /aʊ/, and /ɔɪ/, adapting them into vowel-plus-glide sequence The preservation of the [mid] feature of the GB diphthongs /eɪ/, /ɪə/, /eə/, /əʊ/, and /ʊə/ and their reduction into monophthongs in their IA output forms were attributed to the undominated ranking of the faithfulness constraints IDENT V1 (mid) and IDENT V2 (mid) in narrow diphthong adaptation.

Keywords: Optimality Theory; Iraqi Arabic; Loanword Adaptation; Diphthong Adaptation; Vowel Adaptation

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ARTICLE INFO

Received: 2 September 2024 | Revised: 20 September 2024 | Accepted: 24 September 2024 | Published Online: 12 November 2024
DOI: https://doi.org/10.30564/fls.v6i5.7192

CITATION

Abdulrazzaq, A.H., 2024. Demystifying Diphthong Adaptation Patterns within English Loanwords in Iraqi Arabic: An Optimality-Theoretic Analysis. Forum for Linguistic Studies. 6(5): 447–460. DOI: https://doi.org/10.30564/fls.v6i5.7192

1. Introduction

Borrowing words from other languages is a common way for native speakers of a language to fill up linguistic gaps. The status of the source language, cultural advancements, and other factors may all contribute to the spread of borrowed words. A large number of such words have been adopted from English into IA, and with the advent of globalization, social media, technology, and other platforms that employ English as their primary medium, many more are expected to be borrowed[1].

Several phonological changes are imposed on loanwords when they become part of the target language because the sounds and syllable patterns of certain borrowed foreign words are prohibited in the target language. A limited number of studies have been conducted in the last 20 years to examine the prevalence of English loanwords in IA and the changes those words underwent as they were incorporated into the borrowing language. However, not only were these studies small-scale, but they were also conducted using phonological theories that managed, at best, to describe the changes that took place without attempting to explain them, thus providing an inadequate and limited account of this linguistic phenomenon.

Unlike rule-based theories, which did not have the mechanism to explain how the outputs of phonological rules relate to each other (see McCarthy[2] for examples of how SPE theory fails to account for "conspiracies"), the most important point in favor of Optimality-Theory (OT), which constitutes the theoretical framework of the current study, is its explanatory adequacy[3]. According to Carr and Montreuil[4], a rule in rule-based generative theories may inform us that in context C, the input A is transformed into the output B, "but it does not tell us why this change takes place." In contrast, OT, a constraint-based model first proposed by Prince and Smolensky[5] in the early 1990s, tries to offer an explanatory account of any mismatches between outputs and inputs by utilizing universal constraints, constraint violability, and constraint ranking[6]. Accordingly, an in-depth analysis of the phonological adaptation of English diphthongs in IA loanwords should not only outline the phonological rules that generate the various output forms in different contexts[7]), but also provide an explanation for why these adaptations occur by identifying the relationships between them.

OT is based on the concept of universal constraints that may nevertheless be violated. In OT, it is postulated that constraints are common to all languages and do not vary from one language to another. Despite being present in all languages, the ranking, or relative ordering, of these constraints varies among different languages. OT utilizes these two constraint properties of universality and varying ranking to explain the similarities and differences among human languages. While the universality of constraints provides an explicit way of explaining cross-linguistic commonalities, the different rankings of the same set of constraints are what creates specific language patterns, thus helping account for linguistic variation[6, 8].

In addition to its explanatory power advantage over rule-based approaches, the OT framework has been the method of choice for loanword phonology studies in recent years due to its ability to address the "duplication problem" that has posed challenges for rule-based analyses of loanword adaptations[9, 10]. Based on rule-based model of analysis[11], loanword phonology is composed of rules that the borrowing language lacks. Therefore, extra rules unique to loanword phonology must be introduced to the grammar that duplicate morpheme structure constraints.

Conversely, constraint-based theories, like (OT) contend that they can account for phonological modifications in loanwords without requiring extra phonological rules[12]. These theories propose that loanword phonology is not a distinct component of grammar. Instead, they propose that the phonological differences between foreign words and their native counterparts arise from applying the same constraint hierarchy that governs native phonology to non-native words and phrases[10, 13, 14]. In OT, it is postulated that a language has a single constraint hierarchy, and that the interplay between markedness constraints and faithfulness constraints governs the final form of the language. Accordingly, the output form of borrowed words must adhere to the input form in the source language due to faithfulness constraints, while complying with markedness constraints which provide restrictions on how well-formed the output form must be structurally in the borrowed language[12].

To the best of my knowledge, these constraints and phonological changes in English loanwords in IA have never been studied within an OT framework. Given the considerable ongoing borrowing of English loanwords into IA and the lack of adequate research that is currently available on

the adaptation of English loanwords in IA, an OT analysis is expected to provide a more complete and accurate account of English loanwords in IA that provides an *explanatory* account of these adaptations, thus filling this gap in the body of knowledge about IA loanword phonology.

The present study primarily aims to explore the diphthong adaptations of English loanwords in IA and, using the OT framework, provide an explanatory account of how and why these adaptations occur. More specifically, the study aims to:

a. Identify the phonological constraints involved in the adaptation of English diphthongs as they are incorporated into IA.
b. Explain how and why these diphthong adaptations occur by examining the ranking and interaction of those phonological constraints.

1.1. Phonemic Inventories

Conducting an OT analysis requires dealing with the native variety of the language, the mother tongue of its native speakers, which shows the constraints that universal grammar can impose on its speakers. Accordingly, the following two language varieties are utilized in the current study:

a. General British (GB), commonly referred to as British English, is the standard English language dialect that is spoken and written in the United Kingdom[15].
b. Iraqi Arabic, also known as Baghdadi Arabic, Mesopotamian Arabic, or the gilit-dialect, is the "dominant, both numerically and in prestige," dialect of the Arabic language spoken in Iraq[16].

The GB phonemic inventory comprises a total of 44 phonemes, including 24 consonants and 20 vowels. Vowels are classified into 12 monophthongs and 8 diphthongs[17]. The 12 GB monophthongs (as illustrated in **Figure 1**) consist of the seven short vowels: /ɪ/, /e/, /æ/, /ə/, /ʌ/, /ʊ/, and /ɒ/, and the five long vowels: /i:/, /ɜ:/, /u:/, /ɔ:/, and /ɑ:/.

	Front	Central	Back
High	i:		u:
near High	ɪ		ʊ
Mid	e	ə/ ɜ:	ɔ:
near Low		ʌ	
Low	æ		ɑ:/ ɒ

Figure 1. Chart of GB monophthongs.

Diphthongs, according to Roach[17], are "sounds that consist of a movement or glide from one vowel to another." The 8 diphthongs in GB may be classified into 3 wide diphthongs (/ɔɪ/, /aɪ/, and /aʊ/) and 5 narrow diphthongs (/eɪ/, /əʊ/, /ɪə/, /eə/, and /ʊə/) or alternatively, into 3 centering diphthongs (/ɪə/, /eə/, and /ʊə/) and 5 narrow diphthongs (/eɪ/, /ɔɪ/, /aɪ/, /aʊ/, and /əʊ/)[17–19].

In contrast, the IA phonemic inventory comprises a total of 39 phonemes, including 31 consonants and 8 vowels. All vowels in IA are monophthongs. Following Hassan[20], Ghalib[21], and Abdulrazzaq and Al-Ubaidy[22], the eight monophthongs of IA may be classified as follows (see **Figure 2**):

1. /i:/ a long high front unrounded vowel, e.g., /ʃi:/ *thing*, /ʕi:d/ *repeat*, etc.
2. /ɪ/ a short near-high near-front unrounded vowel, e.g., /sɪn/ *tooth*, /ɪbɪn/ *son*, etc.
3. /ʊ/ a short near-high near-back rounded vowel, e.g., /mʊr/ *bitter*, /nʊsˤ/ *half*, etc.
4. /u:/ a long high back rounded vowel, e.g., /ku:b/ *cup*, /ʃu:f/ *look*, etc.
5. /e:/ a long mid front unrounded vowel, e.g., /be:t/ *house*, /ze:t/ *oil*, etc.
6. /ɔ:/ a long mid back rounded vowel, e.g., /lɔ:n/ *color*, /sˤɔ:t/ *sound*, etc.
7. /a/ a short near low front unrounded vowel, e.g., /sad/ *he closed*, /bas/ *enough*, etc.
8. /a:/ a long low central unrounded vowel, e.g., /ba:b/ *door*, /na:s/ *people*, etc.

	Front	Central	Back
High	i:		u:
near High	ɪ		ʊ
Mid	e:		ɔ:
near Low	a		
Low		a:	

Figure 2. Chart of IA vowels.

As for diphthongs, I agree with scholars like Abdulrazzaq and Al-Ubaidy[22]), Alhoodi[23], Ingham[24], Rahim[25], and Watson[26], among others, that diphthongs are forbidden from surfacing in some Arabic dialects (including IA) and that they are treated as two contiguous units, a vowel plus a glide. Accordingly, in IA, wide diphthongs like GB /aɪ/ in /waɪər/ *wire*, /aʊ/ in /faʊl/ *foul,* and /ɔɪ/ in /kɔɪl/ *coil*, for example, would surface in English loanwords as the vowel-plus-glide sequences /a:j/ in /wa:.jar/, /a:w/ in /fa:.wal/ and /ɔ:j/ in /kɔ:.jɪl/, or in the native IA words /ha:.wan/ *mortar* and /ʧa:.jak/ *your tea*, etc. Similarly, narrow diphthongs like

GB /eɪ/, /əʊ/, /ɪə/, /eə/, and /ʊə/ do not exist in IA. When they do occur within English source words, these diphthongs are typically reduced to IA monophthongs via coalescence in loanwords, e.g., reducing GB /eɪ/ in /leɪ.zər/ to IA /e:/ in /le:.zar/, and GB /əʊ/ in /ləʊd/ to IA /ɔ:/ in /lɔ:d/, etc.

1.2. Models of Loanword Adaptation

The question of whether adaptations occur at the phonemic or phonetic levels is a highly debated topic in loanword phonology. There are three main viewpoints in the current literature: the perceptual approach, the phonological approach, and the Optimality Model [27].

The purely perceptual adaptations approach suggests that loanwords are adapted solely through perception [28]. This perspective's proponents contend that since speakers of the receiving language lack access to the source language's phonological categories and structures, adaptation results from the borrower's misinterpretation of the foreign source word. The phonological adaptations approach, on the other hand, posits that when bilingual speakers proficient in both languages borrow a word from their second language to compensate for a gap in their first language these speakers effectively get the underlying representation of the borrowed word from their mental dictionary for the second language, and then generate the surface representation of the word using the phonological system of the first language [29, 30].

A third "intermediate" model, called the Optimality Model, advocated by Boersma and Hamann [31], Kenstowicz [32], Silverman [11], and Yip [33], aligns with the phonetic model in recognizing that the surface representation of the donor language is used as input. However, this model also suggests that adaptation takes into account the phonological categories and constraints of the native system, as well as potential orthographic effects, in order to achieve the optimal match. Therefore, the Optimality Model allows for the interaction of donor language phonetic features and native grammar phonological and phonotactic limitations in the formation of loanwords, making it a comprehensive and enlightening approach to loanword adaptation.

In addition to oral input to the loan adaptation process, input can be conveyed through written means, where spelling can have an important impact on adaptation. Though researchers have varying opinions on the influence of spelling on loanword adaptation, they generally acknowledge the importance of written input and the difficulty to determine the exact impact of orthography in certain situations, as phonological and orthographical adaptation mechanisms can result in similar loanword adaptation patterns, as noted in Crawford [34], Dohlus [35], and Kang [36].

Within the specific context of diphthong adaptation patterns within English loanwords in Iraqi Arabic, the phonological adaptations approach would thus predict that markedness constraints would totally dominate faithfulness constraints since the borrower would always resort to their native phonology when adapting loanwords. Conversely, the perceptual adaptations approach predicts that it is faithfulness constraints, i.e., how closely loanwords are perceived in relation to the source language, that determines how they adapt. Finally, the optimality model would predict that the adapted forms of loanwords would be the result of the interaction between both types of constraints, as well as the role played by other non-phonological factors.

1.3. Review of Previous Studies

Several studies [7, 37–43] have been undertaken over the last 20 years to investigate English loanwords in IA and the modifications that occurred when these words were assimilated into IA. However, most of these studies were characterized by limited data and a primary emphasis on the morphological or sociolinguistic elements of the adaptations. The only two studies that focused on the phonological aspect and attempted to offer some patterns of adaptation, As-Sammer [7] in terms of vowel quantity vs. quality and Salman [41] in terms of adaptation processes, both failed to offer any quantitative data that would verify those patterns. Moreover, neither of these studies tried to provide an explanatory account for those adaptations utilizing OT as the theoretical framework for their data analysis.

More recently, Abdulrazzaq and Al-Ubaidy [22] conducted a quantitative content analysis of 346 English loanwords in IA to identify and characterize the patterns of diphthong modification involved. The findings revealed that the vowels of the output forms tended to retain as many features of the GB input diphthong as feasible by converting the diphthong into a vowel-plus-glide sequence or reducing it to a single vowel. Despite identifying the patterns of diphthong adaptation in these words, the study failed to explain why these adaptations took place.

On the other hand, most studies on other Arabic dialects[23, 44–46] focused on investigating adaptations of the syllable structure or consonants. Still, two of these studies[23, 43] did address the adaptation of diphthongs in English words as they were borrowed into other Arabic dialects, namely, Ammani Arabic (AA) and Qassimi Arabic (QA), and both conducted quantitative analyses and came up with some patterns of adaptation. As for providing an explanatory account of these diphthong adaptation patterns, only Alhoody[23] used the OT framework, while Abu Guba restricted his OT analysis to the adaptation of suprasegmental features. However, Alhoody[23] did not use the OT framework for identifying constraints and examining their ranking and interaction. Instead, he used Dresher's[47] Contrastive Hierarchy Theory to determine the contrastive aspects of the QA phonological inventory and then transformed the contrastive hierarchy of the QA segment inventory into OT constraints.

When studying languages other than Arabic, researchers have used different models of analysis to understand how diphthongs behave in loanword phonology. These models include Classic OT[48–51], Stochastic OT[52], and a combination of Classic OT and the Unified Feature Geometry Model[53]. By examining various aspects of diphthongs, including their acoustic features[52], glide epenthesis[53], falling sonority diphthongs[50], or diphthong substitution in general[48, 51], these researchers have presented examples of how diphthong reduction and the formation of vowel-plus-glide sequences are commonly used to adapt borrowed diphthongs into Hebrew, Shona, Urdu, Panjabi Persian, Korean, and Thai.

2. Materials and Methods

2.1. Data Collection

The data for the current study were the diphthong adaptation patterns within English loanwords in IA reported in Abdulrazzaq and Al-Ubaidy[21]. These patterns (see **Appendix A**) were based on a quantitative analysis of 346 English loanwords in IA that were drawn from three main sources: an etymological dictionary of loanwords in IA, loanwords listed in four academic research studies of English loanwords in IA, and loanwords collected by the researchers as native speakers of IA using a self-observation technique.

In order to address the two research questions of the current study, all systematic adaptations within English words in IA reported in Abdulrazzaq and Al-Ubaidy[22] were examined. Diphthong changes that appeared only once or twice per GB diphthong (e.g., /eɪ/ to /a:j/ as in /meɪəneɪz/ *mayonnaise* into /ma:jɔ:ni:z/) were identified and excluded as they did not represent systematic phonological adaptations. All remaining diphthong adaptations were deemed systematic and were analyzed within the OT framework.

2.2. OT Analysis

The current study's data analysis was limited to the segmental phonological adaptations of GB diphthongs within English loanwords in IA. Monophthong, consonantal, phonotactic, and suprasegmental adaptations are all outside the scope of the study.

A detailed OT analysis of the data was conducted by choosing an example (typically monosyllabic) loanword of each adaptation pattern, using its GB pronunciation as the input form and as the output candidate with a direct IA counterpart, and its IA pronunciation as the optimal candidate. The input form, the optimal form, as well as the closest possible other candidates (containing all other IA vowels and IA vowel-plus-glide sequences were all then set against each other in a violation tableau to determine the markedness and faithfulness constraints involved in choosing the optimal candidate.

Next, and in order to rank these constraints sets of elementary ranking conditions (ERCs) were obtained and all harmonically bounded candidates and ERCs already entailed by other ERCs by L-retraction and W-extension were identified and excluded as they did not contribute to the ranking of constraints. The remaining ERCs were then examined in terms of winner-rival comparisons, resulting in the final ranking of constraints. Finally, these comparative tableaux were re-examined using constraint demotion to ascertain the accuracy of the results and detect any inconsistencies.

3. Results

As mentioned in Section 1.1, no diphthongs are available in IA phonemic inventory, and consequently, all GB diphthongs within English loanwords in IA must undergo phonological modifications to be acceptable in the borrow-

ing language. Quantitative content analysis of English loanwords in IA, as reported by Abdulrazzaq and Al-Ubaidy [22], revealed that IA speakers attempt to preserve as many elements of both vocalic components of GB diphthongs as feasible. This is done by replacing the three wide GB diphthongs with their vowel-plus-glide sequence counterparts and reducing the five narrow diphthongs, via coalescence, into their single vowel counterparts.

Accordingly, the three GB diphthongs /aɪ/, /aʊ/, and /ɔɪ/ often appear as IA long vowels followed by consonantal glides, with the GB high vowels, which are the second element of these GB diphthongs, appearing as IA glides /j/ and /w/ that share the same vowel height and vowel rounding characteristics. On the other hand, the remaining five GB diphthongs /eɪ/, /ɪə/, /eə/, /ʊə/, and /əʊ/ consistently appear as single IA monophthongs in the adapted forms, where GB /eɪ/, /ɪə/, /eə/, and /ʊə/ are all replaced with IA /e:/, and GB /əʊ/ replaced with IA /ɔ:/.

In the next two subsections, the OT framework is used to evaluate one example of each of the two diphthong adaptation patterns in order to determine the constraints involved, as well as the interaction and ranking of those constraints. Appendix B contains OT violation tableaux for each of the other diphthong adaptations within the remaining five GB diphthongs.

3.1. Replacing Diphthongs with Vowel-Plus-Glide Sequences

This adaptation pattern is resorted to in order to accommodate wide GB diphthongs which are all illicit in IA. To discuss how replacing a GB diphthong with a vowel-plus-glide sequence satisfies the markedness constraints that forbid IA syllables from having these diphthongs, consider the English loanword *light* which is realized as /la:jt/ in IA. A faithful mapping of *light* would violate the markedness constraint NoDIPH which forbids IA syllables from occupying the nucleus of a syllable (see **Table 1** below for constraint definitions which all follow the strategy put forward by McCarthy [2].

To repair this, replacing the GB diphthong /aɪ/ with the vowel-plus-glide sequence /a:j/, or the monophthongs /i:, u:, e:, a, a:/, among other more marked options, can be resorted to. Diphthong substitution with the vowel-plus-glide sequence /aɪ/ would violate the constraint *IDENT V2 (vocalic)*, while substitution with the monophthongs /i:, u:, e:, a, a:/ violates the constraint UNIFORMITY. Since IA typically replaces the GB /aɪ/ with the IA /la:j/, it can be concluded that both *NoDIPH* and *UNIFORMITY* dominate *IDENT V2 (vocalic)*. The interaction of all these constraints is illustrated in **Tableau 1**.

As can be seen from **Tableau 1**, the output candidate with a direct IA counterpart, i.e., the candidate in (a), is eliminated as it fatally violates the undominated markedness constraint *NoDIPH*. Though the candidates (in c-g) satisfy *NoDIPH*, they are all ruled out as they incur a fatal violation of the constraint *UNIFORMITY*. This confirms that *UNIFORMITY* outranks *IDENT V2 (vocalic).* The winning candidate in (b) violates the markedness constraint *IDENT V2 (vocalic)* but satisfies the undominated constraint *NoDIPH*, which confirms that *NoDIPH* dominates *IDENT V2 (vocalic).*

3.2. Reducing Diphthongs to Monophthongs

This pattern of adaptation is utilized to accommodate narrow GB diphthongs which are all prohibited in IA. When analyzing this adaptation pattern, two clear sub-patterns of adaptation were observed based on whether the diphthong was centering or closing. One pattern was found for the conversion of centering narrow diphthongs, while another pattern emerged for the conversion of closing narrow diphthongs.

3.2.1. Reducing Centering Diphthongs to Monophthongs

To discuss how replacing a GB diphthong with a vowel-plus-glide sequence satisfies the markedness constraints that forbid IA syllables from having these diphthongs, consider the English loanword *gear* which is realized as /ge:r/ in IA. A faithful mapping of *gear* would violate the markedness constraint *NoDIPH*. To repair this, reducing the GB diphthong /ɪə/ to the monophthong /e:/ or replacing it with the vowel-plus-glide (or glide-plus-vowel) sequences /ja/ or /ja:/, among other more marked options, can be resorted to. Diphthong reduction to the monophthong /e:/ would violate the constraint *UNIFORMITY* while substitution with the vowel-plus-glide sequences /ja/ or /ja:/ violates the constraint *IDENT V2 (mid)* which assigns one violation mark for every output segment that differs from its corresponding input diphthong's second element in the feature [mid]. Since

Table 1. Constraints used in adapting GB /aɪ/ in IA.

	Constraint	Definitions
1	NoDIPH	Assign one violation mark for every syllable that has a diphthong.
2	UNIFORMITY	Assign one violation mark for every output segment that has multiple correspondents in the input.
3	IDENT V2 (vocalic)	Assign one violation mark for every output segment that differs from its corresponding input diphthong's second element in the feature [vocalic].

Tableau 1. NoDIPH, UNIFORMITY>>IDENT V2 (vocalic).

/laɪt/	NoDIPH	UNIFORMITY	IDENT V2 (vocalic)
a. laɪt	*!		
☛ b. la:jt			*
c. li:t		*!	
d. lu:t		*!	
e. le:t		*!	
f. lat		*!	
g. la:t		*!	

IA typically replaces the GB /ɪə/ with the IA /e:/, it can be concluded that both *NoDIPH* and *IDENT V2 (mid)* dominate *UNIFORMITY*. The interaction of all these constraints is illustrated in **Tableau 2**.

According to **Tableau 2**, the output candidate with a direct IA counterpart, i.e., the candidate in (a), is ruled out as it incurs a fatal violation of the undominated markedness constraint *NoDIPH*. Though the candidates (in c and d) satisfy *NoDIPH*, they are both excluded as they fatally violate the constraint *IDENT V2 (mid)*, confirming that *IDENT V2 (mid)* outranks *UNIFORMITY.* The winning candidate in (b) violates the markedness constraint UNIFORMITY but obeys the undominated constraint *NoDIPH*, confirming that *NoDIPH* dominates *UNIFORMITY.*

3.2.2. Reducing Closing Diphthongs to Monophthongs

To illustrate the pattern observed for the conversion of closing narrow GB diphthongs into single IA vowels, consider the English loanword *brake* which is realized as /bre:k/ in IA. A faithful mapping of *break* would violate the markedness constraint NoDIPH. Alternatively, the GB diphthong may be reduced to the monophthong /e:/ or substituted with the vowel-plus-glide sequences /aj/ or /a:j/, among other more marked options. Diphthong reduction to the monophthong /e:/ would violate the constraint UNIFORMITY while substitution with the vowel-plus-glide sequences /aj/ or /a:j violates the constraint *IDENT V1 (mid)* which assigns one violation mark for every output segment that differs from its corresponding input diphthong's first element in the feature [mid]. Since IA typically replaces the GB /eɪ/ with the IA /e:/, it can be concluded that both *NoDIPH* and *IDENT V1 (mid)* dominate *UNIFORMITY*. The interaction of all these constraints is illustrated in **Tableau 3**.

Tableau 3 shows that the output candidate with a direct IA counterpart, i.e., the candidate in (a), is ruled out as it incurs a fatal violation of the undominated markedness constraint *NoDIPH*. Though the candidates (in c and d) satisfy *NoDIPH*, they are both excluded as they fatally violate the constraint *IDENT V1 (mid)*, confirming that *IDENT V1 (mid)* outranks *UNIFORMITY.* The winning candidate in (b) violates the markedness constraint UNIFORMITY but obeys the undominated constraint *NoDIPH*, confirming that *NoDIPH* dominates *UNIFORMITY.*

4. Discussion

The present study sought to explain the adaptation of GB diphthongs in English loanwords in IA by identifying the phonological constraints imposed on these loanwords and examining the interaction and ranking of those constraints.

4.1. Identification of IA Constraints

The findings of the OT analysis demonstrate that five constraints (one markedness constraint and four faithfulness constraints) were needed to account for all the diphthong

Tableau 3. *NoDIPH, IDENT V2 (mid) >> UNIFORMITY.*

/gɪər/	NoDIPH	IDENT V2 (mid)	UNIFORMITY
a. gɪər	*!		
☛ b. ge:r			*
c. gjar		*!	
d. gja:r		*!	

Tableau 4. NoDIPH, IDENT V1 (mid) >> UNIFORMITY.

/breɪk/	NoDIPH	IDENT V1 (mid)	UNIFORMITY
a. breɪk	*!		
☛ b. bre:k			*
c. brajk		*!	
d. bra:jk		*!	

adaptations in the present study, as shown in **Table 2**.

4.2. Interaction and Ranking of IA Constraints

Now that the phonological constraints involved in the diphthong adaptations within English loanwords in IA have been identified, the next step was to examine their interaction and ranking and the effect of the interaction of these constraints in terms of the phonological adaptations they imposed on English loanwords in IA.

4.2.1. Interaction

As far as the constraint interaction that is involved in the adaptation of GB diphthongs is concerned and bearing in mind the OT claims to psychological reality[54], the results indicate that IA speakers start the adaptation process by utilizing the markedness constraint *NoDIPH* to reject any output candidates that contain diphthongs i.e., all candidates directly matching the input form. The next step depends on the distance between the two elements of the input diphthong. If relatively long (i.e., when encountering any of the three wide GB diphthongs /ɔɪ/, /aɪ/, or /aʊ/), all coalesced candidates are rejected for fatally violating the faithfulness constraint *UNIFORMITY,* leaving the vowel-plus-glide candidate, which obeys *UNIFORMITY* but violates IDENT V2 (vocalic), to emerge as the optimal candidate.

If the distance between the diphthong's two elements is somewhat small (i.e., when encountering any of the five narrow GB diphthongs /eɪ/, /əʊ/, /ɪə/, /eə/, or /ʊə/), the two possible vowel-plus-glide candidates would obey the constraint *UNIFORMITY* but fatally violate one of the faithfulness constraints *IDENT V1 (mid)* or *IDENT V1 (mid) and* would therefore be excluded. In addition, all [+high], and [+low] coalesced candidates violate IDENT V1 (mid) in the case of /eɪ/ and /əʊ/, IDENT V2 (mid) in the case of /ɪə/, /eə/, /ʊə/ and are therefore excluded, allowing the only remaining [+mid] coalesced candidate which violates *UNIFORMITY* but obeys IDENT to emerge as optimal.

4.2.2. Ranking

The OT analysis of the adaptation patterns shows that the markedness and faithfulness constraints involved in adapting GB diphthongs into IA are ranked as illustrated in **Table 3**.

The constraint ranking shown in **Table 3** demonstrates the phonological markedness-based nature of the process of diphthong adaptation within English loanwords in Iraqi Arabic The ranking shows that GB diphthongs cannot appear in their original form owing to the total domination of the markedness constraint *NoDIPH* that opposes diphthongs, thus confirming the position put forward by scholars like Rahim[25], Ingham[24], Watson[26], Alhoodi[23], and Abdulrazzaq and Al-Ubaidy[22] among others that diphthongs never surface in IA output forms. This forces IA speakers to try to retain the characteristics of both vocalic components of the GB diphthongs by using one of two simplification strategies: monophthongization or replacement with a vowel-plus-glide sequence. When deciding on which strategy to follow, the IA speaker takes into account both the GB input form as well as IA phonology to determine the most accurate output.

The findings also showed that faithfulness constraints play a crucial role in determining the relationship between the diphthongs' vocalic elements and their corresponding output segments. These faithfulness constraints were particularly necessary to explain the process of diphthong reduction

Table 2. Phonological constraints used in the diphthong adaptation of English loanwords in IA.

	Constraint	Definition
1	NoDIPH	Assign one violation mark for every syllable that has a diphthong.
2	UNIFORMITY	Assign one violation mark for every output segment that has multiple correspondents in the input.
3	IDENT V1 (mid)	Assign one violation mark for every output segment that differs from its corresponding input diphthong's first element in the feature [mid].
4	IDENT V2 (mid)	Assign one violation mark for every output segment that differs from its corresponding input diphthong's second element in the feature [mid].
5	IDENT V2 (vocalic)	Assign one violation mark for every output segment that differs from its corresponding input diphthong's second element in the feature [vocalic].

Table 3. Final rankings of constraints involved in the adaptation of GB diphthongs.

Constraint Rankings
{NoDIPH, IDENT V1 (mid), IDENT V2 (mid)} >> UNIFORMITY» IDENT V2 (vocalic)

via coalescence where the adapted form typically exhibited characteristics of both elements and where the interaction between these constraints decided which features of the two elements of the diphthong were faithfully maintained in the resulting segment.

Thus, the high ranking of the faithfulness constraint UNIFORMITY when processing wide diphthongs, as shown in **Table 1**, explained IA output forms' tendency to maintain the two-element feature of the three GB diphthongs /aɪ/, /aʊ/, and /ɔɪ/, adapting them into vowel-plus-glide sequences. On the other hand, the undominated ranking of the faithfulness constraints IDENT V1 (mid), and IDENT V2 (mid), as shown in the same table, explained IA output forms' tendency to maintain the feature [mid] in all five narrow GB diphthongs, eventually reducing them into the mid IA monophthongs /e:/ and /ɔ:/.

To sum up, the results suggest that IA speakers place great importance on eliminating diphthongs in the output form and retaining the "wide" and "mid" features of the input diphthong, when available. In order to accomplish these objectives, IA speakers are open to making concessions when it comes to preserving the vocalic nature of the second element of the diphthong, or even relinquishing the dual-element quality of the original diphthong altogether, opting instead for a single monophthong. The results further reveal a unique characteristic of IA where the distance between a diphthong's two elements plays an important role in determining the diphthong's adaptation in IA. This characteristic is unique as it goes against the most prevalent type of coalescence, according to Casali [55, 56], namely height coalescence, where a high V2 and a non-high V1 merge to create a non-high vowel that is otherwise the same as V2, as evidenced in English loanwords in other Gulf Arabic dialects, like Saudi, Kuwaiti, or Emirati, for example, where, unlike IA, the distance between a diphthong's two elements can have no impact, and the two elements in the wide diphthong /ai/ in the English word light /laɪt/, for example, are merged into /e:/ and the word is pronounced as /le:t/.

Out of the several studies that investigated the adaptation of diphthongs in English words as they are borrowed into Arabic dialects, only Alhoody [23] attempted to identify the constraints involved in these adaptations. Even though Alhoody [22] did not make direct use of the OT framework for identifying constraints, when converting the contrastive hierarchy of the QA segment inventory into OT constraints, Alhoody found that both faithfulness and markedness constraints were involved in adapting English loanwords in QA, which aligns with the findings of the present study. The constraints identified by Alhoody consisted of the six faithfulness constraints MAX[BACK], MAX[LOW], MAX[LABIAL], MAX[LONG], MAX[HIGH], and MAX[VOCALIC], as well as the12 markedness constraints *[αLOW, +BACK], *[αLABIAL, -BACK], *[αLABIAL, +LOW], *[αLABIAL, -LOW], *[αHIGH, +LOW], *[αHIGH, -LABIAL], *[αHIGH, -LONG], *[αVOCALIC, +LOW], *[αVOCALIC, -LABIAL], *[αVOCALIC, +LONG], *[αVOCALIC, +HIGH], and *[αVOCALIC, -HIGH].

In addition to Arabic dialects, diphthong adaptation within English loanwords has been repeatedly documented across a number of languages. Cohen [52], Kadenge and

Mudzingwa [53], Hussain et al. [48], Kambuziya and Hosseinzadeh [49], Ryu [50], and Phetkla [51], among others, all report examples of the use of diphthong reduction, and the formation of vowel-plus-glide sequences among the strategies used for adapting diphthongs borrowed into Hebrew, Shona, Urdu, Panjabi Persian, Korean, and Thai.

The segmental nature of the current study's scope may give rise to potential limitations. Thus, the identification, ranking, and interaction of constraints reported in this study remain provisional, pending further consonantal, phonotactic, and suprasegmental analysis results.

5. Conclusions

This research aimed to provide an explanatory account of the diphthong adaptation patterns within English loanwords in IA by identifying the phonological constraints imposed on these loanwords by the phonological systems of IA and GB.

The results indicate that a total of five phonological constraints are involved in adapting GB diphthongs in English loanwords in IA. These constraints are divided into one markedness constraint and four faithfulness constraints. The markedness constraint placed conditions on the structural well-formedness of the IA output form, prohibiting diphthongs from appearing in the IA output form. The faithfulness constraints, on the other hand, worked on preserving the features of the GB input diphthong. With the exception of the constraint *UNIFORMITY* which prevents the merger of multiple elements in the input form into a single element in the output, all the remaining faithfulness constraints had to do with prohibiting output segments from having features that were different from their input correspondent.

Next, the research sought to analyze the interaction and ranking of these constraints and examine their effects in terms of the phonological adaptations that have occurred because of this ranking and interaction. Regarding constraint interaction, the findings indicate that upon hearing a GB diphthong, IA speakers would first reject any output candidates that contain diphthongs using the markedness constraint *NoDIPH*. Depending on the aperture between the two elements of the GB diphthong, IA speakers may then use the faithfulness constraint *UNIFORMITY*, in the case of loanwords containing wide diphthongs, to reject all coalesced candidates allowing the remaining vowel-plus-glide sequence candidate to emerge as the optimal candidate.

As for loanwords containing *centering* narrow GB diphthongs, and right after rejecting candidates containing diphthongs, IA speakers use the faithfulness constraint *IDENT V2 (mid)* to reject all candidates with a high or low V2 and enable the remaining candidate (with a mid V2) to emerge as the optimal candidate.

Finally, in loanwords containing the two *closing* narrow GB diphthongs /eɪ/ and /əʊ/, immediately after applying the markedness constraint *NoDIPH*, IA speakers utilize the faithfulness constraint *IDENT V1 (mid)* to reject all candidates allowing the remaining candidate (with a mid V1) to emerge as the optimal candidate.

As for ranking, the findings indicate that IA speakers' highest priorities are to avoid having diphthongs in the output form altogether and to preserve the [wide] and [mid] features of the input diphthong, when available. To achieve these two priorities, IA speakers are willing to compromise faithfulness to the vocalic nature of the diphthong's second element and instead have it converted into a glide consonant, or even sacrifice the two-element characteristic of the input diphthong altogether and have these two elements merged into a single monophthong.

These rankings have not only confirmed IA's general inclination to transform English vowels (see Abdulrazzaq [57] for IA monophthong adaptations) into predominantly mid-oriented vowels but have also revealed a unique characteristic of IA where the diphthong's adaptation is significantly influenced by the distance between its two elements.

In conclusion, the process of adapting loanwords phonologically is influenced by various linguistic and non-linguistic factors. Given the numerous factors at play, it is not surprising that the results can be quite diverse, sometimes exhibiting peculiar patterns [36] that cannot be accounted for by native phonological processes or constraints. The interaction between the markedness and faithfulness constraints reported in the findings of this study supports the optimality perspective on loanword adaptation which accounts for the formation of loanwords in terms of the interaction of the phonetic features of the donor language and the phonological and phonotactic limitations of the native grammar.

The present study has thus managed to fill a gap in the body of knowledge about IA loanword phonology by

providing insights into the constraints involved in the adaptation of English diphthongs as they are borrowed into IA and offering an explanatory account of these adaptations by examining and determining the interaction and ranking of those phonological constraints. In addition to ranking these constraints, by highlighting the unique characteristic of IA where the distance between a diphthong's two elements plays an important role in its adaptation, the study has hopefully provided a new insight into loanword phonology and the study of human languages in general.

Funding

This research received no external funding.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

The data and materials used in the study are all available either within the article itself or within the resources (books, articles, etc.) that are clearly and explicitly referenced within the present article.

Acknowledgments

The author would like to acknowledge the support of Al Hikma University College, Baghdad, Iraq in producing this study.

Conflict of Interest

The author declares that there is no conflict of interest.

Appendix A

Diphthong adaptation patterns within English words in IA reported in Abdulrazzaq and Al-Ubaidy [22]

GB	Typical IA Mapping	Other IA Mappings
aɪ	a:j	i:, ɪ, a:
ɔɪ	ɔ:j	
aʊ	a:w	ɔ:, u:
eɪ	e:	a:, a, aj, i:, ɪ, a:j
ɪə	e:	ɪ
eə	e:	ɔ:, a:, a
ʊə	e:	
əʊ	ɔ:	a:, a, u:,

Appendix B

Violation tableaux of the adaptations of GB diphthongs into IA vowels

1. ***Adaptation of GB /aʊ/ into IA /a:w/***

Tableau 4. NoDIPH, UNIFORMITY>>IDENT V2 (vocalic).

/aʊt/	NoDIPH	UNIFORMITY	IDENT V2 (vocalic)
a. ʔaʊt	*!		
☛ b. ʔa:wt			*
c. ʔi:t		*!	
d. ʔu:t		*!	
e. ʔe:t		*!	
f. ʔɔ:t		*!	
g. ʔa:t		*!	

2. ***Adaptation of GB /ɔɪ/ into IA /ɔ:j/***

Tableau 5. NoDIPH, UNIFORMITY>>IDENT V2 (vocalic).

/bɔɪ/	NoDIPH	UNIFORMITY	IDENT V2 (Vocalic)
a. bɔɪ	*!		
☛ b. bɔ:j			*
c. be:		*!	
d. bɔ:		*!	
e. ba:		*!	
f. bi:		*!	
g. bu:		*!	

3. ***Adaptation of GB /eə/ into IA /*e*:/***

Tableau 6. *NoDIPH, IDENT V2 (mid)>>UNIFORMITY.*

/speər/	NoDIPH	IDENT V2 (mid)	UNIFORMITY
a. speər	*!		
☛ b. spe:r			*
c. spajr		*!	
d. spa:jr		*!	

4. ***Adaptation of GB /ʊə/ into IA /*e*:/***

Tableau 7. *NoDIPH, IDENT V2 (mid)>>UNIFORMITY.*

/mænɪkjʊər/	NoDIPH	IDENT V2 (mid)	UNIFORMITY
a. manɪkjʊər	*!		
☛ b. manɪke:r			*
c. manɪkwar		*!	
d. manɪkwa:r		*!	

5. ***Adaptation of GB /əʊ/ into IA /ɔ:/***

Tableau 8. NoDIPH, IDENT V1 (mid)>> UNIFORMITY.

/kəʊt/	NoDIPH	IDENT V1 (mid)	UNIFORMITY
a. kəʊt	*!		
☛ b. kɔ:t			*
c. kawt		*!	
d. ka:wt		*!	

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