

## Proposing a Syllable-based Account of Phonological Processes: Epenthesis and Deletion in Mostaganem Spoken Arabic

**Radia Benyoucef**

Department of English

Faculty of Foreign Languages

Mohamed Ben Ahmed University-Oran 2, Oran, Algeria

### Abstract

The study at hand explores the crucial position that the syllable holds in phonological analysis and theorizing by highlighting the analytical issues that might follow the exclusion of the syllable from phonological study. Effectively, the present study attempts to answer three main research questions, namely 1. Can rule-based phonology provide a satisfactory account of non-assimilatory processes such as epenthesis and deletion in Mostaganem Spoken Arabic? 2. Can a syllable-devoid account of epenthesis and deletion in Mostaganem Spoken Arabic be satisfactory? 3. Is the syllable indispensable in accounting for epenthesis and deletion in Mostaganem Spoken Arabic? Indeed, the present study demonstrates that a syllable-devoid analysis provides unsatisfactory accounts of certain phonological epenthesis and deletion. In order to attain the aim of this study, instances of epenthesis and deletion in the Mostaganem spoken variety of Algerian Arabic are analysed. Such instances of epenthesis and deletion were obtained from the recorded speech of a randomly selected sample of fifty native speakers of Mostaganem Spoken Arabic. The findings of this study reveal the indispensability of the syllable in describing and explaining epenthesis and deletion in MTG by comparing a syllable-devoid account and a syllable-based account of such processes. Effectively, syllable-devoid account pertaining to *The Sound Pattern of English* (Chomsky & Halle, 1968) tradition proved short of explanations as to why epenthesis and deletion take place in Mostaganem spoken Arabic as contrasted to a syllable-based account which provides adequate and convincing explanations of those processes.

**Keywords:** Account, deletion, epenthesis, Mostaganem Spoken Arabic, phonological processes, syllable, The Sound Pattern of English

**Cite as:** Benyoucef, R. (2019) Proposing a Syllable-based Account of Phonological Processes: Epenthesis and Deletion in Mostaganem Spoken Arabic. *Arab World English Journal*, 10 (2) 420-430.

DOI: <https://dx.doi.org/10.24093/awej/vol10no2.32>

## Introduction

The modular nature of language divides linguistics into a set of sub-disciplines each one of which emphasizes a certain aspect or else constituent unit of language. Effectively, while branches like syntax and morphology study units like sentences and words respectively, phonology has the segment or else the phoneme as its centre of concern. The elementariness of the phoneme can be traced back to the earliest instances of phonological theorizing within generative phonology, notably in *The Sound Pattern of English* (SPE) as set by Chomsky and Halle (1968). In this book, which introduced a quite influential approach in phonological analysis known as rule-based phonology or linear phonology, the phoneme is the basic unit of phonological analysis. Indeed, account of quite common phonological phenomena as sound change, addition or omission which are all enclosed under the umbrella term phonological processes, was achieved in reference to the phoneme and its constituents without further concern to other sound units. Thus, the phoneme was the sole unit of analysis in SPE. Hence, the aim of the present study is to prove that the syllable is an indispensable unit for explaining epenthesis and deletion in MTG and to demonstrate that a syllable-devoid analysis fails to account for those processes. Moreover, this study attempts to answer the following research questions:

1. Can rule-based phonology provide a satisfactory account of non-assimilatory processes such as epenthesis and deletion in Mostaganem spoken Arabic (MTG)?
2. Can a syllable-devoid account of epenthesis and deletion in MTG be satisfactory?
3. Is the syllable indispensable in accounting for epenthesis and deletion in MTG?

The following hypotheses result from the abovementioned research questions:

- Rule-based phonology provides an unsatisfactory account of non-assimilatory processes such as epenthesis and deletion in MTG since it neglects the unit of the syllable.
- A syllable-devoid account fails to provide a satisfactory description and explanation of non-assimilatory processes such as epenthesis and deletion in MTG.
- The syllable is an indispensable unit in accounting for non-assimilatory processes such as epenthesis and deletion in MTG.

## Phonological Processes and a Phoneme-centred Analysis

Chomsky & Halle (1968) indicated the possibility of a phoneme-centred analysis by developing a distinctive feature theory which was inspired from Jakobson's theory (1952). Such a theory pinpointed the possibility of accounting for phonological processes like assimilation by analysing the constituent features of phonemes solely without having recourse to another sound unit. Thus, account of assimilatory processes like nasalization in French could be achieved in terms of the distinctive features of the vowel that is target to nasalization and the features of its adjacent phonemes without having recourse to any other sound unit. The instance of nasalization in French involves the change of an oral vowel like /a/ in /an/ 'year' to a nasal vowel [ã] yielding the output form [ãn] (Katamba, 1993, p. 121). Such a change is explained as being the result of a change of the feature [-nasal] which constitutes the vowel /a/ in /an/ to the feature [+nasal] which yields the vowel [ã] in the output [ãn]. The reason behind nasalization of /a/ is the [+nasal] /n/ which follows

/a/. Rule-based account of SPE uses a rule to represent and describe processes as nasalization as illustrated in figure 1.

$$\begin{array}{ccc} [+consonantal] \rightarrow [+consonantal] & / \text{ \_\_\_\_\_\_ } [+consonantal] \\ [-nasal] & [+nasal] & [+nasal] \end{array}$$

Figure 1. Rule-based account of nasalization in French (Katamba, 1993, p. 123)

Obviously, Chomsky & Halle (1968) focused only on the phoneme or the segment in their account of different types of phonological processes, especially assimilatory process and discarded any other sound unit. At first, their focus was embraced and welcomed by phonologists as no analytical problem was encountered in the case of assimilatory processes. Indeed, phoneme-centred account proved to be a reliable and useful method of analysis for describing assimilatory processes. However, soon after another type of phonological processes was discovered and the necessity for other sound units to account for them became obvious. Such a type of processes is known as non-assimilatory processes as they do not involve a featural change, so that a sound becomes more like an adjacent sound. In contrary, non-assimilatory processes involve the insertion or deletion of certain sounds in order to serve some principle of phonology (Sloat et al, 1978, p. 117).

The most common types of non-assimilatory processes are insertion or epenthesis which involves the addition of a sound and deletion or syncope which involves the omission of a sound (Shane, 1973, pp. 53-54). Account of this type of processes requires appeal to another sound unit in addition to the phoneme as indicated by Khan (1968), Vennemann (1974), Hooper (1976) and Féry & Vijver (2003). This other sound unit is the syllable and its significance in phonological analysis became quite obvious because of various reasons. We outline in this paper the most relevant reasons.

### The Syllable as a Significant Unit in Phonological Analysis

The syllable as defined by Kahn (1968) is a “unit of perception and production larger than the segment and smaller than the word” (p. 20). The syllable is thus a group of segments or phonemes each one of which occupies a certain position in the syllable. Vowels are the central part of the syllable and are accordingly called peaks or nuclei, whereas consonants are optional and are found on the margins of the syllables; either preceding or following the vowel (Katamba, 1993, p. 154). As indicated by Katamba (1993) a word like *bats* /bæts/ consists of one syllable which is /bæts/ with vowel /æ/ as its nucleus, the consonant /b/ as its margin called the onset and the consonants /t/ and /s/ as its other margins called coda.

Representation of syllable constituents or structure is achieved by using a tree diagram that is reminiscent of the tree diagram of sentences structure in syntax (Spencer 1996, p. 73). Such a tree diagram involves more than one level and is thus in clash with SPE’s linear representation which assembles all phonological elements in one line that is referred to as a rule (Spencer, 1996). The tree diagram for the syllable /bæts/ can be represented as follows:

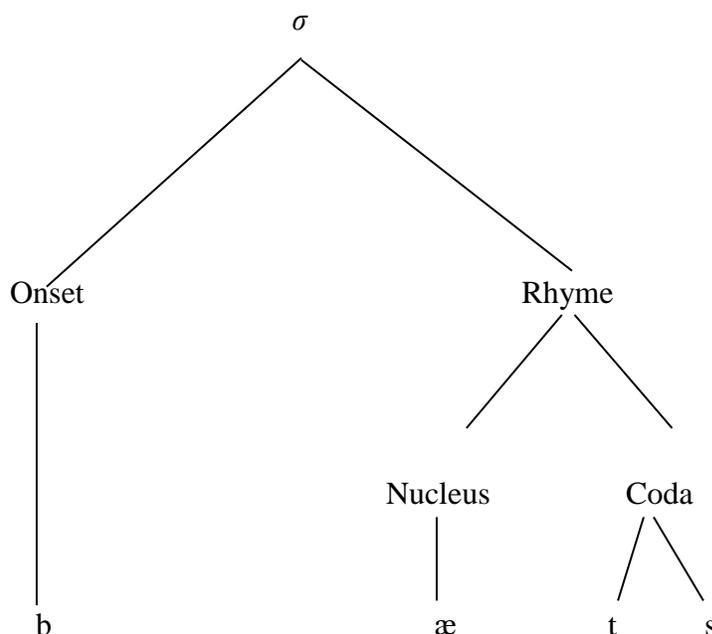


Figure 2. Tree diagram of / bæts/ (Katamba, 1993, p. 154)

The importance of the syllable relates to different aspects of phonological analysis. Among those aspects is the role it plays in formulating those conditions on sound combination and distribution which are dubbed phonotactic constraints (Spencer, 1996, p. 73). Indeed, syllable structure facilitates the formulation of phonotactic constraints of the sort the sounds /k/ and /n/ cannot combine at the beginning of words. Using syllable structure helps us understand why such a sequence is prohibited in cases as ‘know’ (/nəʊ/ not \*/knəʊ/), but is allowed in others like /əknoʊlɪdʒ/ ‘acknowledge’. Including syllable structure in the phonotactic constraint concerning the sequence /kn/ indicates that the sequence /kn/ is disallowed when /k/ and /n/ are tautosyllabic or when they occur as onset of one single syllable. This explains why the sequence /kn/ is allowed in acknowledge. In fact, /k/ and /n/ are part of different syllables in this case with /k/ syllabifying as coda to the first syllable /ək/ and /n/ as onset of the second syllable /nəʊ/.

The relevance of the syllable is also noted in the case of voiceless stops aspiration in English as indicated by Kahn (1968, p. 68) and Spencer (1996, p. 207). The classical phonotactics of voiceless stops aspiration is that /p,t,k/ are aspirated at the beginning or middle of English words like *pacific*, *tomorrow*, *collide*, *appear*, *attempt* and *account*, but not after /s/ as in *spin*, *stem* and *skin* (Kahn, 1968, p. 70). Nevertheless, other forms do not follow this classical version of the aspiration phonotactics. In fact, in words like ‘acknowledge’ /k/ is not aspirated even though it occurs in the same position as in ‘account’ which is word-medial. In order to overcome such a problem, phonologists like Kahn (1968) proposed to include syllable boundaries in the phonotactics of aspiration. Hence, rather than using word boundaries like beginning and middle of the word, syllable boundaries, namely onset of the syllable are more adequate in this case. As a matter of fact, /k/ of *acknowledge* /əknoʊlɪdʒ/ is a coda of the syllable /ək/ which explains the

failure of applying aspiration in this case unlike in ‘account’ /ə-k<sup>h</sup>aunt/ in which /k/ is the onset of the syllable /kaunt/ and is thus aspirated. Furthermore, word boundaries cause a representational problem since the boundary middle of the word is difficult to represent in a rule-based form and may correspond to two different syllable boundaries, namely onset and coda. Thus, rather than using word boundaries in rule-based representations, it is more adequate and simple to use syllable boundaries. The rule of English aspiration is represented as follows in Spencer (1996, p. 205):

$$/p, t, k/ \rightarrow [+spread\ glottis] / \sigma[ \underline{\hspace{1cm}} ]$$

*Figure 3. Rule of English aspiration*

The rule indicates that /p, t, k/ are aspirated or acquire the feature [spread glottis], which represents aspiration, when they are in syllable-initial position or else in onset position.

The relevance of the syllable does not only relate to phonotactics of allophonic distribution as in the case of aspirated and unaspirated allophones of /p,t,k/ in English. The syllable is also an essential unit in accounting for a number of phonological processes which have been assumed by some phonologists, as Shane (1973), Kahn (1968), Katamba (1993), Spencer (1996), Archangelli (1997), Kager (1999) and Féry&Vijver (2003) among others, to apply in order to obey some principles of syllable structure. Indeed, Katamba (1993, p. 167) demonstrates that the process of obstruent devoicing which is observed in German can be better explained if syllable structure is included. The devoicing of German obstruents in cases like /rak/ ‘day’ /tagə/ ‘days’ was traditionally represented by the following rule as indicated in Katamba (199, p. 167):

$$[-sonorant] \rightarrow [-voice] / \underline{\hspace{1cm}} \{C \# \}$$

*Figure 4. Devoicing in German*

The rule above indicates that voiced obstruents in German are devoiced when they occur either before a consonant or word-finally. The environment before a consonant (C) and word-finally (#) both indicate the same syllable boundary which is coda position or syllable-final position. Indeed, in both cases the obstruent which is object to devoicing is part of a coda be it with another consonant or alone. Thus, using syllable structure rather than the traditional (C or #) assures a more economical and general reformulation of rule (4). Hence, reformulation of rule (5) including syllable boundaries can be written as follows:

$$[-sonorant] \rightarrow [-voice] / \underline{\hspace{1cm}} ] \sigma$$

*Figure 5. Reformulation of devoicing in German rule*

The significance of syllable structure is also observed in French in cases of vowel nasalization in cases like /bon/ ‘good’ → [bõn] and /anfle/ ‘swell/swollen’ → [ãnfle]. These instances of vowel nasalization in French are represented by the following rule as indicated in Katamba (1993:167):

$$V \rightarrow [+nasal] / \underline{\hspace{1cm}} N \{C \# \}$$

*Figure 6. Vowel nasalization in French*

The rule implies that a vowel changes from oral to nasal in French when it is followed by a nasal consonant like /n/ before a consonant or in word-final position. It seems like the same problem that is encountered in the case of German obstruent devoicing is encountered here. Effectively, in both instances of nasalization, namely [b<sup>õ</sup>n] and [ã<sup>n</sup>flɛ], the vowel is nasalized if it is followed by a nasal consonant in coda position. As demonstrated earlier both C and #represent coda position. Thus, rule (6) can be reformulated as follows including syllable structure:

$$V \rightarrow [+nasal] / \text{_____N] } \sigma$$

*Figure 7. Reformulation of vowel nasalization in French rule*

Obviously, syllable-based rules of both German obstruent devoicing and French nasalization provide more adequate, economical and general representations both processes. Furthermore, the fact of using syllable structure in these rules provides a common environment, which is coda position, for all instances of obstruent devoicing in German and all those of nasalization in French. As a result, all instances of obstruent devoicing occur because the targeted obstruent occurs in coda position. Similarly, all instances of vowel nasalization take place because the vowel is followed by a nasal occurring in coda position.

### **The Significance of the Syllable in Accounting for MTG's Epenthesis and Deletion**

In addition to the relevance of the syllable in providing an economical and general account of processes like obstruent devoicing and nasalization as demonstrated above, the syllable is also significant in accounting for other processes, namely epenthesis and deletion. The present study analyses the relevance of the syllable in accounting for epenthesis and deletion in the Algerian dialect spoken in Mostaganem and known as Mostaganem Spoken Arabic (MTG).

### **Method**

The corpus of the present study consists of the recordings of the speech of fifty native speakers of the Mostaganem spoken dialect of Algerian Arabic. The settings of the recording sessions include the supermarket, the beach, taxi, and the researcher's home. The sample of the study was randomly selected from the surrounding of the researcher and the age range of the participants is diversified combining children, adolescents and adults. Furthermore, both males and females were recorded. The participants are all inhabitants of the city of Mostaganem, and thus speak the urban accent of Mostaganem spoken Arabic.

After the recording sessions were completed, the speech was transcribed using IPA symbols. Then, the transcription was analyzed by the researcher in order to identify the recurrent instances of epenthesis and deletion. After epenthesis and deletion were identified, analysis of these processes was accomplished by comparing between a syllable-devoid account and a syllable-based account. The results and interpretations of such an analysis are outlined in the subsequent section.

### **Analysis of Epenthesis and Deletion in MTG**

#### *Epenthesis*

The findings of the study revealed the existence of a type of epenthesis in MTG called glide insertion. Glide insertion involves the insertion of the glide /j/ between two vowels in MTG as in

/ʕlabali ana/ 'I know' → [ʕlabali jana]. Such process happens as when the vowel-initial personal pronoun 'ana' (I) follows a word that ends with a vowel such as 'ʕlabali' (I know). The following sample which is extracted from the findings of our study illustrates glide insertion in MTG:

Table 1. *Glide Insertion in MTG*

Input	Output	Word translation	Gloss	Ill-formed forms
ʕlabali ana	ʕlabali jana	Know I	I know'	*ʕlabali ana
jəʕrili ana	jəʕrili jana	Buy I	'he buys me'	*jəʕrili ana
ħawdʒi ana	ħawdʒi jana		'oh my God'	*ħawdʒi ana
ʕi ana	ʕi jana	Just I	'just me'	*ʕi ana
gatti ana	gatti jana	She told I	'she told me'	*gatti ana
jdi:ruli ana	jdi:ruli jana	They do I	'they do me'	*jdi:ruli ana
jəxtuni ana	jəxtuni jana	They leave I	'they leave me'	*jəxtuni ana
jfutuni ana	jfutuni jana	They bail I	'they bail on me'	*jfutuni ana

This case of epenthesis is the result of a common principle in phonological analysis which is avoidance of vowel hiatus. Most languages of the world disallow vowels to occur in a sequence without any intervening consonant in between (Spencer 1996, p. 234). Thus, if a vowel hiatus emerges as the outcome of affixation or at word boundaries, a remedy strategy is adopted in the language in question. In the case of MTG, the remedy is to insert the glide /j/ between the two vowels /i/ and /a/ in /ʕlabali ana/. The glide /j/ is inserted and not any other consonant since, as indicated by Uffmann (2007, p. 465) /j/ is the most suitable consonant in this case as /j/ shares the feature [+high] with the vowel /i/ in [ʕlabali jana].

Account of glide insertion in MTG from SPE's rule-based perspective can be formulated as follows:

$\emptyset \rightarrow j / V \_\_\_\_\_\_ V$

Figure 8. Rule-based account of glide in MTG

Such a rule is satisfactory as far as formal description and representation are concerned. Yet, when one seeks explanation of the process, the rule is not sufficient on its own. Indeed, vowel hiatus is disallowed because of a quite clear reason in this case and such reason is impossible to formulate unless syllable structure is taken into account. In fact, different types of syllables exist in MTG or in any other dialect of any other language. However, one type of syllables is found in all languages of the world, comprehending Arabic and its dialects. This type of syllables has been dubbed the unmarked type of syllables since it is favoured by all languages of the world and is the type of syllables which start with a consonant and ends with a vowel (Féry & De Vijver 2003, p. 6). Such type of syllables is known as the CV-type or open onsetful syllable and vowel hiatus is disallowed because it results in a syllable that has no onset. Thus, when /ana/ follows /ʕlabali/, the syllable /a/ of the word /ana/ is of a V-type which lacks an onset and is thus in clash with the preferred CV-

type. In order to turn the V-type syllable /a/ into the unmarked CV-type, the glide /j/ inserted before /a/ yielding /ja/ which has an onset and is of a CV-type. Obviously, syllable structure is necessary for explaining glide insertion in MTG. In addition, to epenthesis, MTG also displays some instances of deletion. The following section examines deletion in MTG.

### *Deletion in MTG*

MTG displays a case of deletion in instances of affixation like /wáʒəd-a/ → [wáʒ da ] ‘ready’. In such cases, the vowel /ə/ of the adjective [ʒal ət] ‘ready, masculine’ is deleted after the feminine suffix ‘-a’ is added to it in order to form the feminine form of [wáʒ əd] which is [wáʒda]. The following sample which is extracted from the findings of our study illustrates deletion in MTG:

Table 2. *Vowel deletion in MTG*

Input	Output	Gloss	Ill-formed forms
wáʒəd-a	wáʒda	‘ready’	*wáʒədi:n
fáhəm.-a	fáhma	‘wise’	*fáhəma
raf əd-a	ráfda	‘carrying’	*raf əda
ʔáqəl-a	ʔáqla	‘kind’	*ʔáqəla
ʒaj əb-a	ʒaj ba	‘absent’	*ʒaj əbi:n
dʒaj əb-a	dʒaj ba	‘bringing’	*dʒaj əba
kat əl-a	kátla	‘killed’	*kátəli:n
ʒalət-a	ʒal ta	‘mistaken’	*ʒal əta
gábəd-a	gábda	‘grabbing’	*gábəda
daj ər-a	daj ra	‘doing’	*dájəra

It appears from the above sample that whenever the feminine suffix ‘-a’ is added to an adjective or participle, the /ə/ of the root is deleted. Having recourse to rule-based phonology to account for this case of deletion would be in vain since rule-based phonology cannot provide the environment that conditions deletion in this case. On the other hand, if syllable structure is included in the account, deletion in MTG can be explained and adequately described. Indeed, /ə/ is deleted in /wáʒəd-a/ which is realized like [wáʒda] since it occurs in an open unstressed syllable which is /ʒə/.

As indicated by Btoosh (2006) “weak nuclei cannot stand in open syllables in most Arabic varieties” (p. 201). After the feminine suffix ‘-a’ is added to /wáʒəd/, the resulting form is /wáʒədə/ with /d/ syllabifying as the onset of the new syllable which is formed by the suffix /a/ yielding the syllables /wa/, /ʒə/ and /da/. Such syllabification satisfies the preferred CV-type. Indeed, syllabifying /d/ as coda to /ʒə/ would yield the output [wa.ʒəd.a] with the syllable /a/ lacking an onset. Such syllabification is in clash with the unmarked CV-type which requires syllables to have onsets. As a result, the vowel /ə/ is no longer nucleus of a closed syllable as in the masculine form [wáʒəd]. Given that /ə/ is the weakest vowel in any language and is never stressed (Ryu & Hong, 2013, p. 317), it cannot occur in open syllables as indicated by Btoosh

(2006). Thus, /ə/ is deleted and /z/ resyllabifies as the coda of the first syllable /wəz/ yielding the final output [wəzəd]. Such cases of deletion are common in most dialects of Arabic since weak nuclei as /ə/ are disfavoured by most dialects of Arabic (Kabrah, 2011, p. 36).

It is clear from the above analysis that syllable structure is essential in accounting for deletion in MTG. To further prove this point, let us compare between a classical rule-based account in which syllable structure is disregarded and another which takes syllable structure into account. The two accounts are presented in the following rules:

$V \rightarrow \emptyset / \_\_\_\_\_\_ ?$

Figure 9. Rule-based account of vowel deletion in MTG

$[-\text{stress}] \rightarrow \emptyset / \sigma [C \_\_\_\_\_\_ ]$

Figure 10. Rule-based account of vowel deletion in MTG including syllable structure

The first rule which discards the syllable fails to provide the environment that conditions deletion, whereas the second rule which takes syllable structure into account succeeds to account for deletion in MTG and to provide the conditioning environment which is open syllable and is symbolized by  $\sigma [C \_\_\_\_\_\_ ]$ . Rule (10) is then read; weak vowels [-stress] are deleted when they occur in open syllables ( $\sigma [C \_\_\_\_\_\_ ]$ ).

### Conclusion

As demonstrated in the analysis of the findings of our study, the syllable is indispensable in accounting for the most common types of non-assimilatory processes, viz epenthesis and deletion. Indeed, as indicated for MTG's epenthesis and deletion, those processes cannot be satisfactorily described and explained if syllable structure is discarded. For this particular reason, rule-based accounts of epenthesis and deletion which were syllable-devoid were short of explanations for the occurrence of those processes. Effectively, epenthesis and deletion often apply in order to obey some principle of syllable structure such as the necessity of an onset. This link between syllable structure and epenthesis and deletion led to the labeling of epenthesis and deletion 'syllable structure processes' by some phonologists as Shane (1973, p. 52).

It is doubtless now that the syllable is an integral part of speech and is as significant to phonological analysis as the individual sounds. This resolution was to influence a number of phonologists who developed approaches and theories that recognized the importance of the syllable in phonological analysis in addition to the individual sound of course. Among those approaches and theories, one may cite *autosegmental phonology* set forth by Goldsmith (1976) and *optimality theory* introduced by Prince & Smolensky (1993) and McCarthy & Prince (1995). These two waves of phonological theorizing preserve the basic foundations of generative phonology and of SPE. Yet, each one of them brought some useful additions to phonological analysis one of which is the significance of the syllable in phonological analysis.

Interestingly, by demonstrating that the fact of including the syllable in accounting for non-assimilatory processes such as epenthesis and deletion in MTG is indispensable, this study

calls for future studies that will take into account the syllable in their account of other non-assimilatory processes in MTG or for epenthesis and deletion in other varieties of the Arabic language. Such a consideration for the unit of the syllable would further prove the import of the syllable in phonological theorizing and analysis. Besides, such a consideration would justify the necessity for the representational shifts that were established by both autosegmental phonology and optimality theory from phonological rules to multi-tiered representation and to constraints respectively.

### About the Author

**Benyoucef Radia** is a Full-time lecturer at Abdelhamid Ibn Basis University, Mostaganem, Algeria. She has an MA degree in Linguistics, and her main areas of interest include phonology, phonetics, sociolinguistics, linguistics, morphology and syntax. Benyoucef Radia is currently preparing a PhD degree in linguistics at Mohamed Ben Ahmed University, Oran 2, Algeria. ORCID: <https://orcid.org/0000-0002-8015-2340>

### References

- Archangeli, D. (1997), Optimality Theory: An Introduction to Linguistics in the 1990s. In: D. Archangeli, & D. T. Langendoen (Eds), *Optimality Theory: An Overview*. (pp.1-32). Malden, MA: Blackwell Publishers Ltd.
- Btoosh, M. (2006), Constraint Phonotactics: An Optimality Theoretic Approach. *Journal of Language and Linguistics*, 5 (2), 192-221.
- Chomsky, N., & Halle, M. (1968). *The Sound Pattern of English*. New York: Harper & Row.
- Féry, C., & De Vijver, R. V. (2003). *The Syllable in Optimality Theory*. Cambridge: Cambridge University Press.
- Goldsmith, J. (1976). Autosegmental Phonology. PhD dissertation, MIT. (published in 1979, New York: Garland).
- Hooper, J. B. (1976). *An introduction to natural generative phonology*. New York: Academic Press.
- Kabrah, R. (2011), Regressive Voicing Assimilation in Cairene Arabic. *Perspectives on Arabic Linguistics: Papers from Annual Symposia on Arabic Linguistics*, 25, 21-33.
- Kager, R. (1999). *Optimality Theory*. Cambridge: Cambridge University Press.
- Katamba, F. (1989). *An Introduction to Phonology*. New York: Longman Inc.
- Kahn, D. (1968). Syllable-based Generalizations in English Phonology. Unpublished PhD thesis. MIT. Cambridge. USA.
- McCarthy, J. and Prince, A. (1995), Faithfulness and Reduplicative Identity. In J. Beckman, L. W. Dickey & S. Urbanczyk (Eds), *Papers in Optimality Theory* (pp. 249-384), Amherst: GLSA Publications.
- Prince, A., & Smolensky, P. (1993). *Optimality Theory: Constraint Interaction in Generative Grammar*. New Brunswick, Rutgers University Center for Cognitive Science Technical Report 2.
- Ryu, N, Y., & Hong, S, H. (2013). Schwa Deletion in the Conversational Speech of English: The Role of Linguistic Factors. *Linguistic Research* 30 (2), 131-333.
- Shane, S. (1973). *Generative Phonology*. Englewood Cliffs: Prentice Hall Inc.
- Sloat, C, Taylor, S. & Hoard, J. (1978). *Introduction to Phonology*. New York: Prentice Hall.

- Spencer, A. (1996). *Phonology: Theory and Description*. Massachusetts: Blackwell Publishers Ltd.
- Uffmann, C. (2007), Intrusive [r] and Optimal Epenthetic Consonants. *Language Sciences*,29, 451- 476.
- Vennemann, T. (1974). Words and Syllables in Natural Generative Grammar. In: A. Bruck et al (Eds), *Papers from the Parasession on Natural Phonology*, Chicago: CLS.