

## **Causatives in Moroccan Arabic: Towards a Unified Syntax-Prosody**

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This paper explores the nature of the post-syntactic operations responsible for the representations of linear order of terminal nodes. In particular, it argues in favor of a unified model of the morphosyntax and morphophonology, wherein the theory of Distributed Morphology and Optimality theory operate in a single grammar. The testing ground is an investigation of the formation of morphological causatives in Moroccan Arabic. Herein, the process realizing causatives is morphological gemination, whereby the second consonant of the root is doubled. Investigating the question of what triggers the infixal process, we argue against the linearization algorithm suggested in Embick & Noyer (2001), Embick & Marantz (2006), and Embick (2006, 2010). Instead, the claim we defend here is that the onus of the linearization process falls on the prosody in Arabic, the central assumption being that the morphosyntactic structure, the output of the syntactic derivation, is the input to OT morphophonological constraints. These constraints are responsible for the linearization of the terminal nodes of the syntactic derivation.

**Keywords:** Distributed Morphology; Optimality Theory; causatives; Nonconcatenative morphology; linearization.

### **1. Introduction**

The issue of linearization, especially the problem of how morphemes are linearized with respect to the root, is a central issue in Distributed Morphology (DM). Central to DM is the assumption that phonological exponents are conceived of as the outcome of the syntactic derivation, the output of which are morphosyntactic representations. The empirical question herein is how the generated phonological exponents are linearized. Exploring this issue, the present paper is a contribution to this line of research, with the basic claim being that by not appealing to prosody, DM appears to miss essential generalizations and makes wrong predictions. This problem stems from the fact that the theory invokes complex syntax-like machinery that is susceptible to criticism as far as nonconcatenative morphology is concerned. It reduces a number of operations to the detriment of creating more technical complexities. Unquestionably, this narrows down its descriptive as well as explanatory power.

We support our claim by investigating the formation of morphologically-derived causatives in Moroccan Arabic (MA). The process involved in realizing causatives is morphological gemination, wherein the second consonant of the root is doubled. The paradigm in (1) illustrates this process:

(1)

<i>Perfective</i>	<i>Causative Forms</i>	
ktəb	kəttəb	‘to write’
fiɾəb	fiərrəb	‘to run away’
ʃrəb	cərrəb	‘to drink’
xrəʒ	xərrəʒ	‘to go out’
lʁəb	ləʁrəb	‘to play’

As it stands, causativization is uniformly formed via geminating the second consonant of the base. The problem here is why the causative morpheme, being an infix, always skips the first consonant of the root, copying the phonological features of the second consonant. In this paper, we will see how this issue is analyzed in two frameworks, namely DM (Halle and Marantz, 1993, 1994) and Optimality Theory (OT) (Prince and Smolensky, 1993; McCarthy and Prince, 1993, 1999 and related work). In particular, we will show that the linearization algorithm suggested in DM misses interesting generalizations and makes wrong predications. As an alternative, the model we suggest is a grammar in which DM and OT interact, drawing from insights laid down in the literature (Haugen, 2008, 2011; Tucker, 2010, 2011). The central assumption advanced herein is that the morphosyntactic structure, the output of the syntactic derivation, is the input to morphophonological constraints. These constraints are responsible for the linearization of the terminal nodes of the syntactic derivation. The advantage of this model is that it does not only show that a theory where DM and OT interact in a single grammar fares better in accounting for a wide array of data, as one of the advantages of OT grammar is that it does not only predicts that morphology and prosody interact in a single hierarchy, but it also circumvents the problems that DM generates.

This paper is structured as follows. Section 2 presents the morphosyntactic properties of morphological causatives in MA and how they are built how in the clausal syntax. In section 3, we show how the causative morpheme is linearized using Local Dislocation. This section also shows the inadequacy of this linearization algorithm. Section 4 presents our suggested model, with fleshing out our basic analysis. Finally, in section 5, we conclude with showing the advantages of combining both DM and OT in a single model.

## 2. The Morphosyntax of Morphological Causatives

This section presents how morphologically-derived causatives are built in the clausal syntax. A characteristic of morphological causatives in MA is that the causative morpheme functions as a transivizer for intransitive verbs (2-a) and a ditransivizer for transitive verbs (2-c), for the evident reason that it adds an argument to the verbal argument structure, hence its status as a valency-increasing morpheme<sup>1</sup>. The following examples are a case in point:

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<sup>1</sup> For the morphosyntax of causatives in MA, see Benmamoun (1991) and Loutfi (2013, 2015).

(2)

- a. Ayoub xɾəʒ  
Ayoub went out-3sg  
'Ayoub went out'
- b. Ayoub xərrəʒ ddrari.  
Ayoub CAUSE-went-out-3sg the-children  
'Ayoub made the children go out'
- c. d-dərri lʕəb l-kura  
the-boy played-3sg the-ball  
'The boy played football'
- d. ʒamal ləʕʕəb d-dərri l-kura  
Jamal CAUSE-Played-3sg the-boy the-boy  
'Jamal made the boy play football'

In this study, we adopt the morphosyntactic assumptions assumed in the framework of DM. Being a syntactic approach, DM alongside approaches referred to in the literature as the *Constructionist approaches*<sup>2</sup> assume that verbal argument structure is largely determined by the syntactic structure in which a verb appears. For this reason, in this study we follow Loutfi (2013, 2015, in preparation) in assuming that causative verbs in Arabic instantiate a tripartite structure in which the traditional VP trifurcates into three functional heads. These heads are VoiceP, light *v* and the  $\sqrt{\text{Root}}$ <sup>3</sup>. On this view, external and internal arguments are severed from the verb (Borer, 2005b; Ramchand, 2008; Marantz, 2013; Lohndal, 2014, amongst others). Here, the causative morpheme is represented as the  $\text{Affix}_{\text{CAUSE}\mu}$ . This suggests that the causative morpheme is a bare mora affix whose phonological materials are copied from the second radical consonant of the root. This explains why the phonological material of this affix varies as the second consonant of the root varies. The suggested syntactic tree is in (3) below. This tree is sent over to Spell-Out for Vocabulary Insertion:

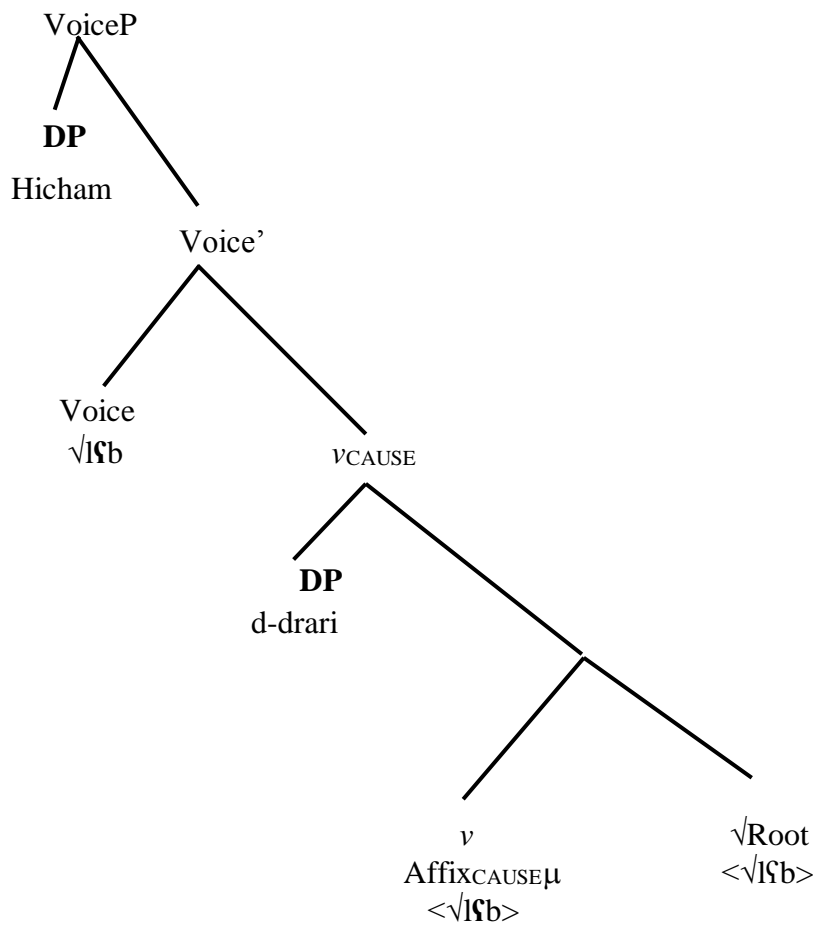
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<sup>2</sup> See Marantz (2013) for a discussion of the Projectionist-Constructionist debate. See Loutfi (in preparation) for arguments that support the syntactic approach to argument structure.

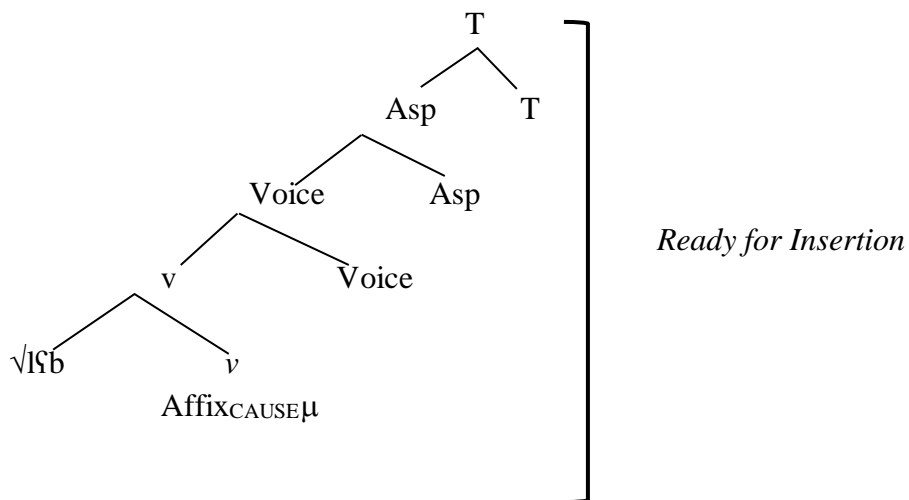
<sup>3</sup> The status of  $\sqrt{\text{ROOT}}$  as a head is not as clear, for the evident reason that it contains no category information; as such, there is no way they can serve as syntactic labels, capable of licensing/theta-assigning theta-roles. Whether  $\sqrt{\text{ROOT}}$  is computed as a pure syntactic head or as a modifier of their categorizer is in essence an empirical issue. See Harley (2014), Acquaviva (2008), Embick (2010), and Lohndal (2014). See Loutfi (in preparation) for a discussion on the basis of the Arabic verbal system.

(3)

a. **The Syntactic Structure of Morphological Causatives in Arabic**



b. **Output Hierarchical Representation**



As shown in (3-b), the suggested syntactic heads, i.e. Voice and light *v* along with the  $\sqrt{\text{Root}}$  get together into a single complex head via the process of head movement, in which the

√Root moves in a successive cyclic fashion via light *v* and Voice, and possibly to Aspect and Tense<sup>4</sup>. What is puzzling is how these heads are linearized with respect to each other deriving the correct linear order, excluding forms such as \*lǝʕǝb, \*lǝʕǝbb. This issue is discussed in the following section.

### 3. Local Dislocation and Linearization

The generative lexicon<sup>5</sup> being absent, DM admits the existence of several post-syntactic operations that can modify terminal nodes. These operations are triggered by language-particular requirements that minimally modify the output of the syntactic structure. Of these processes, there are impoverishment, fusion and fission. Of interest to the present study is the issue of how the linearization of phonological exponents takes place. Following proposals in the literature of DM (Embick & Noyer, 2001; Embick & Marantz, 2006; Embick, 2006, 2010), linearization is the result of the morphological operation Local Dislocation. This process is a type of Morphological Merger, which is defined in Marantz (1988: 261), adopted from Embick & Noyer (2001: 561), as:

*At any level of syntactic analysis (D-Structure, S-Structure, phonological structure), a relation between X and Y may be replaced (expressed by) the affixation of the lexical head of X to the lexical head of Y.*

Succinctly stated, Morphological Merger is a type of a postsyntactic head movement process whose task is to move heads from one structural position to another for language-specific reasons. This type of Merger<sup>6</sup> applies after Vocabulary Insertion. Along the same basic lines, Embick and Noyer (2001) make a distinction between two morphological objects, principally morphosyntactic words (MWd) and subwords (SWd), each of which displays distinct behavior and complies with distinct locality effects. The two are defined as follows:

(4)

**MWd:** A node  $X^0$  is (by definition) a morphosyntactic word (MWd) iff  $X^0$  is the highest segment of an  $X^0$  not contained in another  $X^0$ .

**SWd:** A node  $X^0$  is a subword (SWd) if  $X^0$  is a terminal node and not an MWd.

(Embick and Noyer, 2001: 574)

A SWd represents the terminal nodes and so it immediately dominates a single feature bundle and nothing else, while an MWd is the highest segment which is neither contained nor

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<sup>4</sup> See Rahhali and Souali (1997), Benmamoun (2000) and Aoun *et al.* (2010) for some aspects of verb movement in Arabic.

<sup>5</sup> Lexicalist Approaches assume a particular architectural grammar, wherein there are two generative engines responsible for the derivation and the formation of basic linguistic units, each of which with its own its distinct mechanisms and primitives. This assumption is abandoned in DM. Instead, all derivation of complex objects, be they words, phrases or sentences, are expected to be derived via the rules of syntax (Merge and Move). Under such a view, morphology, as is traditionally conceptualized, operates over multiple points in the derivation. Its characteristics in this sense are distributed, taking place at several stages in the grammar, hence the term distributed.

<sup>6</sup> Another type of Merger is Lowering. This operation is required to join two syntactic terminals that are phonological spelled out together but not joined in syntax (Embick & Noyer, 2001: 561).

dominated by any other segment. These morphological objects are viewed as the basic atoms of postsyntactic movement operations. Roughly speaking, the distinction between MWd and SWd corresponds to the distinction between heads and phrases, respectively. Furthermore, both of these objects are moved by Local Dislocation. However, a restriction is imposed on the application of Local Dislocation in that MWd adjoins only to an adjacent MWd, and the same applies to SWd, a structure preservation effect. The principle capturing this fact is referred to as Typed Linearization, stated as follows:

- (5) **TYPING ASSUMPTION ON LD:** M-Words only dislocate with adjacent M-Words, and Subwords with Subwords.

(Embick, 2006: 4)

To see how the LD mechanism works, consider the derivation of the following sentence:

- (6)
- a. Hicham ləʃʃəb d-drari  
Hicham CAUSE-played-3ms the-boys  
'Hicham made the boys play'
  - b. {[T +past, +NOM], [Asp +Perfective], [D +3rd Singular Masculine, u-Case], [Voice] [<sub>v</sub> CAUSE<sub>μ</sub>, +ACC], [D 3rd Singular, u-Case, √{ʃb}]}

The syntax merges and moves all the feature bundles in the Numeration to create the syntactic tree in (3-a) below, in which all uninterpretable features have been properly checked. As the structure in (3-a) above suggests, the subject in this derived syntactic tree precedes the verb, which, in turn, precedes its complement. By the same reasoning, the definite article in the DP internal arguments precedes the nominal expression. In DM, the linear order is taken to be a PF process. In Embick and Noyer (2007) and Embick (2006, 2010), the linear order is a binary operator, formally represented by ‘\*’ read as “*it is left-adjacent to*”. Another binary operator is suggested whose task is to encode immediate precedence and concatenate terminal nodes. This binary operator is indicated by ‘ $\frown$ ’. Affixation, namely SWd affixation, is represented by  $\oplus$ . The last operator is the one that chains the concatenated elements into a linear representation. For the sentence above, the following linear representation is generated:

- (7)
- a. Linear relations by \*: (DP\*V), (V\*DP), (D\*NP)
  - b. Linear relations by  $\frown$ : D $\frown$ V, V $\frown$ D, D $\frown$ N
  - c. Chained: D-V-D-N

Assuming that these procedures that linearize MWd are correct, Local Dislocation that linearizes SWd is problematic. Data of nonconcatenative morphology constitutes a vexing analytical challenge to any theory that assumes linear, one-to-one, operations. This state of affairs stems from the fact Arabic is a language where a great portion of its morphology is not the result of the concatenation of adjacent morphemes, i.e. morphemes of immediate precedence in the sense of Embick (2006, 2010). Instead, the language also appears to make

use of discontinuous morphemes. By way of illustration, the so-called passive participles are derived by both prefixation of the morpheme {m-} and sporadically involve the infixation of the vowel {-u-}, as seen in (8) below:

(8)

<b>məqtul</b>	‘killed’
<b>məktub</b>	‘written’
<b>məhlul</b>	‘open’
<b>məDrub</b>	‘hit’

As it stands, this discontinuous morpheme /m...u/ is attached to the same morphosyntactic head. In a similar vein, Arabic realizes the feature of tense, aspect, and voice by the same morpheme, i.e. in the vocalic melody (see e.g. McCarthy, 1975 and Tucker, 2010). Following the formalism that accounts for linearization presented above, the problem that arises is how consonants and vowels are placed in the correct linear order. For the formation of morphological causatives in MA, this linearization would proceed as follows:

(9)

- a. [ $\sqrt{\text{ʃb}} \oplus \text{vCAUSE} \oplus \text{Asp}^0$ ] (Complex head- Output of Syntax)
- b. [ $\sqrt{\text{ʃb}} \oplus \text{AffixCAUSE}\mu \oplus \emptyset$ ] (Insertion of Vocabulary Items)
- c. [ $[-\text{AffixCAUSE}\mu\text{-ʃb} + \emptyset]$ ] (Local dislocation of  $\text{AffixCAUSE}$  and  $\sqrt{\text{dab}}$ )
- d. [ $\text{[əʃʃəb]}$ ] (Phonological content of  $\text{AffixCAUSE}$  computed by copying from the base)

Although the correct surface form of forms like these is derived, the theory seems to miss a number of generalizations and phonological regularities in the language. The analysis of the causative data reveals that DM does predict the position of the causative morpheme with respect to the root via Local Dislocation, but it still leaves unanswered the question of why the morpheme appears next to the second consonant of the root.

Another complication arises when we consider more data from Arabic. As has been pointed out, Arabic verbs are structured around a discontinuous root consisting of consonants only. The problem arises when we consider the possibility that, as argued in Bahloul (2008: 31), each vowel carries its own semantic features. For Bahloul, the first vowel in the perfective forms in (10) encodes the aspect-tense properties. The second vowel describes the verb’s valance. As shown in (10), the vowel /a/ appears with transitive verbs, /u/ appears with passive verbs, and /i/ occurs with psychological predicates.

(10)

- a. **DaRab-a** ‘hit’  
**kaSSar-a** ‘break’  
**katab-a** ‘write’
- b. **kabur-a** ‘to become big’  
**qaSur-a** ‘to become short’  
**karum-a** ‘to be noble’
- c. **fariḥ-a** ‘to become happy’  
**Dahik-a** ‘to laugh’  
**karih-a** ‘to hate’

Finally, the vowel that always appears as a suffix is considered to be an agreement morpheme. This is illustrated in the following examples:

(11)

- a. katab-**a**  
wrote-3ms
- b. katab-**u**  
wrote-3pm
- c. katab-**na**  
wrote-1pm/f

As Tucker (2010) points out, the linearization algorithm, that the process of Local Dislocation incarnates, suffers from overgeneration in that there are several possibilities that the system would generate. Considering the linearization of vowels alone, this would give us at least the following possible linearizations<sup>7</sup>:

(12)

- a. V<sub>1</sub> V<sub>2</sub> V<sub>3</sub>
- b. V<sub>2</sub> V<sub>1</sub> V<sub>3</sub>
- c. V<sub>3</sub> V<sub>2</sub> V<sub>1</sub>
- d. V<sub>1</sub> V<sub>3</sub> V<sub>2</sub>
- e. V<sub>2</sub> V<sub>3</sub> V<sub>1</sub>

To constrain the phonological shape of the different forms in Arabic and circumvent the problems described in (12) above, templates have been proposed (McCarthy, 1979, 1981; McCarthy and Prince, 1993, 1995). In the cases at hand, these templates stipulate the position of vowels and consonants. Arad (2003, 2005), for example, argues that templatic properties are encoded in the categorizing head *v*. Vocalic materials, on the other hand, are the spell out of Voice. However, there are evidence from MSA and MA that casts doubt on the existence of templates. First, since different verbs correspond to different templates, these templates seem to encode information on a verb's argument structure. This said, however, the templatic pattern alone does not suffice to identify morphological causatives in MA, as there are verbs whose templates resemble that of causatives as in (13), but they do not exhibit the properties that morphologically-derived causatives do. This evident as this class of verbs does not alternate, as in (14).

(13)

fəlləh	'Agriculture'
səlləf	'lend'
wəlləf	'get used to'
Təlləq	'divorce'
Sərrəf	'Exchange'

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<sup>7</sup> A possible analysis is to argue that these heads may observe the Mirror Principle. The bulk of the data in Arabic shows evidence to the contrary. See Loutfi (in preparation) for a discussion along these lines.



(14)

- a. Hicham Səlləf (\*Ayoub)  
Hicham lent-3ms  
'Hicham lent Ayoub money'
- b. Abdullah sərrəf \*(1-flus)  
Abdullah gave-change-3ms the-money  
'Abdullah gave change'

As shown in the examples in (2) above, the causative morpheme functions as a valency-increasing morpheme. For present purposes, this amounts to say that the causative template CVCCVC augments the argument structure of the verb. This assumption is not borne out, however, as the examples in (14) demonstrate. Note also that it is hard to motivate the claim that gemination in these words is underlying, for the evident reason that their nominal counterparts seem to be realized with a singleton, as the forms below show:

(15)

<i>Nouns</i>	<i>Verbs</i>	
flaha	fəlləh	'Agriculture'
səlf	səlləf	'lend'
wəlf	wəlləf	'get used to'
Tlaq	Təlləq	'divorce'
Sərf	Sərrəf	'Exchange'

The second problem comes from MA, in which the postulation of templates means that schwas would be associated with V-slots. This would treat schwas on a par with full vowels, contrary to fact. In MA, schwas are epenthesized between an unsyllabified CC sequence (Benhallam, 1990a; Boudlal, 2001).

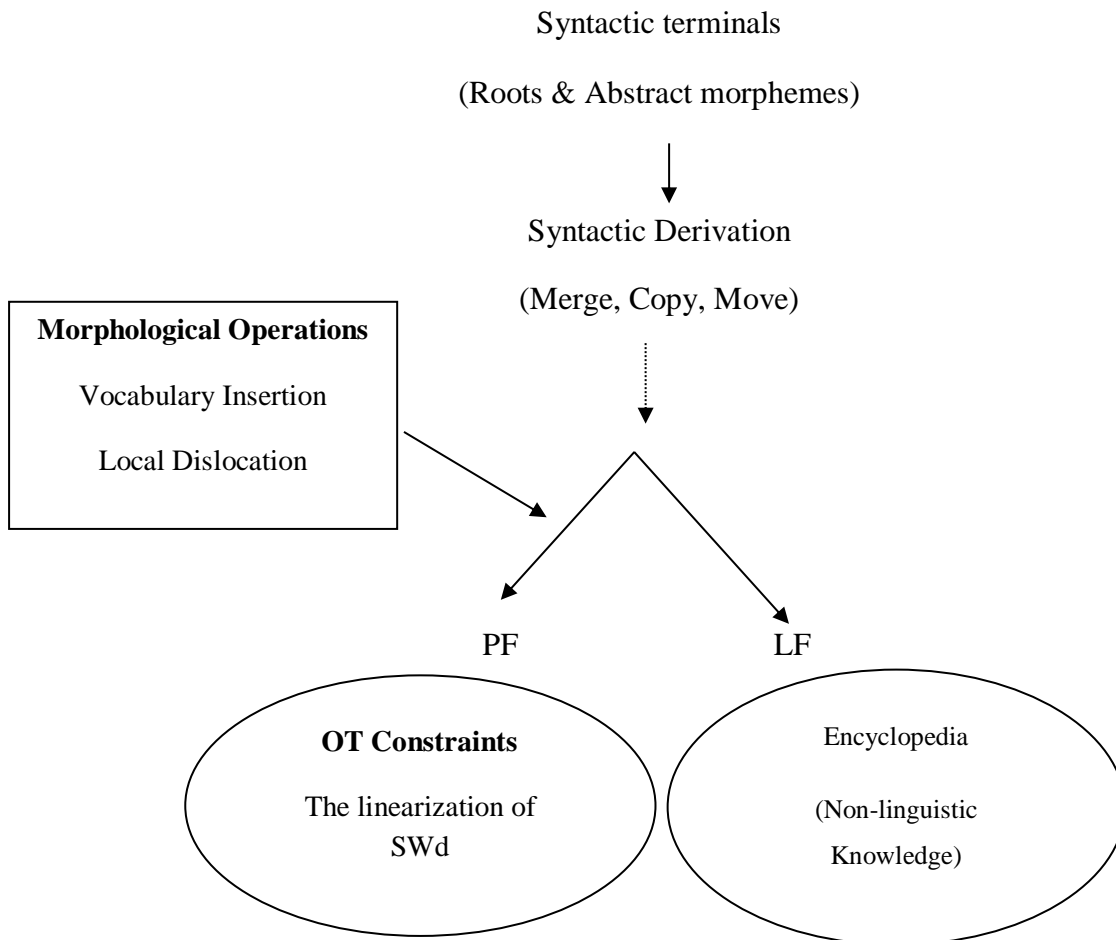
Summarizing thus far, we have provided evidence that casts doubt on the process of Local Dislocation. In particular, we have argued that the process overgeneralizes as far as nonconcatenative morphology is concerned. We have also shown that templates fare no better. The bulk of the evidence coming from causative-like verbs and the status of schwa in MA support this.

#### 4. Towards a DM-OT Model

In view of these facts, the present study argues that linearization is driven in essence by phonological requirements. For this reason, the sections that follow argue for a blended model of DM, where syntax feeds OT. We will argue that this move is motivated by both empirical and conceptual grounds. Much of the impetus of this state of affairs, we argue, stems from the fact that the affixal process makes reference to the prosodic structure of the language under investigation, i.e. syllable structure, in the linearization of the causative morpheme. This cannot be ignored as it misses essential generalizations. This analysis has the phonological effect of the Emergence of the Unmarked (TETU, henceforth) (McCarthy & Prince, 1994), where the

markedness constraint \*COMPLEXONS bears the burden of the explanation, a state of affairs that DM cannot predict. The grammar that present study adopts is as follows:

(16)



With this background in mind, we will show how the OT analysis to the formation of causatives accounts for the linearization process in a systematic way, one that follows from the prosodic considerations active in the language. The section that immediately follows provides the relevant theoretical background of OT alongside the basic assumptions we fall back in our analysis. This will be coupled with a discussion of some facts about the syllable structure in MA, facts that adduce support to our claims.

#### 4.1. Basics of OT

The central claim advanced in OT is that surface forms are the outcome of conflicts between universal constraints. On such a view, the task of individual grammars is to resolve the conflicts by ranking the constraints on a language-particular basis. The OT grammar of a language is made up of three main components: Input, Generator (GEN) and Evaluator (EVAL). GEN is seen as a universal candidate generator whose role is to take an input and emit a set of infinite number of candidates {Cand<sub>1</sub>, Cand<sub>2</sub>...Cand<sub>n</sub>}<sup>8</sup>. EVAL is the central

<sup>8</sup> This property is referred to as *Freedom of Analysis*.

component of OT whose role is to evaluate the candidates against the language-particular constraint ranking as well as assign violation marks whenever a given candidate incurs one. Then, it locates the most harmonic candidate, one which ultimately qualifies as the optimal one, the surface form. In fact, such a view of grammar dispenses with serially ordered rule application conceived in earlier approaches of grammar.

In OT, the ranking of constraints is conventionally demonstrated in the constraint tableau method.

(17)

**Constraint Tableau, Constraint A >> Constraint B<sup>9</sup>**

INPUT	Constraint A	Constraint B
Candidate 1	*!	
☞ Candidate 2		*

In this tableau, candidates generated by GEN appear underneath INPUT. Constraints are listed horizontally in front of INPUT. In this analysis, Constraints A and Constraint B disagree on these two candidates. Since Candidate 2 obeys Constraint A and as it appears it is the optimal one, Constraint A must dominate Constraint B; thus the ranking is indicated by a solid line. If a constraint incurs a violation of a given constraint it receives a violation mark indicated by (\*). Fatal and gratuitous violation is indicated by (\*!). The optimal candidate is called by a pointing hand.

Additionally, OT distinguishes between different types of constraints, most important of which are markedness constraints and faithfulness constraints. Markedness constraints, on the one hand, demand unmarked configuration. Examples of these constraints are ONSET, a constraint militating against onsetless syllables and NOCODA which requires that syllables must be open (CV). Faithfulness constraints, on the other hand, require correspondence between the input and the output, or, put simply, the input and the output must be identical. If markedness constraints dominate faithfulness constraint, M >> F, the language achieves outputs that are minimally marked. The opposite ranking, F >> M, however, yields faithful mappings. Faithfulness constraints are a mandatory requirement in the grammar, as they preserve underlying contrast. Assuming a grammar without faithfulness constraints all underlying contrast will be neutralized and all inputs will favor unmarked configuration, undesired effects. As should be obvious, these constraints are always in conflict with

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<sup>9</sup> Interestingly, if the ranking above Constraint A >> Constraint B is the opposite, i.e. Constraint B >> Constraint A, a different grammar emerges, in which case candidate 1 wins out. This essential property of OT is referred to as *Factorial Typology*. As its core, factorial typology predicts that from reranking the universal constraint of one language, another grammar is obtained.

markedness constraints, for the two interact to derive the optimal form, hence the term constraint interaction.

One corollary of OT grammar is a phenomenon referred as the Emergence of the Unmarked. It is a case where a markedness constraint which is generally dominated/ inactive in a language emerges as decisive in cases when faithfulness constraints fail to select the optimal candidate. This phenomenon is generally attested in cases of reduplication where the reduplicant is observed to opt for unmarked phonological structures, contrary to the base that seems to abide by the phonotactic constraints of the language. More often than not, this tendency violates the phonotactic structure of the language in question.

As the discussion unfolds, it will appear that in MA, the Affix<sub>CAUSE</sub> $\mu$  does not tolerate to appear in positions where \*COMPLEX<sub>ONS</sub> is violated. This accounts for why the causative morpheme appears infixated with respect to the root, a TETU effect. The effect of the TETU is captured by the ranking schema below:

- (18) **Ranking schema for reduplicative TETU** (Alderete *et al.* (1996: 330):  
 Faith<sub>IO</sub> >> M >> Faith<sub>BR</sub>

#### 4.2. Moroccan Arabic Syllable Structure

MA distinguishes between two types of syllables: CV and CVC. The rest of the forms (CCVC and CVCC) are derived by rules (Benhallam, 1990a). Both vowels and schwas can head the nucleus. As opposed to full vowels, however, the distribution of schwa is highly restricted in MA as it is disallowed in open syllables. As argued in Benhallam (1990a), schwa is epenthesized between an unsyllabified CC sequence<sup>10</sup>. Of interest to the present analysis, MA allows complex onsets. As shown in (19), These contexts include verbs, adjectives and nouns.

- (19)
- | <i>Verbs</i> |         | <i>Adjectives</i> |              | <i>Nouns</i> |         |
|--------------|---------|-------------------|--------------|--------------|---------|
| ktəb         | ‘write’ | ʃrəz              | ‘lame’       | rʒəl         | ‘leg’   |
| ʃtəħ         | ‘dance’ | ħwəl              | ‘cross-eyed’ | qfəz         | ‘cage’  |
| DRəb         | ‘hit’   | kħəl              | ‘black’      | ʃsəl         | ‘honey’ |
| gləs         | ‘sit’   | byəd              | ‘white’      | nməl         | ‘ants’  |

Using the logic of OT, one can safely say that \*COMPLEX<sub>ONS</sub> is crucially dominated; hence, it is inactive and irrelevant in such contexts. The constraints that are operative in deriving the syllable structure in MA are ONSET<sup>11</sup>, \*Min-σ, DEP<sub>IO</sub>, MAX<sub>IO</sub>,

<sup>10</sup> Syllable structure in MA is so complex a phenomenon that an attempt to present an adequate analysis is beyond the scope of the present study. Recall that the ultimate goal of this chapter is to showcase the necessity to make reference to prosody in the linearization of the output of syntactic derivation. Accordingly, only the phonological aspects pertaining to the present discussion are reviewed. The interested reader may consult Benhallam (1990a) and Boudlal (2001) and references cited therein.

<sup>11</sup> In this discussion, ONSET is not relevant. Undeniably, this constraint is active in the language as it rules out all instances of onsetless syllables. It is thus undominated with respect to the constraints suggested above.

\*COMPLEX<sub>CODA</sub>, and \*COMPLEX<sub>ONS</sub>. The definition of these constraints and their roles are as follows:

(20)

- a. \*Min- $\sigma$ : Minor syllables are prohibited
- b. MAX<sub>IO</sub>: Every segment of the input has a correspondent in the output (No phonological deletion).
- c. DEP<sub>IO</sub>: Every segment of the input has a correspondent in the output (No epenthesis)
- d. \*COMPLEX<sub>CODA</sub>: More than one consonant in the coda position is prohibited.
- e. \*COMPLEX<sub>ONS</sub>: More than one consonant in the onset position is prohibited.

As should be obvious, the interaction of these constraints is what derives the correct optimal candidates, the surface forms in the language. To illustrate with a pertinent example, the ranking of these constraints is illustrated in the tableau below:

(21)

Input : /bka/	MAX <sub>IO</sub>	*Min- $\sigma$	DEP <sub>IO</sub>	*COMPLEX <sub>ONS</sub>
a. bə.ka		*	*!	
☞ b. bka				*
c. bk	*!			
d. b.ka		*		

Incurring no violation to the higher-ranked constraints, the fully faithful candidate (b) is selected as the optimal one. This is despite its violation of the lower-ranked markedness constraints \*COMPLEX<sub>ONS</sub>. The violation is justified by the presence of two consonants in the onset position. This is indicative of the fact that this constraint is inactive and irrelevant. Candidate (a) is ruled out by virtue of its violation of the higher-ranked \*Min- $\sigma$ . Candidate (d) is similar to the surface form, but the first consonant of the root /b/ constitutes a minor syllable. Interestingly, the main explanatory burden in this case falls on the faithfulness constraints to choose the optimal candidate<sup>12</sup>.

Summarizing thus far, we have presented some of the basic phonological constraints active in the phonology of MA, as these constraints will prove crucial in the sections that follow. We have shown that MA tolerates the presence of complex onsets, as the constraint \*COMPLEX<sub>ONS</sub> is totally irrelevant. In the section that immediately follows we will show how

<sup>12</sup> In this tableau, there is no provable direct ranking holds between the faithfulness constraints DEP<sub>IO</sub> and MAX<sub>IO</sub>.

the linearization of the causative morpheme is affected by phonological well-formedness and how the process is an instance of the TETU.

### 4.3. Proposed Analysis

The constraints proposed in this study along with their relative ranking are as follows:

- (22) REALIZE-MORPH, MAX<sub>IO</sub>, \*COMPLEX<sub>CODA</sub>, \*Min-σ >> DEP<sub>IO</sub> >> \*COMPLEX<sub>ONS</sub> >> ALING- Affix<sub>CAUSE</sub>μ-L.

For expository reasons, the definition and the role of the newly introduced constraints are as follows:

- (23)
- a. REALIZE-MORPHEME<sub>Causative</sub> (RM): An input causative morpheme has a correspondent in the output.
  - b. ALING (Affix<sub>CAUSE</sub>, L, Root, L): Align the left edge of the Affix<sub>CAUSE</sub> with the left edge of the root = every Affix<sub>CAUSE</sub> is a prefix in the Root.

The hierarchy proposed in (24) is what derives the correct surface forms of causatives in MA. For the root input /ktb/, Gen provides many candidates, each of which represents a possible surface form. It is task of the language particular ranking to choose the most harmonic one which will be ultimately spelt out as the surface form. This is illustrated in the tableau below:

(24)

Input : / Affix <sub>CAUSE</sub> μ- ktb/	RM	MAX <sub>IO</sub>	*COMP <sub>CODA</sub>	*Min-σ	DEP <sub>IO</sub>	*COMP <sub>ONS</sub>	ALING
a. ktb	*!			*			
b. kkətəb					*!*	*	
☞ c. kəttəb					*!*		*
d. ktəb.b				*	*		
e. ktət.b				*	*		*
f. ktəbb			*		*	*	*
g. ktətb			*		*	*	*

Candidate (a) fatally fails as the morpheme that encodes causativity is not morphologically realized. This is captured by its violation to RM. Candidates (d) and (e) are

ruled out as the two violate the constraint \*Min-σ. Candidates (f) and (g) satisfy the top-ranked constraint RM and MAX<sub>IO</sub> but fail to satisfy \*COMPLEX<sub>CODA</sub>. Of interest to the present discussion are the two remaining candidates (b) and (c). These candidates tie as to surface well-formedness, in the sense that the two satisfy the higher ranked constraints and incur the same violation to DEP<sub>IO</sub>. A question of considerable interest in this regard is how the tie is resolved. This can be made clear in the tableau below where the irrelevant constraints and candidates are not included:

(25)

Input : Affix <sub>CAUSE</sub> μ- ktb/	DEP <sub>IO</sub>	*COMPLEX <sub>ONS</sub>	ALING	MAX <sub>BR</sub>
b. kkətəb	**	*		**
☞ c. kət.təb	**		*	

If we cancel the violation marks that the two candidates incur, in compliance with the *Method of Mark Cancellation*<sup>13</sup> (Prince & Smolensky, 1993), the faithfulness constraint DEP<sub>IO</sub> becomes totally irrelevant. It naturally follows that the markedness constraint \*COMPLEX<sub>ONS</sub> is what decides on the optimality of the competing candidates in this case. As has been demonstrated earlier, this constraint is crucially dominated in the language. Note also that obedience to \*COMPLEX<sub>ONS</sub> is obtained at the cost of ill-alignment, the resulting affixal process being infixation. This captures the fact that phonological well-formedness, the banning of complex onsets in the case under study, override morphological requirements. This accounts for why the well-aligned candidate (b) is not the actual output. This is example is a highly predicted one of TETU.

## 5. Concluding Remarks and Implications

In this paper, we have attempted to show how the process of infixal gemination is realized in the formation of morphological causatives in MA. To this end, we compared the technical machinery of two frameworks, namely DM and OT. In particular, we have shown that as far as morphophonology is concerned, OT proves more superior than DM. Incorporating DM has its advantages as well. First, assuming that the root is the input to phonological constraints in standard OT leads to the problem of grammatical categorization<sup>14</sup>. What is puzzling in this regard is how the root acquires its category. In the model presented here, this process takes place in the syntax, in compliance with DM assumptions (see Loutfi, 2015, in preparation). Another advantage is that this model explains why lexical causatives are not morphologically marked. As demonstrated in (26-b) and (27-b), these verbs, although encoding causativity, cannot be marked morphologically. This observation is attested in both

<sup>13</sup> The gist of this principle is that the violation marks that two candidates share are cancelled/ignored, provided that these violation marks have no direct bearing on the competition (McCarthy, 2002: 6).

<sup>14</sup> See Loutfi (to appear) for arguments against a word-based approach to word formation.

MA and Moroccan Amazigh (Alalou and Farrell, 1993). This also problematic for standard OT.

- (26) **MA**
- a. Jamal qtəl Khalid.  
Jamal killed-3ms Khalid  
'Jamal caused Kahlid to die'
  - b. \*Jamal qəttəl Khalid.  
Jamal CAUS-killed Khalid  
'Jamal caused Kahlid to die'

- (27) **Amazigh**
- a. y-wt wrba iydi  
3msg-hit boy dog  
'The boy hit the dog'
  - b. \*y-ss-wt-as wrayz iydi I wrba  
3msg-CAUS-hit-DAT man dog to boy  
'The man made the boy hit the dog'

The ungrammaticality of these constructions is explained on the basis of the encyclopedic nature associated with each root<sup>15</sup>. Causative morphology is possible only when the root to which the causative morpheme is attached is not specified as externally caused root. It would therefore appear that roots that derive lexical causatives are all specified as  $\sqrt{\text{externally}}$  caused root. Therefore, the morphological marking on the  $\sqrt{\text{externally}}$  caused root renders the sentences ungrammatical<sup>16</sup>.

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<sup>15</sup> In DM, roots are classified according to their encyclopedic semantics. More precisely, the verbal root is assumed to function as an event modifier introducing the idiosyncratic aspect of the verb's meaning. See Alexiadou *et al.* (2006).

<sup>16</sup> See Loutfi (in preparation) for a detailed discussion.



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