An Optimality-Theoretic Account of Moroccan Arabic Subject Personal Pronoun Affixes

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Abstract
This paper provides a morphological account of Moroccan Arabic subject personal pronoun affixes within the general standard framework of Optimality Theory. It focuses on their positional and affixal allomorphic alternations as well as their correspondence and order. The main claim is that Moroccan Arabic subject personal pronoun affixes are derived from the same input and their derivation is governed by alignment constraints, lexical constraints, maximality and dependency constraints, and finally linearity constraints. In particular, these constraints respectively determine their position when they are expressed by a single affixal material or more, their compatibility when they are expressed by different affixal materials, their correspondence when they are expressed by either identical or different affixal materials, and their order when they are expressed by more than a single affixal material.

Keywords: Moroccan Arabic, Subject Personal Pronoun Affixes, Optimality Theory, Generalized Alignment

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1 The abbreviations used are: 1 = first person, 2 = second person, 3 = third person, Af = affix, Al = ALIGN Asp. = aspect, BR = base reduplicant, C = case, Cons. = consonantal, CT = Correspondence Theory, Dep = DEPENDENCY, Fem. = feminine, G = gender, GA = Generalized Alignment, Imper. = imperative, Imperf. = imperfective, IO = input output, L = left, Lex = LEXICON, Lin = LINEARITY, MA = Moroccan Arabic, Masc. = masculine, Max = MAXIMALITY, N = number, Nom. = nominative, OO = output output, OT = Optimality Theory, P = person, Perf. = perfective, Prep. = preparation, R = right, Voc. = vocalic.

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1. Introduction

In the literature, two different approaches to MA subject personal pronoun affixes can be identified, both of which suffer from limitations. The prosodic-based approach focuses on MA simple verbs (El Himer, 1991) and MA complex verbs (Bernouss, 1994). The constraint-based approach, which focuses on MA subject personal pronoun affixes distribution, shows that they are made up of a zero exponent, a single exponent, or two exponents, and they are attached asymmetrically by considering the exponent of person as affix I and the exponents of number and gender as affix II (Hachoumi, 2016). While the prosodic-based approach is not devoted to MA subject personal pronoun affixes, the constraint-based approach does not take into account the relation among the imperfective, perfective, and imperative paradigms.2,3

The present paper provides a unified morphological account of MA subject personal pronoun affixes within the general standard framework of OT (Prince & Smolensky, 1993/2004; McCarthy & Prince, 1995, 1999), including the subtheory of GA (McCarthy & Prince, 1993a, b). It is underlain by two basic assumptions. Firstly, when MA personal pronoun affixes exhibit no more than positional allomorphic alternation, their distribution is governed by alignment constraints and their order is governed by linearity constraints, while their correspondence is determined by maximality and dependency constraints. Secondly, when they exhibit both positional and affixal allomorphic alternations, their derivation requires additional constraints. These additional constraints ensure the compatibility of the realized personal pronoun affixes and their sets of morphosyntactic features.

The paper is organized as follows. Section 2 provides the basic facts and a short review of the literature on MA subject personal pronoun affixes as well as a brief overview of the adopted theoretical framework along with the nature of affixes and their optimal input/base. Sections 3 and 4 are devoted to their morphological analysis. Section 3 deals with the imperfective and

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2 Hachoumi (2016) also deals with morphophonology of MA personal pronoun affixes. Besides, there is a morphosyntactic treatment that focuses on the perfective paradigm (Lowenstamm, 2011). This study emphasizes the representation of morphosyntactic features (i.e. person, number, and gender) and their exponents. The former are represented as functional heads, while the latter are represented as roots with their own life. Their matching takes place through moving up from their canonical positions to functional heads. In addition, there are several traditional accounts, which are primarily descriptive, rather than explanatory (Harrell, 1962; Abdel-Massih, 1973; Ennaji et al., 2004).

3 The idea of affix I and affix II is not new (see, for example, Siegel, 1974).
perfective paradigms. They are analyzed as concatenated forms. Section 4 deals with the imperative paradigm. It is mainly analyzed as a subtracted form.

2. Preliminaries

In this section, I present the basic facts and previous treatments related to MA subject personal pronoun affixes as well as the relevant aspects of OT, the nature of affixes, and finally the procedures adopted for optimizing their input/base.

2.1 Facts and previous accounts

MA subject personal pronoun affixes exhibit positional and affixal allomorphic alternations. They appear as prefixes or (apparent) circumfixes in the imperfective paradigm and as suffixes in the perfective paradigm as well as in the imperative one. For concreteness, consider the data given in (1), in which I use the verb *ktəb* “to write” as a morphological base.

(1)

<table>
<thead>
<tr>
<th></th>
<th>Imperf.</th>
<th>Perf.</th>
<th>Imper.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sg.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>nə-ktəb</td>
<td>ktəb-t</td>
<td>----</td>
</tr>
<tr>
<td>2 Masc.</td>
<td>tə-ktəb</td>
<td>ktəb-t</td>
<td>k.təb-Ø</td>
</tr>
<tr>
<td>2 Fem.</td>
<td>t-kətb-i</td>
<td>ktəb-t-i</td>
<td>kətb-i</td>
</tr>
<tr>
<td>3 Masc.</td>
<td>jə-ktəb</td>
<td>ktəb-Ø</td>
<td>----</td>
</tr>
<tr>
<td>3 Fem.</td>
<td>tə-kətb</td>
<td>kətb-a/ət</td>
<td>----</td>
</tr>
<tr>
<td>Pl.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>n-kətb-u</td>
<td>ktəb-n-a</td>
<td>----</td>
</tr>
<tr>
<td>2</td>
<td>t-kətb-u</td>
<td>ktəb-t-u</td>
<td>kətb-u</td>
</tr>
<tr>
<td>3</td>
<td>j-kətb-u</td>
<td>kətb-u</td>
<td>----</td>
</tr>
</tbody>
</table>

In addition to their positional allomorphic alternation as shown in (1), MA personal pronoun affixes are expressed by different affixal materials. They are not only expressed by consonantal or vocalic exponents or both but also by zero exponents. Consonantal exponents stand as affix I and express the person affixes, while vocalic exponents stand as affix II and express the feminine gender and plural number affixes. These facts are presented in (2).
MA subject personal pronoun affixes not only involve lexical categorizations but also encode morphosyntactic features (after Radford, 2004). Each of them comprises attributes (i.e. person, number, gender, and case) and values (i.e. first, second, or third for person, singular or plural for number, masculine or feminine for gender, and nominative for case). For example, categorizing \{n\} as a subject personal pronoun affix does not tell us in what ways it differs from the other subject personal pronoun affixes. Put it differently, it says nothing about its morphosyntactic features.

They are described in terms of sets of morphosyntactic features. Thus, the subject personal pronoun affix \{n\} can be described as follows: \{1-P, Sg.-N, Ø-G, Nom.-C, Imperf.-Asp.\}, i.e. the 1Sg.Nom.Imperf. Such grammatical descriptions manage to distinguish all sorts of MA subject personal pronoun affixes, including those whose phonological materializations are identical. When they exhibit affixal allomorphic alternations, morphosyntactic features as well as phonological materializations distinguish them. On the contrary, when they exhibit no affixal allomorphic alternations, only morphosyntactic features distinguish them.

For example, categorizing the 1Sg.Nom. as alternants \{n~t\} tells neither how they differ from each other nor how they differ from the other subject personal pronoun affixes. They are listed in the lexicon as two separate entities because their difference shows no phonological generalization. They are associated with different sets of morphosyntactic features as in (3).

\[\text{(2)}\]

\begin{tabular}{|c|c|c|c|}
\hline
 & Cons. exponents & Voc. exponents \\
\hline
 & P & G & N \\
\hline
\hline
Sg. & 1 & n/t & --- & --- \\
2 Masc. & t & --- & --- \\
2 Fem. & t & i & --- \\
3 Masc. & j/Ø & --- & --- \\
3 Fem. & t & --- & --- \\
\hline
Pl. & 1 & n & --- & u/a \\
2 & t & --- & u \\
3 & j/Ø & --- & u \\
\hline
\end{tabular}

\[\text{Note that Radford (2004) uses grammatical properties to refer to morphosyntactic features.}\]
When MA personal pronoun affixes exhibit no affixal allomorphic alternations, they are categorized through sets of morphosyntactic features such as the 3Sg.Fem.Nom.as in (4).

Irrespective of being expressed by a single exponent or two exponents or by even a null exponent, the person affixes never occur far away from the base; by contrast, the feminine gender and plural number affixes appear adjacent to the base when the person affixes are null or prefixed. Yet, they are never more deeply bracketed than the person affixes and, therefore, function as affix II. In other words, the person affixes are bracketed more deeply than the feminine gender or plural number affixes as shown in schemas (5), (6), and (7). They illustrate respectively the cases expressed by a zero exponent, a single exponent, and two exponents.

These schemas show that MA subject personal pronoun affixes distribution is systematic and restricted to distributional regularity with respect to the closeness of the person affixes to their host. They never occur far away from the base because they are bracketed more deeply than the plural number or feminine gender affixes.

Earlier treatments of MA subject personal pronoun affixes are carried out within the prosodic-based approach (El Himer, 1991; Bernouss, 1994) and the constraint-based approach (Hachoumi, 2016). The former tends to focus on verb morphology, in which El Himer (1991) deals with the derivation of simplex verbs, and Bernouss (1994) focuses on the derivation of complex verbs. In both treatments, MA subject personal pronoun affixes receive little attention. The latter provides an exhaustive analysis of MA subject personal pronoun affixes, in which

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The idea of considering certain affixes as inputs for (or associated with) more than a single set of morphosyntactic features has been inspired from Kurisu (2001). In Kurisu (2001), a (bare) stem can serve as a phonological input for several morphosyntactic categories. According to which, it is a form with no morphosyntactic features. In particular, it consists only of phonological, syntactic, and semantic information. It is also considered as a surface form with a possible actual output.
Hachoumi (2016) focuses on their positional allomorphic alternation as prefixes or prefixes and suffixes in the imperfective, or suffixes in the perfective and imperative exhibiting a zero morphemic affixation, a single morphemic affixation, or a multiple morphemic affixation.

Accordingly, MA subject personal pronoun affixes exhibit a single morphemic affixation when a single exponent expresses them, and a multiple morphemic affixation when two exponents express them standing as affix I or II. Affix I refers to the person exponent, while affix II refers to the feminine gender or plural number exponent by showing that their affixation takes place asymmetrically. In other words, affix I is concatenated with verb stems, whereas affix II is concatenated with verb bases. Let us take, for example, the 1Sg.Nom.Imperf. and 1Pl.Nom.Imperf. The derivation of the 1Sg.Nom.Imperf. calls for the affixation of the prefix \(n\) to verb stems such as \(kt\varepsilon b\) “to write” yielding \(n\varepsilon k.t\varepsilon b\) “I write”, while the derivation of the 1Pl.Nom.Imperf. requires the affixation of the prefix \(n\) to verb stems as \(kt\varepsilon b\) “to write” generating \(n\varepsilon k.t\varepsilon b\) “I write” and the suffix \(\{-u\}\) to verb bases like \(n\varepsilon k.t\varepsilon b\) generating \(n\varepsilon k\varepsilon t.bu\) “we write”.

However, Hachoumi’s (2016) treatment suffers from at least one limitation. It does not show how MA subject personal pronoun affixes are related to each other in that they are treated as separate sets. These separate sets correlate with the imperfective, perfective, and imperative paradigms. In a word, it does not show how these paradigms are related to each other claiming that each of them has its own lexical inventory.

To explain this puzzling relatedness, I make recourse to OT. This standard approach offers an explanatory power. This power rests on that it relies on (the interaction of violable) universal constraints to determine the well-formedness of output forms rather than (a sequence of) language-particular rules (Prince & Smolensky, 1993/2004). This power is also manifested in its ability to account for phonological alternations that are not derivable from the same underlying representations (see McCarthy, 2006). Here, by analogy, its power is portrayed in its ability to account for lexical alternations along with positional ones.

### 2.2 Optimality Theory

In OT, the mapping between input and output forms is obtained through the interaction of universal and violable constraints, which can be in conflict or non-conflict (Prince & Smolensky,
When they are in conflict, they are ranked on a language-particular basis, but they are left unranked when they are not.

Such different interactions are presented in constraint tableaux. These constraint tableaux contain input forms together with their sets of possible candidates as well as constraints. The former are given at the top-left-hand column and their sets of possible candidates appear underneath them, while the latter are given on the top-row. The constraint on the left is higher in ranking than the one(s) to its right, whereas the one on the right is lower in ranking than the one(s) to its left if they are separated by solid lines. Otherwise, they are unranked. The unranked ones are separated by dotted lines. Additionally, their evaluations are presented in the other cells. Violation marks are indicated by “*” when they are not fatal and by “*!” when they are fatal. The optimal candidates are indicated by “∅”. For the sake of concreteness, examine tableau (8).

(8) Constraint tableau: Constraint₁ >> Constraint₂, Constraint₃ >> Constraint₄

<table>
<thead>
<tr>
<th>Input: /X/</th>
<th>Constraint₁</th>
<th>Constraint₂</th>
<th>Constraint₃</th>
<th>Constraint₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Candidate₁</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Candidate₂</td>
<td>!</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OT’s conception is developed into CT (McCarthy & Prince, 1995, 1999), in which the focus has been given to correspondence as defined in (9).

(9) Correspondence (McCarthy & Prince, 1995:14)

Given two strings $S_1$ and $S_2$, correspondence is a relation $\mathcal{R}$ from the elements of $S_1$ to those of $S_2$. Elements $\alpha \in S_1$ and $\beta \in S_2$ are referred to as correspondents of one another when $\alpha \mathcal{R} \beta$.

Correspondence correlates two structures or two strings and their relation is not only limited to BR identity (McCarthy & Prince, 1995) but also to IO faithfulness (McCarthy & Prince, 1995, 1999), and OO correspondence (McCarthy, 1995; Benua, 1997).

Another aspect of OT that plays an essential role in the analysis of MA subject personal pronoun affixes is the subtheory of GA (McCarthy & Prince, 1993a, b). Under GA, affixal status is not granted to a prefix or suffix position. Its location at the left or right edge of any potential host is determined by a high-ranking alignment constraint, and its distance is evaluated gradiently, whereby candidates can receive multiple violation marks on the basis of their extent.
This subtheory requires the edges of phonological and morphological categories to coincide with each other. Its general schema is presented in (10).

\[(10) \text{GA (McCarthy & Prince 1993b: 2)}\]

\[
\text{ALIGN (Cat1, Edge1, Cat2, Edge2) =def} \\
\forall \text{ Cat1 } \exists \text{ Cat2 such that Edge1 of Cat1 and Edge2 of Cat2 coincide.} \\
\text{Where} \\
\text{Cat1, Cat2 } \in \text{PCat} \cup \text{GCat} \\
\text{Edge1, Edge2 } \in \{\text{Right, Left}\}
\]

In schema (10), it is shown that Edge1 of every Cat1 coincides with Edge2 of some Cat2. More precisely, the designated edge of PCat or GCat of Cat1 coincides with the designated edge of PCat or GCat of Cat2.

2.3 The nature of affixes in Optimality Theory

In OT, notably in its standard versions, it is usually assumed that affixes and their hosts are regarded as underlying representations (Prince & Smolensky, 1993/2004; McCarthy & Prince, 1995, 1999). These underlying representations have two main functions. First, they define the set of candidates by determining their structures. Second, their existence is presupposed by faithfulness constraints (Heckf et al., 2002).

This assumption is in conformity with the morpheme-based approaches. In these approaches, affixes are regarded as representations presenting building blocks in the process of derivation because they are encoded in the lexicon as phonological substances (Hockett, 1954; Lieber, 1992; Kurisu, 2001). Their surface forms, therefore, are based on concatenating these representational building blocks with their stems. In other words, morphological rules operate on a set of underlying forms, i.e. sub-parts of words or stems and affixes, which are combined and readjusted to yield surface forms as in Halle and Marantz’s (1994) Distributed Morphology.

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6 McCarthy (2003) proposes an alternative whereby all constraints are considered to be categorical, and he develops it even for cases where gradient constraints seem to be crucial (see Ussishkin, 2007). According to which, categorical constraints differ from gradient constraints in that they assign no more than a single violation mark to candidates, unless the form under evaluation contains several violating structures.

In current linguistic research, affixes are either default-prefixing or default-suffixing (McCarthy & Prince, 1996; McCarthy & Prince 1993a; Ussishkin, 2007). Yet, their appearance as infixes is phonologically driven. In other words, they are primarily prefixes or suffixes, and their alignment as infixes is due to phonotactic requirements. Prefixes are encoded with a morpheme boundary (Lieber, 1992) or an empty slot (de Lacy, 1999) at the right edge, while suffixes are encoded with a morpheme boundary or an empty slot at the left one.

Considering affixes as default-prefixing or default-suffixing may require no more than correspondence constraints (McCarthy & Prince, 1995) as developed by de Lacy (1999). He accounts for their exact position without morphemic constraints. In various cases, however, the direction of affixation is determined by markedness constraints. For this reason, by contrast, McCarthy and Prince (1993b) assume that default-prefixing and default-suffixing do not guarantee the exact position of affixes, and they demonstrate that their position falls beyond their affix property.

Notably, McCarthy and Prince’s (1993b) morphotactic constraints have certain limitations. They are highly stipulative and contradict the constraint-based approach spirit in which constraints are considered to be universal (Trommer, 2001), and they are input driven (Aronoff & Xu, 2010). Furthermore, they are formulated with no consideration of morphosyntactic features (Aronoff & Xu, 2010). As a result, Trommer (2001) and Hachoumi (2016) take into account morphosyntactic features in the formulation of this category of constraints, while Aronoff and Xu (2010) use scope constraints to account for affix ordering.

Given these points, affixes can be regarded as representations with no specification for the affixhood feature. In this sense, affixes are codified in the lexicon as affixes without any

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7 In the word-based approaches, affixes are considered as rules (Aronoff, 1976; Anderson, 1992; Stump 2001) or constraints (Russell, 1995; Hammond, 1995; Xu, 2007; Aronoff & Xu, 2010) since they have no phonological representations in the lexicon. In these approaches, morphological and phonological rules/constraints are assumed to operate on bases, i.e. free-standing surface forms.

8 In the literature, there is another approach to the directionally of affixes. This approach is advocated by Baker (1985), Ackema and Neeleman (2004, 2005), and Wolf (2008). They assume that this directionality of affixation is due to syntactic requirements.

9 The idea of leaving affixes without specifications as either prefixes or suffixes in the lexicon is originally proposed in Minimalist Morphology (Wunderlich & Fabri, 1994; Wunderlich 1996). Accordingly, this device is meant to minimize lexical specifications. This proposal is also found in Optimal Interleaving to account for affix ordering (Wolf, 2008).
morpheme boundary or empty slot to specify their exact position as prefixes or suffixes. Their positions are spelt out by morphotactic constraints as prefixes or suffixes. Specifically, their position is determined by alignment constraints, which mirror the hierarchical structure of morphosyntactic features because they are assumed to have a universal hierarchy. After Noyer (1992), they can be schematized as in (11).

(11) Person > Number > Gender

This schema says that the person morphosyntactic feature is universally higher than the gender and number morphosyntactic features.

2.4 Input/Base optimization

In the general standard framework of OT, especially the input-based versions, it is assumed that underlying representations are selected through the procedure of lexicon optimization, even though it is not restricted under the assumption of the Richness of the Base (Prince & Smolensky, 1993/2004). Lexicon optimization works as a learning strategy from outputs to inputs (McCarthy, 2002) because they are derived from surface forms (Prince & Smolensky, 1993/2004; Benua, 1997; McCarthy, 2002). They are also regarded as a set of uninflected stems (Prince & Smolensky, 1993/2004).

According to Albright (2002), the machinery of identifying underlying forms through comparing surface forms remains problematic in the morpheme-based models because they have no systematic procedure to do so. This criticism is also oriented to the word-based approaches even if they use the device of isolating them from paradigms. Yet, he supports the usage of bases to be used as inputs for grammatical operations since they can be identified systematically. He also states that restrictions on identifying underlying forms make the procedure of identification more complex. Besides, underlying forms are usually adopted by phonologists since they marginalize the morpheme configuration and support the existence of a separate morphological module that takes affixes out of the lexicon and arranges them in a certain fashion. Hence, morphologically complex words are represented as independent entities as /root/stem+affixes/.

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10 The procedure of lexicon optimization may be equated to Kenstowicz and Kisseberth’s (1977) restrictions on the underlying forms, especially restrictions (i) and (ii). Restriction (i) requires underlying forms to be unsuffixed forms, while restriction (ii) requires them to be frequent. The other two restrictions require them to match (iii) surface forms and (iv) surface segments somewhere in the paradigm.
Albright’s (2002) criticism is extended to the constraint-based approaches, notably the output-based versions of CT (McCarthy & Prince, 1995; Benua, 1997; Kenstowicz, 1996; McCarthy, 1998). In these approaches, the base identification remains problematic and difficult to solve because the procedure of evaluation involves three changeable things: (i) the hypothesized underlying representations, (ii) the hypothesized base, and (iii) the ranking of OO faithfulness constraints with respect to IO faithfulness and markedness ones (Albright, 2002).

As a result, Albright (2002, 2005, 2008) proposes an algorithm to identify in a systematic way the privileged surface forms, called global bases. The algorithm says that the privileged surfaces have to be informative, unmarked, frequent, and affixless. This algorithm is also used to identify the less privileged surface forms, which are known as local bases, in the most sophisticated paradigms. These bases are derived forms, which turn to be bases of other forms within the same paradigm, e.g. in Spanish, the 1Sg. indicative *quepo* [*kepo*] is derived from the global base *caber* “to fit”, and the derived form turns to be as a local base for the present subjunctive *quepa* (1Sg.), *quepas* (2Sg.), and *quepa* (3Sg.), etc.

Albright’s assumptions cannot be extended to predict MA local bases of the imperfective, perfective, and imperative paradigms because identifying the exact derived form, which serves as a local base for the other cells within the same paradigm, remains controversial and problematic. Thus, operating on global bases can be understood as a direct concatenation since the optimal outputs are more faithful to their bases. On the contrary, operating on local bases can be seen as an indirect concatenation since the actual outputs are less faithful to their bases. These changes take place for local reasons. They are due to phonotactic reasons or to the nature of affixes. In both cases, bases are forced to undergo certain changes. If it is not the case, the indirect concatenation is supposed to be seen as IO correspondence.

Under this assumption, it can be assumed that MA subject personal pronoun affixes are also related to roots in derivation as sub-parts. This entails that their relation is not only limited to OO correspondence but also to IO correspondence. These two relations show that morphologically related words are required to be connected through OO correspondence and IO correspondence as proposed in Benua (1997) and McCarthy (1995). After Benua (1997), this complex relation can be schematized as in (12).

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11 The idea of algorithm finds its root in the minimal generalization algorithm, outlined by Pinker and Prince (1988) and developed and implemented by Albright and Hayes (2004). They assume that the base is the most frequent shape in any given paradigm.
The schema given in (12) shows that there are two levels of derivation, i.e. IO and OO. It also shows that morphologically related words are not completely identical since the base does not involve affixal materials.

In conclusion, this section has presented the basic relevant issues and previous treatments about MA subject personal pronoun affixes. Then, it has reviewed the basic tenets of the adopted theoretical framework, and finally it has briefly reviewed the nature of affixes along with the procedures that are used to identify and optimize their input/base. In what follows, I provide a unified constraint-based account of MA subject personal pronoun affixes by assuming that their distribution is mainly governed by morphotactic constraints. Correspondence constraints are also invoked to regulate IO correspondence together with OO correspondence. These faithfulness constraints are restricted to regulate MA subject personal pronoun affixes, not their hosts (after McCarthy & Prince, 1994). They assume that affix materials can be regulated separately from root materials under the assumption of the root and affix faithfulness, whereby the former dominates the latter.\(^\text{12}\)

3. Subject personal pronoun affixes concatenation

This section focuses on the derivation of the imperfective and perfective paradigms, in which I show that their derivation is due to either grammatical alignment when their alternation is restricted to their affixal position or lexico-grammatical alignment when their alternation goes beyond their affixal position. In the former case, they are determined by alignment constraints, while in the latter one they are governed by both alignment constraints and lexical constraints. Other constraints are also at play to regulate their order and correspondence.

3.1 Grammatical alignment

Grammatical alignment correlates with MA subject personal pronoun affixes that are expressed by the same affixal materials serving as inputs for both paradigms, and they are

\(^{12}\) Similar ideas are found in Albright (2005).
derived via concatenating their exponents either left or right in the imperfective or right in the perfective. They are achieved through the interaction of gradient alignment and categorical faithfulness constraints, which call on to decide in favor of the best-aligned candidate.

MA subject personal pronoun affixes contain four cases. These cases are given in (13) below. The other MA subject personal pronoun affixes are handled in subsection 3.2.

(13)

<table>
<thead>
<tr>
<th></th>
<th>Imperf.</th>
<th>Perf.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sg.</strong></td>
<td>2Masc.</td>
<td>t-...</td>
</tr>
<tr>
<td></td>
<td>2Fem.</td>
<td>t-...-i</td>
</tr>
<tr>
<td></td>
<td>3Fem.</td>
<td>t-...</td>
</tr>
<tr>
<td><strong>Pl.</strong></td>
<td>2</td>
<td>t-...-u</td>
</tr>
</tbody>
</table>

The data in (13) shows that the 2Sg.Masc., 2/3Sg.Fem., and 2Pl. have the same lexical inventory because they are represented by the same exponent(s) irrespective of their positional allomorphic alternation. This positional allomorphic alternation is not a lexical property of the affixes, but it is a grammatical property which is determined by gradient alignment constraints. To illustrate, examine the data using the verb *ktəb* “to write” as a host. The verb root is √*ktb*.

(14)

<table>
<thead>
<tr>
<th></th>
<th>Base, affixes</th>
<th>Imperf.</th>
<th>Perf.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sg.</strong></td>
<td>2Masc.</td>
<td><em>k.təb, {t}</em></td>
<td><em>tə-k.təb</em></td>
</tr>
<tr>
<td></td>
<td>2Fem.</td>
<td><em>k.təb, {t, i}</em></td>
<td><em>t-kət.b-i</em></td>
</tr>
<tr>
<td></td>
<td>3Fem.</td>
<td><em>k.təb, {t}</em></td>
<td><em>tə-k.təb</em></td>
</tr>
<tr>
<td><strong>Pl.</strong></td>
<td>2</td>
<td><em>k.təb, {t, u}</em></td>
<td><em>t-kət.b-u</em></td>
</tr>
</tbody>
</table>

To account for the positional allomorphic alternation of MA subject personal pronoun affixes that are made up of one exponent, i.e. the 2Sg.Masc. and 3Sg.Fem., I rely on two gradient alignment constraints and two categorical faithfulness constraints. They are respectively given in (15) and (16).

---

13 In MA, schwa, which is seen as an epenthetic segment (see, for example, Benhallam, 1980; Boudlal, 2001; Bensoukas & Boudlal, 2012), has a specific directionality of application; it applies from right to left (Benhallam, 1980) to form a schwa syllable, which is distinguished from a full vowel syllable (Benhallam, 1990). In Benhallam (1990), it is syllabified as a nucleus, while in Bensoukas and Boudlal (2012) it is syllabified as a part of a single branching mora.
The constraint \(AL_{PAF-L}\), which requires that the person affix is a prefix rather than a suffix, interacts with the constraints \(AL_{PAF-R}\) and \(DEP_{OOAF}\) as a top-ranked constraint to derive the imperfective, while the constraint \(AL_{PAF-R}\), which requires the person affix to be a suffix rather than a prefix, interacts with the constraints \(AL_{PAF-L}\) and \(DEP_{OOAF}\) as a higher-ranked constraint to derive the perfective. In both cases, these constraints are dominated by the constraint \(MAX_{IOAF}\), requiring the realization of the person affix. Finally, ranking the constraint \(DEP_{OOAF}\), which regulates OO correspondence, as lower-ranking permits affixal materials to be spelt out.

The issue of reordering the constraints \(AL_{PAF-L}\) and \(AL_{PAF-R}\) pertaining to the imperfective and perfective as well as to the imperative here and throughout the paper is due to their relatedness as sub-paradigms. It suggests that the person affix has three fates. It appears a prefix and suffix in the imperfective and perfective, respectively, while it appears as a subtracted affix in the imperative. Its prefixation fate requires the domination the constraint \(AL_{PAF-L}\), and it suffixation fate calls for the domination of the constraint \(AL_{PAF-R}\), whereas its subtraction fate necessitates leaving both constraints unranked.

The tableaux in (17) and (18) show how the person affix alignment is achieved by using the 2Sg.Masc. as an example. They illustrate the derivation of the imperfective and the perfective, respectively.

(17) 2Sg.Imperf.: \(MAX_{IOAF} >> AL_{PAF-L} >> AL_{PAF-R} >> DEP_{OOAF}\)

<table>
<thead>
<tr>
<th>/ktb, {t}/</th>
<th>Base: [k.təb]</th>
<th>(MAX_{IOAF})</th>
<th>(AL_{PAF-L})</th>
<th>(AL_{PAF-R})</th>
<th>(DEP_{OOAF})</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. tək.təb</td>
<td></td>
<td></td>
<td>****</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. k.təb.t</td>
<td></td>
<td>****!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. k.təb</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

222
In (17), candidate (17a), which is perfectly aligned, is the optimal candidate for satisfying the high-rank constraints, MAX_{IO}^{AF} and AL_{P}^{AF-L}. Candidate (17b) is suboptimal for misaligning the person affix and base by four segments and, thereby, violates the undominated constraint AL_{P}^{AF-L}. Finally, candidate (17c) is out because of the input affix is not spelt out in the output. In (18), candidate (18a) fails to be selected as optimal because it misaligns the person affix and base by four segments and, therefore, violates the top-ranked constraint, AL_{P}^{AF-R}, while candidate (18b) wins since it incurs no fatal violation mark of the dominant constraints, MAX_{IO}^{AF} and AL_{P}^{AF-R}. Candidate (18c) does not win because of not containing the person affix.

Let us now return to MA subject personal pronoun affixes that are made up of more than a single exponent. Their derivation requires additional constraints that ensure the right alignment of the feminine gender affix and plural number affix as formulated in (19).

(19)  a. AL(G_{AF}; Base-R): The gender affix and the base are right aligned.

b. AL(N_{AF}; Base-R): The number affix and the base are right aligned.

Both constraints interact with the gradient alignment constraints AL_{P}^{AF-L} and AL_{P}^{AF-R} as low-ranked constraints in accordance with the universal hierarchy of morphosyntactic features (Noyer, 1992; Hachoumi, 2016) as well as with the faithfulness constraint DEP_{OO}^{AF}, which is outranked by the constraints AL_{P}^{AF-L} and AL_{P}^{AF-R} as established earlier. Their interaction with AL_{P}^{AF-L} as a top-ranked constraint yields the imperfective, while their interaction with AL_{P}^{AF-R} as a dominant constraint obtains the perfective. The constraint AL_{G}^{AF-R} and AL_{N}^{AF-R} must dominate the constraint DEP_{OO}^{AF} to ensure the affixation of the feminine gender and plural number affixes.

Tableau (20) shows that the interaction of these constraints succeeds in the derivation of the imperfective, which is illustrated by the 2Sg.Fem. Tableau (21) shows the generation of the perfective by using the 2Pl. as an illustration.
In (20), candidate (20a) is optimal because it does not violate the top-ranked constraint \( \text{AL}_p^{AF-L} \) by being perfectly aligned. By contrast, candidate (20b) is ruled out for violating the top-ranked constraint \( \text{AL}_p^{AF-L} \) by misaligning the person affix. In (21), candidate (21a) loses since it does not satisfy the dominant constraint \( \text{AL}_p^{AF-R} \) by being misaligned by five segments, while candidate (21b) receives a single violation mark from the constraint \( \text{AL}_p^{AF-R} \) and, therefore, wins.

It is misaligned by one segment.

The tableaux above do not involve other possible output candidates, in which the gender or number affix occurs inside the person affix. These candidates cannot be ruled out by the established ranking constraints. These candidates are ruled out by the constraints \( \text{LIN}_{AF/P>G} \) and \( \text{LIN}_{AF/P>N} \), which can be formulated as in (22).

(22)  

a. \( \text{LIN}_{AF/P>G} \): The person affix never occurs outside the gender affix.  
b. \( \text{LIN}_{AF/P>N} \): The person affix never occurs outside the number affix.

These constraints regulate the well-formedness of affix ordering of MA personal pronoun affixes. They associate their morphosyntactic features and morphophonological units, i.e. affixes. This assumption can be simplified as in (23). The morphosyntactic features are represented in capitals, whereas their corresponding affixes appear in lower cases and between slashes.
(23) If X is structurally higher than Y
X is phonologically realized as /x/
Y is phonologically realized as /y/
then /x/ is linearly internal to /y/


In conformity with Baker’s principle, the affix /x/ must occur external to the affix /y/ and the surface position of affixes should reflect syntactic representations. In this sense, the outermost affixes c-command the innermost ones and, therefore, the former affixes occur outside the latter. More precisely, the functional head person c-commands the functional heads gender and number, so the person affix must occur outside the gender and number affixes.

This assumption fails to predict the affix ordering of MA subject personal pronoun affixes. In addition, the Mirror Principle has no effect on the surface position and order of affixes because it shows no interaction between the domains of morphology and syntax (Grimshaw, 1986), and it fails to explain the affixal status of prefixes and suffixes since they are treated equally as affixes (Trommer, 2001).

Tableaux (24) and (25) show how these two constraints work, whereby I use the 2Sg.Fem.Imperf. and the 2Pl.Perf. as representative examples. These two examples are given in tableaux (24) and (25), respectively.

(24) 2Sg.Fem.Imperf.: \[\text{Lin} \_{\text{Af}}^{\text{P-G}} \gg \text{AL}_{\text{P}}^{\text{AF-L}} \gg \text{AL}_{\text{P}}^{\text{AF-R}} \gg \text{AL}_{\text{G}}^{\text{AF-R}} \gg \text{DEP}_{\text{OO}}^{\text{AF}}\]

<table>
<thead>
<tr>
<th>/ktb, {t, i}/</th>
<th>Lin_{Af}^{P-G}</th>
<th>AL_{P}^{AF-L}</th>
<th>AL_{P}^{AF-R}</th>
<th>AL_{G}^{AF-R}</th>
<th>DEP_{oo}^{AF}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base: [ktb]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. t.kat.bi</td>
<td></td>
<td>***</td>
<td>***</td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>b. tik.tab</td>
<td>*!</td>
<td>***</td>
<td>****</td>
<td>***</td>
<td>**</td>
</tr>
<tr>
<td>c. kat.bit</td>
<td>*!</td>
<td>*****</td>
<td></td>
<td>*</td>
<td>**</td>
</tr>
</tbody>
</table>

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Candidates (24a) and (25b) win since they do not respectively violate the top-ranked constraints \(\text{LIN}_{\text{AF/P}}^{G} \) and \(\text{LIN}_{\text{AF/P}}^{N} \) by not having the person affix far away from the base. On the contrary, candidates (24b) and (24c) as well as (25a) and (25c) are ruled out since they respectively incur a fatal violation mark the constraints \(\text{LIN}_{\text{AF/P}}^{G} \) and \(\text{LIN}_{\text{AF/P}}^{N} \), dominant constraints. The person affix appears far away from the base.

It must be noted that the 2Sg.Fem.Imperf. may be predicted without resorting to the constraint \(\text{LIN}_{\text{AF/P}}^{G} \) since its absence leaves the choice up to the constraint \(\text{AL}_{\text{G/AF-R}} \). By contrast, predicting the 2Pl.Perf. requires ranking the constraint \(\text{AL}_{\text{N/AF-R}} \) over the constraint \(\text{AL}_{\text{P/AF-R}} \). This ranking can be justified by what is dubbed the Emergence of the Unmarked (McCarthy & Prince, 1994). It appears only where a lower-ranked constraint surfaces to be a higher-ranked constraint in certain cases.

Other key candidates that are not included in tableaux (20), (21), (24), and (25) involve, for instance, \(*\text{kät.b}, *\text{täk.tab}, *\text{k.tab.t}, *\text{kät.bät}, *\text{kät.bi}, \) and \(*\text{kät.bu} \). These candidates can be actual outputs, but they do not correlate with the 2Sg.Fem.Imperf. or 2Pl.Perf. To rule out these candidates, I rely on the top-ranked constraint \(\text{MAX}_{\text{IO/AF}} \) given in (16b). (For its application, see tableaux (17) and (18) above).

### 3.2 Lexico-grammatical alignment

Lexico-grammatical alignment is associated with MA subject personal pronoun affixes that are expressed by different affixal materials. Each affixal material serves as an input for the imperfective or perfective since it is restricted to a single set of morphosyntactic features. This kind of alignment is not only governed by alignment constraints but also by lexical constraints, including faithfulness constraints.
As noted earlier, MA subject personal pronoun affixes are not purely grammatical. They are not only governed by grammar, i.e. alignment constraints (McCarthy & Prince, 1993a, b) but also by lexical specifications specifying their paradigms. These lexical specifications must be connected to the imperfective or perfective. These facts are given in (26) below.

<table>
<thead>
<tr>
<th></th>
<th>Imperf.</th>
<th>Perf.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sg.</strong></td>
<td>1</td>
<td>n-...</td>
</tr>
<tr>
<td></td>
<td>3 Masc.</td>
<td>j-..</td>
</tr>
<tr>
<td><strong>Pl.</strong></td>
<td>1</td>
<td>n-...-u</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>j-...-u</td>
</tr>
</tbody>
</table>

In (26), the data shows that the imperfective and perfective paradigms exhibit both segmental and positional allomorphic alternations. Each paradigm contains its own lexical inventory: \{n-\} versus \{-t\}, \{-j\} versus \{-Ø\}, \{-u\} versus \{-a\}, and \{j-...-u\} versus \{-Ø-u\}. Such segmental alternations are lexical rather than phonological because they fall beyond phonological generalizations. Each affixal material is associated with a given morphosemantic feature, namely the imperfective or perfective (after Kibort, 2010; Corbett, 2010). For example, the 1Sg. \{n\} is lexically associated with the imperfective morphosemantic feature, while the 1Sg. \{t\} is lexically associated with the perfective morphosemantic feature.

These subject personal pronoun affixes are assumed to be specified in the lexicon with no affix feature as either prefixes or suffixes as well. The affix features are assumed to be grammatical, not lexical and their affixal alternation is assumed to be lexical because they share no phonological generalization. As an illustration, consider the data in (27) below using the verb *ktəb* “to write” as a host. The verb root is \sqrt{ktb} as notified earlier.

<table>
<thead>
<tr>
<th></th>
<th>Base, affixes</th>
<th>Imperf.</th>
<th>Perf.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sg.</strong></td>
<td>k.təb, {n ~ t}</td>
<td>nə-k.təb</td>
<td>k.təb-t</td>
</tr>
<tr>
<td></td>
<td>k.təb, {j ~ Ø}</td>
<td>jə-k.təb</td>
<td>k.təb</td>
</tr>
<tr>
<td><strong>Pl.</strong></td>
<td>k.təb, {n, u ~ a}</td>
<td>n-kət.b-u</td>
<td>k.təb-n-a</td>
</tr>
<tr>
<td></td>
<td>k.təb, {j ~ Ø,u}</td>
<td>j-kət.b-u</td>
<td>kət.bu</td>
</tr>
</tbody>
</table>

\[14\] In Kibort (2010) and Corbett (2010), tense and aspect are seen as morphosemantic features rather than morphosyntactic ones.
To account for the segmental and positional allomorphic alternations of MA subject personal pronoun affixes that are made up of one exponent, i.e. the 1Sg. and 3Sg.Masc., I rely on the alignment constraints regulating the distribution of the person affixes given in (15) and the faithfulness constraints regulating IO and OO correspondence given in (16) along with the constraint LEX\(^\circ\) which demands the stored information to be spelt out in the output. The constraint is given in (28) below (after Xu, 2007: 80).

(28) LEX\(^\circ\): Information stored in the lexicon should be spelled out in the output.

The device \(\diamond\) refers to the stored information. It shows that the parsed segment is inherently associated with the given morphosyntactic features in the lexicon. The unparsed segment does not match the entire morphosyntactic features and, therefore, violates the constraint LEX\(^\circ\).

The interaction of the constrains \(\text{MAX}_{\text{IO}}^{\text{AF}}, \text{AL}_{\text{P}}^{\text{AF-L}},\) and LEX\(^\circ\) as dominant predicts the imperfective, while the interaction of the constraints \(\text{MAX}_{\text{IO}}^{\text{AF}}, \text{AL}_{\text{P}}^{\text{AF-R}},\) and LEX\(^\circ\) as top-ranked predicts the perfective as tableaux (29) and (30) illustrate, respectively. The 1Sg. is used as an example. In both cases, the constraints \(\text{MAX}_{\text{IO}}^{\text{AF}}\) and LEX\(^\circ\) must dominate the alignment constraints, which guarantee the exact position of the person affix, to rule out the candidates that are spelt out with no affixes or less affixes and to guarantee the realization of the stored information, respectively. These two undominated constraints are in conflict with each other in that the constraint \(\text{MAX}_{\text{IO}}^{\text{AF}}\) must be outranked by the constraint LEX\(^\circ\) to permit the candidates with null or less affixes to appear as actual outputs. The constraint DEP\(_{\text{OO}}^{\text{AF}}\) must be dominated to allow the realization of the candidates with the person affix.

\(^{15}\) The constraint LEX\(^\circ\) is used here as IO correspondence constraint, not as OO correspondence constraint as proposed by (Xu, 2007). The constraint LEX\(^\circ\) can be equated to Bonet’s (2004) proposition. Bonet (2004) proposes two constraints. The first one is the constraint PRIORITY. This constraint ensures the input “preference relation” indicated by “>”. It shows the preference relation by prioritizing the realization of the left affixes, which are assumed to be unmarked. The second one is the constraint RESPECT. This constraint predicts the affixes that are specified in the lexical entry as “idiosyncratic lexical specifications” or “subcategorization requirements.” For the reason of space, I leave this issue for future research. However, I refer the reader to Xu (2007) for a basic partial equation. In Xu (2007), the constraint LEX is equated only to the constraint PRIORITY. According to which, the constraint PRIORITY is considered to be stipulative. Other shortcomings are also observed.
In tableau (29), candidate (29a) is optimal because it does not violate the higher-ranked constraints, i.e. \( \text{LEX}^\alpha \) and \( \text{AL}_{P/AF-L} \). It is spelt out as it is codified in the lexicon and perfectly aligned. The remaining candidates (29b), (29c), and (29d) are ruled out since they do not satisfy the top-ranked constraints. They are either misaligned (29c), not realized as specified in the lexicon (29b), or (both misaligned and) not spelt out as codified in the lexicon (29d). Finally, candidate (29e) loses since it is spelt out without the person affix. By the same token, candidates (30a), (30b) and (30c) are ruled out since they are either misaligned (30a), not spelt out as specified in the lexicon (30c), or (both misaligned and) not spelt out as codified in the lexicon (30b). Candidate (30d) is optimal because it satisfies the dominant constraints \( \text{LEX}^\alpha \) and \( \text{AL}_{P/AF-R} \), and finally candidate (30e) is ruled out since it violates \( \text{MAX}_{IO/AF} \).

In tableaux (29) and (30), it would seem that \( \text{LEX}^\alpha \) and \( \text{MAX}_{IO/AF} \) are supposed to be unranked with respect to each other since their ranking might make no difference in predicting the desired results. If it is the case, the established ranking must be revised. However, if these two
constraints emerge as unranked they predict the undesired results in a number of cases. To see this, let us take, for example, the derivation of the 3Sg.Masc.Perf. as given in (31) below.

(31) 1Sg.Perf.: \( \text{LEX}^\circ \gg \text{MAX}_{IO}^{AF} \gg \text{AL}_P^{AF-R} \gg \text{AL}_P^{AF-L} \gg \text{DEP}_{OO}^{AF} \)

<table>
<thead>
<tr>
<th>Base: ([q.t, a])</th>
<th>LEX(^\circ)</th>
<th>MAX(_{IO})(^{AF})</th>
<th>AL(_P)(^{AF-R})</th>
<th>AL(_P)(^{AF-L})</th>
<th>DEP(_{OO})(^{AF})</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ( j, q.t, a )</td>
<td>(*!)</td>
<td>****</td>
<td>***</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. ( q.t, j )</td>
<td>(*!)</td>
<td>****</td>
<td>***</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>c. ( q.t)</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In tableau (31), candidates (31a) and (31b) are suboptimal since they are realized with the non-stored information and thus fatally violate the constraint LEX\(^\circ\), a higher-ranked constraint. Candidate (31b) is optimal because it spares violating the constraint LEX\(^\circ\).

After dealing MA personal pronoun affixes that are expressed by a single exponent, let us look now at the ones that are expressed by multiple exponents. To account for this type of lexico-grammatical alignment, I need the alignment constraint AL\(_N\)\(^{AF-R}\) given in (19b) together with the constraints given above. This additional alignment constraint ensures the right alignment of the plural number affix and interacts with the constraints AL\(_P\)\(^{AF-L}\) and AL\(_P\)\(^{AF-R}\) as a lower-ranked constraint to respect the universal hierarchy of morphosyntactic features (Noyer, 1992; Hachoumi, 2016), and it interacts with DEP\(_{OO}\)\(^{AF}\) as dominant to license candidates to appear with the plural number affix in both paradigms. The interaction of these constraints and the constraint LEX\(^\circ\) as a higher-ranked constraint as notified earlier yields the desired results as illustrated in (32) and (33) by using the 1Pl. as an illustration. The former illustrates the imperfective, while the latter illustrates the perfective.

(32) 1Pl.Imperf.: \( \text{LEX}^\circ \gg \text{AL}_P^{AF-L} \gg \text{AL}_P^{AF-R} \gg \text{AL}_N^{AF-R} \gg \text{DEP}_{OO}^{AF} \)

<table>
<thead>
<tr>
<th>Base: ([k.t, b])</th>
<th>LEX(^\circ)</th>
<th>AL(_P)(^{AF-L})</th>
<th>AL(_P)(^{AF-R})</th>
<th>AL(_N)(^{AF-R})</th>
<th>DEP(_{OO})(^{AF})</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ( n.k, a.t, b)</td>
<td>****</td>
<td>(*!)</td>
<td>***</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>b. ( n.k, a.t)</td>
<td>(*!)</td>
<td>****</td>
<td>***</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>c. ( k.t, b.n)</td>
<td>****</td>
<td>(*!)</td>
<td>*</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>d. ( k.t, b.n)</td>
<td>(*!)</td>
<td>****</td>
<td>*</td>
<td>**</td>
<td></td>
</tr>
</tbody>
</table>
In (32), candidate (32a) is optimal because it does not violate the top-ranked constraints, LEX° and AL_P^AF-L. By contrast, candidates (32b) and (32d) are excluded for incurring a fatal violation mark of the undominated constraint, i.e. LEX°, by lexically having an exponent unspecified for the 1Pl.Imperf., and finally candidate (32c) is excluded by the constraint AL_P^AF-L since it is misaligned. In (33), candidates (33a) and (33c) are suboptimal since they incur a fatal violation mark of the high-ranked constraint, LEX°. Candidate (33b) is ruled out by the constraint AL_P^AF-R because of being misaligned by five segments. Finally, candidate (33d) is optimized because it satisfies the constraint LEX°.

Other possible output candidates are not shown in the tableaux above, namely *nuk.təb, *nak.təb, *kat.bun, and *kat.ban. In the imperfective, these candidates are ruled out by the constraint AL_P^AF-L or the constraint LIN_AF>P>N, while in the perfective they are ruled out by LIN_AF>P>N (see (25) above for its application). Otherwise, they are ruled out by the constraint AL_N^AF-R, which must surface as a higher-ranked constraint under the assumption of what is termed the Emergence of the Unmarked (McCarthy & Prince, 1994). Other candidates that do not contain the input personal pronoun affixes are ruled out by the constraint MAX_IO^AF, e.g. *k.təb, *nak.təb, and *kat.bu (see (31) above for illustration).

In sum, this section has shown how MA subject personal affixes are aligned to yield the imperfective and perfective. It has shown that their alignment is governed by morphotactics when they are expressed by the same affixal materials or by morphotactics and lexical specifications when they are expressed by different affixal materials. Their order is shown to be governed by faithfulness constraints.

<table>
<thead>
<tr>
<th>/ktb, {n,u ~&lt;a&gt;}</th>
<th>LEX°</th>
<th>AL_P^AF-R</th>
<th>AL_P^AF-L</th>
<th>AL_N^AF-R</th>
<th>DEP OO^AF</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. n.kat.bu</td>
<td>*!</td>
<td>*****</td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>b. n.kat.ba</td>
<td></td>
<td>*****!</td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>c. k.təb nu</td>
<td>*!</td>
<td>*</td>
<td>****</td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>d. k.təb na</td>
<td>*!</td>
<td></td>
<td>****</td>
<td></td>
<td>**</td>
</tr>
</tbody>
</table>

Base: [k.təb]
4. Subject personal pronoun affixes subtraction and concatenation

This section focuses on the derivation of the imperative paradigm. It shows how it is derived via subtracting the person affix and aligning the feminine and plural affixes.

In the literature, subtraction is defined as a morphological process that shortens the shape of words. It takes place in both derivation and inflection by deleting phonemes and morphemes (Manova, 2011, 2019) to derive the marked forms (Manova, 2011). It has been used to refer to subtraction-like shortenings, e.g. minus feature (Bloomfield, 1933), subtractive morpheme (Nida, 1949), and truncation (Aronoff, 1976). Yet, subtraction is distinguished from its subtraction-like shortenings in several works. For example, it is distinguished from backformation in Bauer (1988), (templatic) truncation in Kurisu (2001), and haplology in Manova (2011).

Backformation is seen as a diachronic rule because the deleted segment is assumed to be a morpheme found elsewhere in the language (Bauer, 1988). In English, the verb *edit* is derived from the noun *editor* by the deletion of the affix *-or*. The absence of diachronic evidence opens up the floor to subtraction. In Kurisu (2001), subtraction and templatic truncation are considered to be types of morphological truncation. The former correlates with deriving a new category, whereas the latter does not. It is mainly employed for hypocoristics. In Bulgarian, the form *Eli* is a truncated form of *Elisaveta* “Elizabet”\(^{16}\). In Manova (2011), haplology is seen as a rule that deletes one of two identical phonological segments. In English, the form *sorceress* is derived by the deletion of one of the affix *-er* found in *sorcerer*.

In the context of MA subject personal pronoun affixes, the process of subtraction takes place at the level of the imperative paradigm. It is derived by subtracting the person affix as shown in (34) below.

\[(34)\]

<table>
<thead>
<tr>
<th></th>
<th>Imperf.</th>
<th>Perf.</th>
<th>Imper.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sg.</td>
<td>2 Masc.</td>
<td>t-...</td>
<td>...-t</td>
</tr>
<tr>
<td></td>
<td>2 Fem.</td>
<td>t-...-i</td>
<td>...-ti</td>
</tr>
<tr>
<td>Pl.</td>
<td>2</td>
<td>t-...-u</td>
<td>...-tu</td>
</tr>
</tbody>
</table>

In (34), the data shows that the imperative paradigm contains three cases, namely the 2Sg.Masc., 2Sg.Fem., and 2Pl. It differs from the imperfective and perfective in having no person affix.

\(^{16}\) This example is cited in Manova (2011).
Therefore, its derivation is due to subtracting the person affix and aligning the feminine gender affix and the plural number affix in the 2Sg.Fem. and 2Pl., respectively. As an illustration, consider the data in (35) below. I use the verb *ktəb* “to write” as a morphological base. The root of this morphological base is √*ktb* as given elsewhere.

(35)

<table>
<thead>
<tr>
<th>Base, affixes</th>
<th>Imper.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sg. 2 Masc.</td>
<td><em>k.təb, {t}</em></td>
</tr>
<tr>
<td>2 Fem.</td>
<td><em>k.təb, {t, i}</em></td>
</tr>
<tr>
<td>Pl. 2</td>
<td><em>k.təb, {t, u}</em></td>
</tr>
</tbody>
</table>

To account for the imperative paradigm, I need to split the constraint DEP_{OO/AF} given in (16a) above into three constraints: DEP_{OO/P-AF}, DEP_{OO/G-AF}, and DEP_{OO/N-AF}. They are given in (36).

(36) a. DEP_{OO/P-AF}: Every person affix in the derived word has a base correspondent.  
   b. DEP_{OO/G-AF}: Every gender affix in the derived word has a base correspondent.  
   c. DEP_{OO/N-AF}: Every number affix in the derived word has a base correspondent.

To optimize the imperative forms, the constraint DEP_{OO/P-AF} must dominate the constraints AL_{P/AF-L} and AL_{P/AF-R} given in (15) and the constraint MAX_{IO/AF} given in (16b) along with the constraints AL_{G/AF-R} given in (19a) and DEP_{OO/G-AF} as well as the constraints AL_{N/AF-R} given in (19b) and DEP_{OO/N-AF} to ban the person affix realization. The constraints AL_{G/AF-R} and DEP_{OO/G-AF} correlate with the 2Sg.Fem., whereas the constraints AL_{N/AF-R} and DEP_{OO/N-AF} are associated with the 2Pl. This domination is interpreted with what is called the Emergence of the Unmarked (McCarthy & Prince, 1994) since its domination correlates only with the derivation of the imperative.

Let us start with the 2Sg.Masc. Deriving the 2Sg.Masc. requires the constraint DEP_{OO/P-AF} to outrank the constraints MAX_{IO/AF} to ban the realization of the person affix. The peripheral constraints AL_{P/AF-L} and AL_{P/AF-R} are invoked as dominated and unranked with each other to

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17 Considering the imperative, perfective, and imperative as related sub-paradigms is not new. In Tiberian Hebrew, the imperative is shown to be derived from either the imperfective (Prince, 1975) or the underlying representation and imperfective (Benua, 1995, 1997). In Standard and Sudanese Arabic, including MA, the imperative is also shown to be related to the imperative (Benmamoun, 1995). Still, relating the imperative to the imperative or to the underlying representation and imperfective may not confirm any significant relation between the imperfective and perfective or the imperative and perfective.
assure neither left nor right alignment. Tableau (37) shows how these constraints interact to derive the 2Sg.Masc.

(37) 2Sg.Masc.Imper.: DEP\textsubscript{OO/AF} \gg\gg MAX\textsubscript{IO/AF} \gg AL\textsubscript{P/AF-L} , AL\textsubscript{P/AF-R}

<table>
<thead>
<tr>
<th>/ktb, {t}/</th>
<th>DEP\textsubscript{OO/AF}</th>
<th>MAX\textsubscript{IO/AF}</th>
<th>AL\textsubscript{P/AF-L}</th>
<th>AL\textsubscript{P/AF-R}</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. tək.təb</td>
<td>*!</td>
<td></td>
<td></td>
<td>*****</td>
</tr>
<tr>
<td>b. k.təb.t</td>
<td>*!</td>
<td></td>
<td></td>
<td>****</td>
</tr>
<tr>
<td>c. k.təb</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Candidates (37a) and (37b) are ruled out because of violating the dominant constraint DEP\textsubscript{OO/AF} by containing the person affix. Candidate (37c) is optimal even though it incurs a minimal violation of the low-ranked constraint MAX\textsubscript{IO/AF} by not containing the person affix.

Unlike the 2Sg.Masc., which requires only the alignment constraints AL\textsubscript{P/AF-L} and AL\textsubscript{P/AF-R}, the 2Sg.Fem. and 2Pl. require also the alignment constraints AL\textsubscript{G/AF-R} and AL\textsubscript{N/AF-R} since they are distinguished by the feminine gender and plural number affixes, respectively. The derivation of the 2Sg.Fem. requires the constraint DEP\textsubscript{OO/AF} to interact with the constraints MAX\textsubscript{IO/AF}, AL\textsubscript{P/AF-L}, AL\textsubscript{P/AF-R}, AL\textsubscript{G/AF-R}, and DEP\textsubscript{OO/G-AF} as undominated to ensure the non-realization of the person affix. As established earlier, the constraint MAX\textsubscript{IO/AF} outranks the constraints AL\textsubscript{P/AF-L} and AL\textsubscript{P/AF-R}, which are ranked over the constraint AL\textsubscript{G/AF-R} to meet the universal hierarchy of morphosyntactic features, to ban forms with no affixes or fewer affixes. Finally, the constraint DEP\textsubscript{OO/G-AF} must be dominated to allow candidates with the feminine gender affix to be realized.

Tableau (38) shows how these constraints interact to generate the 2Sg.Fem. This generation applies to the 2Pl. which requires no more than replacing the constraint AL\textsubscript{G/AF-R} by AL\textsubscript{N/AF-R} and DEP\textsubscript{OO/G-AF} by DEP\textsubscript{OO/N-AF}.
(38) 2Sg.Fem.Imper.: \( \text{DEP}_{OO}^{P-AF} \gg \text{MAX}_{IO}^{AF} \gg \text{AL}_{P}^{AF-L}, \text{AL}_{P}^{AF-R} \gg \text{AL}_{G}^{AF-R} \gg \text{DEP}_{OO}^{G-AF} \)

<table>
<thead>
<tr>
<th>/ktb, {t, i}/</th>
<th>( \text{DEP}_{OO}^{P-AF} )</th>
<th>( \text{MAX}_{IO}^{AF} )</th>
<th>( \text{AL}_{P}^{AF-L} )</th>
<th>( \text{AL}_{P}^{AF-R} )</th>
<th>( \text{AL}_{G}^{AF-R} )</th>
<th>( \text{DEP}_{OO}^{G-AF} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. t.kat.bi</td>
<td>!</td>
<td>*****</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. k.tab.ti</td>
<td>!</td>
<td>***</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. kat.bi</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. kat.b</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Candidates (38a) and (38b), which contain the person affix, fatally violate the high-ranked constraint, \( \text{DEP}_{OO}^{P-AF} \). Candidate (38c) is optimal because it satisfies the top-ranked constraint, \( \text{DEP}_{OO}^{P-AF} \). Finally, candidate (38d) is out because it incurs two violation marks of \( \text{MAX}_{IO}^{AF} \).

In summary, this section has dealt with MA subject personal affixes in the context of the imperative paradigm. It has shown that it is generated through subtracting the person affix and concatenating the feminine gender and plural number affixes. More precisely, it has portrayed that the person affix is governed by faithfulness constraints, while the feminine gender and plural number affixes are determined by alignment constraints.

5. Conclusion

This paper has offered a morphological analysis of MA subject personal pronoun affixes within the general standard framework of OT. It has shown how they are distributed, realized, and ordered. In particular, it has analyzed them as concatenated forms in the imperfective and perfective paradigms and subtracted and concatenated forms in the imperative paradigm. It has shown that their distribution is governed by alignment constraints and their compatibility is governed by lexical constraints, which appear in the form of a general constraint, i.e. \( \text{LEX}^\prime \), when they are expressed by different affixal materials, while their order is determined by linearity constraints. Concerning their correspondence and subtraction, it has portrayed that they are regulated by IO and OO correspondence constraints.

Together with this contribution, this work does not take into account the issue of considering alignment constraints as categorical ones under the assumption that all constraints are categorical and thus there is no room for gradient evaluation as proposed in McCarthy (2003).
These alignment categorical constraints are shown to be inadequate since they are developed even for cases where gradient alignment constraints seem to be fundamental (Ussishkin, 2007). Such cases may include MA perfective paradigm because adopting categorical constraint evaluation may not predict the desired results. Additionally, McCarthy’s (2003) categorical alignment constraints are shown to be adequate in no more than two cases. Without getting into details, the issue of contrasting gradient alignment and categorical alignment constraints is left for future research.

It is worth mentioning that the provided analysis can be extended to the other MA personal pronoun affixes, namely the accusative and genitive ones. First, their distribution is determined by alignment constraints whether they have the same phonological information or not. Second, their realization is determined by the constraint LEX” when they have no identical phonological information. Finally, their order is regulated by linearity constraints, which forbid the person affix to be far away from the host.

References


D.E.S. dissertation. Faculty of Letters, Rabat.


of California, Santa Cruz.


