People's Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research

University of Abdelhamid Ibn Badis- Mostaganem

Faculty of Foreign Languages

Department of English

A Corpus-assisted Examination of McCarthy's Theory: Template Morphology on Selected Verbs from the Holy Quran

A Dissertation Presented in Partial Fulfilment for the Requirements of a Master's Degree in

'Linguistics'

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Academic Year: 2018-2019

DEDICATION

To the joy of my life, my Parents

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to all those who contributed in the fulfilment of this work.

I especially would like to thank my Supervisor Dr. S.Hamrelain, who was the lecturer who made me instantly love, and later choose as a specialty Linguistics; who helped me in polishing this humble work

I would like to thank the Examiner Mrs. R.Benyoucef, who was my former teacher of phonetics, phonology, and linguistics; who was a real source of motivation and who made us love her subjects; who directed my interest towards the present research topic

I would like to thank Dr. N.Larbi who accepted to be the Chairwoman of my viva voce, who once honoured us with a fortnight of literature classes

I thank everyone, my family, friends, teachers and fellow students, who supported me throughout my journey with this research

ABSTRACT

The present piece of research revolves around morphological processes in the Holy Quran. This work is intended to examine the working of Template Morphology. The latter is an approach suggested by the linguist McCarthy (1979) with regard to Semitic languages and especially Arabic. It is a non-linear model which provides canonical templates for the different derivational classes (or binyanim) of Arabic roots, as well as a morphological representation whose notational system and principles stem from Autosegmental Phonology. Hence, the kernel of the work at hand is to examine the extent to which template morphology succeeds in accounting for Quranic Arabic verbs, given that the Holy Quran is bound to Tajweed rules. In the course of conducting the experiment, a corpus-assisted morphological analysis was done via the collection of 25 verbs selected from different Sourahs from the Holy Quran. Each verb was provided a morphological, autosegmental representation, in addition to an evaluative comment. The outcome of this study was that template morphology applies effectively to some verbs. Yet, it fails in other instances for the canonical templates are restricting. That is, they do not allow all potential distributions of vowels and consonants, such as in the case of weak verbs. Another challenging issue is the interference of Tajweed rules in the representation of morphemes, by introducing additional segments, and provoking floating ones. The latter violates the approach's Well-Formedness Conditions (WFC). Therefore, an urgent endeavour would be to edit the canonical templates and formulate them in a way that leaves them open to more possibilities. Another suggested procedure is to create templates that reconcile the requirements of Tajweed rules and the principles of the approach adopted.

Keywords: Template Morphology, John McCarthy, nonconcatenative, binyanim, autosegmental phonology, Tajweed rules, canonical templates.

LIST OF ACRONYMS

TM: Template Morphology

WFC: Well Formedness Conditions

QAC: Quranic Arabic Corpus

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The IPA Symbols of Arabic Consonants

	labial	dental	alveolar	emphatic	palatal	velar	uvular	pharyngeal	glottal
nasal	m		n						
stop	b		t d	tˤ dˤ		k	q		ʔ
fricative	f	θ ð	s z	sˤ ðˤ	ʃ		ɣ x	ʕ ħ	h
affricate					ʤ				
trill			r						
Approximant			l		j	w			

The IPA Symbols of Arabic Vowels

	Short		Long	
	Front	Back	Front	Back
Close	/i/	/u/	/i:/	/u:/
Open	/a/		/a:/	

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GENERAL INTRODUCTION

In the realm of linguistic investigations, Quranic Arabic has been at the forefront of subjects of interest and objects of study on the part of several scholars, due to its intermittently productive aspect as a timeless religious text (for Muslims). Some have tackled the subtle way in which the Quranic language vehicles meaning. Other scholars have rather dealt with the structure of the Holy Quran at different linguistic levels (phonological, morphological, syntactical).

As a matter of fact, different languages are characterized by different morphologies, and Arabic is no exception. It is a Semitic language known for its nonconcatenative morphological processes, where morphemes, the smallest units of meaning, are discontinuous; they interrupt one another. Indeed, a typically interesting area lies in the way morphological elements are displayed in the Holy Quran, which is known for its recitation (or Tajweed) rules. Because the aforementioned area is insufficiently covered, it remains unclear, and it needs to be investigated.

On the grounds of the researcher's personal interest in the Quranic Arabic and the different micro linguistic phenomena, the reading process led the researcher to come across a morphological theory conceived by the linguist John McCarthy in 1979, known as Template Morphology. It deals with the phonology and morphology of Semitic languages, and offers a formal apparatus for representing discontinuous morphemes. Therefore, working to provide a clear, formal representation of Arabic morphemes with regard to the language of the Quran represents the focal impetus to the researcher.

The research at hand aims at shedding light on the working of the model of Template Morphology on verbs in the Holy Quran. That is to say, it investigates the extent to which the theory's canonical patterns and defining principles are respected. In addition, the study

examines the role that the rules of Tajweed could play in yielding deviations or facing potential challenges when applying the theory.

The attempts of this research crystalize into handling one major issue, namely the applicability of Template Morphology to Quranic verbs, and the preservation of the theory's principles and templates while representing the verbs' different morphological levels, whose phonological realizations necessarily abide by Tajweed rules. Consequently, in order to dismantle the task, the following Research Questions have been established:

1-Would the application of Template Morphology on Quranic verbs yield alternations into the theory's canonical distribution of vowels and consonants?

2-How could Tajweed rules be involved in the adoption of these templates?

3-Would this application preserve Well Formedness Conditions (WFC)?

Hence, the questions represent the points of reference to the whole work, as they englobe the aspects to be studied, that is the applicability of the model on Quranic verbs, the role of Tajweed rules, and the respect of the theory's basic principles. The endeavour to tackle the questions is initiated by a reflexion on the part of the researcher. Connectedly, a number of hypotheses have been suggested to be tested and, ultimately, validated or refuted via the experiment. The potential answers are set forth respectively:

1-There could be some alternations in the canonical shape of templates.

2-Tajweed Rules could be the reason behind potential alternations and deviations.

3-It is hypothesized that in case of some deviations, the preservation of Well Formedness Conditions would be problematic.

The research provides an experimental study that adheres to a mixed method approach: a quantitative and qualitative one. It is about a collection of 25 verbs selected carefully from various Sourahs of the Holy Quran, according to their relevance to the objectives of the work. To facilitate data collection and accessibility, an electronic website which preserves the database of an annotated version of the Holy Quran called the Quranic Arabic Corpus, by Kais Dukes, has been used. It serves the practical part in providing accurate references to each selected verb, that would direct the reader back to the database. Besides, as an additional assistance, the website's section of 'Quranic Dictionary' provides the derivational class, or binyan (a Hebrew word which means word stem or root) that each verb belongs to.

In order to analyse the data, the researcher has relied on McCarthy's linguistic model that would account for the morphological process of derivation as far as the selected verbs are concerned. An evaluative comment on the autosegmental representation of verbs is set forth to provide analysis and ultimately come up with conclusive results.

The work is divided into three chapters; the first two are theoretical, and the last one is practical. To start, the first chapter offers an introduction to the field of morphology. It provides definitions to fundamental terms and concepts (morphology, the morpheme, roots and affixes, etc.), demonstrates the fields of morphology (derivational, inflectional), explains morphological processes (concatenative and nonconcatenative), and exposes the most known theories (pre-generative and generative ones).

After that, the second chapter moves on to the linguistic theory adopted in this work, that is Template Morphology. Close attention is paid to Goldsmith's Autosegmental Phonology (1976), being the origin of the morphological model, along with the notation and principles it embraces. Then, the focus is on McCarthy's own contribution in the way he used the fundamentals of the phonological theory to fit in morphological representations, namely

through the Morpheme Tier Hypothesis and the Consonant and Vowel Templates (CV Templates) to account for Arabic derivational classes.

Coming up to the third chapter, the content is devoted to the practical side of the research. It assembles the nature of enquiry (the approach adopted), the tools used for the data collection and analysis, where special attention is paid to the Quranic Arabic Corpus (QAC). Then, the chapter includes the process of data analysis, and finally the discussion of findings, where a comparison between the results and the hypotheses takes place.

CHAPTER ONE: AN OVERVIEW OF MORPHOLOGY

Introduction

The field of language study has several branches, devoting each one to a certain linguistic level. The branch that tackles word level is known as morphology. Hence, the chapter at hand attempts to provide a sketch of the rudiments of morphology. It starts with defining this sub-discipline according to different linguists. Then, it moves on to explaining the main concepts and terminologies and elaborating on the most known morphological operations. Finally, this chapter ends up with some theories adopted in morphological analysis.

I. CONCEPTS AND TERMINOLOGIES

This section exposes basic terms and notions in the field of morphology. It initiates the task with some definitions of morphology. Next, it explains fundamental concepts that are necessary to a clear understanding of the following content.

1. Definition of Morphology

According to the online 'Oxford Advanced Learner's Dictionary' (2019), the word 'morphology' has the Greek root *morphē* that is 'form' and -ology which is 'a subject of study'. The term 'morphology' is used in various disciplines, such as biology and geology, to mean a branch devoted to the study of form and structure. In the field of linguistics, morphology stands for the study of the structure of words. In fact, scholars have provided different definitions to it.

To start, Matthews (1991, p.3) conceives of morphology as “Simply a term for that branch of linguistics which is concerned with the ' forms of words ' in different uses and constructions.” Hence, this sub-field of the study of language focuses on the internal structure of the word. It also considers the way words are altered to serve grammatical considerations in the process of building up larger units such as the phrase or sentence.

Then, Aronoff and Fudeman (2011, p.2) claim that morphology “Refers to the mental system involved in word formation or to the branch of linguistics that deals with words, their internal structure, and how they are formed.” That is to say, it could be defined in two ways: Either as the cognitive mechanism yielding operations of word formation, or as the sub-discipline of linguistics which tackles the word’s process of constitution and final composite. One could notice that the aforementioned definitions have in common ‘the word’, being a central unit of study in morphology, and having an internal structure.

Furthermore, as early as 1946 (p.1), Nida states that: “Morphology is the study of morphemes and their arrangements in forming words.” Indeed, this linguist uses ‘morphemes’, a principal term in morphology that would be discussed in the following section. At this stage, it could be understood that the internal structure of a word is a set of elements known as morphemes that are put together in a certain order, and the concern of morphology is to dismantle words into their constituent morphemes, and see how the latter are brought together to form words. In fact, Haspelmath & Sims agree with Nida and mention that “Morphology is the study of the combination of morphemes to yield words.” They also attribute another interpretation to morphology, not that of a branch of linguistics, but rather of the word aspect of language per se. (2010, p.3)

II. FUNDAMENTAL CONCEPTS

The following sub-section sheds light on rudimentary terms in the domain of morphology. The morpheme, morph and allomorph are three interrelated terms that would be

defined, followed by the notions of roots and affixes. The latter would be explained with a brief introduction of other terms, since a superficial understanding would be enough.

1. The Morpheme, Morph and Allomorph

The morpheme, according to Katamba (1993, p.20) "is used to refer to the smallest, indivisible units of semantic content or grammatical function which words are made up of." To illustrate, the English verb in 'he speaks' is a word which consists of two morphemes: the first is 'speak', and it has a separate entry in the dictionary for it possesses 'semantic content', whereas the second '-s' has a 'grammatical function' that of establishing subject-verb agreement and demonstrating the present simple.

To go further with the previous example, morphemes that can stand alone like 'speak' are called free or independent morphemes, while others like '-s' need to be attached to another morpheme and are named bound or dependent morphemes. Morphemes are considered to be abstract units and the term for their phonetic representation is morph. In case a morpheme has more than one morph, we refer to its allomorphs (Crystal, 2008, p.313). Thus, the morpheme '-s' could be realized /s/ in 'speaks', /z/ in 'drives', or /ɪz/ in 'watches'. An analogous illustration from the domain of phonology is the basic idea that a phoneme is an abstract unit which is realised into a phone, and when there is more than one realization, we refer to allophones. To sum up, morphemes are abstract, morphs are their phonetic realization, and allomorphs are the variants of the same morpheme.

2. Roots and Affixes

As mentioned earlier, morphemes can be free or bound. In fact, morphologists have provided some terminologies for both types. First, bound morphemes are generally known as affixes. An affix is an umbrella term for prefixes, suffixes, and infixes. The shared trait among

these sub-types is that they are relatively short compared to free morphemes, and they get attached to the latter. The difference is that prefixes are attached at the beginning of the morpheme, infixes in the middle, whereas suffixes at the end. One remark is that infixes exist in some languages, namely Semitic ones like Arabic and Hebrew, but not in all languages, such as English and other Indo-European languages. Some examples are provided from English and Arabic so as to clarify the idea:

Prefix: mislead, unveil, irrelevant, etc.

taktobo (she writes), ʔakhlasa (he was faithful), yaqifuuna (they stand up), etc.

Infix: tasaa3ada (it raised up), yaqtasimuuna (they share among themselves), etc.

Suffix: closed, reader, sailing, etc.

Sakatna (they kept silent; feminine), momarrida (female nurse), etc.

Second, free or independent morphemes could be bases, stems, or roots. What these have in common is that they are relatively long compared to affixes, and they carry the latter. First, Haspelmath et al (2010, p.36) define the base of a morphologically complex word as: "The element to which a morphological operation applies." This means that a word is a composite of a main component called base that goes through a morphological process. Second, a base to which an inflection applies is called a stem (Haspelmath, 2010, p.20). The following section would tackle 'inflection' with explanations and illustrations. Third, a root is defined by Haspelmath et al (2010, p.21) as "A base that cannot be analysed any further into constituent morphemes". To exemplify, the base 'beauty' consists of one single morpheme, which means that it cannot be dismantled into constituent morphemes, so it is considered a root. Moreover, it would be a stem if it inflects for the plural 'beauties'.

III. FIELDS OF MORPHOLOGY

Morphology is interested in dealing with two major phenomena of word formation: Derivation and inflection. Morphemes are arranged together to form words via derivational and inflectional operations. Widdowson (1996, p.47) describes the former as 'lexical innovation' since it is a process of creating a new word with a new meaning, and the latter as 'grammatical adaptation' for it adjusts words to satisfy grammatical requirements. in this respect, words obtained from derivation have their own entry in the dictionary and are named lexemes. In addition, they are abstract in the sense that they do not have a phonetic representation; they are not pronounceable. As opposed to words that go through inflection and result in word-forms. They are concrete, pronounceable realizations of their lexeme. (cf. Haspelmath et al, 2010; Katamba, 1993). For example, LISTEN (verb) is a lexeme which can be looked up in the dictionary. It has the following word-forms obtained via attaching inflectional suffixes to it: listens, listened, listening. The three word-forms result in a paradigm. If the derivational suffix -er is attached to LISTEN, a new derived lexeme is obtained with a new grammatical category: LISTENER (noun)

IV. MORPHOLOGICAL PROCESSES

Morphological processes are the different operations that could lead to word formation. One could consider a fundamental dichotomy that summarises these operations, which is *concatenative* versus *non-concatenative processes*. When morphemes are stringed as units in an orderly manner without one interrupting the other, it is a concatenative pattern (Haspelmath et al, 2010, p.34). Apart from that, it is all about non-concatenative operations. Morphologists recognize the latter as being less prominent in world's languages compared to concatenative patterns.

1. Concatenative Processes

When a concatenative process happens, a mere combination of morphemes which have distinct forms takes place. Thus, the result is a continuous string of morphemes. Concatenative phenomena could be of many sorts:

A. Affixation

Affixation is described by Crystal (2008, p.16) as "The morphological process whereby grammatical or lexical information is added to a stem". That is to say, affixation attaches a stem to an affix, be it a prefix, suffix, or infix, either to form a new lexeme, or just to ensure grammatical adaptation. Hence, all instances of inflection or derivation where an affix is added to the base form are cases of affixation. Notwithstanding, this process is said to be governed by some parameters, such as the combinatory potential of the affix. It means that not any affix can attach to any word class of the stem (Haspelmath et al, 2010, p.34). For example, the suffix -ing can attach only to verbs to form the present participle or gerund, but not to adjectives or adverbs.

B. Compounding

It is the operation of bringing together two or more free morphemes to obtain a new word. Spencer (1991) notes that compounding is a typical pattern in the morphology of some languages like Chinese and Vietnamese. In fact, words from different grammatical categories can form compounds. Two nouns can yield a compound noun such as 'motorway' which comes from motor+way. Next, it could be a compound of an adjective and a noun like in the case of 'blackbird' (black+bird) and 'Englishman' (English+man). Moreover, there are cases of

compounding a noun and an adjective such as ‘cobalt blue’, or rarely a verb and a noun such as ‘payday’.

2. Non-concatenative Processes

As opposed to concatenative ones, nonconcatenative phenomena involve the discontinuous combination of morphemes. Consequently, they would exist in one word interrupting one another. A few types are put forward:

A. Base Modification

Haspelmath et al (2010, p.35) claim that “A range of morphological patterns exists that cannot be straightforwardly segmented into two meaningful parts.” Indeed, base modification is a set of operations that are not achieved via the concatenation of morphemes. Thus, the output is not a string of separable morphemes and attached affixes, but rather a base form that has undergone modification. There are several instances of this non-concatenative category. To start, shortening is a process found in Hindi and Urdu, the official languages of India and Pakistan respectively, where the stem vowel is shortened in order to obtain an intransitive verb from a transitive one, e.g., ‘mar’ (die) from ‘maar’ (kill). Another case is gemination in Arabic, a phenomenon that lengthens the root consonant so as to form a causative verb, e.g., ‘kattaba’ (He caused to write) which comes from ‘kataba’ (He wrote).

B. Reduplication

It is a non-concatenative operation of repeating partially or fully the base form. In other words, the stem is either doubled as it is, or a reduced part of it is attached before or after it. For instance, Hindi language contains the case of forming adverbs through the process of reduplication as ‘chupke-chupke’ (secretly). In addition, Rehg (1981, p.78) notes that the

language of Ponapean exhibits a partial repetition of the base in ‘du-duhp’ (be diving), given that the base is ‘duhp’ (dive) (mentioned in Haspelmath, 2010, p.38)

C. Conversion

This process denotes obtaining a new lexeme, that is a derived morpheme of a new grammatical category, dispensing with the use of any affix or other form. Thus, no alternation is noticed at the level of the morph. (Crystal, 2008, p.114). Conversion exists in the English language and examples are *hammer, bet, visit,* and *drink.* These instances are at the same time verbs and nouns.

V. ABOUT SOME MORPHOLOGICAL THEORIES

Hitherto, the chapter has presented fundamental concepts in the field of morphology, in addition to most known word formation phenomena that morphologists have discovered. Hence, this section opts for an outline of some morphological theories that allow linguists to describe and explain morphological operations. The theories are divided up into pre-generative and generative theories, because of the shift in thought that Generative Grammar as a landmark has brought about.

At this juncture, note that before the 20th century, morphology was practiced according to the philological fashion. In other words, language scholars at the time relied on the forms of words in order to trace similarities among languages. After the 20th century, with the emergence of the Structural trend and especially American Structuralism, morphology shifted its approach into analysing words and morphemes at a point in time, meaning synchronically. (Katamba, 1993, p.3)

1. Pre-generative Theories

In the 20th century, the field of linguistics witnessed the progress of structuralism, and the tenets of the American structuralist school had gained widespread currency. Its main contribution was to give independence to morphology as a separate branch of linguistics. In the realm of morphological analysis, theories were grounded on the structuralist tradition of dealing with language, which gave importance to form and structure. Therefore, three main models emerged in that period:

A. Item and Arrangement (IA) and Item and Process (IP)

These are two models provided by Hockett in 1954, which gave prior importance to the morpheme. Subsequently, it was the basic unit to be analysed in morphology. However, the two models display some divergences. On the one hand, IA conceives of words as linear sequences of minimal units; morphemes. That is to say, morphemes are stringed one next to the other in order to yield words. Hence, morphology tackles the combination of morphemes the same way as syntax tackles the combination of words. Moreover, IA considered, according to Johannessen (1989, p.53), "That there is ideally a one-to-one relationship between morpheme and allomorph", meaning that each morpheme is realized into one allomorph. On the other hand, IP is a model that abides by the conception of the morpheme and its realization into an allomorph. However, it differs from IA in that it can, as mentioned in Johannesen (1989, p.53), account for alternations that occur when externalizing the morpheme into its allomorph. The operation that happens is considered by this model as a morphological process, altering the overall shape of the underlying morpheme, or just specific phonemes of it, such as the process of modifying /u/ in 'foot' into /i:/ in its plural 'feet'.

B. Word and Paradigm (WP)

Long before the linguist Hockett pointed at Word and Paradigm (WP) as a linguistic model for morphological analysis in the same article he published in 1954 which advocated IA and IP , the roots of WP date since the interest of traditional grammarians in creating sets of morphologically related words, known as paradigms, hence the name of the model. It was the case of languages such as Latin and Greek. Indeed, this model deals primarily with inflections and word-forms. For this reason, it is also known as a word-based model, since it focuses on the relationship between word-forms and sets them up as lexical groupings. To illustrate, the words *work, works, worker, workers, working, workings* are related to one another by inflectional and derivational means and thus are considered word-forms of the lexeme WORK.

2. Generative Theories

In the second half of the 20th century, the Chomskian perspective of language study rose to ascendancy and culminated in the establishment of the generative school. The pioneer of Generative Grammar, Noam Chomsky, was interested in finding out universal principles that make up speakers' linguistic knowledge, in addition to how human beings acquire language. In his theory of Generative Grammar, Chomsky focused primarily on phonology and syntax, and relegated morphology as an element in language theorising, claiming: "I do not think there are many spectacular successes to point to in morphology" (Chomsky; Huybregts; Riemsdijk; Fukui; Zushi, 2004, p.119) . This is how interest in morphological studies had initially declined, especially with the generativists' view that morphology depends on phonology and syntax in order to yield a fruitful study. (Katamba, 1993, p.11). However, focus on morphology was later renewed, and new theories of word formation emerged within the ambiance of Generative Linguistics.

A. Lexical Morphology

It is a linguistic model within the Generative Approach, which attempts to unveil the intersection between phonology and morphology. That is to say, it is a theory which considers the overlap of phonological operations with morphological phenomena. Nonetheless, it is considered a word-based model since the basic unit of analysis is the word. Hence, it is reminiscent of earlier morphological theories during the structuralist phase of language study. This theory deals with phonological and morphological phenomena by organizing them in levels or strata. (katamba, 1993, p.89)

B. Natural morphology

It is a generative approach advocated in the 1970's which attempts to find out the universal principles. The latter could describe and explain morphological phenomena perceived in natural languages. Some proponents of the approach are Dressler, Wurzel, and Mayerthaler. Spencer explains that this approach "seeks to provide a theory of what constitutes a 'natural' morphological system, and what laws govern deviations from that natural (or 'unmarked') state." (1991, p.125)

Conclusion

To sum up, morphology is an established field with its own terminology and notions. It has gone through many developmental stages along with the evolution of the way linguists perceived morphological phenomena. Nevertheless, there remain some challenges and problems that are not yet dealt with especially that languages display different morphologies.

CHAPTER TWO: JOHN MCCARTHY'S TEMPLATE MORPHOLOGY

Introduction

The second chapter attempts to flesh out the model that is used in the practical part, that is Template Morphology as applied by the morphologist John McCarthy, whose work extends from 1979 to 1981. The chapter will first shed light on autosegmental phonology and the basics of this theory. Then, it will elaborate on the basic principles of the theory, as well as the notation it uses. After that, the content will be focused on the contribution of McCarthy and the way he made use of the conceptual apparatus when dealing with the morphology of deriving Arabic verbs.

I. GOLDSMITH'S AUTOSEGMENTAL PHONOLOGY

It is a theory of sound phenomena proposed by John Goldsmith in 1976 in his PhD thesis entitled 'Autosegmental Phonology'. The initial impetus was to deal with tone languages. In fact, the issue of contour tones was central to the call for a new theory, so Goldsmith attempted to suggest a theory of phonology which would allow a representation of tone. (Cf. Goldsmith 1976; Katamba 1989; Katamba 1993). Indeed, the autosegmental formal apparatus provides a satisfactory phonological account for natural language properties, namely tone.

As its name entails, autosegmental phonology is about having a phonological representation which includes more than one level, or 'tier'. Each level contains a sum of ordered segments such as vowels and consonants, tones, or stress. Goldsmith defines segments as "atomic elements ordered linearly left to right;" (1976, p.40). What he means by atomic elements is that segments cannot be divided further; they are basic units in the overall structure

of the phonological representation. In addition, these segments are put one next to the other from left to right to form a sequence.

What is fundamental to the theory is that what happens in one tier does not necessarily affect the other tiers, since they are independent from one another. That is why the levels are assigned the name ‘autosegmental’. Another basic idea is that these tiers are linked thanks to association lines, which associate a segment on one tier with another segment on another tier. Note that, up to now, autosegmental theory includes only two levels: the segmental tier, and the skeletal or CV tier; the case of tonal languages requires an additional ‘tonal’ tier. This is how autosegmental, or non-linear phonology differs from its precursor, that is linear phonology. The latter, according to its name, provides an account for phonological phenomena in the form of one line. This idea is summarized in Goldsmith’s thesis: “Autosegmental phonology is a particular claim, then, about the geometry of phonetic representation.” (1976, p.28)

The example below from katamba (1993, p.156) demonstrates a non-linear account of three levels: the tonal, skeletal, and segmental tiers. First, the tonal tier contains either H (high tone) or L (low tone). Second, the skeletal tier has as function to join all the other tiers, just like a skeleton. It is composed only of C’s (consonant) and V’s (vowel). Third, the segmental tier consists of the phonemes that are going to be realized. The vertical lines between the tiers are called association lines. They are among the notation used in autosegmental phonology.

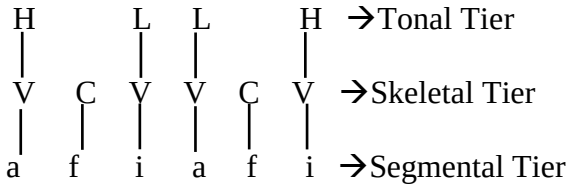


Figure 2.1: The Tiers of an Autosegmental Tonal Representation

Note: Cited in (Katamba, 1993, p.156)

1. The Notational System of Autosegmental Phonology

The system of notation consists of other symbols that are mentioned below from katamba (1993, p.157), each with its explanation:

a. | An unbroken **association line indicates pre-linking**, i.e. prior association in the lexicon of elements on separate tiers

b. ¦ A broken association line indicates **linking**, i.e. the creation of an association line

c. ǂ A crossed-through **association line** shows **delinking**, i.e. the [severence] by rule of an association line linking elements on different tiers.

d. [ ] A left bracket shows the left boundary and a right bracket shows a right boundary. (In this book these brackets will only be used where their presence is particularly important for the point under consideration.)

e. Ⓥ A circle around an item indicates that the item has been deleted.

2. Well-Formedness Conditions (WFC)

Also known as Mapping Principles, WFC are universal principles that should be respected while associating elements from different levels, in order to result in a correct representation. According to Goldsmith, there are two main conditions, as stated in McCarthy (1981, p.231):

1- Every unit on one level must be associated with at least one unit on every other level.

2- Association lines may not cross.

The first principle means that no segment is allowed to be floating, while the second principle presupposes that since segments are ordered from left to right in correspondence with the elements of the other tiers, there would be no two association lines crossing each other.

II. MCCARTHY'S CONTRIBUTION

Besides the theory that Goldsmith has established with all its elements and principles, other linguists such as Clements and Keyser (1983) have again used and developed it. The linguist John McCarthy made use of the autosegmental apparatus of phonology in the sub-field of morphology, namely with Semitic languages. in fact, he published his PhD thesis entitled 'Formal Problems in Semitic Phonology and Morphology' where he basically dealt with Arabic and Hebrew in 1979. Because the Arabic language is our concern, a review from the first chapter would be useful.

As previously sketched, morphological processes can be either concatenative or nonconcatenative. The latter is the case of Arabic, and it is relatively rare among languages. A nonconcatenative language does not have sequences of morphemes, one next to the other, but rather discontinuous morphemes which 'interrupt' one another. Hence, McCarthy's choice of the theory gave prior consideration to the nature of the language being analysed, which made his attempt a relevant and targeted one. In other words, because Arabic has somehow a complex morphology, a linguistic model that offers some flexibility in terms of independent tiers was required.

1. The Morpheme Tier Hypothesis

This hypothesis has been postulated by McCarthy in 1981, and has to do with the idea that each tier in an autosegmental morphological representation is itself a morpheme. Since he

worked on Arabic verbs, he claimed that there is the root tier, the vocalic melody tier, the affixal tier, and the skeletal tier, all put together in a discontinuous manner, to represent one word. To start, the root tier is usually composed of three (triliteral) or four (quadriliteral) consonants, and embodies the meaning of the action, such as *rsm* ‘to draw’, *ksb* ‘to earn’. Then, the vocalic melody tier has from two to four vowels, and the information it expresses is grammatical, including aspect, tense and voice. Next, the affixal tier displays affixes in the form of segments such as /t/, /j/, /at/, /st/, etc. There could be one or more than an affixal tier. Usually, if it is a prefix or a suffix, it provides grammatical data like agreement in gender and number, and mood. However, if this affix is an infix, it is mostly used for derivational purposes, which would be explained in the coming section. Nevertheless, the skeletal tier gathers the aforementioned tiers, and it is also going to be mentioned in what is coming for its importance.

2. Arabic Binyanim

Traditional grammar of Arabic acknowledges the presence of a particular resemblance between verb forms. Perhaps that an example of verb paradigm from McCarthy (1981) would be useful:

a. kataba 'he wrote'
b. kattaba 'he caused to write'
c. kaataba 'he corresponded' (reciprocal, i.e. letters went to and fro between him and someone else)'
d. takaatabuu 'they kept up a correspondence'
e. ktataba 'he wrote, copied'
f. kitaabun 'book (nominative)'
g. kuttaabun 'Koran school (nominative)'
h. kitaabatun 'act of writing (nominative)'
i. maktabun 'office (nominative)'

Table 2.1: Verb Paradigm of the Root *ktb*

Cited in (McCarthy, 1979, p.209)

What is clearly noticed is the repetition of /k/, /t/, and /b/; these are in fact the consonantal roots of the verb *ktb* 'write'. All these forms are yielded from the root *ktb* via derivational processes. Hence, /kataba/, /kattaba/, /kaataba/, etc are called binyanim (verb forms). One verb form is a binyan, a key word in the work of McCarthy. A significant characteristic of Arabic derivation is that is abides by patterns that define the distribution of vowels and consonants in the process of obtaining the different derivational classes, or binyanim. The table below provides the first ten binyanim of the root *ktb* 'write' (the whole number is fifteen for triliteral roots, but the practical part includes only the first ten, because the remaining ones are relatively rare). The following binyanim are those of the perfective (past simple) and imperfective (present simple) aspects, in both the active and passive voice:

Perfective		Imperfective	
Active	Passive	Active	Passive
I katab	kutib	aktub	uktab
II kattab	kuttib	ukattib	ukattab
III kaatab	kuutib	ukaatib	ukaatab
IV ʔaktab	ʔuktib	uʔaktib	uʔaktab
V takattab	tukuttib	atakattab	utakattab
VI takaatab	tukuutib	atakaatab	utakaatab
VII nkatab	nkutib	ankatib	unkatab
VIII ktatab	ktutib	aktatib	uktatab
IX ktabab	aktabib	-	-
X staktab	stuktib	astaktib	ustaktab

Derivational Classes of the Root *ktb*

Cited in (McCarthy, 1979, p. 244)

What is meant by the fact that verbs abide by derivational patterns is that substituting the root *ktb* into *rsm*, for instance, will not change anything in the place of vowels and consonants, and will basically preserve the vocalic system in all binyanim, so only the consonants of the root will change. This is what triggered the interest of McCarthy into conceiving canonical templates which represent the various verb binyanim. In fact, he used the skeletal tier to form his templates, and kept away all additional consonants and vowels, that is those of affixal tiers that have a grammatical function.

3. CV Templates

The following table contains the sum of templates that McCarthy came up with. Roman numerals are put next to each template to know which binyan(im) it/they represent:

a. CVCVC	I	CV ((CV) [+seg]) CVC
b. CVCCVC	II, IV	
c. CVVCVC	III	
d. CVCVCCVC	V	
e. CVCVVCV	VI	
f. CCVCVC	VII, VIII, IX	CCV ([+seg]) CVC
g. CCVCCV	X	

Table 2.2: The Binyanim's Templates and Canonical Stems

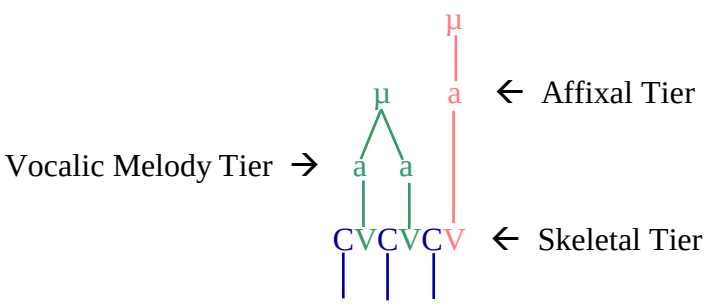
Cited in (McCarthy, 1979, p.246)

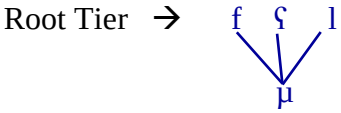
According to the model, the templates on the left are abbreviated into the two formulas on the right. McCarthy makes an important, yet strong claim about the latter: “The stem patterns of Arabic must be selected from this restricted group of possibilities and no others.” (1979, p.247).

A remark about the ninth binyan is that its template CCVCVC is an underlying representation; it is not the one uttered in speech, but rather its output CCVCCV. What happens is the phenomenon of metathesis which refers to “an alteration in the normal sequence of elements in a sentence – usually of sounds,” (Crystal, 2008, p.303). Thus, what happens to the ninth binyan is a modification in the order of the last V and C. What is noticed is that the phenomenon of metathesis happens also to geminate roots, and this would be illustrated in the third chapter.

4. The Morphological Representation of the Binyanim

It is based on the autosegmental theoretical framework, as well as Mapping Principles of association between the segments. Since each morpheme is represented on a separate tier, the conventional symbol ‘μ’ is used. Moreover, a formal apparatus is required for generating the different verb forms: the two formulas mentioned above, and necessarily the CV templates, the segments /ʔ/, /t/, /n/, and /st/, Left-to-Right Consonant Association, and WFC. An example would provide a demonstration of how a morphological representation of verbs looks like. Let’s deal with ‘*kataba*’ (he wrote) in what follows:





The Tiers of a Morphological Representation

In this instance, there is the root tier *fʕl* which represents the morpheme ‘to do’. The level above is the skeletal tier, and includes the canonical template of the first binyan CVCVC in addition to the affixal material V that refers to the third person singular. From this standpoint, the CV tier corresponds to the template suggested by McCarthy. The vocalic melody tier represents the grammatical idea of the perfective active. The last tier is the affixal one, and in this case it is a mere /a/ that represents the third person singular. Hence, each autosegmental level is considered to be a separate morpheme which represents a certain idea. The use of association lines offers a clear vision about the idea of discontinuous morphemes.

Conclusion

In conclusion, template morphology has been established by John McCarthy, as it draws its principles from autosegmental phonology. The notion of autonomous tiers showed its effectiveness with the Arabic morphological system of derivation, and concretises the nature of Arabic morphology. Nevertheless, McCarthy provided a number of possibilities and asserted that all verb forms would respect them. This point is going to be the central concern of the coming chapter.

CHAPTER THREE: METHODOLOGY, RESULTS AND DISCUSSION

Introduction

So far, the first chapter has introduced the domain of morphology with its basic notions, and the second chapter has fleshed out the linguistic model of Template Morphology and its emergence, formal apparatus and kernel principles. The following chapter is moving to the crux of the matter, that is the application of McCarthy's model to selected verbs from the Holy Quran.

I. FUNDAMENTALS OF THE RESEARCH

The present piece of research is grounded on one cornerstone that represents the work's most important aspect, that is the applicability of Template Morphology to Quranic verbs, and the preservation of the theory's principles and templates while representing the verbs' different morphological levels, whose phonological realizations necessarily abide by Tajweed rules. Thus, the following chapter makes the transition towards the experimental part which embraces the work's objectives, namely evaluating the existence of potential alternations in the CV templates when applying the theory on Quranic Arabic verbs, investigating the influence that the rules of Tajweed could have in the process of this application, and examining the extent to which WFC are respected or violated.

II. METHODOLOGY: EXPLAINING THE NATURE OF THE INQUIRY

The study at hand adheres to the mixed method approach. It has opted for an autosegmental representation by resorting to a corpus of 25 verbs selected from different verses of the Holy Quran (*Riwayat Hafs An Asim)*. Each verb has been given a morphological

representation based on the morpheme tier hypothesis and mapping principles. Then, attention is paid to the extent to which the distribution of consonants and vowels is respected vis-à-vis the canonical templates. Subsequently, a linguistic analysis is provided.

III. DATA COLLECTION: METHODS AND TOOLS

The experimental application has been achieved with the use of McCarthy's model of analysis on 25 verbs from the Holy Quran. Choosing the Holy Quran as a case study is due to the researcher's interest in Quranic studies, as well as the appealing aspect of Tajweed rules that the Quran is known for. Another reason is the relevance of the Holy Quran as far as McCarthy's theory is concerned. The latter is a linguistic model established for the sake of Semitic languages, so this makes it suitable for having Quranic Arabic as an object of study.

The process of organizing the data has been made possible thanks to the Quranic Arabic Corpus (QAC) by Kais Dukes available on: http://corpus.quran.com/ . It is an online database which preserves an electronic version of the Holy Quran, with grammatical and morphological annotations for each word in the Holy book. It has facilitated the task of organizing the data in that it provides the binyan, or the derivational class of the verb (form), the reference of the verb shown by three numbers between parentheses (Sourah, verse, word), an Arabic translation as well as some grammatical information (aspect, mood and verbal agreement).

The researcher has used the QAC's system of referencing verbs and their translation. In addition, the QAC was a tool for verifying that the verbs forms (binyanim) shown in the following tables are correct. Yet, note that the binyan of the verb /tadʒallaa/ in table 3.18 has been identified with the researcher's own efforts, for the binyan suggested by the database is not a correct one. For a clearer idea of the database layout, see Appendix 2.

The data collection involves a sum of 25 verbs from the Holy Quran. They were selected carefully from different Sourahs in order to be relevant to the objective of the research: To

expose instances where the application of TM works effectively, and other instances where the theory faces problems and challenges, especially with the presence of Tajweed rules. The collected verbs belong to various derivational classes, that is to different binyanim ranging from I to X. The selected verbs are: /xalaqa/, /karraha/, /ʕaaqaba/, /ʔaslama/, /tafarraquu/, /tabaaraka/, /nfadʒarat/, /staraqa/, /bjadˁdˁat/, /staftaħuu/, /qaala/, /dʒaaaaʔa/, /dʒiiiiʔa/, /ħaaaaaadʒdʒa/, /wadʒada/, /jadʒid/, /qadˁaa/, /tadʒalla/, /tataðakkaruuna/, /jaððakkaruuna/ and /taðakkaruuna/.

It should be noted that grammatical information falls out of the scope of this research, so any related affixal segments would be represented in separate morphemic tiers without further specifications. Hence, the researcher suggests the use of tables that include all necessary data about the verbs. Each table has a column for the reference of the verb, that can be easily used in the website of QAC. Then, the next column contains the verb's translation, also brought from the website with a few modifications on the part of the researcher for the sake of meaning accuracy. The third column provides the phonemic transcription which represents the final result of tiers conflation and the pronunciation of the verb at the same time. Below these three columns, there is a space devoted to the ausegmental representation of verbs. Its binyan is provided on the left, and the canonical template is on the right.

Thus, the autosegmental representation is composed of, from bottom to top, the root tier, the skeletal or CV tier, the vocalic melody tier, and affixal tiers (the remaining ones). The researcher invites the reader to compare the canonical template that is on the right with the CV tier of the verb to see whether the latter respects the canonical distribution of vowels and consonants (the template conceived by McCarthy) or not. A remark is that some prepositions were not included in the analysis even though they are part of the reference of verbs, such as *'wa'* (and) in *'wa karraha'* (and has made hateful) (49:7:21). In addition, the analysis at hand involves only triliteral roots that are composed of three radicals (consonants); Quadrilateral

roots are not included. The researcher has also opted for the use of colours in the association lines of and segments of the autosegmental representation. Blue, green and pink are used respectively for the root tier, the vocalic melody tier, and affixal tiers (that show grammatical information mainly verbal agreement). Grey is used for the tiers that demonstrate the segments required in the obtention of some binyanim (such as /ʔ/ in binyan IV). Red is used only for alternations of the templates, or where an introduction of new segments or new associations takes place.

IV. DATA ANALYSIS: APPLYING MCCARTHY'S MODEL ON THE COLLECTED DATA

Analysis of the findings has been divided into two parts, depending on whether or not the morphological representation was successful. The first part deals with 10 verbs that adhere to the arrangement of consonants and vowels suggested by the theory. They belong to the first 10 binyanim, since the 5 remaining forms are not part of the analysis for they are rarely identified in Arabic language. The second part tackles 15 verbs where the theory faces unusual cases that fall out of the canonical vocalism and consonantism. A thorough linguistic description of the findings is provided.

Reference	Translation	Transcription
(67:2:2)	He created	/xalaqa/
Binyan I		CVCVC

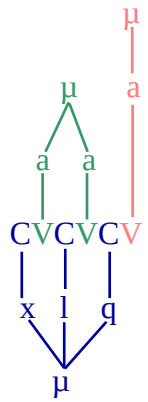


Table 3.1. Morphological Representation of /xalaqa/

Reference	Translation	Transcription
(49:7:21)	He has made hateful	/karraha/
Binyan II		CVCCVC

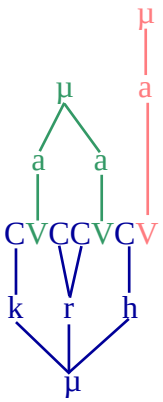


Table 3.2. Morphological Representation of /karraha/

Reference	Translation	Transcription
(22:60:3)	He has retaliated	/ʕaaqaba/
Binyan III		CVVCVC

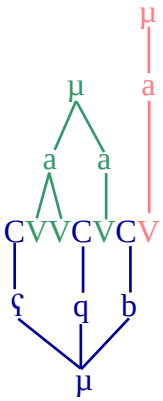


Table 3.3. Morphological Representation of /ʕaaqaba/

Reference	Translation	Transcription
(37:103:2)	Both of them had submitted	/ʔaslamaa/
Binyan IV		CVCCVC

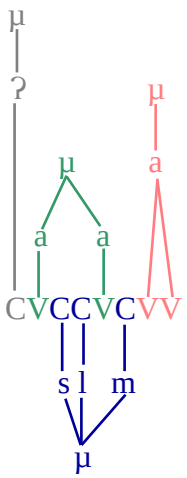


Table 3.4. Morphological Representation of /ʔaslamaa/

Reference	Translation	Transcription
(3:103:6)	Be divided	/tafarraquu/
Binyan V		CVCVCCVC

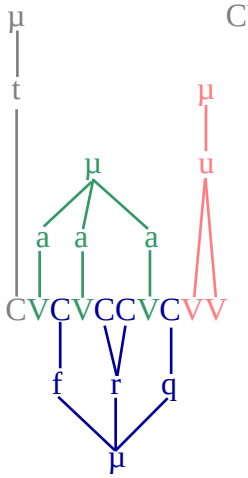


Table 3.5. Morphological Representation of /tafarraquu/

Reference	Translation	Transcription
(67:1:1)	Blessed is He	/tabaaraka/
Binyan VI		CVCVVCVC

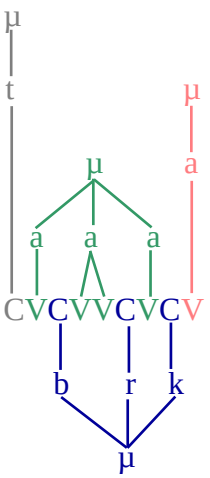


Table 3.6. Morphological Representation of /tabaaraka/

Reference	Translation	Transcription
(2:60:9)	Gushed forth	/nfadʒarat/
Binyan VII		CCVCVC

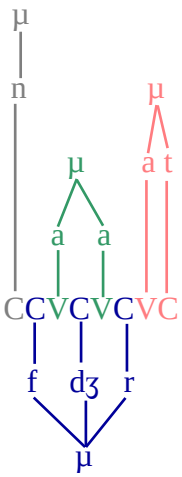


Table 3.7. Morphological Representation of /nfadʒarat/

Reference	Translation	Transcription
(15:18:3)	Steals	/staraqa/
Binyan VIII		CCVCVC

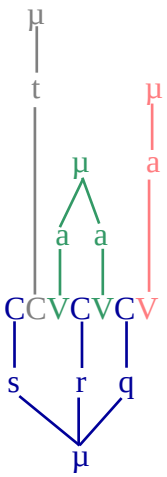


Table 3.8. Morphological Representation of /staraqa/

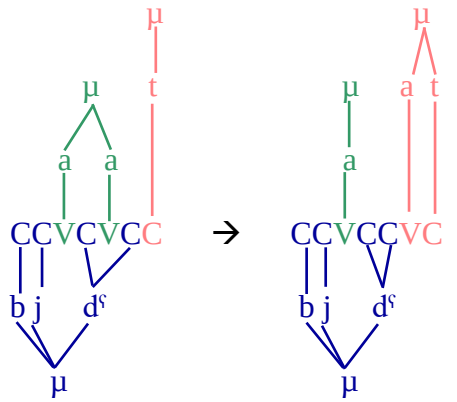
Reference	Translation	Transcription
(3:107:3)	Turn white	/bjadˤdˤat/
Binyan IX CCVCVC 		

Table 3.9. Morphological Representation of /bjadˤdˤat/

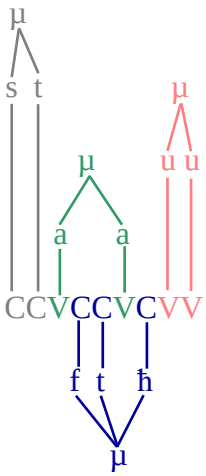
Reference	Translation	Transcription
(14:15:1)	They sought victory	/staftaħuu/
Binyan X CCVCCVC 		

Table 3.10. Morphological Representation of /staftaħuu/

The multi-tiered morphological representation of these verbs has been made possible thanks to McCarthy's linguistic model. Close attention of the results suggests that this autosegmental tool manages to provide a satisfactory description of verbs from each binyan. In addition, the skeletal tier corresponds to the canonical distribution of vowels and consonants in all cases. Thus, there is no violation of the templates or Well Formedness Conditions, and no flopping segments. On the contrary, the CV tier succeeds to bear all segments from the different morphological levels, with no crossing association lines, or a restricting number of tiers. Moreover, the ninth binyan has been provided a plausible autosegmental representation thanks to the rule of metathesis mentioned in the second chapter. This infers that McCarthy's nonconcatenative model is appropriate and effective to account for Arabic verbs. Now let us

move to the second part of the analysis. We just would like to recall the stem patterns conceived by McCarthy:

a. CV ((CV) [+seg]) CVC

b. CCV ([+seg]) CVC

Reference	Translation	Transcription
(12:92:1)	He said	/qaala/

Binyan I CVCVC

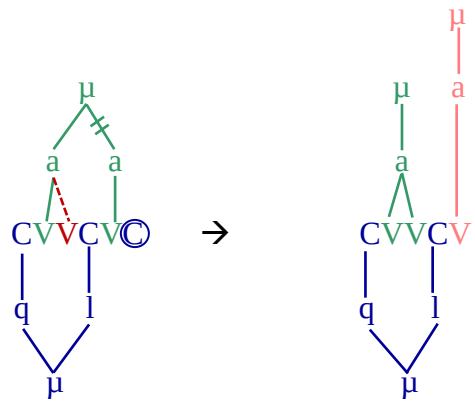


Table 3.11. Morphological Representation of /qaala/

Reference	Translation	Transcription
(6:160:2)	He came	/dʒaaaaʔa/

Binyan I CVCVC

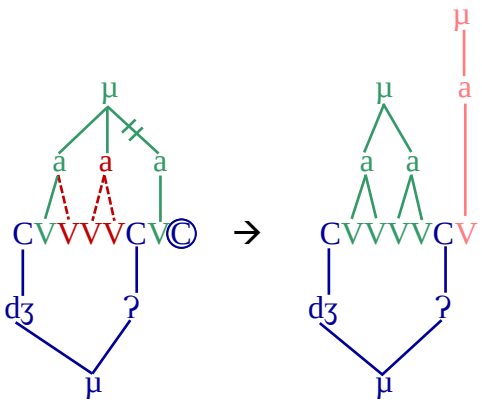


Table 3.12. Morphological Representation of /dʒaaaaʔa/

Reference	Translation	Transcription
(89:23:1)	Is brought	/dʒiiiiʔa/

Binyan I CVCVC

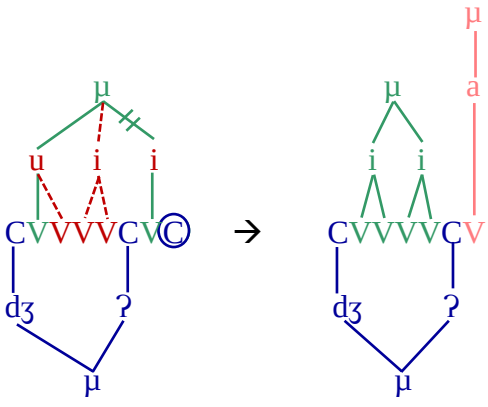


Table 3.13. Morphological Representation of /dʒiiiiʔa/

Reference	Translation	Transcription
(2:258:5)	He argued	/ħaaaaaadʒdʒa/

Binyan III CVVCVC

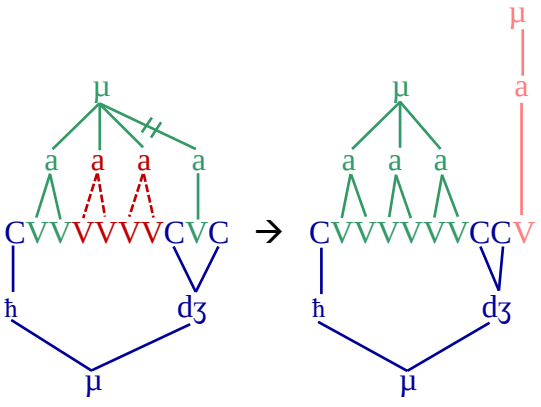


Table 3.14. Morphological Representation of /ħaaaaaadʒdʒa/

To start, the four verbs above are called weak verbs, more precisely hollow verbs because they have a glide as a medial radical. In fact, these verbs have been mentioned briefly in McCarthy's thesis. He related them mainly to Hebrew, and he stated that a lengthened vowel replaces the glide. Notwithstanding, he did not take them into account when providing verb templates.

First, the verb /qaala/ has the template CVVC, which has no correspondence with the first binyan CVCVC. There is the insertion of a vowel slot next to the first vowel of the canonical template and the first /a/ is linked to it, to become a long vowel. The third consonant is deleted, and the second /a/ is delinked from the μ of the vocalic melody tier, to have its own affixal tier and represent the third person singular.

Second, the verbs /dʒaaaaʔa/ (active voice) and /dʒiiiiʔa/ (passive voice) display unusual vowel length. The fact of having four vowels is due to recitation requirements of vowel lengthening mentioned in Appendix 1. Hence, for both /dʒaaaaʔa/ and /dʒiiiiʔa/, CVVVVC differs from CVCVC in that the third consonant slot is deleted and three extra vowel slots are added next to the first vowel on the CV tier. The result is a length of four vowels. Yet, the case of /dʒiiiiʔa/ is different in that /u/ is changed into /i/, and another new /i/ is associated with the new vowel slots.

Third, the case of /ħaaaaaadʒdʒa/, the geminate verb, demonstrates vowel lengthening of six vowels because of the long vowel /aa/ followed by a geminate consonant. Thus, /aa/ is required to be lengthened according to Tajweed rules (see Appendix 1). Since the verb is a geminate root, there is the operation of metathesis which takes place between the last vowel and consonant slots. Consequently, the tier CVVVVVVCC does not correspond to CVVCVC of the third binyan.

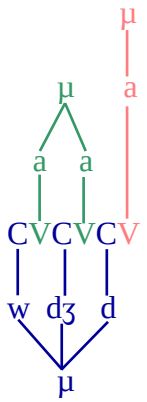
Reference	Translation	Transcription
(3:37:15)	He found	/wadʒada/
Binyan I 		CVCVC

Table 3.15. Morphological Representation of /wadʒada/

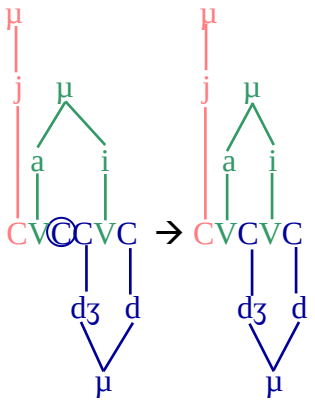
Reference	Translation	Transcription
(5:89:28)	Find	/jadʒid/
Binyan I 		VCCVC

Table 3.16. Morphological Representation of /jadʒid/

The following pair is also about weak verbs, but in this instance the glide is root initial. Since McCarthy gave no account to such type, the researcher attempted to describe it morphologically. What has been noticed is that the verb /wadʒada/ in the perfective aspect was identical to the binyan CVCVC, whereas in the imperfective aspect, on the right table, there is a loss of the glide and, as McCarthy commented on Hebrew hollow verbs, *wdʒd* becomes a biliteral root. As a result, the first consonant at the root tier is deleted, and the template VCVC is different from the canonical template VCCVC of the imperfective aspect.

Reference	Translation	Transcription
(33:23:11)	Has fulfilled	/qadˤaa/
Binyan I		CVCVC

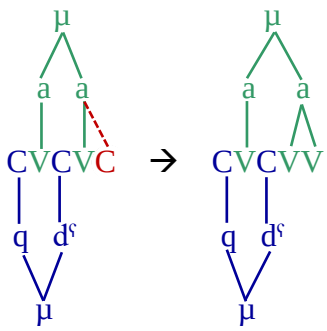


Table 3.17. Morphological Representation of /qadˤaa/

Reference	Translation	Transcription
(7:143:25)	Revealed His glory	/tadʒallaa/
Binyan V		CVCVCCVC

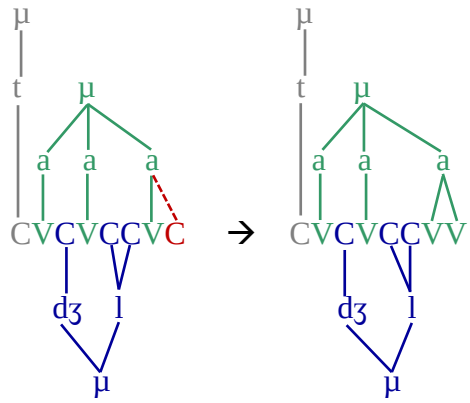


Table 3.18. Morphological Representation of /tadʒallaa/

One could take into account the existence of another kind of weak verbs, where the glide is root final. Both examples in the table above have biliteral roots and subsequently diverge from the canonical Templates. CVCVV is not CVCVC, and CVCVCCVV differs from CVCVCCVC in the alternation of the final consonant at the skeletal tier into a vowel. As a conclusion, both cases have in common one missing C that is substituted by V. In addition, close attention suggests that it is problematic to have the perfective suffix of 3rd person masculine singular /a/. Since the last C in the canonical template is replaced by vowel length, the researcher found no place in the CV tier for the perfective suffix.

Reference	Translation	Transcription
(6:80:25)	You take heed	/tataðakkaruuna/

Binyan V VCVCVCCVC

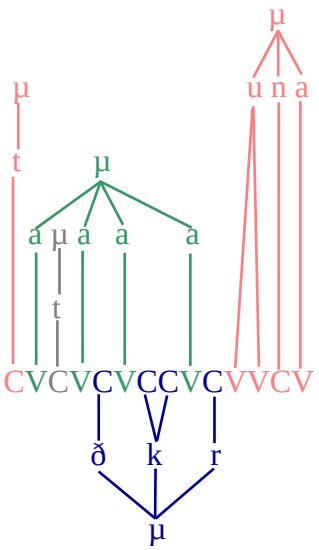


Table 3.19. Morphological Representation of /tataðakkaruuna/

Reference	Translation	Transcription
(7:26:19)	They will remember	/jaððakkaruuna/

Binyan V VCVCVCCVC

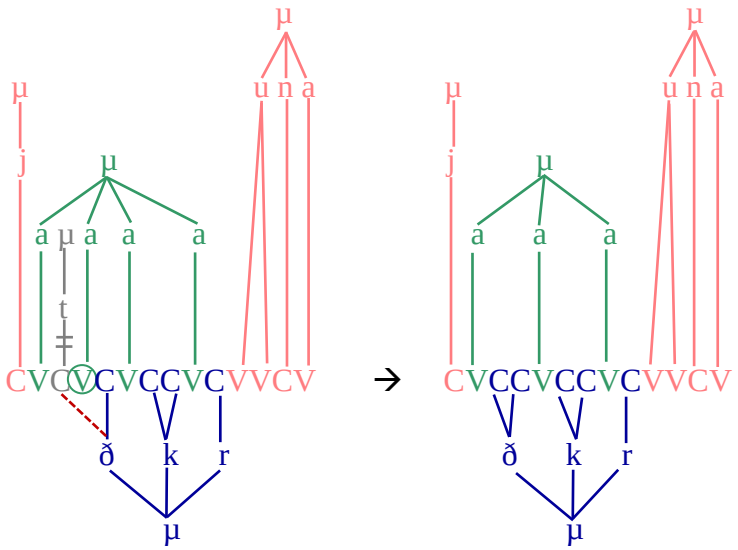


Table 3.20. Morphological Representation of /jaððakkaruuna/

Reference	Translation	Transcription
(6:152:35)	You may remember	/taðakkaruuna/
Binyan V		VCVCVCCVC

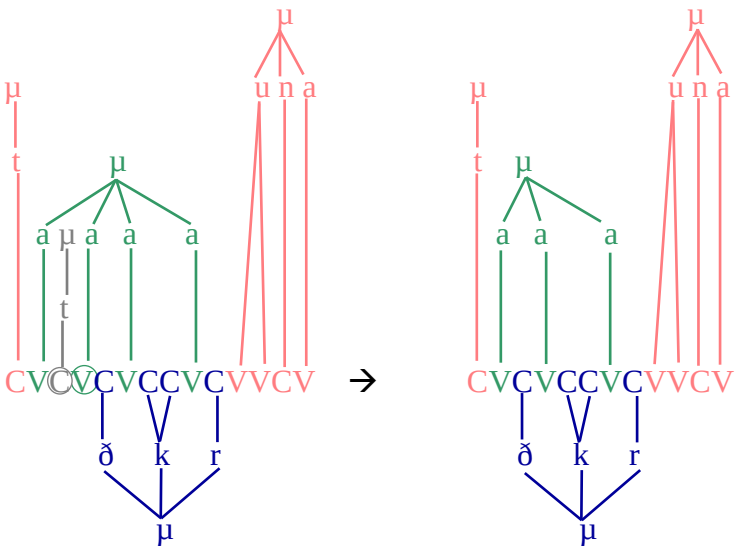


Table 3.21. Morphological Representation of /taðakkaruuna/

The three cases at hand could be reminiscent of the different allomorphs of the same morpheme. While the first table is identical to the template of the fifth binyan, the second and third tables belong to the same binyan, but have some missing elements, and unusual morphological representations. The verb on the second table misses the affix /t/ that is necessary in the generation of the 5th binyan. The available C slot is associated to the first root consonant, yielding a gemination of the first radical and the pattern VCCVCCVC that is not the canonical VCVCVCCVC.

Furthermore, the third verb misses the morphological tier of /t/ that is needed in the obtainment of the fifth binyan, and it is different from the previous verb in that there is no gemination that somehow ‘makes up’ for the lacking segment; but rather a deletion of the C slot. The V slot that is next to it on the right is deleted, too. The result is VCVCCVC which violates the canonical pattern VCVCVCCVC. To conclude, the 5th binyan is realized differently

through these instances, which incites us to view morphological representation from another dimension, in the sense of considering how these verbs display the same meaning despite their different morphemic realizations.

Reference	Translation	Transcription
(77:20:2)	We create you	/naxluqkum/

Binyan I VCCVC

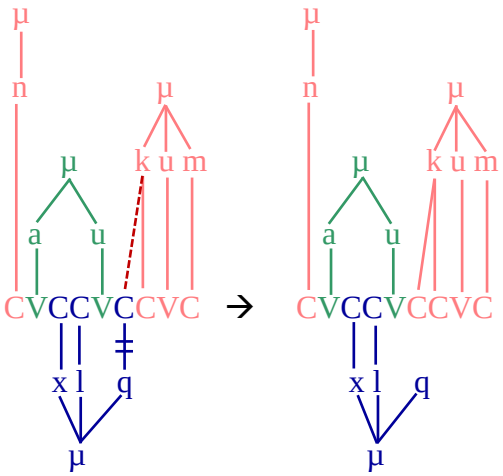


Table 3.22. Morphological Representation of /naxluqkum/

Reference	Translation	Transcription
(2:158:16)	He walks	/jatˁtˁawwafa/

Binyan V VCVCVCCVC

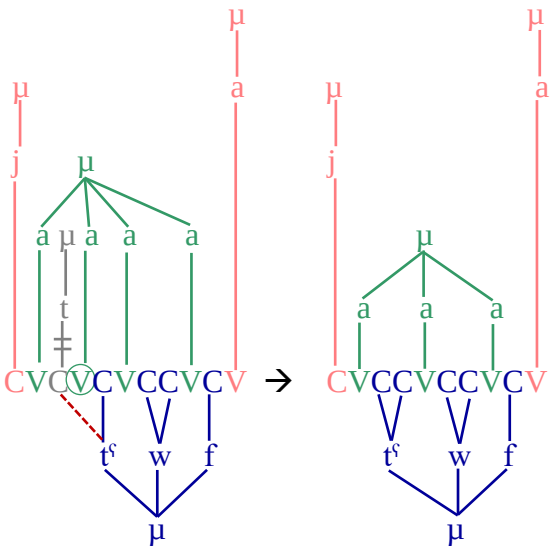


Table 3.23. Morphological Representation of /jatˁtˁawwafa/

Reference	Translation	Transcription
(12:80:21)	You failed	/farratˁtum/
Binyan II CVCCVC		

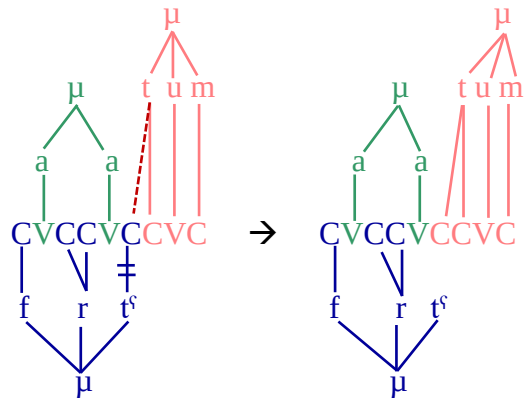


Table 3.24. Morphological Representation of /farratˁtum/

Reference	Translation	Transcription
(5:89:10)	You contracted	/ʕaqqadtumu/
Binyan II CVCCVC		

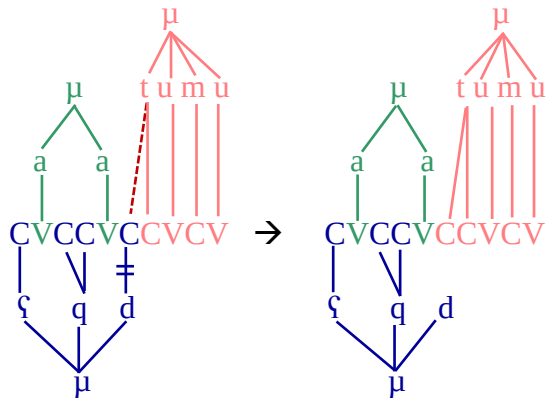


Table 3.25. Morphological Representation of /ʕaqqadtumu/

Coming to the last four verbs in the corpus, we could start with the second verb /jatˁtˁawwafa/ for it could be related to the previous discussion. Despite the fact that it belongs to the 5th binyan, there is no infix /t/ in its morphological representation, and a gemination takes place instead; since the deleted infix /t/ leaves the C slot available, the latter is associated with the first root consonant. Consequently, its template VCCVCCVC diverges from the canonical one VCVCVCCVC. It was the case of the verb /jaððakkaruuna/. This could mean that there is a pattern which could lie behind these linguistic phenomena.

Moreover, the remaining tables display three examples of morphological representations where there is a floating segment in the root tier: /q/, /tˁ/, and /d/ in the verbs /naxluqkum/, /farratˁtum/, and /ʕaqqadtumu/ respectively. What happens is the delinking of the root segment from the C slot, and the linking of the first consonantal segment of the adjacent suffixal tier to the C slot, leaving the third consonant of the root tier floating. The reason behind this phenomenon is the rule of Tajweed of adjacent similar sounds mentioned in Appendix 1. Thus, the autosegmental representation faces a problem of the violation of WFC. A further

investigation is required in order to find out solutions that allow a morphological representation where both Tajweed rules and WFC are respected.

V. DISCUSSION OF FINDINGS

The analysis of the data collected validates the hypotheses provided by the researcher and answers the rationale of the research: the canonical templates that John McCarthy suggested are not representative of all Arabic verbs, because the attempt of a morphological representation of Quranic verbs provokes alternations in the canonical distribution of vowels and consonants, namely extra lengthening of some vowels, loss of others, lack of an affixal tier, and different realisations of the same verb . Indeed, Tajweed rules were behind some of the phenomena observed, such as those that caused flopping segments and violated WFC.

VI. RECOMMENDATIONS AND SUGGESTIONS

Given the challenges and problems that have been faced throughout the application of TM to Quranic verbs, the researcher recommends an editing of the canonical distributions of vowels and consonants that McCarthy suggested in his theory. An appealing endeavour could be to make the templates more inclusive in terms of possible occurrences of segments, be they vowels or consonants. That would perhaps allow the templates to be more representative of Arabic verbs.

Notwithstanding, what ought to be taken in charge is the issue of weak verbs. Since they could occur in different binyanim, a modification at the level of the root consonant of the template would be useful, by turning it into a vowel, depending on the position of the weak letter, that is the glide, in the root. The result would be a set of special templates specific to the case of weak verbs.

Since the Arabic language is reminiscent of the Holy Quran, a recommended procedure is to create templates that reconcile the requirements of Quranic recitation and the principles of the theory adopted. In order to do so, a thorough investigation of the repeated instances of Tajweed rules interacting with the morphological levels of the verbs could be relied on to generate patterns. The more they are repeated, the more we could consider them as patterns that require their own templates.

A final ambitious recommendation is to create a software, equipped with the necessary algorithms which would allow an easy, quick and manageable processing of Arabic roots, as well as providing a ready autosegmental, morphological representation to any derived form for future researchers in the field. It could be equipped with a set of computational rules that account for the modifications which happen when moving from one derivational class to another, along with an autosegmental description which will contribute in making the intricacy of discontinuous morphemes more visible. Yet, a special section dedicated to all Quranic verbs could be realized in order to investigate the existence of rules proper to the Holy Quran. The rules are considered to be potential principles linking between the morphology of Arabic and Tajweed rules.

Such a software could be helpful in the field of learning and teaching Arabic morphology and grammar in Arabic speaking countries, as well as foreign communities. The fact that it would offer visible representations and clear rules, could be thought of a tool that facilitates the discovery and understanding of the way Arabic morphology functions, and thus helps in using the language more effectively. An additional section in the software is to have a kind of lexical groupings of the different derivational classes of the same root. The idea of a dictionary with morphological, grammatical, phonological, and semantic properties of Arabic roots is also suggested, along with the assistance of the autosegmental tool.

Further horizons to this humble work could be the suggestion of an interdisciplinary collaboration which gathers specialists from different fields, namely Arabic grammar and morphology, Tajweed science, phonetics and phonology, and computational linguistics. Having a group of specialists who work together, especially if they are speakers of Arabic, would be a fruitful project in deepening our insight in the way language functions. Indeed, the intricacy of the topic requires that scholars enrich one another in the process of establishing a theory that could handle better the nature of Arabic morphology in the Quranic context.

VII. LIMITATIONS OF THE RESEARCH:

In the course of tackling the topic at hand, the researcher has encountered some challenges related merely to the theory itself. In fact, the formulas of the canonical patterns that McCarthy conceived were not so easy to grasp, namely 'CV ((CV) [+seg]) CVC' and 'CCV ([+seg]) CVC'. Their importance lies in that they are the paramount representations that the theory provides, and they are at the centre of McCarthy's claims. It is a responsibility on the researcher to master all details of the theory so as to use it effectively.

Hence, that was a reason behind putting them next to the binyanim they represent in the second chapter. Saving time and energy, and making the transmission of information easeful to the reader is considered a priority by the researcher. Also, the need to know the binyan of each CV template urged the researcher to mention the number of the binyan next to the corresponding template for the sake of the reader.

In addition, the researcher did not include a fundamental concept in the whole body of the research, that is 'Prosody'. In fact, McCarthy's theory is called Template Morphology, but it is also a prosodic theory, hence the title of his article mentioned in the bibliography. Prosody is the study of suprasegmental phonetic features such as intonation, stress and rhythm. Such

phonetic features do not concern individual sounds, but rather ‘spread’ over syllables, words, and utterances. Since the syllable is an object of study in the field of prosody, and at the same the main constituent of the CV templates that McCarthy established, it is believed to be the main element which relates the theory in this dissertation to the prosodic domain.

Nevertheless, this topic is a source of motivation and will for the new perspective it offers to the researcher and the scientific community as a whole. It is also special in that it is full of technical elements and notions. Discovering and experiencing the mechanisms of such a sophisticated theory has introduced new horizons and has opened new avenues of knowledge.

Conclusion

All in all, the stem patterns of Arabic verbs cannot be selected only from the restricted group of possibilities: CV ((CV) [+seg]) CVC or CCV ([+seg]) CVC. A theory of language could be more inclusive and open to as many probabilities as possible. Since the representation of a linguistic theory is formal and based on variables such as C, V or [+seg], a thorough exploratory research is required in order to obtain a satisfactory rule that includes all possible distributions of consonants and vowels, and preserves the principles of the theory as well.

GENERAL CONCLUSION

In conclusion, a reminder could be that the research was about the application of a nonconcatenative theory of morphology, named Template Morphology, on a collection of 25 Quranic Verbs. The main objective was to demonstrate instances where the theory works without any trouble, and others where it faces important challenges. The presence of Tajweed rule is considered to be a major factor in provoking those challenges.

The overall piece of research is structured in the form of three chapters. The first one spotted light on the sub-branch of linguistics which deals with morphemes, the units that relate form to meaning. It introduced basic concepts and terms that are rudimentary for building an understanding of what the domain of morphology is about. Then, it exposed concatenative and nonconcatenative processes, with focusing on the latter category, and sketched some of the theories that scholars used in order to account for those processes.

In a similar vein, the second chapter presented necessary data and went more specific into shedding light on the linguistic modal that the research at hand relies on. After exposing autosegmental phonology, the theoretical prelude, the chapter explained thoroughly the notions of Template Morphology and the reason behind its relevance to the present study. Hence, Important technical elements of the theory, along with McCarthy's claims, were put forward. Thus, the two chapters dealt with the theoretical part of this dissertation.

Moving to the third chapter, the autosegmental, morphological theory was applied on 25 selected verbs to examine the extent to which it succeeds in representing Quranic verbs. The results of the data analysis demonstrate that the modal does not work in all cases. A first encountered problem was the lack of representativeness of McCarthy's canonical templates. That is, there are some patterns that fall out of the set of possibilities claimed by the linguist, such as in the case of weak verbs. A second challenge was the additional segments that Tajweed

rules introduced in the morphological representation of verbs, namely at the vocalic melody tier. These segments had no acknowledgement in the theory's templates. A further and more important problem was the floating segments at the root tier of some verbs, that also happened due to recitation requirements.

To conclude, the theory of Template Morphology applies to Quranic Verbs to a considerable extent, despite the issues it encountered. It could be revisited in order to find out ways which allow more cases to be dealt with effectively. Hence, it is highly recommended to tackle both the templates and the notation principles of this theory.

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Appendices

Appendix 1:

The following appendix would provide the literature which explains the rules of Tajweed used in this work, as well as the context that requires their application.

1. *Al Madd Al Muttasil* (Connected Vowel Lengthening)

   This rule requires extra lengthening of the long vowel when it is followed by a *hamzah* (voiceless glottal stop). The number of the resulting vowels is four. (Chokri, 2015, p.77)

   Example: /ʤaaʔa/ → /ʤaaaaʔa/

2. *Al Madd Allazim Alkalimi Almuthqal* (Obligatory Word-internal Heavy vowel lengthening)

   This rule requires extra lengthening of the vowel when it is followed by a *chaddah* (gemination). The number of the resulting vowels is six. (Chokri, 2015, p.89)

3. *Idgham Al Mutajanisayn* (gemination of harmonious sounds)

   When two sounds share the same place features, one is assimilated into the other, and the result is a geminate sound. (Chokri, 2015, p.59)

   (Author's translation)

Appendix 2:

The following appendix demonstrates the layout of the Quranic Arabic Corpus: