Consonantal Harmony in the Holy Qur'anic Vocabulary: An Optimality-Theoretic Study

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Abstract:

The study at hand explores harmony (a long-distance aspect of assimilation) as a phonological phenomenon. It concentrates on harmony elicited in consonant segments in the Holy Qur'anic Vocabulary (HQV hence after) as an essential portion of Classical Arabic (CA). This is because harmony process characterizes various Arabic dialects. The current study contributes to filling a research gap by treating HQV. The selected data of HQV are described and analysed by using Optimality Theory (OT) as a constraint-based framework that Prince and Smolensky (1991) proposed and was then developed by Prince and McCarthy(1993). The major objective of the present study is to identify the phenomenon of consonantal harmony (CH) in CA rather than dialects.

Keywords: Harmony, Consonant Harmony, Autosegmental Approach, Optimality Theory

Received: 13/03/2022 **Accepted:06/06/2022**

تناسق الصوامت في المفردات القرآنية : دراسة تفاضلية

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الملخص:-

تعتبر ظاهرة التناسق الصوتي (التناغم) احدى مظاهر التماثل (الادغام) المتباعد. تعنى هذه الدراسة بظاهرة التناسق الصوتي بين الصوامت المتباعدة في المفردات القرآنية التي تمثل اللغة العربية الفصحى القديمة. يعزو ذلك لانتشار ظاهرة التناسق في اللهجات العربية المتنوعة. تهدف هذه الدراسة لوصف وتحليل عينة من المفردات القرآنية المختارة حسب النظرية التفاضلية كما انها تميز بين المفردات المتناسقة وغير المتناسقة. تظهر نتائج الدراسة على ان الاصوات المتباعدة في المفردات القرآنية تتناسق مع بعضها البعض حيث يحدث التناسق في اللغة العربية الفصحى القديمة كما يحدث في اللهجات كما ان الدراسة توضح مدى صلاحية النظرية التفاضلية في تحليل واعطاء نتائج دقيقة. توصي الدراسة بقاعدة بيانات للمفردات القرآنية المتناسقة وغير المتناسقة للدراسات اللاحقة.

كلمات مفتاحية: التناسق ، تناسق الصوامت ، النظرية ذاتية التقطيع ، النظرية التفاضلية .

تاريخ الاستلام: ٢٠٢٢/٠٣/١٣ **تاريخ القبول: ٢٠٢٢/٠٦/٠٦**

Introduction:-

Harmony as a term means" a state of existence and agreement or a combination of related things"(Hornby, 2005:710). However, Halle and Vergnaud (1981: 1) define the process of harmony as "characteristically regulates the distribution of a given feature or feature complex in specific, not necessarily contiguous phonemes of a word". On the other hand, Rose and Walker view harmony as a system that refers to "a phonological assimilation for harmonic features that may operate over a string of multiple segments" (2011: 240).

For Hansson (2010:1), harmony has certain principles to function. The first condition is the existence of a specific feature on a single segment to be spread. This is why it is called the "trigger segment". Second, one or more segments permit to host the transmitted feature which are called 'target segments' due to the interaction of that feature between the trigger and target segments. Finally, Neutral segments: the segments either participate or block the harmony progress. They explain how some segments are harmonically determined whether they are covert or overt segments. They are divided into three types: opaque, transparent, and skippable. The opaque segments play a role in blocking the spread of harmonic features into another segment; consequently, it obstacles the progression of harmony process (McCarthy, 2003: 123). The opaque segments of the Arabic system are [y, i, ʤ, ʃ], and [ʧ] the latter segment incurs only in dialects (Davies, 1995:). They are characterized as high segments, hence, their function as blockers is to obstacle the spreading of the harmonic feature. In backward harmony, high segments have nothing to do with harmonic spreading. The rest consonantal segments are transparent and skippable since they allow harmony to propagate. Gafos (1998:230) noted that coronal and guttural segments are the only transparent segments as they have the ability to acquire place features of the contiguous segment especially vowels.Many valuable studies concentrate on harmony from both phonological and morphological perspectives. Most of the studies deal with vowel harmony the most common phenomenon in different African languages in addition to Turkish and Hungarian. Conversely, less interest is directed toward consonant harmony. Moreover, numerous worthy studies are concerned with harmony in Semitic languages done by McCarthy and others. In Arabic dialects,

the attempts focus on vowel-consonant harmony. It is familiar as an Emphatic Harmony. This gives rise to the present study to fill this gap. It tries to tackle the harmony process in consonantal segments with reference to the vocabulary of the Holy Qur'an. This will explore the average and the frequency of consonantal harmony occurrence in addition to the context of that phenomenon.

The fundamental purpose of the study is to explore consonantal harmony in CA. This is through examining the HQV. It is necessary to identify this phenomenon as well as the context in which it operates. In addition, the present study endeavours to explore to what extent OT works in the autosegmental approach. The research questions that the present study attempts to answer are:

1- How to identify consonantal harmony in HQV as a phonological phenomenon of CA?

2. In what contexts does consonantal harmony occur and function in CA?

3. To what extent can OT operate in Autosegmental phenomena in CA?

2. Theoretical framework:

The current study is based on the autosegmental theory that concerns with tones, intonations in African languages. It is extended to include vowel harmony.

2.1 Autosegmental Approach AAP:

A recent approach is derived from Autosegmental Phonology. It is a part of the main contribution of John Goldsmith in 1976. It is viewed as an improved theoretical framework to that of Generative Phonology (Goldsmith, 1976: 5). It is a portion of his PhD dissertation at M. I. T. in which he for the first time reveals the significance of African languages as a flourishing rich field for tones and intonational features. Then, VH is an extension of that theory. For Clements (1976: 117), AAP is "an

attempt to construct a formal theory to express the prosodic structure". The fundamental objective is to explore the phenomenon of segmental organization of tonemes and intonations of "Igbo", a tonal African language (Goldsmith, 1976: 6; Clements, 1977: 112).

2.1.1. The Major Tents of AAP:

The key principles of AAP that Goldsmith proposed are phonological representations of tones and features that occurr in certain segments that are called tone bearing units(Nathan, 2008: 140). They are represented in multi-level rather than an isolated tier. However the tiers of

various entities are represented in the underlying level, they are missing in the surface level (Goldsmith, 1976:159). Multi-tiers may encompass segmental tier, tonal tier, autosegmental tier, harmonic featured tier, CV tier, to name but a few. Each tier does not only consist of entities but also their associations. They are governed by certain constraints (Goldsmith, 1976: 16). They are vertical lines, according to Clark and Yallop (1995: 405), having one direction from left to right, mostly in a one-to-one relation, and they do not cross each other (Clements, 1976:). Moreover, floating features are non-correspondent to feature bear unit (FBU). They re-associate with the adjacent FBU. This reveals the fact of one-to-many correspondences between the features and the segments on which they are represented (Katamba, 1996: 198-199). Despite Clements' Well-Formedness Condition (WFC) is designed to tackle VH, it is appropriate to treat CH in the HQ samples. They are in parallel conditions.

2.1.2 Clements' model:

Goldsmith proposed WFC to meet the principle with the criteria of derivations. WFC has the following principles:-

1. All vowels are associated with at least one tone,
2. All tones are associated with at least one vowel, and
3. Association lines do not cross(Clements, 1976: 45).

The general principles are formulated in order to meet the phenomenon of vowel harmony. the 'WFC' general principles of vowel harmony can outlines as follows:

1- All P-bearing units (vowels)are associated with at least one P- segment (harmony feature); all P-segments (harmony features) are associated with at least a single P-bearing unit (Clements and Sezer, 1982: 218-219).

2- Association lines do not cross(Clements, 1976: 113).

WFC principle operates on both derivations: well-formed derivations, and ill-formed ones. It has a great role in correcting the latter to produce well-formed representations through the application of certain rules (Clements, 1976:11 3). However, representations that violate WFC are not viewed as ill-formed since WFC treats them either by adding minimal associations or removing minimal associations in order to obtain the maximal satisfaction to the principles of WFC (Goldsmith, 1976: 27).

2.2. The Arabic Phonological System:

Classical Arabic has a pivotal phonological system. It consists of thirty-six sounds of vowel and consonant segments. Arabic vowels are of eight segments: three short vowels (/ a/, / i/, /u/), and three long vowels (/a:/, / i:/, /u:/); in addition to only two diphthongal segments (/aw/, /ay/) (Alqarhi, 2019: 1). Consonantal segments of Arabic are (/ʔ /, / b/, / t /, /θ/, /ʤ /, / ħ/, / x/, / d/, /ð/,/r/, /z/, /s/, / ʃ /, / ṣ/, / ḍ/, / ṭ/, /ð/,/ ɋ/, / ġ/, /f/, /q/ , /k/, /l /, /m/, /n/, / h/, /w/, and /y/). every single sound has certain characteristics with respect to the point of articulation, manner of articulation and voicing (Alduais, 2013:40-41). However, a portion of the Arabic system is syllabic patterns. Arabic composes of five syllables that occur in any position. The exception is that superheavy syllables come in final position or pausing places of the verses.: i) light open syllable CV. ii) heavy open syllable CVV. iii) heavy closed syllable

CVC. iv) superheavy CVCC, CVVC . v) Al-Ani (1983) appends CVVCC to superheavy syllables (Jameel,2017: 365).

2.3 Consonant Harmony:

The assimilation between two or more identical consonantal segments in terms of specific articulatory features or acoustic ones is considered a sort of harmony. It is called consonantal harmony (CH). It holds a particular phenomenon in which non-local interaction is permitted. Thus, the unaffected segments which lie between the assimilated consonants are skipped(Finely, 2011: 75). From the autosegmental point of view, two consonantal segments behave a long-distance harmonization when they are identically conditioned and non-obstructed vocalic intervening presents (Gafos,1998: 223). Another way to define CH by the virtue of deficit language is that consonantal segments behave harmonization when they appear to be identical in the surface level despite they are different in the underlying level (AlMathhaji,2020: 151).Hansson (2001:4) summarizes the major principles of CH as follows: CH is defined as "the assimilatory effect of a consonant segment on other consonant segments. It also refers to assimilatory co-occurrence restrictions holding two consonant segments". This is due to two conditions: (i) a sequence of segments including vowel segments that function to discrete the assimilatory consonant segments, (ii) the assimilatory feature has no impact on the

intervening vowels (Hansson, 2001: 34). The more appropriate definition of the concept of CH is feature agreement among separating consonantal segments(Hansson, 2007: 77).

2.4. Consonantal Harmony Types: CH varies into numerous types. They are branched into coronal, nasal, liquid, dorsal; in addition to sub-types. CH sorting depends on the phonetic-phonological parameter since it plays a salient role in CH interaction (Hansson, 2001: 133).

2.4.1.Coronal Consonantal Harmony: It is sub-branched sibilants and non-sibilants that encompass both dental harmony and retroflex harmony (Rose and Walker, 2011: 241-242).

i) Sibilant Harmony: It exhibits the most familiar type. It is viewed to encompass not only identical sibilant segments but also other vowels and coronal segments, such segments are characterized by the posterior position. In most cases, sibilant harmony is of a progressive directionality in which the agent is palato-alveolar and the focus is the alveolar. For instance, /sundusin/ "soft silk"(44:53).

ii) Dental Harmony: Both dental and alveolar stop segments contribute this sort of assimilation. They assimilate due to the effect of any segment in any position. Both /da:wu:da/ "David"(38:22) and /ʔatmamtu/ "completed"(5:3) are exemplified this sort of harmony.

iii) Retroflex harmony: It occurs in an Omotic language in the sense the root sibilant segments satisfy the retroflex feature.

2.4.2. Nasal Harmony: The nasal consonants satisfy with voiced and oral segments as in stop segments. They operate to trigger harmony when they participate with voiced stop and oral soronant segments. Prenasalised segment does not block harmony. For example, /tansawna/ " you forget"(2:44).

2.4.3. Liquid harmony: The two sounds that are involved to alternate to each other are /l/ and /r/ in Sudanese like /lamursalu:n/ "the messangers" (36:16).

2.4.4. Dorsal Harmony: In which velar and uvular segments participate to alternate each other as in /ðikrakum/ "your Reminder" (21:10).

2.4.5. Laryngeal harmony: It may occur when consonants need to reflect the feature of laryngeal segments as aspiration, voicing, etc. In some cases / l/, /d/ are converted to or transparent segment intervening the consonant and the vowels but not blockers (Rose and Walker, 2011: 243). As in /huda:hum/ "their guidance"(2:272) and /ʔana:ʔa/ "during the hours" (39:9) .

2.5 Optimality Theory: OT is one of the influential consequences of generative frameworks of phonological theory. It represents a radical dissatisfaction at previous generative rule-based theories (Kager, 2004). It is a recent constraint-based approach proposed by Alan Prince and Paul Smolensky in 1991 to analyse linguistic phonological entities. The effort of McCarthy and Prince leads to develop a new version of OT to concentrate on different linguistic aspects of morphology. The Theory extends to include syntax, semantics and sociolinguistics as well (McCarthy, 2008:1). At the centre of OT, it is assumed that the constraints interact with each other to provide an optimal candidate of outputs. Also, there should be a conflict between these constraints of grammar in a universal manner. To resolve such a conflict, constraints should be ranked in "a strict domination hierarchy". In which, a high-rank constraint is prior to a low-rank constraint. The satisfaction of OT on an isolated constraint displays the priority of a single constraint over the other (Prince and Smolensky, 2004: 3).

OT framework is based on three mechanisms: GEN, EVAL, and CON. GEN is responsible to create a relationship between the segments of input and output candidates, on the one hand, and assigning their phonological structure on the other (Gouskova, 2010: 536). The following formula illustrates how GEN operates: /input/⟶ GEN ⟶ {CAND 1, CAND2....} On the other hand, EVAL functions to discover the optimal candidate which is minimally violated from a sequence of candidates (McCarthy, 200 8:19). It is shown by the following:

/input/⟶ GEN ⟶ {CAND1, CAND2,..}⟶ EVAL⟶ [output].

The job of EVAL is to rank constraints in the sense that its work begins from ranking CONs, one after the other horizontally from left to right. The selecting the candidates are arranged from top to bottom. Some candidates obey these CONs more and which does not. Other candidates violate that CONs. The violation is are represented by (*). The most favourable candidate is the least violating the CONs (ibid, 23).

Moreover, OT possesses two kinds of constraints (CON): markedness constraints and faithfulness constraints. The former is viewed as the

output constraint. It is responsible for capturing the linguistic generalizations concerning the common/ uncommon linguistic structures in terms of unmarked and marked respectively. The

latter is faithfulness which means input-output correspondence. As a result, the input forms and output forms have no overt difference between them (McCarthy, 2008: 13). However, each constraint favours a candidate and disfavours the other. The winner is considered by a pointing hand possesses a least violated the CONs; conversely, the loser is marked by (*!). The number of violations is accounted for by the number of (*).

2.6 Related Studies:

Hansson (2001) carries out an essential study on consonant harmony entitled "Theoretical and Typological Issues in Consonant Harmony". The reasoning of conducting this study is because CH is of less interest to the researchers and not quite common in comparison with VH. What characterizes CH is that it requires distance between segments. The fundamental objective is to introduce a comprehensive survey insights of cross-linguistically samples, to provide a unified typology containing all typologies of rarely presented properties of assimilation. The scope of the study is to distinguish CH from VH in terms of the intervention of vowels and consonants which are inaudibly affected by assimilatory interaction as long-distance, its uniqueness, but excluding dissimilation of consonants. Furthermore, two important issues are highlighted: the cases of directionality structure and cases of the subtle interaction between harmony and phonotactics which are subjected to cross-linguistic data. As for methodology, the collected data are qualitatively analysed via OT framework with regard to agreement constraints that have a role in interpreting CH rather than spreading constraints. Unlike OT, target constraints enable to provide solutions for the proposed problems of directionality. The results of the study show a kind of contradiction to what Gafos (1998) claims about the locality principle that is affected by the articulatory theory which is vindicated by the CH system and its typology. It also predicts that non-coronal CH cannot exist.

Moreover, Gafni (2012) produces a study of consonant harmony in terms of language development. For him, CH represents a long-distance phenomenon in which C-C are assimilated. CH becomes a complex issue when it is integrated with language acquisition. This is due to the intervention of vowel segments. The main concern of this study is to explore how CH motivates the process of language acquisition. It also tries to answer certain questions as the

main objectives of the study as whether or not children represent a source for CH. This is due to a grammatical rule. The kind of support provided by the speech error to operate CH is another questionable area. Moreover, CH is found in the first use of a target word, regardless if the child feels difficulty in the linguistic structure and content or not. The study displays that CH cannot be identified due to the ignorance of the mechanisms of the target words of adults as an individual factor. Concerning the methodology, the study deploys longitudinally selected data from two children who speak Hebrew. The children's speech seems to be associated with the representational system on the one hand, and the speech planning process on the other. The analysis of this study reveals many sources for CH rather than a distinct phenomenon. Phonologically speaking, it operates to replace some non-acquired segments. It also has an essential role to simplify the process of articulation for both difficult sequences and intricate patterns. The focus of the study is to analyze CH in relation to stress and directionality which proved to some extent that CH is affected by prosodic development. The findings show the inductivity of the individual through language acquisition and this has a significant role in restricting the generalizations. Also, the influence of variation is clearly observed in this study in the sense that children display variation in the use of CH in both language acquisition and language development.

A further study on harmony in Arabic dialects is that of Zellou (2013). It concerns Moroccan Arabic (MA). It is entitled "Consonant Harmony in Moroccan Arabic: Similarity and Incomplete Neutralization". As it is familiar, CH is a unique issue in Arabic as a Semitic language. This process is synchronically determined, affecting one segment over the other. However, the phonological change in adjacent consonant stems tends to be accomplished by virtue of identical properties. The main aim is to distinguish sibilant segments that undergo harmony in terms of place of articulation. The researcher assumes that MA CH is of a regressive principle of directionality, a long-distance process in which the trigger segment affects other segments of adjacent and non-adjacent positions. The methodology is a quantitatively acoustic study to display the higher frequency of harmonic palatal sibilant segments.

The collected data the researcher utilizes are oral selected words from four MA natives who are fluent in English and French as well. The researcher utilizes" Similarity Avoidance Tendency" as a

tool to investigate his distinction as it functions only in phonetic representations. It grows from Obligatory Contour Principle (OCP) that prohibits identical segments in an isolated root. The researcher claims that phonetic realization plays a significant role as it reflects the fact that segments are of free variations. Thus, identical segments of a root are not of the same realization even though they are contiguous. In MA, harmony takes place in alveolar sibilant segments when palatal sibilant segments follow. CH is a cross-linguistically conditioned issue. MA is affected by the contact and the diffusion of surrounding Berber languages. Thus, it borrows a sibilant consonant harmony with regressive direction from other languages. The results show that the acoustic features of harmonized sibilant segments show a state of incomplete neutralization in comparison with regular sibilant segments because of the higher frequency of centre of gravity. This is due to comparing harmonized palatal sibilant segments with disharmonized palatal sibilant segments.

3. Methodology:

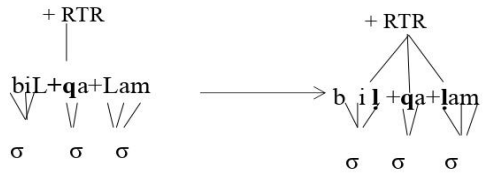
A descriptive qualitative research design is deployed to tackle harmony in CA. It is a numberless-oriented paradigm. It is not surprising that the qualitative approach has a diversity of principles and strategies to analyse qualitative data in nature (Tesch, 2013:4). The researcher concerns with words in terms of describing, analysing and reporting through a phonological strategy. The selected data are gained from the Holy Qur'an. By taking notes (Creswell, 2009) the data are gathered through reading and listening. This is because both the Holy Qur'an Scripture and the audial records of the Egyptian reciter Abdul-Bassit Abdul-Samad are used. They are extracted from all the chapters with reference to Hafs an Assim as the common recitation among Muslims. It is easy to be used for native and non-native Arabic speakers (Arabic101, 2022). This indicates the letters and harakat as well as extralong vowel (almadd) are clearly pronounced. The selected samples are trisyllabic and polysyllabic. They are transliterated into English in order to not only support the study at hand with their phonological representations but also make the analysis easier. The insertion of English meaning between two parentheses provides more clarification and explanation.

4. Consonant Harmony in The Holy Qur'anic Vocabulary:

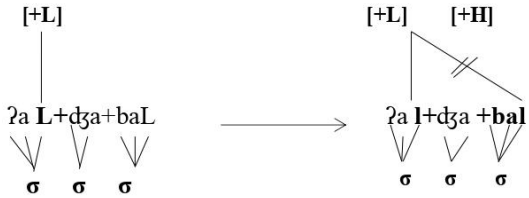
It is assumed that the HQV does not only reveal VH but also CH, as Hansson (2001: 42) assumes. It is the objective of the present study to reveal the assumption of feature agreement between consonant segments that co-occur within a single domain to behave harmonization.

The researcher observes the co-occurrence of the identical segments in the same domain by the virtue of feature agreement. The following samples illustrate the autosegmentality of harmony and disharmony in HQV.

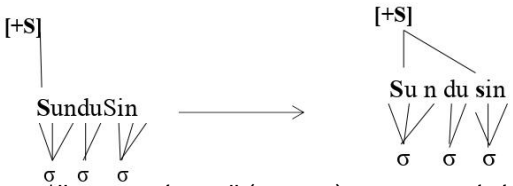
The domain /bilqalam/ "by the pen" (63:8) shows the effect of /q/ on the /l/ in two positions to reveal an emphatic harmony in adjacent and non-adjecent segments that acquire retracted tongue root [+RTR] feature.



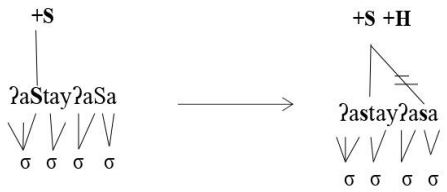
On the other hand, /ʔal ʤabal/ " the mountain" (7:143) displays disharmony as the high /ʤ/ segment blocks the harmony progress.



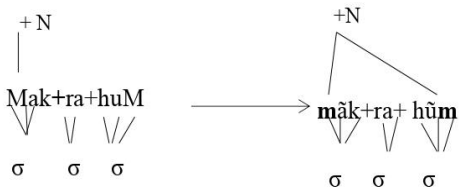
The domain /sundusin/ "fine silk " (44:53) reveals the agreement between sibilant segments



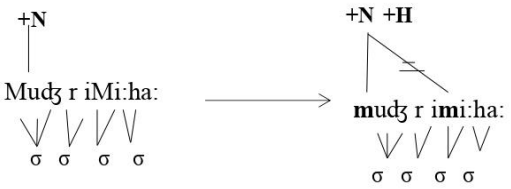
On the contrary, /ʔastayas/ "gave up hope " (12:110) expresses disharmony. This is because /y/ obstacles the harmony progress.



The domain /makrahum/ "their plotting " (13:33) illustrates the nasal harmony of /m/



The disharmony of nasal segments is presented in /muʤrimi:ha:/ "its wicked people " (6:123).



5. Optimality Analysis of Consonant Harmony:

The mechanisms of OT framework are suitable to analyze the various sorts of harmony between the consonantal segments that are represented by HQV.

5. 1. Optimality Analysis of Liquid harmony:

Tableau (1) A Bi-directional Liquid Harmony of a Voiced Uvular Stop on the Voiced Alveolar Lateral segments promoted in the underlying form /bilqalam/ "by the pen"(96:4).

/bil qalam/	Lateral	Spread	Uvularized	Ident[RTR]
(a) bilqalam		*	*!	
☞ (b) bilqaḷam				*

lateral >> spread >>uvularized>> Ident[RTR]

The candidate (a) obeys the higher-ranked constraints. This gives rise to exclude it. On the contrary, the candidate (b) does not satisfy the lower-ranked constraints. As a result, it becomes the optimal candidate.

The domain structure consists of two heavy syllables and a light syllable. It forms a CVCCVCVC pattern. The voiced uvular /q/ segment functions as a trigger. It fills the onset position of the penultimate syllable. On the contrary, the voiced lateral alveolar /l/ are the target segments. They occur in the coda of the initial syllable and the onset of the final syllable. This means a consonantal harmony is of two directions.

Tableau (2) A Regressive Liquid Harmony of the voiced Lateral Alveolar /l/ segments existing in the output form /lamubtali:n/ of the underlying form /lanabluwanna/ '' You shall certainly be tried and tested" (3:186)

/latubluwanna/	NO CODA	*LATERAL	DEP	MAX
(a)latubluwanna		**!		
☞ (b)lamubtali:n	*		**	**

NO CODA>> *LATERAL>>DEP>>MAX

The typical candidate (a) is eliminated as it promotes the higher-ranked constraints. The candidate (b) , on the other hand, is the surviving one. It does not satisfy the lower-ranked constraints. It is in conflict with the faithfulness constraints.

The polysyllabic domain consists of three light syllables and two heavy syllables. It is of CVCVCCVCVCCV structure. The trigger segment incurs in the onset of the third syllable while the target comes in the onset of the initial syllable. This is because the direction of harmony is assigned by the root. Thus, it is regressive since it is from the root to a prefix.

5. 2. Optimality Analysis of Sibilant Harmony:

Tableau (3) A Bidirectional Sibilant Harmony of a Voiced Emaphatic Alveolar Stop /ṭ/ on the Voiceless Alveolar Fricative (Sibliant) segments existing in the output form /bilqiṣṭa:ṣi/ of the input /bilqis ṭaa si/ "with the balance" (17:35).

bilqis ṭa: si	*Spread	*Sibilant	*Emphatic Sibilant	Ident [RTR]
(a)bilqis ṭa: si		*!	**	
☞(b)bilqiṣ ṭa: ṣi	*			*

*Spread>> *Sibilant>> *Emphatic Sibilant >> Ident[RTR]

The faithful candidate (a) is pushed out of the evaluation. This is due to its satisfication to the higher-ranked constraints. Conversely, candidate (b) resembles the optimal form. It defies the faithfulness constraints in terms of lower-ranking.

The polysyllabic domain has a CVCCVCCVVCV pattern. It encompasses three heavy syllables and a single light syllable. The onset of the penultimate syllable affects both the coda of the second syllable and the onset of the final syllable. This indicates the harmony spreads into two directions.

Tableau (4) A *Regressive Sibilant Harmony of the Voiceless Alveolar Fricative (Sibilant) segments existing in* the underlying form / mustamsik +pl / "they are holding fast" (43:21).

/mustamsik+pl/	**No Coda**	***Sibilant**	**DEP**	**MAX**
(a) ʔastamsaka		**!	*	
☞(b)mustamsiku:n	*	*		**

NO CODA>>*SIBILANT>>DEP>>MAX

Candidate (b) is the winner of the evaluation in the sense that it flouts the lower-ranked constraints. Conversely, candidate (a) is pushed out. This is due to the fact it faithfully contains the highest-ranked constraints.

The polysyllabic domain is of a CVCCVCCVCVVC structure. It contains three heavy syllables, in addition to a light and extramora syllables. The trigger lies between /m/ and /i/, in the onset of the penultimate syllable. on the other hand, the target fills the coda of the initial syllable. hence, the direction is regressively determined.

5.3. Optimality Analysis of Nasal Harmony:

5.3.1 NASAL Harmony of Bilabial Nasal /m/:

Tableau (5)A Progressive Nasal Harmony of the Voiced Bilabial Nasal segments existing in the input form /mawla:kum/ "your Maula (Patron, Lord)" (22:78).

/maw la:kum/	Nasal	*NVoral	*Vnasal	IDENT (nasal)
(a)maw la:kum		*!		
☞ (b)mãw̃ la:kũm			**	*

NASAL>> *NV oral >>*Vnasal >> IDENT(nasal)

The candidate (b) represents the optimal candidate. The reason behind that is it does not satisfy the lower-ranked constraints; instead, it violates them. On the other hand, the implementations of the higher-ranked constraints that the candidate (a) makes lead to put it out of the competition.

The structure is of a CVCVVCVC pattern. It consists of three syllables: a light and two heavy syllables. The trigger fills the initial onset position. It precedes a diphthong /aw/ vowel.

Conversely, the target segments occupies the final coda after a short round /u/ vowel. It represents an onset-to-coda mapping.

5.3.2 Nasal Harmony of the Voiced Alveolar Nasal /n/:

Tableau (6) A Progressive Nasal Harmony of the Voiced Alveolar Nasal segments existing in the input /naka:lan/ "a punishment" (5:38).

/ naka:lan/	Nasal	*NVoral	*Vnasal	IDENT (nasal)
(a) naka: lan		*!		
☞ (b) nãka: lãn			**	*

NASAL>> *NVoral >>*Vnasal >> * NC̥>>IDENT(nasal)

The typical candidate (a) is eliminated. This is due to contain the highest constraints. Unlike candidate (a), the unfaithful candidate (b) is winning. The reason behind that is the violation of the lowest constraints rather than abeyance them.

This domain is of CVCVVCVC pattern. The trigger occurs in the onset of the initial light syllable while the target fills the coda of the final heavy syllable. it is of leftward direction.

5.4. Optimality Analysis of Laryngeal Harmony:

5.4.1 Laryngeal Harmony of the Glottal Stop /ʔ/ :

Tableau (7) A Progressive Laryngeal Harmony of the Voiceless Glottal Stop segments /ʔ/ as existed in the input / ʔal ʔassam +pl/ " the names" (7:71).

/ʔal-ʔassa m+pl /	**ʔ**	**DEP**	**MAX**
(a) ʔas ma: ʔihim		***	***
☞ (b) ʔas-sa ma: ʔa		*	

ʔ>> DEP >> MAX

The typical candidate (a) is excluded since it conforms the faithfulness constraints with reference to the highest ranking. On the other hand, the winner is candidate (b). This is because it disobeys the constraints of lower-ranking.

The polysyllabic domain consists of two heavy and two light syllables pattern. It is of a CVCCVCVVCV structure. Thus, the environment of /ʔ/ is onset-to-onset mapping in the sense that it fills the onset position; consequently, it precedes /a/ of the first heavy syllable. Also, it

occurs between a long non-high vowel /a:/ and a short non-high vowel /a/ of the last light syllable.

5.4.2 Laryngeal Harmony of A Glottal fricative segment /h/:

Tableau (8)A Progressive Laryngeal Harmony of A Voiceless Glottal fricative segment /h/ as in the output form / ʃaha:datahum */ of the input* form /ʔaʃhadttuhum / "witness " (18:51).

ʔaʃhadttuhum	h	Dep	Max
(a)ʔaʃhattuhum			*!
☞ (b)ʃaha:datuhum		**	*

h>> DEP >> MAX

It is evident that elimination of candidate (a) leads to consider candidate (b) as the optimal form of the input. This is because the former obeys the faithful constraints of higher ranking whereas the latter flouts the lower constraints.

The structure of the polysyllabic domain is of a CVCCVCCCVCVC pattern. The trigger occupies the onset of the second heavy syllable whereas the target fills the onset of the final heavy syllable.

5.5. Optimality Analysis of Dental Harmony:

Tableau (9) A Progressive Consonant Dental Harmony of a Voiceless Alveolar Stop /t/ as presented in the output of the input / tu qa:tihi/ "feared" (3:102).

/ tu qa:tihi/	**T**	**DEP**	**MAX**
(a) tu qa:tih			*!
☞ (b) ʔittaqu:		*	**

t>>Dep>> Max

Conforming to the faithfulness constraints gives rise to exclude candidate (a) of the competition. As a result, candidate (b) is the optimal one as it violates the lower-ranked constraints.

The polysyllabic has the structure of CVCVVCVCV. It consists of three light syllables and a heavy syllable. Both the trigger and the target fill the onset position of the initial and the penultimate syllables respectively.

Tableau (10)A Progressive Consonant Dental Harmony of a Voiceless Alveolar Stop /t/ as presented in the output of the input /taʕammadat/ "your hearts deliberately intended" (3

/ taʕammadat/	t	*ALIGN L/R	DEP	MAX
(a) taʕammadat		*!		
☞ (b)mutaʕammadan			***	**

***t>>*ALIGN L/R>> DEP>>MAX**

The typical candidate contains the highest ranked constraints. This gives rise to eliminate it of the competition. On the other hand, the unfaithful candidate (b) flouts the faithfulness constraints; consequently, it is selected as the optimal form of the input.

The polysyllabic encompasses two light syllables and three heavy syllables. The onset-to-coda mapping of the initial and final syllables is the context of harmony.

5.6. Optimality Analysis of *Dorsal Harmony:*

Tableau (11)A Progressive Dorsal Harmony of the Voiceless alveolar Stop segments /k/ as existed in the input /ʔakramakum/ "the most honourable of you" (49:13).

/ʔakramakum/	NO CODA	K	DEP	MAX
(a) ʔakramakum	*!			
☞ (b)karramta			*	***

NO CODA>> k>>DEP>> MAX

It is important to notice that the implementation of the faithfulness constraints of candidate (a) leads to its elimination. Thus, the alternative candidate (b) is the winner of the evaluation. It flouts the lower-ranked constraints.

The polysyllabic domain has a CVCCVCVCVC pattern. It contains two light and two heavy syllables. The environment is coda-to-onset mapping of the initial and the final syllables.

Tableau (12)A Progressive Dorsal Harmony of the Voiceless alveolar Stop segments /k/ as existed in the input /kaððabu:ka/ "they belie you" (10:41).

/kaððabu:ka/	K	*ALIGN L/R	DEP	MAX	LINEARITY
(a)kaððabu:ka		*!			
☞(b)makðu:b			*	**	*

k>> *ALIGN L/R>>DEP>> MAX>> LINEARITY

Since the unfaithful candidate (b) defies the lower ranked constraints, it is considered as the optimal candidate. On the contrary, candidate (a) is removed from the evaluation. This is because it conforms the highest-ranking constraints.

The structure of this polysyllabic is of a CVCCVCVVCV pattern. The trigger incurs in the initial light syllable whereas the target is in the final light syllable. The onset-to-onset mapping represents the context of harmony.

5.7. Optimality Analysis of Stricture Harmony:

Tableau (13)A Regressive Stricture Harmony of the Voiceless fricative /f/ as existed in the output form of the input */faʔawfu:/" so give " (7:85).*

/faʔawfu:/	***Fricative**	**DEP**	**MAX**
(a) *faʔawfu:*	**!		
☞ (b) *ʔawfu:*	*		**

***f>> DEP >> MAX**

Since candidate (a) is pushed out, the unfaithful candidate (b) is selected to be the optimal candidate in the sense that it violates the lower-ranked constraints.

It has a CVCVCVV pattern. the trigger fills the final onset position while the target comes in the initial onset position.

Tableau (14)A Regressive Stricture Harmony of the Voiceless fricative /f/ as existing in the underlying form /fa ʔafu: za/ " achieve "(4:73).

faʔafu:za	**NOCODA**	**Fricative**	**Dep**	**Max**
(a) fa ʔafu: za				
☞ (b)fawzan	*		**	**

NOCODA>> f ricative>> Dep >> Max

Removing candidate (a) from the competition leads to consider the alternative candidate (b) as the winner. Unlike candidate (a) that conforms the faithfulness constraints, candidate (b) defies the lower-ranking constraints.

The polysyllabic domain is of a CVCVCVVCV pattern. The trigger occurs in the penultimate onset heavy syllable while the target position of /f/ is in the initial onset of a light syllable.

6. Results and Discussion:

From the OT analysis, the selected14 representative samples, the findings are the following points: . CH gets (28%) in comparison with VH (43%) and disharmony (30%) rating. It has a peculiar role in the HQV. The HQV exhibits various sorts of harmony of consonantal segments to identify such as coronal sibilant, nasal, laryngeal, dorsal to cite but few. The domain behaves harmonization in one context in which it takes place in contiguous and non-contiguous segments as Hansson (2001: 4) mentions. Other domains show disharmony because of the opaque segments. To a great extent, the HQV does not only behave autosegmentally in contiguous segments but also in non-contiguous ones within the word \From a prosodic point of view, it is essential to consider the circumstances in which a consonantal harmony takes place with reference to the trigger segments and the target segments. The rating of onset-to-onset mapping is outnumbered. It scores (64.27%) percentage. The rating of coda-to-onset mapping follows as it is of (28.56%) percentage. Finally, the onset-to-coda mapping registers the lowest rating, (7.14%) percentage. This is achieved by using Prosodic Phonology. In addition, a progressive directionality of CH has a higher rating. It gets (57.14%) percentage. Both regressive and bi-direction follow. They score (28.57%) and (14.28%) percentages respectively.

The analysed samples display the conflict of OT constraints. The IDENTITY constraints have got (21.15%)the higher percentage. Then, MAX constraints follow since they score (19.23%). DEP constraint comes after by getting (17.30%). On the other hand, the rating of markedness constraints vary between (5.76%), (3.84%), and (1.92%); thus, the average of all the markedness constraints is (42.24%) percentage of the sum up.

7. Conclusions:

i) Likewise harmony systems of Turkey and Hungary; besides, African languages, Arabic possesses a peculiar harmony system. The phenomenon of harmonization is not restricted to be a property of Arabic dialects; rather, it attributes Classical Arabic in terms of long-distance segments of contiguous segments. To a great extent, segmental harmony is autosegmentally determined.

ii) HQV confirms the validity of the two senses of consonant harmony: CA asserts both the effect of one segment on another and the agreement of the features by the segment co-occurrence.

iii) CH of the HQV is a directional process. The progressive harmony scores (57.14%) percentages. Thus, it is outnumbered both regressive and bidirectional.

iv)The harmonized domain may represent more than a single type of harmony, it may show at least two types. That is to say, each HQV may fulfil a CH besides a VH or VCH. On the other hand, it may be harmonized in one context and disharmonized in the other. This is due to different principles as morphological boundaries.

v)As for the OT framework, the conflict between the constraints is recognized in which the Faithfulness constraints fulfil spreading harmony more used than the markedness constraints. The rating of the IDENTITY constraints is at the top (21.15%) percentage followed by MAX and DEP (19.23%) and (17.30%) respectively.

8. Recommendations:

This study recommends the following issues.

1. It contributes to provide a comprehensive Arabic Harmony System in terms of LHQ as a pattern of a Classic language. It also produces this system as a database for Arab or foreign researchers.

2. It also recommends new strategies and techniques to study phonological issues by using technology and applications to encounter harmonic features in harmonized segments and syllables.

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