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An Autosegmental Analysis Of The Derivation Of Passive Participles From Triconsonantal Verbs In Modern Standard Arabic: A Replication Study

Eman Awni Ali[1] , Radwan Salim Mahadin[2]

[1]Associate Professor in linguistics/ Isra University, Amman, Jordan.
[2]Professor in linguistics/ University of Jordan, Amman, Jordan.

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Abstract

The study mainly attempts to assess the validity of a non-corpus-based phonological analysis. The targeted analysis is Abushunar and Mahadin's (2017) non-linear phonological investigation of the derivation of the passive participle (PP) in Modern Standard Arabic (MSA). Abushunar and Mahadin (2017) examined the phonological processes that a sample of PPs undergoes during their derivation from triconsonantal verbal stems. Their analysis targeted the PPs on the pattern |ma+C1C2u:C3| which are derived from strong, weak, geminated, and glottalized stems of imperfective verbs. The current study aims to replicate Abushunar and Mahadin's (2017) research by adopting the same phonological model, i.e. the X-slot and the feature geometry models of non-linear phonology, to analyze the derivation of PPs from their verbal stems. The difference between the two studies is that the replication study is a corpus-based analysis of the derivation of the 515 PPs that are listed under triconsonantal verbs in the corpus-based dictionary muᶜdʒam ʔalluɣah ʔalᶜarabijjah ʔalmuᶜa:sirah 'Dictionary of Modern Arabic Language'. The replicated study, on the other hand, did not base its analysis on a corpus, rather it targeted a sample of PPs which is selected from three sources, viz. Al-Wasi:t Dictionary (2004), Wright (1996) and Wehr (1994). Moreover, to improve the feasibility of the investigation, one type of PPs is chosen in this study, viz. the weak PPs. Weak PPs are targeted because of their susceptibility to various phonological rules which is caused by the inherent instability of the glides which constitute at least one of their radicals. Conducting the replication study revealed that the non-corpus-based phonological study of the derivation of PPs provided similar analysis to its corpus-based counterpart. This indicates that employing a carefully selected sample to examine a phonological phenomenon does not necessarily affect the comprehensiveness and thoroughness of a phonological analysis.

Keywords: Corpus-study, Replication, Autosegmental phonology, MSA, PPs.

1.1. Introduction

Modern Standard Arabic (MSA) is a relatively recent variety of standard Arabic. Arabic as a Semitic language has a consonantal system that incorporates a wide number of consonants including a rich inventory of gutturals and emphatics, whereas its vocalic system utilizes a limited number of vowels (Watson 2002,

1-5). Table 1 and Table 2 which are cited from Ali and Mahadin (2020, 2131-2132) and Ali and Mahadin (2022, 1-2) present the consonantal and the vocalic inventories of MSA, respectively.

Table 1. The consonantal inventory of MSA

b	Voiced bilabial stop	s	Voiceless dental-alveolar fricative	k	Voiceless velar plosive
m	Voiced bilabial nasal	z	Voiced dental-alveolar fricative	x	Voiceless uvular fricative
f	Voiceless labiodental fricative	t̲	Voiceless emphatic dental alveolar plosive	ɣ	Voiced uvular fricative
j	Voiced palatal glide	d̲	Voiced emphatic dental alveolar plosive	q	Voiceless uvular stop
w	Voiced labiovelar glide	s̲	Voiceless emphatic dental alveolar fricative	h̲	Voiceless pharyngeal fricative
θ	Voiceless interdental fricative	ð̲	Voiced emphatic interdental fricative	ʿ	Voiced pharyngeal fricative
ð	Voiced interdental fricative	r	Voiced dental-alveolar tap	ʔ	Voiceless glottal stop
t	Voiceless dental-alveolar stop	l	Voiced dental-alveolar lateral	h	Voiceless glottal fricative
d	Voiced dental-alveolar stop	ʃ	Voiceless postalveolar fricative		

Table 2. The vocalic inventory of MSA

i	high front unrounded
a	low central unrounded
u	high back rounded

As can be shown in Table 1. MSA has 28 consonantal phonemes and they are produced in different places of articulation. The six glottal (ʔ, h), pharyngeal (h̲, ʿ) and uvular (x, ɣ) consonants constitute the set of guttural sounds used in MSA. McCarthy (1994) presents several arguments that justify treating gutturals as a natural class of sounds based on their participation in phonological rules and phonotactic constraints.

For example, it is demonstrated that gutturals participate fully in the Arabic phonotactic constraint that imposes restrictions on the co-occurrence of root consonants. Based on this constraint, the consonants that are homorganic in certain places of articulation, such as bilabials and velars, rarely co-occur within the same root. The participation of the guttural in the Arabic root co-occurrence restriction is evident in the observation that roots "combining two gutturals are significantly infrequent" (McCarthy 1994, 205).

Further phonological arguments for identifying gutturals as a natural class include the lowering effect that they have on adjacent vowels, their infrequent occupation of syllable-coda positions and their transparency to vowel harmony. It should be indicated that the /q/, despite being classified as a uvular sound, is not considered a member of the guttural class. This is attributed to the

phonological tendency of /q/ to block vowel harmony processes and to pattern as a velar, and not as a guttural, with respect to root co-occurrence restrictions (ibid).

In addition to gutturals, another class of consonants that exhibits MSA Semitic origin is the class of emphatic consonants and it consists of the four phonemes /t̲, d̲, s̲, ð̲/ which contrast with their non-emphatic counterparts /t, d, s, ð/ (e.g. sa:r 'walked' and s̲a:r 'happened'). The production of emphatic consonants involves a primary constriction in the interior region of the vocal tract, or the oral cavity, accompanied by a secondary retraction of the tongue towards the posterior region of the vocal tract, or the pharyngeal cavity.

Emphatic consonants commonly trigger the phonological process of emphatic spread which involves spreading emphasis from emphatics to their neighboring sounds (Davis 1993, Mahadin and Bader 1996). An example of this process is found in the word xalat̲-a 'he mixed' where "all sounds preceding and following the emphatic consonant t̲ are emphaticized or backed" (Younes 1993, 119).

In addition to the feature guttural, another three cover features are utilized for grouping consonants into natural classes based on their places of articulation. These three features include labial, coronal and dorsal. The labial feature is proposed by Selkirk (1993) in his [Labial]-Only Theory. This theory states that "[t]he place feature repertoire of phonological theory includes only the feature [labial] for the representation of labial articulation" (ibid, 2). Accordingly, this cover feature encompasses the bilabial and labiodental consonants and plays a secondary role in defining the articulation of the labiovelar /w/. As for the coronal feature, it describes sounds produced by the tongue tip and blade and it comprises the interdental, dental-alveolar and postalveolar consonants. Finally, the dorsal feature represents sounds articulated with the dorsum of the tongue and it includes the palatals and the velars and also participates in the description of the uvulars.

The vocalic inventory of MSA only contains three short vowels which are presented in Table 2. Despite the fact that each of the three short vowels /i/, /u/ and /a/ has a long counterpart, the long vowels /i:/, /u:/ and /a:/, are only present on the surface, i.e. phonetic, level of representation. These three long vowels contain a sequence of a short vowel and a glide in the underlying representation which is changed to a long vowel through applying some phonological processes such as syllabicity, or glide, assimilation (e.g. /ij/→ /ii/→ /i:/) and glide deletion (e.g. /uwu/→ /uu/ → /u:/) (cf. Brame, 1970; Levy, 1971).

As for MSA syllable structure, each syllable must start with one consonant and no more than one consonant. In contrast with the onset which is an obligatory constituent, coda is an optional constituent of the syllable in this standard variety of Arabic. Furthermore, as opposed to the onset constituent which is not to be composed of a consonant cluster in MSA, the coda constituent might contain a cluster of no more than two consonants (Ryding 2005, 35-36).

1.2. Aims of the Study

This study attempts at replicating Abushunar and Mahadin's (2017) research by adopting the same phonological models, i.e. the X-slot and the feature geometry models of autosegmental phonology, for the examination of the phonological processes that the PP undergoes in the course of its derivation from verbal stems in MSA. The only difference between the two studies is that the current study is a corpus-based analysis of the derivation of the PPs which are listed under triconsonantal verbs in the corpus-based dictionary muᶜdʒam ʔalluɣah ʔalᶜarabijjah ʔalmuᶜa:s̲irah 'Dictionary of Modern Arabic Language'. The replicated study, on the other hand, did not base its analysis on a corpus, rather it targeted a sample of PPs which is selected from three sources, namely Wehr (1994), Wright (1996), and Al-Wasi:t̲ Dictionary (2004). The comprehensive and thorough analysis that a corpus-based study can provide is utilized for

assessing the validity of a phonological examination which employs a set of carefully selected examples from different sources as the basis of its analysis.

Similar to Abushunar and Mahadin's (2017), the imperfective stem of the verb, rather than the perfective stem, is considered the base for deriving the analyzed sample of PPs. Choosing the imperfective as the base for derivation is attributed to the assumption that it provides "the minimum amount of information required for deriving the passive participle and other linguistics forms" (Abushunar and Mahadin 2017, 254-255). For example, the imperfective and the PP patterns are of the shapes |**CC**VC| and |ma-**CC**u:C|, respectively, in which there are no vowels between the first and second radicals. On the other hand, there is a vowel between the first and second radicals of the perfective pattern because it is of the shape |**CaC**VC|. Accordingly, deriving the PP from the perfective stem requires applying an additional deletion, or syncope, rule which targets this vowel.

Moreover, the PPs can be derived from the ten forms of the imperfective stems, this study, in line with Abushunar and Mahadin (2017), is restricted to exploring the derivation of PPs from form I of the imperfective verb. Form I is selected as the base of derivation because it serves as the source of derivation of the other nine verbal forms (form II- form X) (cf. Ryding 2005). This form has the pattern |ja+C_1C_2 {V} C_3| (e.g. ja-drus 'he studies') which consists of the third person masculine prefix |ja| and a triconsonantal stem that has one stem vowel. Only the stem, which is of the shape |CCVC|, is used as the base for deriving other forms from the verb and this entails that the |ja| prefix and the other prefixes and suffixes that can be attached to this stem are not part of this derivational base.

Abushunar and Mahadin (2017) explored the derivation of PPs that has strong, weak, glottalized and geminated stems. On the other hand, one type of PPs is chosen in the present study, namely the weak PPs. Weak PPs are targeted because they have a glide as one of their radicals. Glides are susceptible to diverse phonological rules due to their inherent instability. The analysis of a category of PPs that contain glides can, hence, provide a more in-depth view of the phonological rules that are involved in their derivation (cf. Mahadin 1982). Additionally, the weak PPs are subject to many more phonological rules than the other types of PPs which makes the analysis of their derivation more useful for testing the comprehensiveness and thoroughness of Abushunar and Mahadin's study.

2. Method

2.1. The corpus

The first phase of this study involves assembling a corpus of weak PPs from a well-established corpus-based dictionary, namely muᶜdʒam ʔalluɣah ʔalᶜarabijjah ʔalmuᶜa:s̲irah 'Dictionary of Modern Arabic Language'. This corpus-based dictionary is compiled by trained researchers led by Omar in 2008 and it is meant for the general user of the language and thus it contains words of general use that represent various spheres of life. The dictionary compilers' key objectives are covering the majority of words used in MSA and avoiding the inadequacies of the pre-existing dictionaries such as mixing obsolete and common words and building on earlier lexicographic work without conducting thorough examinations (Omar 2008). Various sources of MSA serve as the bases of data collection in this dictionary such as audio materials presented in MSA, religious sources, contemporary newspapers and magazines and prominent publications on education, philosophy, law, sports technology, literature, history, science, psychology, economy, arts, environment, etc. The data from these sources are assembled in a corpus that contains more than one hundred million words. The corpus is analyzed statistically in order to include the common words in the

dictionary and exclude the uncommon ones.

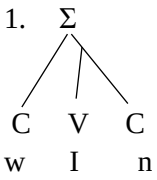
The corpus-based dictionary muᶜdʒam ʔalluɣah ʔalᶜarabijjah ʔalmuᶜa:s̲irah 'Dictionary of Modern Arabic Language' is the source of compiling the corpus of weak PPs which is analyzed in the current study. The corpus contains 515 PPs which are listed under triconsonantal (form I) weak verbal entries in muᶜdʒam ʔalluɣah ʔalᶜarabijjah ʔalmuᶜa:s̲irah. These PPs are categorized, in accordance with the position of the glide in their stems into initially, medially, finally and doubly weak PPs and they are presented in Table (1) Table (2), Table (3) and Table (4) in the appendices, respectively. The tables in the appendices present the dictionary entry number, the consonantal root, the imperfective verb and the gloss corresponding to each instance of these PPs. The phonological symbols which are presented in Table 1 and Table 2 above, and not MSA orthography system, are employed for transcribing the targeted PPs along with their consonantal roots and imperfective verbs. This is ascribed to the fact that this study aims at analyzing the phonological aspects of derivations of the targeted PPs.

2.2. The approach

Autosegmental phonology is an approach of non-linear phonology which is developed by Goldsmith (1976) for overcoming the shortcomings of the linear approach of generative phonology. Overcoming the shortcomings of the linear approach is accomplished by segregating its linear structure of representation into separate levels which are ordered independently of each other but are interconnected by means of association lines (McCarthy 1982, 2).

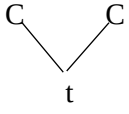
CV phonology and feature geometry are two of the major models of autosegmental phonology. The former model is proposed Clements and Keyser (1983) for the representation of the internal structure of the syllable. In CV phonology, the syllable has a three-tier hierarchical structure which includes the syllable node, CV and segmental tiers. The three-tier hierarchical structure of the syllable /win/ is used as a demonstrative illustration:

1.

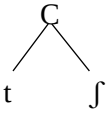


The association between elements on the CV tier and the segmental tier must conform to a number of association conventions. An example of these conventions is the no-crossing constraint which prohibits the crossing of association lines. The obligatory contour principle (OCP) is another association convention which prohibits adjacent segments at the segmental tier (Goldsmith, 1976). Conforming to these conventions allows accounting for cases in which the association between these two tiers is not designed in a one-to-one fashion. An instance of a many-to-one association between the CV tier and the segmental tier is found in the geminate /t:/, whereas the affricate /tʃ/ which is classified as a contour segment exemplifies a one-to-many association pattern. These are shown, respectively, in 2 (a) and (b).

2. a.



b.



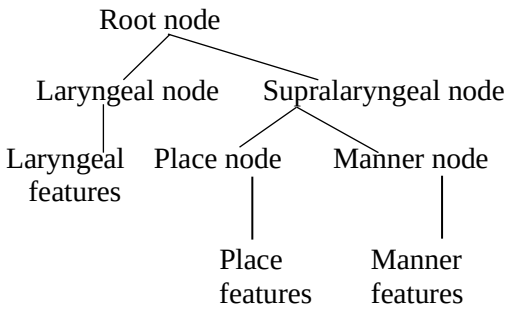
Some modifications are proposed in the course of the development of CV phonology. One of these modifications is associated with observing that the distinction between the C and V elements on the CV tier is redundant and suggesting replacing these elements with empty uniform positions labelled as X slots

(Levin, 1985). A major motivation for developing the X-slot model is attributed to noting that C elements can be mapped to vowels and V elements can be linked to consonants. An instance of this case is found in the examination of the common phonological rule of compensatory lengthening. This rule involves lengthening a segment after the elision of an adjacent segment (Clements & Keyser, 1983). For example, the elision of the /s/ in the Latin word kasnus 'grey' results in lengthening its preceding vowel /a/ and produces the surface representation ka:nus. Within the autosegmental model of generative phonology, the autonomy of the elements that occupy distinct tiers allows providing an accurate account of this rule. This entails that the elision of the /s/ takes place only on the segmental tier which leaves its C element, or timing slot, empty. The empty timing slot spreads to the vowel that precedes the deleted /s/ forming the long vowel /a:/ (Hayes 1989, 260-261). Spreading the timing slot of a consonant to its adjacent vowel requires leaving these timing slots unspecified for the C and V features and this is proposed in the X-slot model.

Feature geometry is the other model of autosegmental phonology which is employed in the current study. This model is proposed by Clements (1985) for depicting the internal structure of speech sounds by organizing the features from which sounds are composed into functionally independent classes that are grouped under nodes of a tree structure.

The features within the tree structure of the feature geometry model occupy the terminal nodes and they are dominated by intermediate nodes called the class nodes. The class nodes are divided into two categories identified as the laryngeal and supralaryngeal nodes. The supralaryngeal node further encompasses the place and manner subnodes. The laryngeal and supralaryngeal class nodes are dominated by the root node which groups all the features of a given speech sound and links them to the CV tier. The following diagram shows the outline of Clements' (1985) feature geometry model:

3.



The feature geometry model treats features as independent units, or autosegments, which entails that they can participate independently in phonological processes and this facilitates accounting for the phonetic naturalness of assimilation processes. Subsequent to the development of Clements' (1985) model of feature geometry, several amendments to this model were proposed through research in this area. One of the principal proposals is hypothesizing that the major class features [consonantal] and [sonorant] constitute the root node of the features. This is based on the observation that these features rarely spread outside of total assimilation processes (Halle 1992, Kenstowicz 1994, among others).

A second significant modification is proposed by McCarthy (1988) who argued for eliminating the manner and the supralaryngeal nodes. The proposal of eliminating the manner node is attributed to testing it against various phonological rules and finding out that the daughters of this node do not act as a unit in these rules. After dispensing with the manner node, the supralaryngeal node ends up dominating only the place node in addition to playing secondary roles in phonological rules which results in its elimination (McCarthy 1988, 92-93).

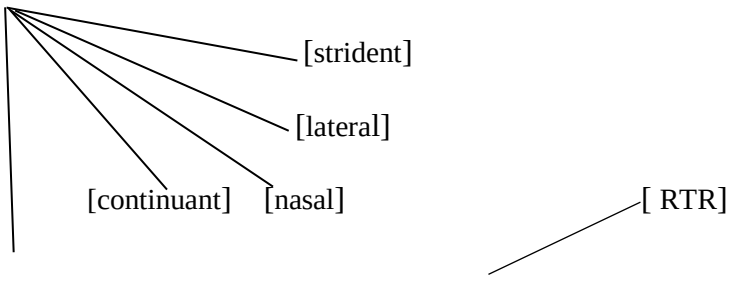
Introducing the articulator theory by Sagey (1986) is a further modification to the model of feature geometry. Within the articulator theory, the place node is divided in accordance with the constricting gestures of the active articulators during the production of a speech sound into labial, coronal and dorsal classes and each them dominates a set of articulator-bound features. Articulator-bound features, in contrast with articulator-free features such as the root and manner features, depend entirely for their execution on one of these three articulators (ibid, 3). The articulator-bound feature [round] is a dependent of [labial]; [anterior] and [distributed] are dependents of [coronal]; and [back], [high] and [low] are dependents of [dorsal].

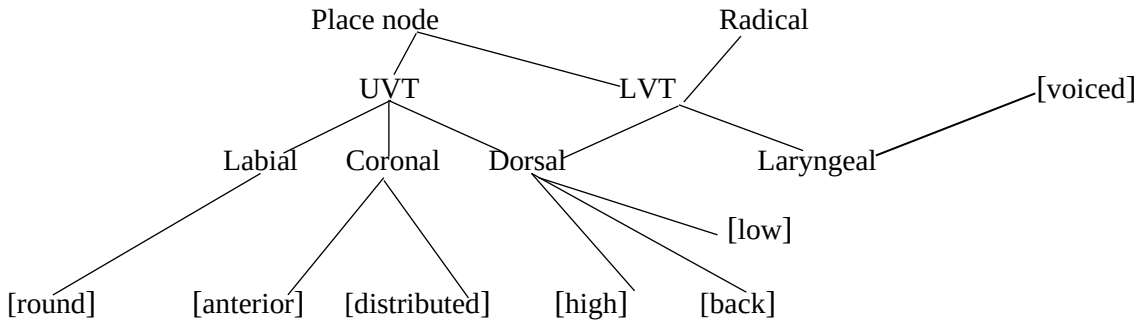
A further amendment to the place node is suggested by McCarthy (1994) and it involves the introduction of the pharyngeal place node to represent gutturals. To place the pharyngeal place node in the hierarchical tree, Vaux (1993) splits the place node into two branches, viz. the upper vocal tract node (UVT) and the lower vocal tract node (LVT). The former node is employed for producing the oral sounds and dominates the labial, coronal and dorsal articulators and the latter is utilized for producing the guttural sounds and dominates the dorsal, laryngeal and radical articulators. The articulator-bound retracted tongue root [RTR] is dominated by the radical articulator, while [voiced] is the articulator-bound feature which is dominated by the laryngeal articulator (Vaux 1996). As for the dorsal articulator, it should be indicated that it is dominated by the UVT and LVT nodes because this articulator lies at the boundary between the oral and pharyngeal cavities and can hence enter either of them (Kenstowicz1994, 459).

The last modification to the feature geometry model which is used in the current research is its integration with the underspecification theory which causes all the features within the present model to be monovalent (cf. Watson 2002 and Bin Muqbil 2006). It should be indicated that this model of feature geometry was employed by the researchers in a previous study and was found to provide comprehensive and thorough analysis of the phonological processes that are involved in the derivation of another type of nouns in MSA. This model is cited from Ali and Mahadin (2022, 9) and presented in Diagram (4) below.

The feature geometry model allows accounting for the naturalness of the assimilation processes that the analyzed PPs undergo in the course of their derivation because it provides a comprehensive depiction of the internal structure of speech segments. To make the analysis achievable, only the parts of the feature geometry trees that are relevant for the analysis will be shown. The X-slot model is utilized for representing the rules which do not involve referring to the internal structure of speech segments such as deletion and insertion. For example, deletion rules result in the deletion of whole speech segments and not specific features of them; hence representing them within the X-slot model is more effective and economical. This model uses the syllable, a purely phonological domain, for the statement of phonological rules. In addition to the syllable, the morpheme and word domains are also employed for the statement of phonological rules to account for the close interactions between morphology and phonology (cf. Gussmann 1985, Oztaner 1996).

4. [consonantal], [sonorant]





3. Results and Discussion

The PP, also identified as the noun of object, is a nominal derivative of verbs which indicates the object of the verb or the result of a completed action. The PP is substantive in form, i.e. it inflects for definiteness, case, gender and number, and it may function as a noun (e.g. mu-waððaf 'employee'), adjective (e.g. mu-hmal 'neglected') or verb substitute (e.g. ma-smuːᶜ 'heard'). Determining the stem from which the PP is derived is a controversial issue in the literature. For instance, Brame (1970, 381) used the perfective stem as the base for deriving PPs, whereas Abushunar and Mahadin (2017, 255) maintained that deriving these forms from their imperfective stems is more economical. Al-Faxiri (1996, 215), Abd Al-Ghani (2010, 199) and Al-Samurrai (2013, 105) proposed that the passive form of the verb is the base for deriving the PP without rationalizing their proposal. Al-Raajihi, (1984, 81), Rydying (2005, 113) and Abushunar and Mahadin (2017, 254) argued that PPs are only derived from transitive verbs because they denote the object of the verb and thus their derivational bases should be able to take direct objects. However, one can argue that even though PPs are typically derived from transitive verbs, it is possible to form them from intransitive verbs if they are followed by an appropriate preposition. For instance, the intransitive verb ja-ʔsaf 'he regrets' can serve as the stem from which the PP ma-ʔsuːf 'regretted' is derived provided that it is followed by the preposition ᶜala: 'upon'.

In this study, the active form of the transitive or intransitive imperfective stem is utilized as the base for forming the PP. Table 3 shows the PP patterns which are derived from the ten forms of the imperfective verb with illustrative examples.

Table 3. The imperfective patterns from which the PP forms are derived

AP forms	Imperfective patterns	Examples	Gloss	AP patterns	Examples
I	ja+$C_1C_2\begin{Bmatrix}a\\u\\i\end{Bmatrix}C_3$	ja+ktub	to write	ma+C_1C_2u:C_3	ma+ktu:b
II	ju+$C_1aC_2C_2iC_3$	ju+ᶜallim	to teach	mu+$C_1aC_2C_2aC_3$	mu+ᶜallam
III	ju+C_1a:C_2iC_3	ju+xa:tib	to address	mu+C_1a:C_2aC_3	mu+xa:tab
IV	ju+$C_1C_2iC_3$	ju+hmil	to neglect	mu+$C_1C_2aC_3$	mu+hmal
V	ja+ta+$C_1aC_2C_2aC_3$	ja+ta+waqqaᶜ	to expect	mu+ta+$C_1aC_2C_2aC_3$	mu+ta+waqqaᶜ
VI	ja+ta+C_1a:C_2aC_3	ja+ta+qa:tal	to fight	mu+ta+C_1a:C_2aC_3	mu+ta+qa:tal
VII	ja+n+$C_1aC_2iC_3$	ja+n+xafid	to decrease	mu+n+$C_1aC_2aC_3$	mu+n+xafad
VIII	ja+$C_1taC_2iC_3$	ja+ ntaxib	to elect	mu+$C_1taC_2aC_3$	mu+ntaxab
IX	ja+$C_1C_2aC_3C_3$	ja+hamarr	to become red	mu+$C_1C_2aC_3C_3$	mu+hmarr

X	ja+sta+$C_1C_2iC_3$	ja+ sta+xridʒ	to derive	mu+sta+$C_1C_2aC_3$	mu+staxradʒ

The current analysis only targets the PPs that are derived from form (I) of the imperfective verb. The PPs that are derived from this form are all on the pattern |ma+$C_1C_2u:C_3$|. This PP pattern has the long vowel /u:/ which, according to Brame (1970), Mahadin (1994) and Abushunar and Mahadin (2017), among others, does not exist in the underlying representation of this pattern. According to them, the vowel /u:/ in this pattern is underlyingly composed of the short vowel /u/ and its cognate glide, i.e. the /w/. The /uw/ sequence in |ma+$C_1C_2uwC_3$|, the underlying representation of the PP pattern |ma+$C_1C_2u:C_3$|, surfaces as /u:/ through the application of the glide assimilation rule which assimilates a glide to its preceding cognate vowel. The following sections discuss the derivation of the initially, medially, finally and doubly weak PPs that have the underlying shape |ma+$C_1C_2uwC_3$| from their imperfective stems.

The starting point for tracking the derivations of PPs in Abushunar and Mahadin's (2017) study is the underlying representations of the selected PPs, which share the same shape in all types of PPs. The main attempt of their study is to account for the deviations of the surface representations of PPs from their underlying counterparts. As opposed to Abushunar and Mahadin (2017), the discussion of the derivation of each type of the targeted PPs in this study starts with determining the underlying phonological shape of the imperfective stems from which they are derived. Accounting for the phonological shapes of the sources of derivation, viz. the imperfective stems, can provide a more in-depth account of the formation of PPs.

3.1. Initially-weak PPs

The imperfective stems of initially-weak PPs

Form I of initially-weak imperfective stems from which PPs on the pattern | ma+$C_1C_2uwC_3$| are derived have the underlying representation |GC2VC3|. These stems begin with a glide which can be a /j/ or a /w/. According to Mahadin (1982), most of the initially-weak imperfective stems have the glide /w/ as their first radical, whereas a very few of them begin with the glide /j/. In line with Mahadin (1982), the majority of the imperfective stems of initially-weak PPs start with a /w/ and few of them start with a /j/. The /j/ is never deleted when it occupies the initial position of weak imperfective stems, whereas the /w/ can be deleted when it occupies this position. The elision of the /w/, through the /w/-deletion rule which is taken from Mahadin (1982, 273) and stated in 5, only takes place when the stem vowel of the imperfective is underlyingly /i/.

5. w →Ø/ Ca#--C2iC3] [+B-verbs] (# = morpheme boundary, +B = basic)
[personal prefix]

The w-deletion rule requires the deletion of /w/ when it is preceded by a personal prefix, in this case the third person masculine prefix 'ja' and followed by a |C2iC3| sequence. The rule only targets basic, i.e. non-derived or form I, verbs when their stem vowel is /i/. Brame (1970) and Mahadin (1982) argued that the deletion of the glide /w/ in some of the imperfective stems that have the stem vowel /a/ does not stand in contradiction to the w-deletion rule. This is ascribed to the hypothesis that the stem vowel of these stems is originally /i/ but it becomes /a/ through applying the laryngeal-assimilation rule which is stated in 6.

6. $i \rightarrow a \;\; / \_\_ L \; / \begin{bmatrix} + \text{ imperfect} \end{bmatrix}$

L— - derived

This rule involves changing the vowel /i/ to /a/ in basic imperfective stems when this vowel is contiguous to a laryngeal sound. According to Brame (1970, 159), laryngeal includes "those sounds produced in the area extending from the larynx to the upper regions of the pharynx." It can be observed from the definition that the term laryngeal includes not only the laryngeals but also the uvulars and pharyngeals. Consequently, the laryngeal assimilation rule is expected to target the three subcategories of guttural sounds, i.e. the pharyngeal, uvular and laryngeal sounds. This is consistent with the lowering effect that the guttural category of sounds has on adjacent vowels (cf. McCarthy 1994). Table 4 presents the surface representations of the initially-weak imperfective verbs that begin with a /w/ and serve as the stems for deriving PPs.

4. The initially-weak imperfective bases of PPs which begin with /w/

The imperfective patterns	Frequencies	percentages
ja-C_2iC_3	56	72.7%
ja-C_2aC_3	9	11.7%
ja-wC_2aC_3	10	13%
ja-wC_2uC_3	2	2.6%
Total	77	100%

As shown in Table 4, the /w/-deletion rule affects the imperfective verbs that have the surface patterns |ja-C_2iC_3| and |ja-C_2aC_3|. These two patterns constitute 72.7% and 11.7%, respectively, of the total number of the imperfective verbs that have /w/ in their initial position. On the other hand, the imperfective verbs that have the patterns |ja-wC_2aC_3| and |ja-wC_2uC_3| are not affected by this rule because their stem vowels are underlyingly /a/ and /u/, and not /i/. Table 5 presents the initially-weak imperfective stems of PPs which start with a /j/ and shows that the /j/ is retained in all of these stems.

Table 5. The initially-weak imperfective bases of PPs which begin with /j/

ja- jC_2aC_3	3	50%
ja-jC_2aC_3 ja-jC_2iC_3	1	16.7%
ja-jC_2uC_3	1	16.7%
ja-jC_2iC_3	1	16.7%
Total	6	100%

The derivation of initially-weak PPs from their imperfective stems

In agreement with Brame (1970), Ryding (2005), Abd Al-Ghani (2010), Al-Samurrai (2013) and Abushunar and Mahadin (2017), initially-weak PPs follow the same derivational patterns of the strong PPs which denotes that they are stable and show no deviation from the general pattern. The derivation of these PPs involves adding the prefix /ma/ to their imperfective stems, which have the underlying shape |$GC_2\begin{Bmatrix}a\\u\\i\end{Bmatrix}C_3$|, and changing their stem vowel to /u/ through an ablaut rule, i.e. "a rule that involves systematic

alterations in the stem vowel to indicate modifications of meaning or inflectional information" (Ali and Mahadin 2020, 2139). The resultant form, i.e. |ma+GC_2uC_3|, lacks the /w/ which occurs after the stem vowel /u/ in the underlying PP pattern |ma+$C_1C_2uwC_3$|. The /w/ is argued to be a member of the underlying sequence /uw/ which surfaces as /u:/ in this PP pattern. The first member of this sequence, i.e. the /u/, emerged through applying an ablaut rule to the stem vowel of its imperfective base. It should be indicated that Abushunar and Mahadin (2017) did not refer to changing the stem vowel of the imperfective verb to /u/ through an ablaut rule which is attributed to the fact that they used the underlying representations of PPs, instead of the imperfective stems from which they are derived, as the starting point of derivation. As for the /w/, none of the researchers who maintained, including Abushunar and Mahadin (2017), that it is part of the underlying representation of this PP pattern attempted to account for its source. To account for the source of this /w/, it can be postulated that the construction of the non-derived PP requires adding the prefix /ma/ and the infix /w/ to its imperfective stem which results in the underlying pattern |ma+$C_1C_2uwC_3$|.

Another point which is not indicated in the previous literature, including Abushunar and Mahadin (2017), about the PP pattern |ma+$GC_2u{:}C_3$| is that the long vowel /u:/ in the surface representation of this pattern meets the conditioning environment for the vowel shortening rule which is cited from Brame (1970, 91) and stated in 7:

7. V: → V/ _____ C# (#designates the word boundary)

This default rule applies regularly to long vowels in MSA when they are followed by one consonant which occurs word-finally and results in shortening them. Since the /u:/ in the surface PP pattern is followed by a consonant which occurs in the final position of the word, it should be shortened. Consequently, the PP pattern should surface as |ma+$C_1C_2uC_3$| instead of |ma+$C_1C_2u{:}C_3$|. In line with Ali and Mahadin (2022, 19), this inconsistency can be avoided by indicating that the stems which are targeted by the vowel shortening rule in the literature are observed to be followed by a suffix which has one consonant. Based on this observation, the long vowels which are subjected to the vowel shortening rule in the literature are found to be followed by a consonant which is not part of the stem itself but part of a suffix which is added to it. Illustrative examples are cited from Ali and Mahadin (2022, 19) and presented in 8:

8. a. da:ᶜi:-**n** → da:ᶜi-**n** 'a caller' (the /n/ is the indefinite suffix)

b. rama:-**t** → rama-**t** 'she threw' (the /t/ is the feminine suffix)

Alternatively, when the long vowels are followed by a consonant which is part of the stem, the vowel shortening rule does not apply to them and hence they remain long (e.g. ma-ʔku:l 'eaten' and kutta:b 'writers'). Accordingly, all the long vowels that are targeted by this rule are followed by a consonant which is followed by a word boundary and preceded by a morpheme boundary. The vowel shortening rule, on the basis of this observation and in line with Ali and Mahadin (2022), can be restated in 9.

9. V: → V/ _____ +C# (+ and # designate the morpheme and word boundaries, respectively)

Similar to the derivation of the three initially-weak PPs that are presented by Abushunar and Mahadin (2017), the derivation of the 83 initially-weak PPs that are analyzed in the present corpus, which are shown in Table 1 in in the appendices, from their imperfective stems requires no additional processes to the ones that are employed for deriving their strong counterparts. For instance, deriving the initially-weak PP ma-wsu:m 'marked' from wsim, the underlying representation of the stem of its imperfective verb ja-sim 'he marks', requires changing the stem vowel of wsim to /u/ (wsim → wsum) and adding the prefix /ma/ and

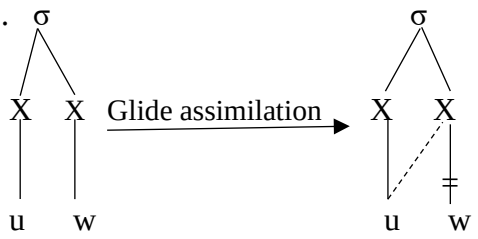
the infix /w/ to it (wsum→ ma-wsuwm). The second /w/ in ma-wsu**w**m meets the conditioning environment for the glide assimilation rule which is presented in 10. The glide assimilation rule targets the sequence/uw/ and changes it to /uu/ and the sequence /ij/ and changes it to /ii/, when these two sequences occur word-finally or before a consonant specified for the feature [consonantal], i.e. a non-glide consonant (cf. Ali and Mahadin 2020 and Ali and Mahadin 2022).

10. $\begin{Bmatrix} j \\ w \end{Bmatrix} \rightarrow \begin{Bmatrix} i \\ u \end{Bmatrix} / \begin{Bmatrix} i \\ u \end{Bmatrix} \_\_ \begin{Bmatrix} C\ [consonantal] \\ \# \end{Bmatrix}$ (# designates word boundary)

As opposed to most of the other assimilation rules, the feature geometry model is not required for the representation of the glide assimilation rule. This is ascribed to the fact that glide assimilation is a total assimilation rule which involves assimilating a sequence of phonetically similar sounds, i.e. assimilating a glide to its cognate vowel. The two members of this sequence of sounds have the same phonetic internal structure and thus share the same representation in the current model of feature geometry. Hence, this model is not needed for the depiction of the total assimilation of one of these members to the other and the X-slot model is used instead because it provides a more efficient and economical representation of a rule that applies directly to segments on the segmental tier and does not affect the internal structure of sounds.

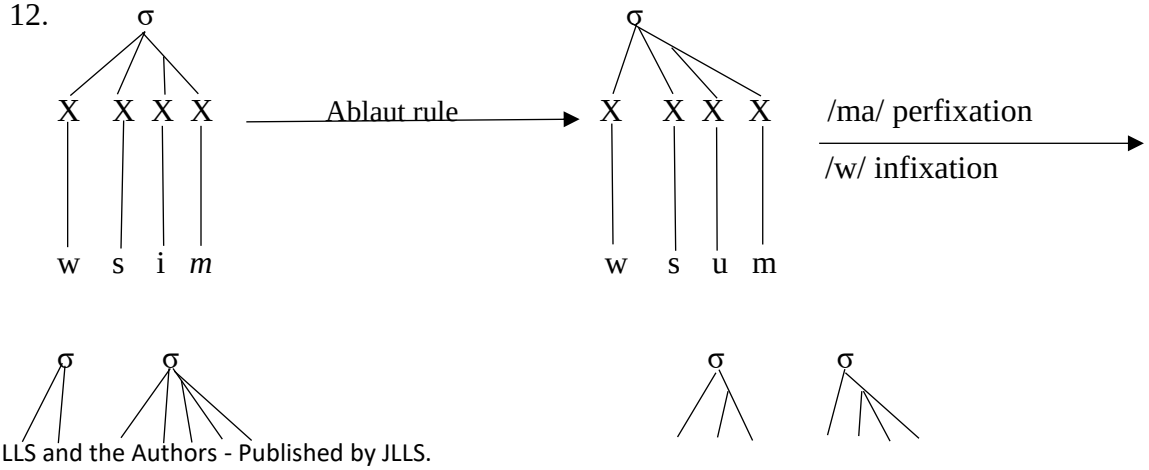
The representation of the phonological feature that distinguishes between a glide and its cognate vowel, which is the position they occupy in the syllable, within the X-slot model involves delinking the glide from its onset or coda position, i.e. a non-nucleus position, and attaching it to the nucleus position of its cognate vowel and this results in forming a long vowel. Comparable to this study, Abushunar and Mahadin (2017) used the X-slot model instead of the feature geometry model to represent the glide assimilation rule, which is referred to as syllabicity assimilation by them, but without giving a justification for using the former model instead of the latter. Changing the /uw/ sequence to /u:/ through the glide assimilation rule is straightforwardly depicted in in the X-slot model in 11.

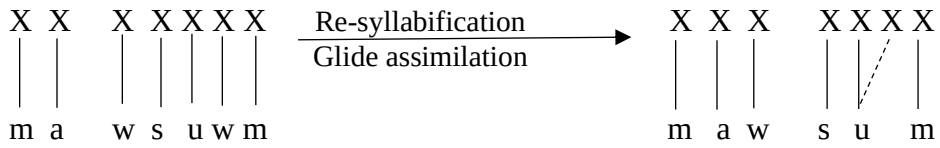
11.



The representation of this derivation process in the X-slot model of autosegmental phonology is given in 12.

12.





The final point regarding the derivation of this initially-weak PP is the application of a re-syllabification process which operates when the output of a phonological rule does not conform to the constraints on the syllable structure of a language in the course of derivation (Clements and Keyser 1983, 54; Mahadin 1994, 56). A re-syllabification process applies to wsuwm after the perfixation of /ma/ because it has a cluster of two consonants in the onset position, i.e. /w/ and /s/, which is prohibited in MSA (see Section 1.1). Consequently, this process re-syllabifies the first consonant in the cluster, i.e. /w/, as the coda of the prefix /ma/ which results in forming the two well-formed syllables /maw/ and /su:m/.

3.2. Medially-weak PPs

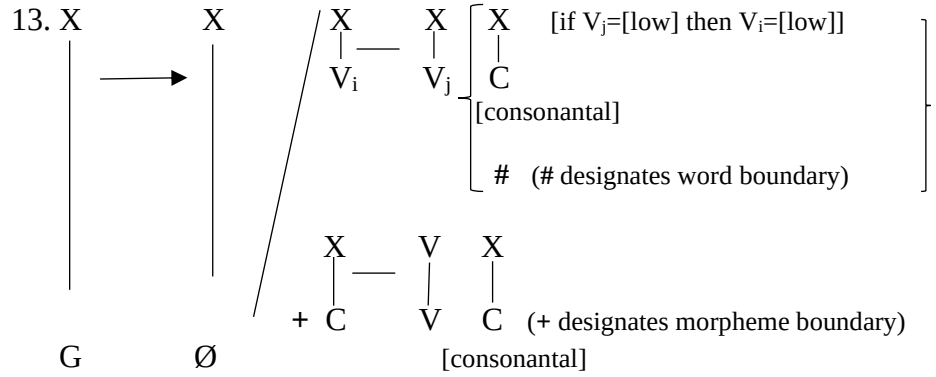
The imperfective stems of medially-weak PPs
Table 6 below presents the percentages of the imperfective verbs from which the medially-weak PPs are derived in the examined corpus.

Table 6. The medially-weak imperfective bases of PPs

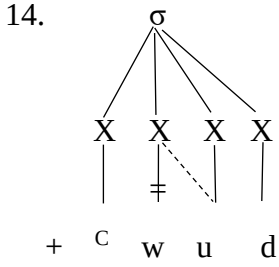
The imperfective patterns	Frequencies	percentages
ja-C_1u:C_3	120	58.2%
ja-C_1i:C_3	76	36.9%
ja-C_1a:C_3	8	3.9%
ja-C_1i:C_3 ja-C_1a:C_3	2	1%
Total	206	100%

In 58.2% of the instances of these imperfective verbs, the surface long vowel is /u:/ (e.g. ja-qu:m ‘he stands up’); in 36.9% of them, the long vowel is /i:/ (e.g. ja-ki:l ‘he weighs’); in 3.9%, the long vowel is /a:/ (e.g. ja-na:m ‘he sleeps’) and in 1%, the long vowel can be /i:/ or /a:/ (e.g. ja-^{c}a:f or ja-^{c}i:f ‘he hates’). As can be noticed, the surface representations of all these imperfective stems are of the pattern |C_1V:C_3| and they appear to biconsonantal because this pattern consists of a long vowel which is surrounded by two consonants. On the basis of the hypotheses that MSA underlying representations have no long vowels and that weak stems have the same structures as those of their strong counterparts, the medially-weak imperfective stems are assumed to have a triconsonantal structure which is underlyingly the same as that of the strong imperfective stems, i.e.|$C_1C_2VC_3$| (cf. Brame 1970, Mahadin and El-Yasin 1998). The second consonant of the weak stems, i.e.|C_2|, does not appear on the surface representations because it is generally hypothesized to be a glide which is subjected to phonological processes due to its susceptibility to them. This hypothesis can be supported by noting that even though the glide does not exist in form I of the medially-weak imperfective verb (e.g. ja-xa:f ‘he feels scared’ (form I)), it exists in the derived forms of the verb (e.g. ju-xawwif ‘he causes someone to get scared’ (form II)).

Accordingly, all the stems of the medially-weak imperfective verbs have the underlying shape |C_1GVC_3| which surfaces as |$C_1V{:}C_3$| through the application of the glide elision rule, which is cited from Ali and Mahadin (2022, 19) and stated in 13, because they meet its second conditioning environment. Based on the second conditioning environment of this rule, the glide is deleted when it occurs in a |CGV| sequence which is preceded by a morpheme boundary if the vowel in this sequence is followed by a [consonantal] consonant and the only consonants that lack specification for this feature are the glides (cf. Spencer 1996)



For instance, the /w/ in the imperfective stem ja-**ᶜwud** 'he comes back' occurs in a |CGV|, viz. |ᶜwu|, sequence which is preceded by a morpheme boundary and hence it meets the second conditioning environment of the glide elision rule. Within the X-slot model of autosegmental phonology, the deletion of the /w/, takes place only on the segmental tier which leaves its timing slot which is not unspecified for the feature [±consonantal] empty. The empty X slot spreads to the vowel that follows the deleted /w/ forming the long vowel /u:/. This is presented in 14.



The derivation of medially-weak PPs from their imperfective stems

The medially-weak PPs are formed on the basis of the underlying representations, rather than the surface representations, of their imperfective stems. The derivational process of these PPs involves adding the participle prefix /ma/ and the infix /w/ to imperfective stems of the shape |C_1GVC_3| and changing their stem vowels to /u/. This derives the underlying PP pattern |$ma+C_1GuwC_3$| which should surface as |$ma+C_1Gu{:}C_3$|, akin to strong PPs, through the application of the glide assimilation rule. For example, deriving the PP forms of the medially-weak verbs ja-qu:l 'he says' and ja-bi:ᶜ 'he sells' from the underlying representation of their imperfective stems, i.e. qwul and bjiᶜ, should yield ma-qwu:l and ma-bju:ᶜ. However, these two forms surface as mqu:l 'said' and ma-bi:ᶜ 'sold', respectively.

To account for the surface representations of medially-weak PPs, classical Arab grammarians and the researchers who follow their leads, suggested that these PPs undergo ʔalʔiᶜla:l binnaql which involves moving the vocalic diacritic of their medial glides to the letters that precede them (|$ma+C_1$**Gu**wC_3|→|$ma+C_1$**uG**wC_3|). Consequently, the medial glide of these PPs and the /w/ of the PP

pattern become adjacent and unvocalized, i.e. unfollowed by a vocalic diacritic (|ma+C_1u**Gw**C_3|). The co-occurrence of two adjacent unvocalized letters is prohibited in Arabic and as such the /w/ of the PP pattern is deleted (|ma+C_1u**G**C_3|). If the glide is /j/ in this pattern, its preceding vocalic diacritic, i.e. the /u/, is changed to /i/ to make it congruent with it (|ma+C_1ujC_3|→|ma+C_1ijC_3|) and if it is /w/ the /u/ remains unchanged (|ma+C_1uwC_3|) (cf. Ibin ki 1954, Sibawayh 1982, Ibin Asfor 1987, Al-Raajihi 1984).

Interestingly, the analysis of the derivational process of medially-weak PPs in the standard and autosegmental approaches of generative phonology, including Abushunar and Mahadin's (2017) analysis of the derivations of the two medially-weak PPs that they analyzed, namely mabi:ᶜ 'sold' and maqu:l 'said', resembles the account given by classical Arab grammarians. The first step of this derivational process in generative phonology is applying the glide metathesis rule, which resembles ʔalʔiᶜla:l binnaql, to the sequence |CGVC| in the targeted PP pattern which changes it to |CVGC| (|ma+**C_1Guw**C_3|→|ma+**C_1uGw**C_3|). Afterward, the consonant deletion rule applies to the consonant cluster |GwC$_3$| in the PP pattern and deletes its medial consonant, i.e. the /w/ (|ma+C_1u**GwC$_3$**|→ |ma+C_1u**GC**$_3$|). Thirdly, if the glide in this pattern is /j/, the vocalic assimilation rule changes the /u/ to the cognate vowel of the /j/. i.e. the /i/ (|ma+C_1**uj**C_3|→|ma+C_1**ij**C_3|). Subsequently, the glide assimilation rule assimilates the /j/ in the sequence /ij/ and the /w/ in the sequence /uw/ to their cognate vowels which yields /ii/ and /uu/, respectively (|ma+C_1**ij**C_3|→|ma+C_1**ii**C_3|, |ma+C_1**uw**C_3|→|ma+C_1**uu**C_3|). Finally, the vowel lengthening rule changes the /ii/ and /uu/ into /i:/ and /u:/, respectively. It should be indicated that the vowel lengthening rule is only needed in the standard approach because total assimilation processes, like glide assimilation, directly result in producing single long segments in the autosegmental approach.

Correspondingly, the applications of the glide metathesis, consonant deletion, vocalic assimilation and glide assimilation rules, as restated in 15 (a), (b), (c) and (d), respectively, are found to produce the two surface representations of the 207 medially-weak PPs, which are listed in Table 2 in the appendices, that are analyzed in the current study. It should be noted that the glide elision rule does not apply to the medially-weak PPs even though they are preceded by a morpheme boundary. This is ascribed to the observation that these PPs are of the shape |ma+**C_1Guw**C_3|. As stated in the second conditioning environment for the glide elision rule which is presented in 13, the glide which undergoes this rule in the sequence |+CGVC| must be followed by a vowel which is in turn followed by a consonant specified for the feature [consonantal] and the vowel /u/ in these PPs is followed by the glide /w/ which is not specified for this feature. Accordingly, the glide elision rule does not apply to these PPs which makes them eligible for rules in 15.

15. (a) CGVC → CVGC

(b) C→Ø/ C__C

(c) $\begin{Bmatrix} u \\ i \end{Bmatrix} \rightarrow \begin{Bmatrix} i \\ u \end{Bmatrix} / \_\_ \begin{Bmatrix} j \\ w \end{Bmatrix} C$

(d) $\begin{Bmatrix} j \\ w \end{Bmatrix} \rightarrow \begin{Bmatrix} i \\ u \end{Bmatrix} / \begin{Bmatrix} i \\ u \end{Bmatrix} \_\_ \begin{Bmatrix} C \\ \Psi \end{Bmatrix}$

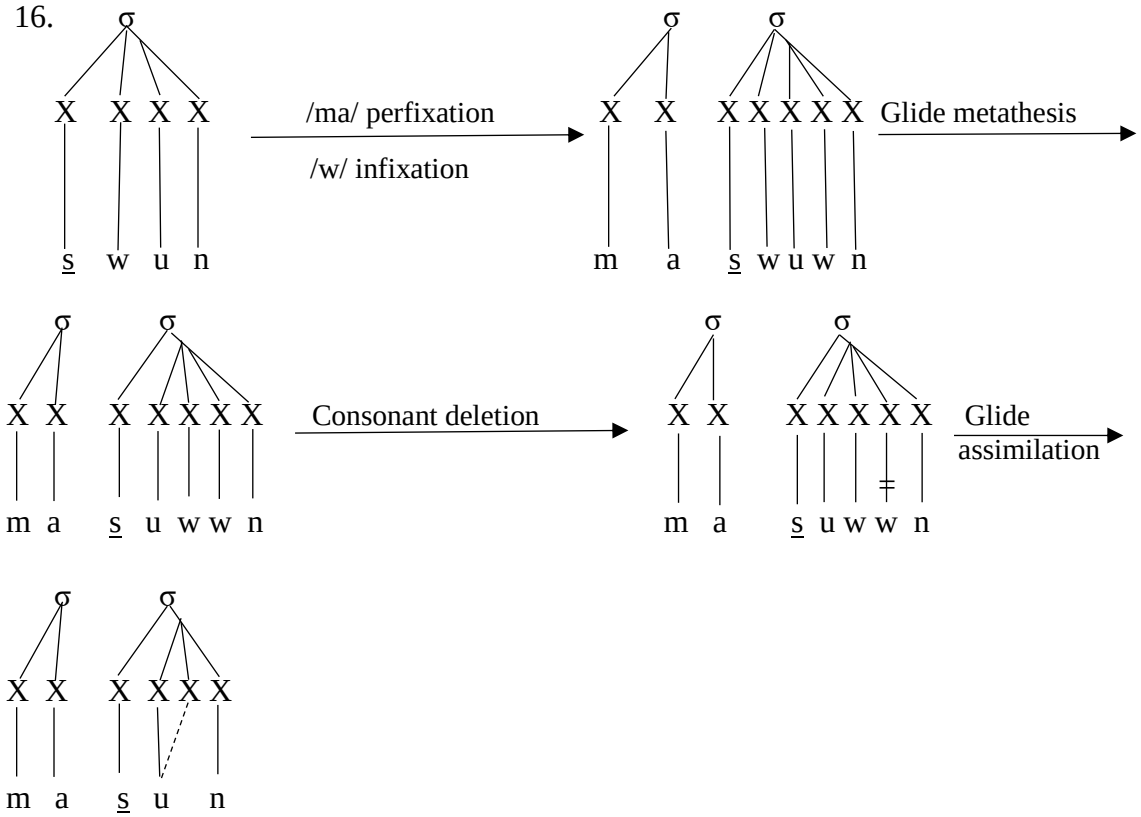
As shown in Table 7, the two surface representations of the analyzed medially-weak PPs are |ma+C_1u:C_3| (e.g. ma+qu:l 'said') and |ma+C_1i:C_3| (e.g. ma-bi:ᶜ 'sold'). The former representation accounts for 59% of these PPs and latter constitutes 41% of them. The medial radical of all the PPs that have the pattern |ma+C_1u:C_3| is /w/, whereas the medial radical of those that have the surface pattern |ma+C_1i:C_3| is /j/.

Table 7. The surface representations of medially-weak PPs

The PP pattern	Frequencies	Percentages
ma+C_1u:C_3	122	59%
ma+C_1i:C_3	85	41%
Total	207	100%

The autosegmental representation of the formation of medially-weak PPs from their imperfective stems is exemplified by the derivation of the PP ma-su:n ‘protected’ from swun, i.e. the underlying representation of the stem of its imperfective verb ja-su:n ‘to protect’, which is depicted in 16:

16.



As can be noticed, the stem of the PP ma-**su:n**, as well as the stems of all the analyzed instances of medially-weak PPs, is underlyingly triconsonantal but it surfaces as biconsonantal through the deletion of its medial radical, which is a glide, and the lengthening of its preceding vowel in compensation. It should be also noted that the formation of the PPs on the basis of the imperfective stems that have stem vowels other than /u/ requires the application of the ablaut rule to change these vowels to /u/. Moreover, the derivation of the PPs that have /j/ as their medial glide involves applying the vocalic assimilation rule after the consonant deletion rule which changes the sequence /uj/ to /ij/ to make it eligible for the application of the glide assimilation rule which is the last step of deriving its surface representation.

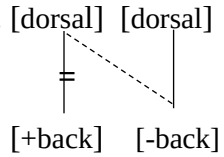
For instance, the derivation of the PP ma-di:n ‘borrower’ from djin, i.e. the underlying representation of the stem of its imperfective verb ja-di:n ‘he borrows’, entails the addition of the affixes /ma/ and /w/ to djin and the application of the ablaut rule to change its stem vowel /i/ to /u/ which yield ma-djuwn. This sequence is subjected to the glide metathesis rule which changes it to ma-dujwn. The application of the consonant

deletion rule results in the deletion of the medial consonant in the consonant cluster /jwn/ which yields ma-dujn. The /u/ in the /uj/ sequence partially assimilates to its following glide the /j/ through the application of the vocalic assimilation rule.

The vocalic assimilation rule cannot be accounted for in the X-slot model of autosegmental phonology. Rather, the representation of this rule requires utilizing another model of autosegmental phonology which enables referring to the features from which segments are composed. The feature geometry model of autosegmental phonology straightforwardly represents assimilation processes, of which vocalic assimilation is an example, by giving the features of sounds a relative degree of independency which makes them capable of autonomous behavior like spreading and delinking.

Abushunar and Mahadin's (2017, 260) representation of the application of the vocalic assimilation rule to the sequence /uj/ to derive /ij/ involves spreading the dorsal feature [-back] from the /j/ to the /u/ after delinking the feature [+back] from the latter. This is depicted in 17.

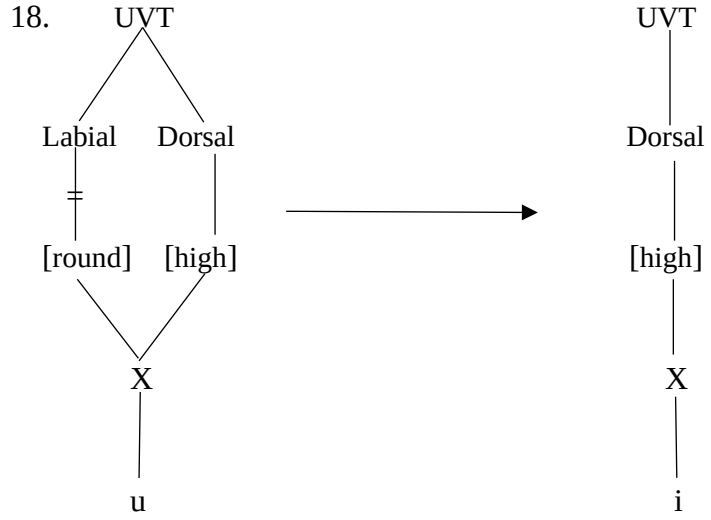
17.



This instance of vocalic assimilation cannot be represented by spreading the [-back] feature from the /j/ to the /u/ in this study because all the features within the present model of feature geometry are monovalent due to the integration of the feature geometry with the underspecification theory. Featural monovalency entails leaving the absence of a feature underspecified and only specifying its presence. Consequently, only back sounds are specified for the feature [back]. The other sounds, on the other hand, do not carry any information about this feature and thus no sound is marked as [-back].

Alternatively, this instance of vocalic assimilation can be simply accounted for by delinking the feature [round] from the /u/ vowel due to its adjacency to the /j/ which lacks this feature. This assimilation in roundedness changes the /u/ to /i/ because the only high unrounded vowel in MSA is the /i/. Changing the /u/ to /i/ through the vocalic assimilation rule is depicted within the feature geometry model in 18 where only the relevant features for the analysis are represented.

18.



3.3. Finally-weak PPs

The imperfective stems of finally-weak PPs

As shown in Table 8, all the surface representations of finally-weak verbs are of the pattern |C_1C_2V:|.the long vowel is /u:/ (e.g. ja-rdʒu: 'he hopes') in 48% of these surface representations, /i:/ (e.g. ja-rmi: 'he throws') in 26% of them, /a:/ in 25.5% (e.g. ja-ʃfa: 'he heals') and alternative /a:/ and /i:/ in 0.5% (ja-ɣθa: and ja-ɣθi: 'he talks a lot'). The underlying representations of all the imperfective verbs from which finally-weak PPs are derived are of the shape |ja- C_1C_2VG| which surface as |ja- C_1C_2V:| through the application of phonological rules. In that respect, Mahadin (1982) noticed that the interactions between the stems of finally-weak verbs and the suffixes that are attached to them cause most of the changes to their underling representations. He further indicated that the glide, i.e. the third radical of finally-weak verbs, regularly undergoes an elision process when these verbs inflect for their indicative case. The elision process is caused by meeting the first conditioning environment of the glide elision rule, as stated in 13, which causes the deletion of the glide which occurs in a |CGV| sequence which is followed by a [consonantal] consonant or a word boundary, except for when the first vowel is high and the second is low, i.e. |uGa| and |iGa|.

Table 8. The finally-weak imperfective bases of PPs

The imperfective patterns	Frequencies	Percentages
ja-C_1C_2u:	98	48%
ja-C_1C_2i:	53	26%
ja-C_1C_2a:	52	25.5%
ja-C_1C_2a: ja-C_1C_2i:	1	0.5%
Total	204	100%

For example, adding the indicative case suffix /u/, which is the unmarked case of verbs, to the imperfective verb ja-dᶜuw 'he invites' causes the appearance of the sequence |uwu|. This sequence is followed by a word boundary and the glide /w/ in it occurs in an intervocalic position which triggers its deletion by the glide elision rule. Afterwards, the vowel lengthening rule, which is taken from Brame (1970) and stated in 19, applies to the two identical short vowels /uu/ and changes them to the long vowel /u:/. Applying these phonological rules to the underlying representations of the imperfective verb ja-dᶜuw produces its surface representation, i.e. ja-dᶜu: 'he invites, indicative case'.

19. $V_i\ V_i \rightarrow V_i$:

The aforementioned phonological processes apply successively to the imperfective verbs that have identical stem and case vowels to produce their surface representations, on the other hand, a vowel assimilation rule is posited between the glide elision rule and the lengthening rule to enable the derivation of the imperfective verbs that have non-identical stem and case vowels. This can be exemplified by the inflection of the imperfective verb ja-rmij 'he throws' for the indicative case which forms ja-rmij-u. Subjecting this sequence to the glide elision rule causes the appearance of the two adjacent vowels /iu/. As can be noticed, the vowel lengthening rule cannot apply to these two vowels because they are not identical. Furthermore, the vowel cluster /iu/ is prohibited for two reasons. The first is that the nucleus position cannot be occupied simultaneously by two different vowels. The second reason is that if each of these vowels is presumed to constitute its own syllable, then the second syllable becomes onsetless and this is not allowed in MSA.

Accordingly, in line with Mahadin (1982, 234) , the /iu/ vowel cluster is targeted by a vowel assimilation rule, stated as Vi → Vj/ Vj ___, which causes assimilating the second member of the cluster to its first member. The resultant sequence, i.e. /ii/, becomes eligible to the vowel lengthening rule which produces the surface representation of this imperfective verb, i.e. ja-rmi: 'he throws, indicative case'.

The derivation of finally-weak PPs from their imperfective stems

Similar to Abushunar and Mahadin's (2017) two selected examples of finally-weak PPs, there are two surface representations of finally-weak PPs, which are presented in Table 3 in the appendices, in the current corpus. The first surface representation is of the shape |ma+$C_1C_2iC_3C_3$| and the second is of the shape |ma+$C_1C_2uC_3C_3$|. As presented in Table 9, the former representation accounts for 52% of the finally-weak PPs while the latter represents 48% of them.

Table 9. The surface representations of finally-weak PPs

The PP pattern	Frequencies	Percentages
ma+$C_1C_2iC_3C_3$	106	52%
ma+$C_1C_2uC_3C_3$	98	48%
Total	204	100%

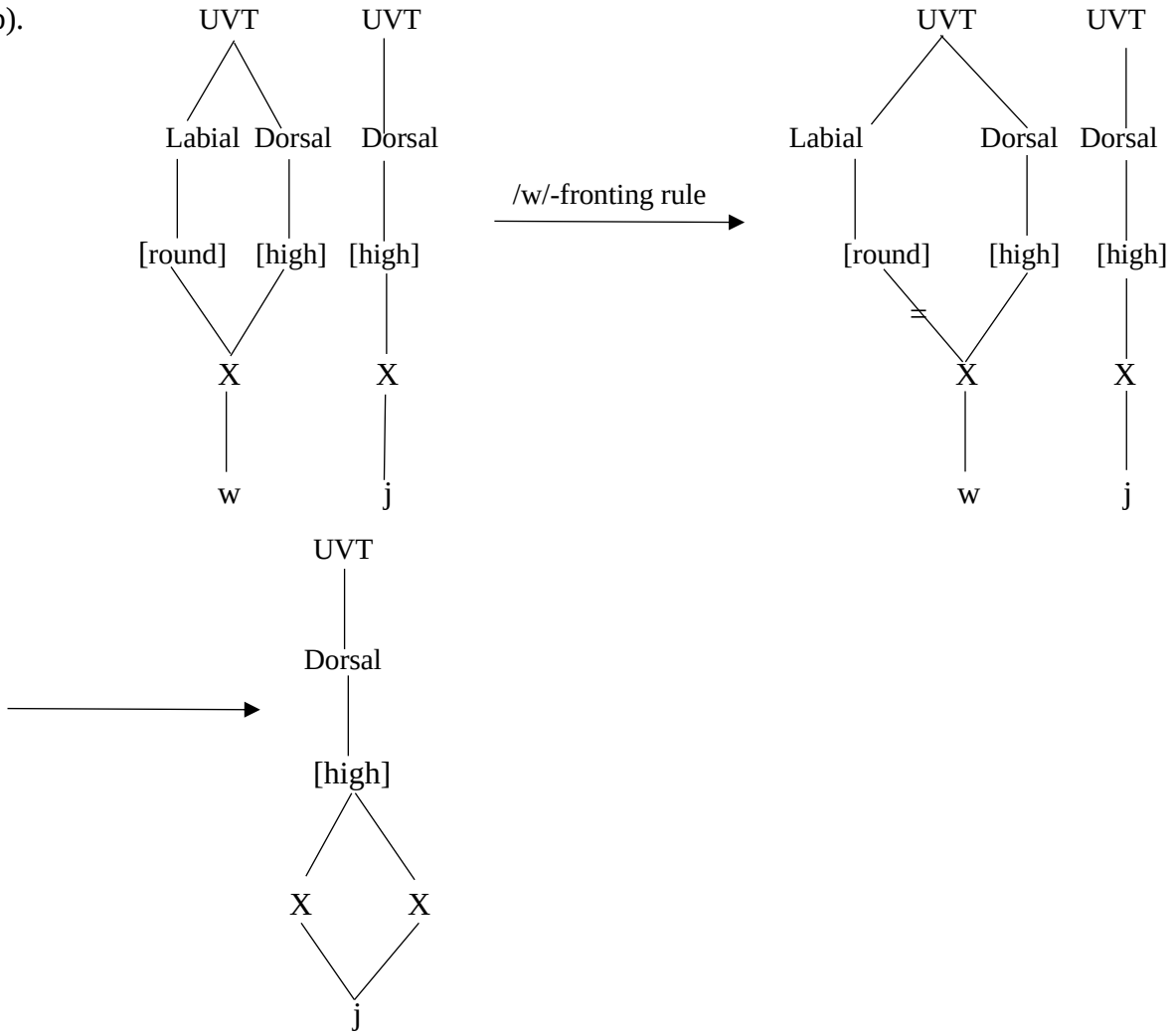
The third consonant of the imperfective stems from which the PPs of the shape |ma+$C_1C_2uC_3C_3$| are derived is always /w/. The derivation of the underlying representations of these PPs from imperfective stems of the shape |C_1C_2Vw| involves attaching the prefix /ma/ and the infix /w/ to them and changing their stem vowel to /u/ through the ablaut rule which results in a pattern of the shape |ma+C_1C_2uww|. Interestingly, the surface representations of these PPs are the same as their underlying representations. For example, applying this derivational process to the stem sluw, i.e. the underlying stem of the imperfective verb ja-slu: 'he forgets', yields ma-sluww 'forgotten' which serves as the underlying and surface representation of this PP.

The appearance of the infix /uw/ in the surface representation of finally-weak PPs is an apparent confirmation of its existence in the underlying representation of the PP forms. The appearance of this infix in finally-weak PPs is ascribed to the failure of the glide assimilation rule, as stated in 10, to change it to /u:/ in these PPs because this rule applies to the sequence |VGC| and changes it to |V:C| when its |C| element is specified for the feature [consonantal]. In these PPs, the infix /uw/ is followed by a glide which is not specified for the feature [consonantal] and this prevents the application of this rule to it.

As opposed to |ma+$C_1C_2uC_3C_3$|, the surface representations of the PPs of the shape |ma+$C_1C_2iC_3C_3$| are different from their underlying representations. That is, the formation of the underlying shape of the PPs of the pattern |ma+$C_1C_2iC_3C_3$| involves the addition of the affixes /ma/ and /w/ to imperfective stems of the shape |C_1C_2Vj| and the application of the ablaut rule to change their stem vowel to /u/. Similar to Abushunar and Mahadin's (2017), the resultant underlying PP form |ma+C_1C_2uwj| is subjected to two phonological rules to derive its surface shape, i.e. |ma+C_1C_2ijj|. The first rule is the /w/-fronting rule, as stated in 20, which is a total assimilation rule that changes the /w/ to /j/ when it is preceded or followed by /j/ (Brame 1970, 453). The representation of application of the /w/-fronting rule to the /w/ to change it to /j/ in the feature geometry model is cited from Ali and Mahadin (2022, 13) and depicted in 20 (b).

20 (a). $w \rightarrow j / \left\{ \begin{matrix} - \, j \\ j \, - \end{matrix} \right\}$

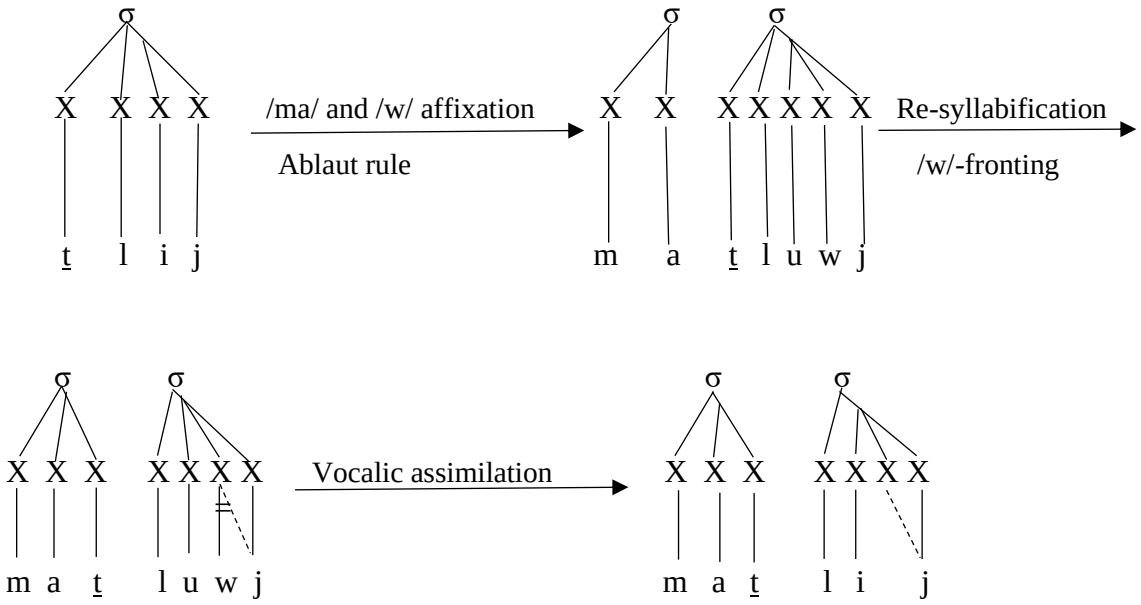
20 (b).



As shown in 20 (b), the assimilation of the /w/ to the /j/ through the /w/-fronting rule is represented in the feature geometry model by delinking the feature [round] from the /w/ which results in changing it to /j/ because these two glides differ only in this feature. It should be noted that the sounds which act as the targets of the assimilation processes that the analyzed PP forms undergo are specified for the feature [round], whereas the sounds which act as the triggers of these processes lack specifications for this feature. In accordance with Mohanan's (1993) dominance model which is adopted by Watson (2002) and Al-Deaibes (2016) in their analyses of assimilation processes in Arabic, the feature [round] is proposed to be relatively weak . Accordingly, a rounded sound tends to be less dominant than an unrounded sound; thus it generally functions as the target, and not the trigger, of assimilation processes.

The application of the /w/-fronting rule to the form |ma+C_1C_2uwj| changes it to |ma+C_1C_2ujj|. The form |ma+C_1C_2ujj| is subsequently subjected to the vocalic assimilation rule which partially assimilates the /u/ to its following /j/, as depicted in 18, to derive the surface PP pattern |ma+C_1C_2ijj|. The autosegmental representation of the derivation of the finally-weak PP ma-t̲lijj 'painted' from t̲lij, i.e. the stem of the imperfective verb ja-t̲li: 'he paints', is used as an illustrative example in 21.

21.



3.4. Doubly-weak PPs

The imperfective stems of doubly-weak PPs

The 21 doubly-weak imperfective stems which are the sources of deriving PPs in the present study are divided into two categories. The first category includes of 16 stems which have glides as their second and third radicals, while the second category contains 5 stems which have their first and third radicals as glides. The underlying representation of the former category of stems is of the shape $|C_1G_1VG_2|$ which surfaces as $|C_1G_1V:|$ (e.g. ja-**nwij**→ ja-**nwi**: 'he intends'), while the latter category has an underlying representation of the shape $|G_1C_2VG_2|$ which surfaces as $|C_2i:|$ (e.g. ja-**wfij**→ ja-**fi**: 'he fulfills').

The surface representations of the second category of stems are derived in the same way as those of the initially and finally weak verbs. That is, the initial and final glides in the underlying representation of these stems undergo the glide elision and assimilation rules, respectively, thus these glides do not appear in the surface representation. On the other hand, the final glides in the stems of the first category undergo the glide assimilation rule but their medial glides are not subjected to the glide elision rule, which applies to their medially-weak counterparts, hence their medial glides are not deleted. Restricting the second conditioning environment for the glide elision rule, as stated in 13, by proposing that the vowel in the |CGVC| sequence must be followed by a [consonantal] consonant accounts for retaining the medial glide of the $|C_1G_1VG_2|$ stems because the vowel in these stems is followed by a glide which lacks this feature.

The derivation of doubly-weak PPs from their imperfective stems

The 21 doubly-weak PPs, which are presented in Table 4 in in the appendices, display derivational patterns that resemble the two categories of the imperfective stems from which they are derived. The PPs that are derived from imperfective stems of the shape $|G_1C_2VG_2|$, in parallel with their imperfective bases, follow the general pattern of the derivation of initially and finally weak PPs which entails retaining their initial and final glides. For example, the derivation of the PP ma-wh<u>i</u>jj 'inspired' from the imperfective stem wh<u>i</u>j involves the affixation of the /ma/ and /w/ to this stem and the alternation of the stem vowel into /u/ which yield ma-wh<u>u</u>wj. The successive applications of the /w/-fronting and the vocalic assimilation rules to this sequence produce its surface representation.

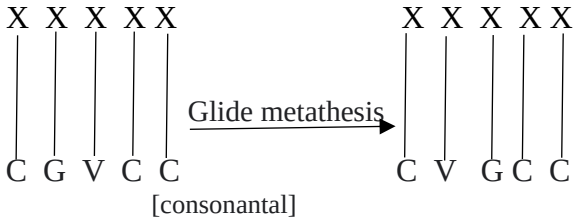
As for the PPs that are constructed on the basis of stems of the shape |$C_1G_1VG_2$|, they are observed to follow the same derivational pattern of finally-weak PPs but deviate from that of medially-weak PPs. Accordingly, these PPs undergo the /w/-fronting and vocalic assimilation rules that form finally-weak PPs. However, they fail to undergo the glide metathesis, consonant deletion and glide assimilation rules that regularly apply to medially-weak PPs. According to Brame (1970, 267) and Abushunar and Mahadin (2017, 263), the doubly-weak PPs which are derived from roots of the shape |CGG| do not undergo the glide metathesis rule as stated in 22. The glide metathesis rule is considered the first step of the derivation of medially-weak PPs which entails that its output serves as the input to its subsequent rules. Therefore, failing to apply this rule to stems of the shape |$C_1G_1VG_2$| causes the non-application of its following rules to these stems.

22. CGVC→ CVGC

Instead of regarding these doubly-weak PPs as exceptional to the glide metathesis rule, the conditioning environment for this rule can be slightly modified to avoid its application to them. This rule applies to sequences of the shape |CGVC| and changes them to |CVGC| by metathesizing the glide and its preceding vowel. The doubly-weak PPs which do not undergo the glide metathesis rule are of the underlying shape |ma+CGVGG|. In order to prevent the application of the glide metathesis rule to them, the last consonant of the |CGVC|, i.e. the sequence which is subjected to the glide metathesis rule, is required to be followed by a non-glide consonant, i.e. a consonant specified for the feature [consonantal].

This modification to the glide metathesis rule prevents it from applying to the doubly-weak PPs because the |CGVC| sequence in them is followed by a glide (ma+CGVG**G**). It should be noted that the last consonant in this sequence is not required to be a non-glide consonant because the glide metathesis rule affects the medially-weak PPs which have the underlying shape |ma+CGVGC| (see Section 3.2). The re-statement of the glide metathesis rule in the X-slot model of phonology with the modification to its conditioning environment is given in 33:

5.12.



The ability of this modification to the glide metathesis rule to straightforwardly accounts for its failure to apply to PPs of the underlying shape |ma+CGVGG| is illustrated by deriving the surface representation of the doubly-weak PP ma-ʃwijj ‘barbequed’ from its underlying representation, i.e. ma-ʃwuwj. As can be noticed, the glide metathesis rule does not apply to the underlying representation of this PP because the consonant which occupies its last position, i.e. the /j/, lacks the specification for the feature [consonantal]. Since ma-ʃwuwj does not undergo the glide metathesis rule, the conditioning environments for the consonant deletion and glide assimilation rules which are employed for deriving the surface representations of medially-weak PPs are not met and thus they do not target this PP. On the other, the rules that derive the surface representations of finally-weak PPs, i.e. the /w/-fronting and the vocalic assimilation rule, apply to ma-ʃwuwj because it meets their conditioning environments. The successive application of these rules to ma-ʃwuwj causes it to surface as ma-ʃwijj ‘barbequed’.

4. Conclusion

The present study aimed at replicating Abushunar and Mahadin's (2017) research by adopting the same phonological models, i.e. the X-slot and the feature geometry models of autosegmental phonology, for the examination of the phonological processes that PPs undergo in the course of their derivation from triconsonantal verbal stems in MSA. The only difference between the two studies is that this study is a corpus-based analysis of the derivation of the PPs, whereas the replicated study is not based on a corpus. The analysis revealed that the non-corpus-based phonological study of the derivation of PPs provided similar analysis to its corpus-based counterpart. This indicates that employing a carefully selected sample to examine a phonological phenomenon does not necessarily affect the comprehensiveness and thoroughness of a phonological analysis. Similar to Abushunar and Mahadin (2017), the underlying representations of the analyzed PPs are formed through subjecting their verbal stems to the ablaut rule which changes their stem vowels to /u/ and adding the prefix /ma/ and the infix /w/ to them. As for the surface representations of these PPs, deriving them generally involves the applications of the glide metathesis, vocalic assimilation, consonant deletion and glide assimilation rules to their underlying forms.

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Appendices: The PP corpus

Table 1. Initially-weak passive participles of the pattern ma+$C_1C_2u:C_3$

Number	Dictionary entry number	Consonantal root	Imperfective verb	Gloss	Passive participle
1	5525	w ʔ d	jaʔid	to bury alive	mawʔu:d

2	5527	w ʔ m	jawʔam	to agree with	mawʔu:m
3	5539	w b q	jawbaq	to perish	mawbu:q
4	5540	w b l	jabil	to rain heavily	mawbu:l
5	5541	w t d	jatid	to wedge	mawtu:d
6	5542	w t r	jatir	to hold back	mawtu:r
7	5545	w θ b	jaθib	to jump	mawθu:b
8	5547	w θ q	jawθuq	to fasten	mawθu:q
9	5547	w θ q	jaθiq	to trust	mawθu:q
10	5548	w θ n	jaθin	to settle	mawθu:n
11	5499	w dʒ b	jadʒib	to fall down to be imperative	mawdʒu:b
12	5550	w dʒ d	jadʒid	to be sad for to adore to hate to come across to know	mawdʒu:d
13	5551	w dʒ z	jadʒiz	to be brief	mawdʒu:z
14	5553	w dʒ ᶜ	jawdʒaᶜ	to be in pain	mawdʒu:ᶜ
15	5556	w dʒ m	jadʒim	to be speechless	mawdʒu:m
16	5558	w dʒ h	jadʒih	to hit one's face	mawdʒu:h
17	5560	w h ʃ	jawhaʃ	to miss	mawhu:ʃ
18	5565	w x z	jaxiz	to pierce	mawxu:z
19	5566	w x t	jaxit	to become gray-haired	mawxu:t
20	5567	w x m	jawxam	to glut	mawxu:m
21	5575	w ð r	jaðar	to leave	mawðu:r
22	5577	w r θ	jariθ	to inherit	mawru:θ
23	5578	w r d	jarid	to arrive	mawru:d
24	5582	w r ᶜ	jaraᶜ	to be devout	mawru:ᶜ
25	5582	w r ᶜ	jawruᶜ	to be devout	mawru:ᶜ
26	5585	w r k	jarik	to have large hips	mawru:k
27	5592	w z r	jazir	to sin to become a minister	mawzu:r
28	5594	w z ᶜ	jaziᶜ	to stop	mawzu:ᶜ
29	5596	w z n	jazin	to weigh	mawzu:n
30	5600	w s t	jasit	to be centered to mediate	mawsu:t
31	5601	w s ᶜ	jawsaᶜ	to expand	mawsu:ᶜ
32	5601	w s ᶜ	jasaᶜ	to encompass	mawsu:ᶜ
33	5602	w s q	jasiq	to envelop	mawsu:q
34	5603	w s l	jasil	to need	mawsu:l

35	5604	w s m	jasim	to mark	mawsu:m
36	5608	w ʃ dʒ	jaʃìdʒ	to intertwine	mawʃu:dʒ
37	5613	w ʃ m	jaʃìm	to tattoo	mawʃu:m
38	5616	w s̲ b	jas̲ib	to be consistent	maws̲u:b
39	5618	w s̲ f	jas̲if	to describe	maws̲u:f
40	5619	w s̲ l	jas̲il	to arrive to connect to treat good	maws̲u:l
41	5620	w s̲ m	jas̲im	to disgrace	maws̲u:m
42	5625	w d̲ ᶜ	jad̲aᶜ	to put to humiliate to deprive	mawd̲u:ᶜ
43	5626	w d̲ m	jad̲im	to put on the cutting board	mawd̲u:m
44	5627	w d̲ n	jad̲in	to weave	mawd̲u:n
45	5628	w t̲ ʔ	jat̲aʔ	to be simple to step	mawt̲u:ʔ
46	5630	w t̲ d	jat̲id	to affirm	mawt̲u:d
47	5632	w t̲ s	jat̲is	to break	mawt̲u:s
48	5634	w t̲ n	jat̲in	to inhabit	mawt̲u:n
49	5636	w ð̲ b	jað̲ib	to be persistent	mawð̲u:b
50	5638	w ᶜ b	jaᶜib	to collect	mawᶜu:b
51	5640	w ᶜ d	jaᶜid	to promise to threaten	mawᶜu:d
52	5641	w ᶜ r	jawᶜar	to be bumpy	mawᶜu:r
53	5642	w ᶜ z	jaᶜiz	to designate	mawᶜu:z
54	5643	w ᶜ ð̲	jaᶜið̲	to preach	mawᶜu:ð̲
55	5644	w ᶜ k	jaᶜik	to be in pain	mawᶜu:k
56	5648	w ɣ r	jaɣir	to be filled with hatred	mawɣu:r
57	5649	w ɣ l	jaɣil	to intrude upon to delve into	mawɣu:l
58	5651	w f d	jafid	to arrive at	mawfu:d
59	5657	w q t	jaqit	to time	mawqu:t
60	5661	w q r	jaqir	to be deaf	mawqu:r
61	5663	w q ᶜ	jaqaᶜ	to happen to appear to fall to insult	mawqu:ᶜ
62	5664	w q f	jaqif	to stand up to inform to stop	mawqu:f

63	5672	w k z	jakiz	to hit	mawku:z
64	5673	w k s	jakis	to decrease	mawku:s
65	5676	w k l	jakil	to delegate	mawku:l
66	5678	w l t	jalit	to decrease	mawlu:t
67	5679	w l dʒ	jalidʒ	to enter	mawlu:dʒ
68	5680	w l d	jalid	to give birth	mawlu:d
69	5681	w l ᶜ	jawlaᶜ	to love	mawlu:ᶜ
70	5682	w l ɣ	jalaɣ	to drink	mawlu:ɣ
71	5685	w l h	jalih	to grieve	mawlu:h
72	5688	w m ʔ	jamaʔ	to indicate	mawmu:ʔ
73	5694	w h b	jahab	to bestow	mawhu:b
74	5697	w h l	jawhal	to be weak	mawhu:l
75	5698	w h m	jahim	to imagine	mawhu:m
76	5698	w h m	jawham	to be delusion	mawhu:m
77	5699	w h n	jahin	to be weak	mawhu:n
78	5709	j ʔ s	jajʔas jajʔis	to lose hope	majʔu:s
79	5739	j s r	jajsar	to become easy	majsu:r
80	5749	j f x	jajfax	to hit on the fontanelle	majfu:x
81	5754	j q n	jajqan	to believe with certainty	majqu:n
82	5757	j m n	jajmun	to make blessed to be blessed	majmu:n
83	5757	j m n	jajmin	to turn right	majmu:n

Table 2. Medially-weak passive participles of the pattern ma+C_1C_2u:C_3

Number	Dictionary entry number	Consonantal root	Imperfective verb	Gloss	Passive participle
1	335	ʔ w b	jaʔu:b	to come back	maʔu:b
2	345	ʔ w d	jaʔu:d	to feel tired	maʔu:d
3	361	ʔ w l	jaʔu:l	to be handed over to	maʔu:l
4	387	ʔ j d	jaʔi:d	to return	maʔi:d
5	804	b w ʔ	jabu:ʔ	to deserve	mabu:ʔ
6	812	b w h	jabu:h	to reveal	mabu:h
7	822	b w s	jabu:s	to kiss	mabu:s
8	829	b w ᶜ	jabu:ᶜ	to sell	mabu:ᶜ
9	871	b j d	jabi:d	to lay eggs	mabi:d
10	873	b j ᶜ	jabi:ᶜ	to sell	mabi:ᶜ
11	1006	t w b	jatu:b	to repent	matu:b
12	1013	t w q	jatu:q	to long	matu:q

13	1018	t w h	jatu:h	to get lost	matu:h
14	1022	t j h	jati:h	to make possible for	mati:h
15	1029	t j m	jati:m	to be in love	mati:m
16	1031	t j h	jati:h	to get lost	mati:h
17	1079	θ w b	jaθu:b	to come back to one's senses	maθu:b
18	1080	θ w r	jaθu:r	to rebel	maθu:r
19	1261	dʒ w b	jadʒu:b	to wander	madʒu:b
20	1264	dʒ w d	jadʒu:d	to lavish	madʒu:d
21	1267	dʒ w r	jadʒu:r	to be unjust	madʒu:r
22	1269	dʒ w z	jadʒu:z	to be accepted	madʒu:z
23	1270	dʒ w s	jadʒu:s	to keep coming back	madʒu:s
24	1282	dʒ j ʔ	jadʒi:ʔ	to occur	madʒi:ʔ
25	1500	h w ð	jahu:ð	to keep	mahu:ð
26	1501	h w r	jahu:r	to come back	mahu:r
27	1502	h w z	jahu:z	to possess	mahu:z
28	1503	h w ʃ	jahu:ʃ	to stop	mahu:ʃ
29	1507	h w t	jahu:t	to guard	mahu:t
30	1510	h w k	jahu:k	to contrive	mahu:k
31	1511	h w l	jahu:l	to elapse	mahi:l
32	1511	h w l	jahu:l	to stop	mahu:l
33	1513	h w m	jahu:m	to move in circles	mahu:m
34	1518	h j d	jahi:d	to alter one's course	mahi:d
35	1520	h j z	jahi:z	to possess	mahi:z
36	1523	h j s	jahi:s	to try to escape	mahi:s
37	1526	h j f	jahi:f	to be unfair	mahi:f
38	1527	h j q	jahi:q	to confine	mahi:q
39	1528	h j k	jahi:k	to weave	mahi:k
40	1530	h j n	jahi:n	to approach	mahi:n
41	1705	x w d	jaxu:d	to go through	maxu:d
42	1706	x w f	jaxa:f	to be scared	maxu:f
43	1708	x w n	jaxu:n	to betray	maxu:n
44	1711	x j r	jaxi:r	to pick	maxi:r
45	1715	x j t	jaxi:t	to sew	maxi:t
46	1716	x j l	jaxa:l	to assume	maxi:l
47	1884	d w r	jadu:r	to keep moving in circles	madu:r
48	1887	d w s	jadu:s	to step on	madu:s
49	1892	d w l	jadu:l	to be changed	madu:l

50	1896	d w m	jadu:m	to persist	madu:m
51	1898	d w n	jadu:n	to be despicable	madu:n
52	1922	d j n	jadi:n	to borrow to believe in	madi:n
53	1985	ð w d	jaðu:d	to prevent	maðu:d
54	1986	ð w q	jaðu:q	to experience	maðu:q
55	2220	r w h	jaru:h	to leave to feel comfortable	maru:h
56	2221	r w d	jaru:d	to lead	maru:d
57	2228	r w d	jaru:d	to train	maru:d
58	2229	r w ᶜ	jaru:ᶜ	to be scared	maru:ᶜ
59	2230	r w ɣ	jaru:ɣ	to elude	maru:ɣ
60	2231	r w q	jaru:q	to be pure	maru:q
61	2234	r w m	jaru:m	to aspire to	maru:m
62	2243	r j b	jari:b	to make skeptical	mari:b
63	2246	r j h	jari:h	to smell	mari:h
64	2247	r j ʃ	jari:ʃ	to have feathers	mari:ʃ
65	2252	r j m	jari:m	to depart	mari:m
66	2253	r j n	jari:n	to cover	mari:n
67	2373	z w h	jazu:h	to dislocate	mazu:h
68	2374	z w d	jazu:d	to prepare supplies	mazu:d
69	2375	z w r	jazu:r	to visit	mazu:r
70	2382	z w l	jazu:l	to cease to exist	mazu:l
71	2386	z j t	jazi:t	to oil	mazi:t
72	2390	z j h	jazi:h	to disappear	mazi:h
73	2391	z j d	jazi:d	to increase	mazi:d
74	2395	z j ɣ	jazi:ɣ	to swerve	mazi:ɣ
75	2399	z j n	jazi:n	to beautify	mazi:n
76	2666	s w x	jasu:x	to sink	masu:x
77	2667	s w d	jasu:d	to prevail	masu:d
78	2670	s w s	jasu:s	to rule	masu:s
79	2672	s w t	jasu:t	to lash	masu:t
80	2673	s w ɣ	jasu:ɣ	to be permitted	masu:ɣ
81	2677	s w q	jasu:q	to lead	masu:q
82	2678	s w k	jasu:k	to rub	masu:k
83	2682	s w m	jasu:m	to wander	masu:m
84	2687	s j b	jasi:b	to flow	masi:b
85	2693	s j x	jasi:x	to sink	masi:x
86	2695	s j r	jasi:r	to walk	masi:r
87	2703	s j ɣ	jasi:ɣ	to taste good	masi:ɣ

88	2916	ʃ w b	jaʃu:b	to blemish	maʃu:b
89	2921	ʃ w t̲	jaʃu:t̲	to kick	maʃu:t̲
90	2923	ʃ w f	jaʃu:f	to see	maʃu:f
91	2925	ʃ w q	jaʃu:q	to yearn	maʃu:q
92	2926	ʃ w k	jaʃu:k	to be pierced with a thorn	maʃu:k
93	2925	ʃ w k	juʃa:k	to be pierced with a thorn	maʃu:k
94	2928	ʃ w l	jaʃu:l	to become high	maʃu:l
95	2938	ʃ j d	jaʃi:d	to build	maʃi:d
96	2941	ʃ j t̲	jaʃi:t̲	to burn	maʃi:t̲
97	2947	ʃ j l	jaʃi:l	to pick up	maʃi:l
98	2949	ʃ j n	jaʃi:n	to disgrace	maʃi:n
99	3073	s̲ w b	jas̲u:b	to be correct	mas̲u:b
100	3078	s̲ w r	jas̲u:r	to direct	mas̲u:r
101	3079	s̲ w ᶜ	jas̲u:ᶜ	to measure	mas̲u:ᶜ
102	3080	s̲ w ɣ	jas̲u:ɣ	to mold	mas̲u:ɣ
103	3082	s̲ w l	jas̲u:l	to assault	mas̲u:l
104	3087	s̲ w n	jas̲u:n	to protect	mas̲u:n
105	3089	s̲ j h̲	jas̲i:h̲	to scream	mas̲i:h̲
106	3089	s̲ j h̲	jus̲a:h̲	to scream	mas̲i:h̲
107	3090	s̲ j d	jas̲i:d	to hunt	mas̲i:d
108	3092	s̲ j r	jas̲i:r	to become	mas̲i:r
109	3095	s̲ j f	jas̲i:f	to stay in the summer	mas̲i:f
110	3152	d̲ w r	jad̲u:r	to be hungry	mad̲u:r
111	3156	d̲ j r	jad̲i:r	to harm	mad̲i:r
112	3159	d̲ j f	jad̲i:f	to host	mad̲i:f
113	3160	d̲ j q	jad̲i:q	to be narrow	mad̲i:q
114	3161	d̲ j m	jad̲i:m	to be unjust	mad̲i:m
115	3252	t̲ w h̲	jat̲u:h̲	to go astray	mat̲u:h̲
116	3258	t̲ w ᶜ	jat̲u:ᶜ	to obey	mat̲u:ᶜ
117	3259	t̲ w f	jat̲u:f	to go around	mat̲u:f
118	3260	t̲ w q	jat̲u:q	to bear	mat̲u:q
119	3261	t̲ w l	jat̲u:l	to reach	mat̲u:l
120	3294	t̲ j h̲	jat̲i:h̲	to go astray	mat̲i:h̲
121	3265	t̲ j r	jat̲i:r	to fly	mat̲i:r
122	3267	t̲ j ᶜ	jat̲i:ᶜ	to obey	mat̲i:ᶜ
123	3268	t̲ j f	jat̲i:f	to go around	mat̲i:f
124	3269	t̲ j q	jat̲i:q	to bear	mat̲i:q
125	3271	t̲ j n	jat̲i:n	to throw mud at	mat̲i:n
126	3489	ᶜ w dʒ	jaᶜu:dʒ	to contort	maᶜu:dʒ
127	3490	ᶜ w d	jaᶜu:d	to return	maᶜu:d

128	3491	ᶜ w ð	jaᶜu:ð	to seek protection	maᶜu:ð
129	3493	ᶜ w z	jaᶜu:z	to miss	maᶜu:z
130	3496	ᶜ w d	jaᶜu:d	to compensate	maᶜu:d
131	3497	ᶜ w q	jaᶜu:q	to be stopped	maᶜu:q
132	3498	ᶜ w l	jaᶜu:l	to be unjust	maᶜu:l
133	3500	ᶜ w m	jaᶜu:m	to float	maᶜu:m
134	3504	ᶜ j b	jaᶜi:b	to disfigure	maᶜi:b
135	3505	ᶜ j θ	jaᶜi:θ	to ravage	maᶜi:θ
136	3506	ᶜ j r	jaᶜi:r	to disgrace	maᶜi:r
137	3510	ᶜ j f	jaᶜa:f jaᶜi:f	to hate	maᶜi:f
138	3511	ᶜ j q	jaᶜi:q	to stop	maᶜi:q
139	6324	ɣ θ w	jaɣu:θ	to help	maɣu:θ
140	3625	ɣ w r	jaɣu:r	to fall in	maɣu:r
141	3628	ɣ w s	jaɣu:s	to dive	maɣu:s
142	3629	ɣ w t	jaɣu:t	to sink	maɣu:t
143	3631	ɣ w l	jaɣu:l	to destroy	maɣu:l
144	3633	ɣ j b	jaɣi:b	to speak ill of somebody to fall into a coma to absent oneself from	maɣi:b
145	3634	ɣ j θ	jaɣi:θ	to help	maɣi:θ
146	3636	ɣ j r	jaɣa:r	to be jealous	maɣi:r
147	3638	ɣ j t	jaɣi:t	to sink	maɣi:t
148	3642	ɣ j l	jaɣi:l	to harm	maɣi:l
149	3872	f w t	jafu:t	to pass	mafu:t
150	3882	f w z	jafu:z	to win	mafu:z
151	3890	f w q	jafu:q	to surpass	mafu:q
152	3900	f w h	jafu:h	to utter	mafu:h
153	4129	q w t	jaqu:t	to feed	maqu:t
154	4131	q w d	jaqu:d	to lead	maqu:d
155	4133	q w s	jaqu:s	to measure	maqu:s
156	4134	q w d	jaqu:d	to demolish	maqu:d
157	4137	q w f	jaqu:f	to follow	maqu:f
158	4141	q w l	jaqu:l	to speak	maqu:l
159	4145	q w m	jaqu:m	to stand up	maqu:m
160	4151	q j d	jaqi:d	to tie	maqi:d
161	4154	q j s	jaqi:s	to measure	maqi:s
162	4158	q j d	jaqi:d	to crack	maqi:d
163	4159	q j ð	jaqi:ð	to become hot	maqi:ð

164	4451	k w z	jaku:z	to drink from a jug	maku:z
165	4480	k j d	jaki:d	to deceive	maki:d
166	4487	k j l	jaki:l	to weigh	maki:l
167	4641	l w θ	jalu:θ	to dirty	malu:θ
168	4644	l w h	jalu:h	to appear	malu:h
169	4645	l w ð	jalu:ð	to escape	malu:ð
170	4649	l w z	jalu:z	to ask for protection	malu:z
171	4651	l w t	jalu:t	to cling to	malu:t
172	4653	l w ᶜ	jalu:ᶜ	to be impatient	maluːᶜ
173	4655	l w f	jalu:f	to chew	malu:f
174	4656	l w k	jalu:k	to chew	malu:k
175	4660	l w m	jalu:m	to blame	malu:m
176	4666	l j t	jali:t	to deprive from	mali:t
177	4675	l j q	jali:q	to be fit for	mali:q
178	4683	l j n	jail:n	to be flexible	mali:n
179	4974	m j d	jami:d	to sway	mami:d
180	4976	m j r	jami:r	to provide	mami:r
181	4977	m j z	jami:z	to distinguish	mami:z
182	4979	m j t	jami:t	to move away from	mami:t
183	4990	m j l	jami:l	to deviate from	mami:l
184	5265	n w ʔ	janu:ʔ	to burden	manu:ʔ
185	5266	n w b	janu:b	to be affected by to take place of to return	manu:b
186	5269	n w h	janu:h	to moan	manu:h
187	5271	n w r	janu:r	to illuminate	manu:r
188	5275	n w s	janu:s	to vacillate	manu:s
189	5276	n w ʃ	janu:ʃ	to take	manu:ʃ
190	5278	n w s	janu:s	to resort to	manu:s
191	5279	n w t	janu:t	to be dependent on	manu:t
192	5281	n w f	janu:f	to rise	manu:f
193	5284	n w l	janu:l	to get	manu:l
194	5285	n w m	jana:m	to sleep	manu:m
195	5291	n j b	jani:b	to be unfortunate	mani:b
196	5296	n j r	jani:r	to line up	mani:r
197	5303	n j l	jana:l	to achieve	mani:l
198	5480	h w d	jahu:d	to repent	mahu:d
199	5482	h w r	jahu:r	to collapse	mahu:r

200	5486	h w l	jahu:l	to fear	mahu:l
201	5488	h w n	jahu:n	to be easy	mahu:n
202	5492	h j ʔ	jaha:ʔ	to look good	mahi:ʔ
203	5494	h j b	jaha:b jahi:b	to fear	mahi:b
204	5496	h j dʒ	jahi:dʒ	to be agitated	mahi:dʒ
205	5510	h j d	jahi:d	to break	mahi:d
206	5514	h j l	jahi:l	to disseminate	mahi:l
207	5517	h j m	jahi:m	to wander to be thirsty	mahi:m

Table 3. Finally-weak passive participles of the pattern ma+C_1C_2u:C_3

Number	Dictionary entry number	Consonantal root	Imperfective verb	Gloss	Passive participle
1	43	ʔ b w	jaʔbu:	to become a father	maʔbuww
2	45	ʔ b j	jaʔba:	to refuse	maʔbijj
3	56	ʔ t j	jaʔti:	to come	maʔtijj
4	83	ʔ x w	jaʔxu:	to have a brother	maʔxuww
5	178	ʔ s w	jaʔsu:	to comfort	maʔsuww
6	179	ʔ s j	jaʔsa:	to feel sorry	maʔsijj
7	179	ʔ s j	jaʔsi:	to heal	maʔsijj
8	253	ʔ l w	jaʔlu:	to weaken	maʔluww
9	522	b d w	jabdu:	to appear	mabduww
10	605	b r j	jabri:	to sharpen	mabrijj
11	689	b ɣ j	jabɣi:	to be unjust to want	mabɣijj
12	703	b q j	jabqa:	to stay	mabqijj
13	713	b k j	jabki:	to cry	mabkijj
14	751	b l w	jablu:	to test	mabluww
15	789	b n j	jabni:	to build	mabnijj
16	803	b h w	jabhu:	to look beautiful	mabhuww
17	985	t l w	jatlu:	to follow to recite	matluww
18	1078	θ n j	jaθni:	to bend	maθnijj
19	1110	dʒ b w	jadʒbu:	to collect	madʒbuww
20	1111	dʒ b j	jadʒbi:	to collect	madʒbijj
21	1172	dʒ z j	jadʒzi:	to recompense	madʒzijj
22	1197	dʒ f w	jadʒfu:	to harden	madʒfuww

23	1214	dʒ l w	jadʒlu:	to rinse	madʒluww
24	1245	dʒ n j	jadʒni:	to commit a crime to gather	madʒnijj
25	1328	h̲ θ w	jah̲θu:	to throw	mah̲θuww
26	1329	h̲ θ j	jah̲θi:	to throw	mah̲θijj
27	1337	h̲ dʒ w	jah̲dʒu:	to be wise	mah̲dʒuww
28	1347	h̲ d w	jah̲du:	to sing for camels to follow	mah̲duww
29	1355	h̲ ð w	jah̲ðu:	to imitate	mah̲ðuww
30	1378	h̲ r w	jah̲ru:	to be advisable for	mah̲ruww
31	1397	h̲ s w	jah̲su:	to sip	mah̲suww
32	1404	h̲ ʃ w	jah̲ʃu:	to stuff	mah̲ʃuww
33	1425	h̲ ð̲ w	jah̲ð̲a:	to have	mah̲ð̲ijj
34	1434	h̲ f w	jah̲fu:	to give generously	mah̲fuww
35	1434	h̲ f w	jah̲fa:	to walk barefoot	mah̲fijj
36	1446	h̲ k j	jah̲ki:	to talk	mah̲kijj
37	1459	h̲ l w	jah̲lu:	to be sweet	mah̲luww
38	1459	h̲ l w	jah̲la:	to be sweet	mah̲lijj
39	1477	h̲ m j	jah̲mi:	to protect put someone on a diet to be hot	mah̲mijj
40	1493	h̲ n w	jah̲nu:	to feel compassion for	mah̲nuww
41	1494	h̲ n j	jah̲ni:	to bend	mah̲nijj
42	1624	x ʃ j	jaxʃa:	to fear	maxʃijj
43	1632	x s̲ j	jaxs̲a:	to be castrated	maxs̲ijj
44	1657	x f w	jaxfa:	to be hidden	maxfijj
45	1658	x f j	jaxfi:	to hide	maxfijj
46	1673	x l w	jaxlu:	to be empty to be devoted to	maxluww
47	1696	x n w	jaxnu:	to use impolite language	maxnuww
48	1697	x n j	jaxni:	to use impolite language	maxnijj
49	1753	d h̲ w	jadh̲u:	to flatten	madh̲uww
50	1754	d h̲ j	jadh̲i:	to flatten	madh̲ijj
51	1803	d ᶜ w	jadᶜu:	to call	madᶜuww

52	1840	d l w	jadlu:	to express one's opinions	madluww
53	1863	d n w	jadnu:	to get closer	madnuww
54	1876	d h w	jadhu:	to be experienced by	madhuww
55	1878	d h j	jadha:	to be experienced by	madhijj
56	1958	ð r w	jaðru:	to disperse	maðruww
57	1959	ð r j	jaðri:	to disperse	maðrijj
58	1969	ð k w	jaðku:	to immolate	maðkuww
59	2032	r b w	jarbu:	to increase	marbuww
60	2032	r b w	jarba:	to grow	marbijj
61	2045	r θ w	jarθu:	to commemorate	marθuww
62	2046	r θ j	jarθi:	to commemorate	marθijj
63	2059	r dʒ w	jardʒu:	to hope	mardʒuww
64	2066	r h̲ w	jarh̲u:	to cause to revolve	marh̲uww
65	2067	r h̲ j	jarh̲i:	to grind	marh̲ijj
66	2104	r s w	jarsu:	to moor	marsuww
67	2112	r ʃ w	jarʃu:	to bribe	marʃuww
68	2124	r d̲ w	jard̲a:	to be satisfied	mard̲uww
69	2140	r ᶜ j	jarᶜa:	to herd sheep to care for	marᶜijj
70	2160	r f w	jarfu:	to get married	marfuww
71	2171	r q j	jarqi:	to recite Quran over someone for healing and protection	marqijj
72	2171	r q j	jarqa:	to advance	marqijj
73	2196	r m j	jarmi:	to throw	marmijj
74	2206	r n w	jarnu:	to look forward to	marnuww
75	2274	z dʒ w	jazdʒu:	to push gently	mazdʒuww
76	2369	z h w	jazhu:	to be arrogant	mazhuww
77	2434	s b j	jasbi:	to imprison	masbijj
78	2454	s dʒ w	jasdʒu:	to cover	masdʒuww
79	2466	s h̲ w	jash̲u:	to dredge	mash̲uww
80	2466	s h̲ j	jash̲a:	to dredge	mash̲ijj

81	2474	s x w	jasxu:	to become generous	masxuww
82	2475	s x j	jasxa:	to become generous	masxijj
83	2509	s r w	jasru:	to remove	masruww
84	2511	s r j	jasri:	to walk	masrijj
85	2520	s t̲ w	jast̲u:	to assail	mast̲uww
86	2527	s ᶜ j	jasᶜa:	to strive to betray	masᶜijj
87	2545	s f j	jasfa:	to disperse	masfijj
88	2554	s q j	jasqi:	to give someone a drink	masqijj
89	2590	s l w	jaslu:	to forget	masluww
90	2590	s l w	jasla:	to cause to forget	maslijj
91	2618	s m w	jasmu:	to rise up	masmuww
92	2652	s n w	jasnu:	to lighten	masnuww
93	2652	s n j	jasna:	to lighten	masnijj
94	2658	s h w	jashu:	to forget	mashuww
95	2760	ʃ t w	jaʃtu:	to rain	maʃtuww
96	2766	ʃ dʒ w	jaʃdʒu:	to become sad	maʃdʒuww
97	2766	ʃ dʒ w	jaʃdʒa:	to become sad	maʃdʒijj
98	2788	ʃ d w	jaʃdu:	to sing	maʃduww
99	2813	ʃ r j	jaʃri:	to buy	maʃrijj
100	2858	ʃ f j	jaʃfa:	to heal	maʃfijj
101	2858	ʃ f j	juʃfa:	to heal	maʃfijj
102	2866	ʃ q w	jaʃqu:	to be distressed	maʃquww
103	2873	ʃ k w	jaʃku:	to complain	maʃkuww
104	2875	ʃ k j	jaʃki:	to complain	maʃkijj
105	2915	ʃ h w	jaʃhu:	to love	maʃhuww
106	2915	ʃ h w	jaʃha:	to love	maʃhijj
107	2969	s̲ b w	jas̲bu:	to long for	mas̲buww
108	2970	s̲ b j	jas̲ba:	to act boyishly	mas̲bijj
109	3010	s̲ ɣ w	jus̲ɣu:	to decline from	mas̲ɣuww
110	3011	s̲ ɣ j	jas̲ɣa:	to decline from	mas̲ɣijj
111	3020	s̲ f w	jas̲fu:	to be pure	mas̲fuww
112	3039	s̲ l j	jas̲li:	to be tortured	mas̲lijj
113	3126	d̲ r j	jad̲ra:	to fight hard	mad̲rijj
114	3184	t̲ h̲ w	jat̲h̲u:	to flatten	mat̲h̲uww
115	3217	t̲ f w	jat̲fu:	to float	mat̲fuww
116	3030	t̲ l j	jat̲li:	to paint	mat̲lijj

117	3248	t̲ h w	jat̲hu:	to cook	mat̲huww
118	3249	t̲ h j	jat̲ha:	to cook	mat̲hijj
119	3330	ᶜ d w	jaᶜdu:	to run to be unjust	maᶜduww
120	3355	ᶜ r w	jaᶜru:	to befall	maᶜruww
121	3367	ᶜ z w	jaᶜzu:	to be ascribed to	maᶜzuww
122	3368	ᶜ z j	jaᶜzi:	to be ascribed to	maᶜzijj
123	3384	ᶜ ʃ w	jaᶜʃu:	to be night-blind	maᶜʃuww
124	3395	ᶜ s̲ j	jaᶜs̲a:	to disobey	maᶜs̲ijj
125	3419	ᶜ f w	jaᶜfu:	to be removed to forgive	maᶜfuww
126	3419	ᶜ f w	jaᶜfa:	to be left for	maᶜfuww
127	3449	ᶜ l w	jaᶜlu:	to be high	maᶜluww
128	3451	ᶜ l j	jaᶜla:	to rise	maᶜlijj
129	3462	ᶜ m j	jaᶜma:	to be blind	maᶜmijj
130	3482	ᶜ n w	jaᶜnu:	to take by force	maᶜnijj
131	3482	ᶜ n w	jaᶜnu:	to submit to	maᶜnuww
132	3484	ᶜ n j	jaᶜna:	to pay attention to to be exhausted	maᶜnijj
133	3527	ɣ b j	jaɣba:	to be stupid	maɣbijj
134	3531	ɣ θ j	jaɣθi:	to feel sick	maɣθijj
135	3531	ɣ θ j	jaɣθa:	to feel sick	maɣθijj
136	3531	ɣ θ j	jaɣθa: jaɣθi:	to talk a lot	maɣθijj
137	3538	ɣ d w	jaɣdu:	to become	maɣduww
138	3540	ɣ ð w	jaɣðu:	to feed	maɣðuww
139	3559	ɣ r w	jaɣru:	to glue	maɣruww
140	3559	ɣ r w	jaɣri:	to love	maɣrijj
141	3559	ɣ r w	jaɣra:	to love	maɣrijj
142	3565	ɣ z w	jaɣzu:	to invade	maɣzuww
143	3571	ɣ ʃ j	jaɣʃa:	to darken to come upon to faint	maɣʃijj
144	3603	ɣ l w	jaɣlu:	to be excessive	maɣluww
145	3604	ɣ l j	jaɣli:	to boil	maɣlijj
146	3615	ɣ m j	jaɣma:	to faint	maɣmijj
147	3622	ɣ n j	jaɣna:	to become rich	maɣnijj
148	3714	f d j	jafdi:	to sacrifice	mafdijj
149	3761	f r j	jafri:	to lie	mafrijj
150	3845	f l w	jaflu:	to delouse	mafluww
151	3848	f l j	jafli:	to delouse	maflijj
152	3863	f n j	jafna:	to perish	mafnijj

153	3945	q b w	jaqbu:	to bend	maqbuww
154	4007	q r w	jaqru:	to follow	maqruww
155	4008	q r j	jaqri:	to host	maqrijj
156	4021	q s w	jaqsu:	to be harsh	maqsuww
157	4042	q s̲ w	jaqs̲u:	to become distant	maqs̲uww
158	4042	q s̲ w	jaqs̲a:	to become distant	maqs̲ijj
159	4046	q d̲ j	jaqd̲i:	to judge	maqd̲ijj
160	4073	q f w	jaqfu:	to follow	maqfuww
161	4089	q l j	jaqli:	to fry	maqlijj
162	4089	q l j	jaqla:	to hate	maqlijj
163	4121	q n w	jaqnu:	to become red	maqnuww
164	4224	k b w	jakbu:	to fall	makbuww
165	4342	k s w	jaksu:	to sheathe	maksuww
166	4372	k f j	jakfi:	to have enough	makfijj
167	4428	k n j	jakna:	to call	maknijj
168	4428	k n j	jakni:	to imply	maknijj
169	4603	l q j	jalqa:	to encounter	malqijj
170	4634	l h w	jalhu:	to be amused	malhuww
171	4634	l h w	jalhu:	to be distracted	malhijj
172	4634	l h w	jalha:	to divert from	malhijj
173	4754	m h̲ w	jamh̲u:	to remove	mamh̲uww
174	4756	m h̲ j	jamh̲i:	to erase	mamh̲ijj
175	4769	m d j	jamdi:	to stab	mamdijj
176	4808	m r j	jamri:	to be ungrateful	mamrijj
177	4838	m ʃ j	jamʃi:	to walk	mamʃijj
178	4848	m d̲ j	jamd̲i:	to go away	mamd̲ijj
179	4848	m d̲ j	jamd̲i:	to sign	mamd̲ijj
180	4927	m n w	jamnu:	to test	mamnuww
181	4928	m n j	jamna:	to test	mamnijj
182	4999	n ʔ j	janʔa:	to be distant	manʔijj
183	5026	n b w	janbu:	to be inconsistent with to turn away from	manbuww
184	5055	n dʒ w	jandʒu:	to survive to make a secret conversation	mandʒuww
185	5066	n h̲ w	janh̲u:	to head for	manh̲uww
186	5103	n z w	janzu:	to need	manzuww
187	5116	n s w	jansu:	to leave	mansuww

188	5117	n s j	jansa:	to forget	mansijj
189	5133	n ʃ w	janʃa:	to get drunk	manʃijj
190	5142	n s̲ w	jans̲u:	to catch from the forelock	mans̲uww
191	5150	n d̲ w	jand̲u:	to undress	mand̲uww
192	5172	n ᶜ j	janᶜa:	to announce the death of someone	manᶜijj
193	5200	n f j	janfi:	to deny	manfijj
194	5235	n k j	janka:	to defeat	mankijj
195	5248	n m w	janmu:	to grow	manmuww
196	5250	n m j	janmi:	to increase	manmijj
197	5264	n h j	janha:	to prevent	manhijj
198	5366	h dʒ w	jahdʒu:	to satirize	mahdʒuww
199	5379	h d j	jahdi:	to guide	mahdijj
200	5383	h ð j	jahði:	to ramble	mahðijj
201	5399	h r w	jahru:	to hit with a baton	mahruww
202	5402	h r j	jahri:	to wear out clothes	mahrijj
203	5429	h f w	jahfu:	to be mistaken	mahfuww
204	5464	h m j	jahmi:	to wander	mahmijj

Table 4. Doubly-weak passive participles of the pattern ma+$C_1C_2u:C_3$

Number	Dictionary entry number	Consonantal root	Imperfective verb	Gloss	Passive participle
1	372	ʔ w j	jaʔwi:	to accommodate	maʔwijj
2	1083	θ w j	jaθwi:	to settle	maθwijj
3	1514	h̲ w j	jah̲wi:	to include	mah̲wijj
4	2241	r w j	jarwi:	to quench to narrate	marwijj
5	2385	z w j	jazwi:	to dismiss	mazwijj
6	2686	s w j	jaswa:	to draw oneself up	maswijj
7	2932	ʃ w j	jaʃwi:	to barbeque	maʃwijj
8	3155	d̲ w j	jadwi:	to join	mad̲wijj
9	3262	t̲ w j	jat̲wi:	to fold	mat̲wijj
10	3632	ɣ w j	jaɣwi:	to deviate from what is right	maɣwijj
11	4147	q w j	jaqwa:	to become strong	maqwijj
12	4477	k w j	jakwi:	to burn	makwijj

13	4664	l w j	jalwi:	to bend	malwijj
14	5289	n w j	janwi:	to intend	manwijj
15	5490	h w j	jahwi:	to fall	mahwijj
16	5490	h w j	jahwa:	to love	mahwijj
17	5564	w h̲ j	jah̲i:	to inspire	mawh̲ijj
18	5574	w d j	jadi:	to perish	mawdijj
19	5646	w ᶜ j	jaᶜi:	to enclose	mawᶜijj
20	5655	w f j	jafi:	to fulfill	mawfijj
21	5687	w l j	jali:	to come close	mawlijj