

# The formation of deverbal nouns in Arabic

*draft*

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## 1 Introduction

Arabic morphology includes a nominal form, traditionally called *maṣdar*, whose meaning and form is related to that of a verb. The form relation, although clearly visible, is complex, the meaning relation is straightforward: the masdar is a complex event nominal, in terms of Grimshaw (1990), and names the action expressed by the verb, retaining the verb's argument and event structure.<sup>1</sup>

The masdar has been analysed among others by Fassi Fehri (1993) and Kremers (2003), who both base themselves on Abney's (1987) analysis of English gerunds. These analyses are purely syntactic, however. Neither discusses how the morphology of these forms functions, the tacit assumption being that the masdar form is derived by some post-lexical process that does not play a role in syntax.

Ackema & Neeleman (2004) discuss so-called *mixed categories* such as English gerunds, Dutch nominal infinitives (which are also event nominals) and Norwegian *-ing* forms in the framework of their theory on word formation and morphological structure. They argue that the peculiar syntactic properties of such structures follow from the way in which they are formed morphologically.

Arabic masdars share the peculiar syntactic properties of other mixed categories, but Ackema & Neeleman's analysis does not provide any direct insight into the reason why this should be so. Their analysis crucially depends on the concatenative nature of morphology in the languages that they discuss, and since masdar formation in Arabic uses non-concatenative morphology, the analysis does not carry over straightforwardly.

The goal of this paper is to show how Ackema & Neeleman's theory can be extended to include non-concatenative Arabic morphology, providing an explanation why Arabic masdars behave basically the same as mixed categories in languages with concatenative morphology.

## 2 Abney's analysis of English gerunds

In his influential PhD dissertation, Abney (1987) presents an analysis of the English gerund that tries to account for the fact that the gerund can be used in at least three different constructions:

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<sup>1</sup>The same nominal forms can also have non-event meanings, making them result or simplex event nominals, in Grimshaw's terms. These lack the argument and event structure of the corresponding verb, and have no systematic meaning relation to it. See Fassi Fehri (1993) and Kremers (2003) for some discussion.

- (1) a. John's singing of the Marseillaise  
 b. John's singing the Marseillaise , John singing the Marseillaise

In all three constructions in (1), the gerund *singing* is an event nominal, in the sense that it retains the argument and event structure of the underlying verb *to sing*. In other words, all three phrases describe an event, and the subject and object of the event are expressed. Abney observes (as others have done before him) that there is a decreasing degree of nominality in the structures (1a-c): (1a), the so-called *Ing-of* construction, is the most nominal, in that it expresses both the subject and the object with nominal means: the Saxon genitive 's and the dummy preposition/case marker *of*, respectively. (1b), the *Poss-ing* construction, is more nominal, in that the object is marked with accusative case, rather than with *of*. Yet, the subject is still marked with the Saxon genitive. Lastly, (1c), the so-called *Acc-ing* construction, marks the object with accusative, and the subject as well. This is therefore the most verbal of the three constructions, in that there is no nominal marking present anymore.

Crucially, the fourth logical possibility, the subject being marked with accusative and the object with *of*, does not occur:

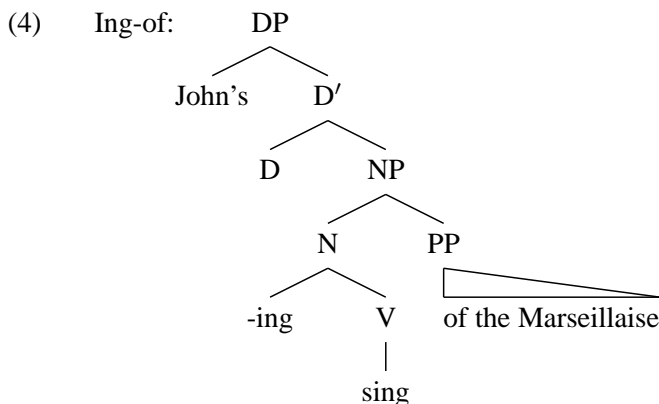
- (2) \*John singing of the Marseillaise

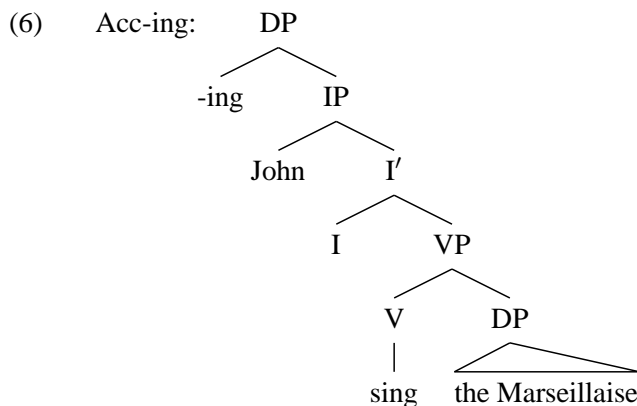
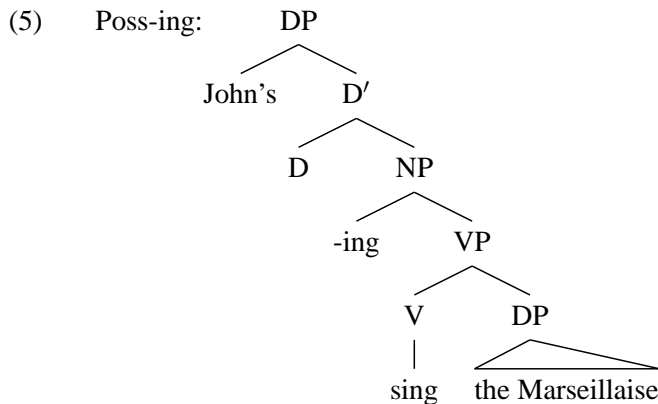
This fact can be accounted for if we assume, as Abney does, that gerunds start out as V projections, and change into an N projection somewhere along the way. Until the point where the change takes place, arguments can be licensed through case, but after the change, only nominal licensing mechanisms are available. Once the change has taken place, it cannot be undone, which accounts for the impossibility of (2).

The analysis is supported by the observation that (1b-c) allow adverbs but no adjectives, while (1a), the purely nominal gerund type, allows adjectives but no adverbs:

- (3) a. John's constant/\*constantly singing of the Marseillaise  
 b. John's \*constant/constantly singing the Marseillaise , John \*constant/constantly singing the Marseillaise

The analysis that Abney proposes assumes that there is an affix *-ing*, which attaches to a verbal category, changing it into its corresponding nominal category. It can attach at three levels: at V, creating an N, at VP, creating an NP, and at IP, creating its corresponding nominal projection DP. Crucially, *-ing* is not a head, i.e., it does not project a syntactic phrase of its own. It just attaches to a projection, changing its category. The tree structures that Abney proposes are the following:





There is of course one unattractive aspect to these structures: it is not clear how the verb stem *sing* and the suffix *-ing* combine to form the gerund *singing*. In fact, it is not at all clear what it really means for an affix to attach to an XP.<sup>2</sup>

### 3 Ackema & Neeleman's treatment of mixed categories

Ackema & Neeleman (2004) retain the idea that what is different about the different gerund structures is the level at which the nominalising affix attaches in syntax. However, they place this idea in the context of a much broader theory on word formation, which enables them to show what exactly it means for an affix to attach to different levels of projection. Before we look at how they deal with gerunds, it is necessary to discuss some of the aspects of their theory.

#### 3.1 Short outline of the theory

Ackema & Neeleman argue for a view of the language faculty that is inspired by Jackendoff (1997, 2002). In this view, the language faculty contains three generative systems, one for syntax, one for semantics and one for phonology. The output of these generative systems are linked to each other by a set of mapping rules. Furthermore, each of these modules contains two submodules, one for phrasal structures and one for word structures.<sup>3</sup>

<sup>2</sup>Abney notices this problem himself. In order to solve it, he argues for an elaboration of X' theory, which basically makes a distinction between below X<sup>0</sup> and above X<sup>0</sup> syntax, which is not altogether convincing.

<sup>3</sup>What this means is that there is no separate morphology module in the language faculty. Instead, morphological structures are considered to be on a par with phrasal structures, in that they have a semantic, a syntactic and a phonological

An important aspect of Ackema & Neeleman’s theory is that when two elements are to be merged, this merger can in principle take place both in phrasal syntax and in “word syntax” (i.e., morphology). In languages such as English, syntactic merger is preferred, and hence morphological merger is only applied when there is some factor that requires it. E.g., a specific lexical element, such as an affix, may require morphological merger.<sup>4</sup>

In this model of the language faculty, a lexical item is not just a conglomerate of the semantic, syntactic and phonological properties of a word. Rather, the three types of features are essentially separate, but linked through mapping rules. So a word such as “tree” has the (simplified) semantic representation TREE, which features in the semantic module; it has the (simplified) syntactic representation N[+count,sg], which is used in the syntactic module; and it has the phonological representation /tɪi:/, which features in the phonological module. This can be indicated in the following manner:

$$(7) \quad \text{TREE} \leftrightarrow \text{N} \leftrightarrow /tɪi:/$$

[+count,sg]

Affixes function the same way: they have, apart from a semantic representation, which does not concern us here, a morphosyntactic one, which Ackema & Neeleman represent as AFFIX, and a morphophonological one, which they represent as /affix/. The point is that what is traditionally seen as a single affix actually consists of three separate elements, linked by mapping principles. Ackema & Neeleman argue that there are (at least) three general mapping principles, of which two concern us here:<sup>5</sup>

- (8) a. Linear Correspondence:  
 If X is structurally external to Y, then /x/ is linearly external to /y/.
- b. Input Correspondence:  
 If an AFFIX selects (a category headed by) X, then /affix/ takes /x/ as its host.

Linear Correspondence states that a morphosyntactic representation such as [[ROOT SF<sub>1</sub>] SF<sub>2</sub>] is mapped onto a morphophonological representation in which the order of the two suffixes is retained, i.e., /root-sf<sub>1</sub>-sf<sub>2</sub>/. It can in principle not be mapped onto a structure in which both suffixes have switched places: \*/root-sf<sub>2</sub>-sf<sub>1</sub>/.

Input Correspondence states that if an AFFIX in morphosyntax attaches to an element X of a specific category, *or to a projection of that category*, then the morphophonological form to which AFFIX is mapped must attach to the morphophonological element associated with X. In other words, something that is a nominal affix in morphosyntax cannot attach to a morphophonological form that is mapped onto a V head; it must attach to something that is mapped onto an N head.

Note, by the way, that although Ackema & Neeleman only apply Linear Correspondence to morphosyntactic structures, it is in fact a far more general principle of linearisation: it applies to phrasal syntactic structures just as well. For this reason, I will adopt a slightly different formulation of Linear Correspondence. This reformulation changes nothing about the principle itself,<sup>6</sup> but it lays more

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representation, which are linked through mapping rules. The exact reasons behind this assumption are not relevant for the current discussion, but the argument basically comes down to the fact that if one wants to maintain the idea that morphology is part of the (phrasal) syntax module, one is forced to extend one’s syntactic theory, for the simple reason that morphological principles differ from syntactic ones. One therefore ends up with a syntactic module that must make a distinction between >X<sup>0</sup> structures and <X<sup>0</sup> structures, which is tantamount to saying that morphology is handled by a separate submodule.

<sup>4</sup>Though even affixes do not have to require it, as will become clear below.

<sup>5</sup>The third mapping principle is *Quantitative Correspondence* (QC) which states that no element in the morphosyntax is spelled out more than once. It basically prevents a single morpheme being realised more than once.

<sup>6</sup>In fact, given the way Ackema & Neeleman apply the principle in mixed categories, they must have had a more general

emphasis on the fact that it is a more general principle. First, I adopt the following two notational shorthands:

- (9) a. D(X): the subtree that has X as root<sup>7</sup>  
 b. F(X): the phonological material onto which D(X) is mapped

With these, we can formulate Linear Correspondence as in (10):

- (10) Linear Correspondence:  
 If X is structurally external to Y, then F(X) is linearly external to F(Y).<sup>8</sup>

I will adopt a similar reformulation for Input Correspondence. Again, it changes nothing about the principle itself:<sup>9</sup>

- (11) Input Correspondence:  
 If an AFFIX selects (a category headed by) X, then F(AFFIX) takes F(X) as its host.

Apart from these general mapping principles, there are also idiosyncratic mapping principles that make reference to specific lexical elements. For example, the English agentive suffix ER is normally mapped onto the phonological form /əʔ/: *to write* → *writer*. This fact is recorded in the lexical entry for the affix:

- (12) AGENTIVE NOUN ↔ ER ↔ /əʔ/  
 [N,sg]

There are, however, specific cases in which ER receives an idiosyncratic mapping. One example is the case of the verb *to type*, where ER is mapped onto /ɪst/: *typist*. That is, there is an idiosyncratic mapping rule of the form:

- (13) [[TYPE] ER] ↔ /təɪp/ /ɪst/

This rule says that a syntactic structure of the form [[TYPE] ER] is mapped onto a phonological structure /təɪp/ /ɪst/. Note that mentioning the stem phonological form of the stem in the rule is in fact redundant: there is no reason to assume that the lexical entry for TYPE cannot provide its phonological form in (13). Therefore, I adopt a slightly different notation for such idiosyncratic mapping rules. Instead of (13), I will write the following:

- (14) ER/TYPE ↔ /-ɪst/

(14) expresses that ER, when attached to (a structure headed by) TYPE is mapped onto /-ɪst/.<sup>10</sup>

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application of the principle in mind as well.

<sup>7</sup>“Subtree” in this definition is to be understood as including material inserted in any node dominated by X.

<sup>8</sup>Another way to formulate the principle would be: If X and Y are sisters, then F(X) is adjacent to F(Y). The intuition that Linear Correspondence expresses is that if X is merged to a structure Y, /x/ will be to the left or the right of /y/. That is, if Y is a subtree containing several terminal elements, say /a/, /b/ and /c/, then /x/ will appear before /abc/ or after it, but not in between; i.e., \*/axbc/ and \*/abxc/.

<sup>9</sup>Note that I will continue to use the notation /x/ informally when it is clear what is meant.

<sup>10</sup>Note that I use a hyphen here in the affix -ɪst. In Ackema & Neeleman’s original formulation, this is not necessary, because the mapping rule explicitly mentions the stem and with that, the position of the affix with respect to the stem. In my reformulation, some way is needed to indicate that the affix is actually a suffix. Note also that although I use a double arrow in (14), this is not meant to indicate that the mapping of /-ɪst/ onto syntax/semantics is absolute: in words like *communist*, *guitarist*, /-ɪst/ maps onto other elements. Here, Ackema & Neeleman’s formulation may seem to have an advantage, since

Affixes are well-known to have selectional restrictions. For example, the English agentive suffix *-er* must attach to a word, and moreover, this word must be a verb. The point that Ackema & Neeleman make is that these selectional restrictions are in fact of non-uniform nature, and must therefore lie in different modules of grammar.

As just indicated, Ackema & Neeleman distinguish between a morphosyntactic SUFFIX ER and the morphophonological /suffix/ /er/. Of these two elements, ER has the requirement that it must attach to something of category V, and /er/ has the requirement that it must attach to something that is a (phonological) word. That means that ER does *not* (necessarily) require that it be attached to a head; instead, it can attach to any projection of category V.<sup>11</sup> In this way, Ackema & Neeleman account for the existence of agentive nouns such as in (15):

- (15)    spring-in-’t-veldje  
           jump-in-the-field.DIM  
           ‘little madcap’

The phrase *spring-in-’t-veld* is a VP, containing an intransitive verb and a locative PP. In order to derive its meaning as an agentive noun, Ackema & Neeleman assume that the Dutch ER SUFFIX is present in the syntactic structure, and that it is (idiosyncratically) mapped onto /∅/:

- (16)    [[SPRING [IN ’T VELDJE]] ER] ↔ /sprɪŋ/ /ɪmət/ /vɛlcə/ /∅/

In much the same way that ER does not require attachment to a head, the morphophonological suffix /er/ does not require attachment to something that is of category V. However, the principle of Input Correspondence requires that /er/ attaches to something that is the head of the phrase to which the corresponding ER attaches. Since this phrase must be of category V, we derive the observation that /er/ attaches to /v/, and not to /n/ or any other head.

The success of any affixation of course depends on the possibility of mapping the resulting syntactic structure to a licit phonological structure. Here, Input Correspondence requires that if an AFFIX attaches to a morphosyntactic element X *or to a phrase headed by X*, the corresponding /affix/ must attach to the corresponding /x/. Ackema & Neeleman recognise two cases in which this requirement can be met: (a) if /x/ and /affix/ are adjacent;<sup>12</sup> or (b) if /affix/ is null. The latter option exists because Input and Linear Correspondence refer to overt phonological material. Therefore, when an /affix/ is phonologically null, these principles apply vacuously.<sup>13</sup>

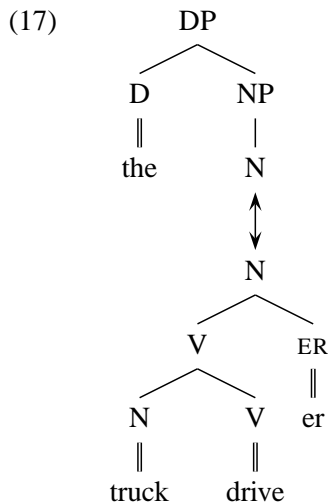
Another aspect of the theory that is relevant for the present discussion is the relation between phrasal syntax and word syntax. As stated earlier, when two elements need to be merged, this merger can take place either in phrasal syntax or in word syntax (i.e., morphology). In which submodule the merger takes place is determined by several factors, but in any case, there will be some point where morphological structures must be inserted into syntactic structures. Ackema & Neeleman argue that this insertion is primarily a process of association, rather than of true insertion: a position in one structure is associated with a position in another structure. The typical (but not the only) example is the root node of a morphological structure that is associated with a terminal node in a syntactic structure; i.e., lexical insertion. Ackema & Neeleman indicate insertion with a double-headed arrow:

the equivalence does hold both ways. As we will see below, however, this is not the case in every kind of idiosyncratic mapping rule that we need.

<sup>11</sup>Note that other requirements do apply. Since ER saturates the external argument of the verb it attaches to, it cannot attach to a vP of which the external theta role has already been assigned.

<sup>12</sup>And in the right order: /affix/ will generally be either a /prefix/ or a /suffix/, so it can only attach to /x/ if it finds itself on the correct side of it.

<sup>13</sup>Which accounts for the grammaticality of (16).



Here, the morphologically formed structure [[truck drive] er] is inserted into the syntactic structure [ D [NP N ] ]. This is achieved by associating the top node of the morphological structure with a terminal node in the syntactic structure. For such an association to be possible, there must be a feature match between the two nodes: in this case, it is the categorial feature that matches.

The double-headed arrow is meant to indicate the association, while at the same indicating that the two associated structures are separate: the morphological structure does not become part of the syntactic structure: the syntactic structure cannot “look into” the morphological structure, so to speak. In this way, insertion accounts for the well-known Lexical Integrity Principle.

The double lines in (17) indicate the mapping to morphophonology. That is, everything under double lines is not present in the syntactic or morphological structure.

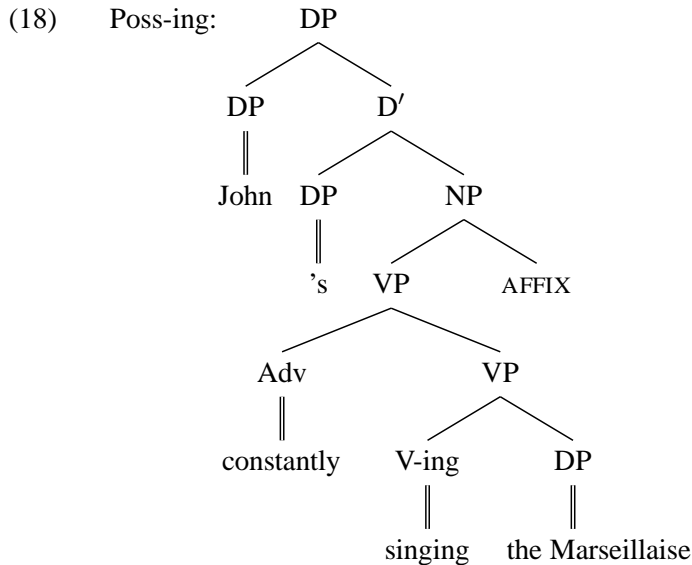
### 3.2 English gerunds

In their account of the properties of English gerunds, Ackema & Neeleman assume that the actual nominalising affix in gerunds is not *-ing*. The reason for this is that *-ing* does not just derive nominal categories, it also derives the verbal participle, which indicates that it is probably best categorised as a non-finite verb suffix. Therefore, there must be another affix in the structure that is responsible for the nominalisation. Because no such overt affix exists, Ackema & Neeleman assume that its phonological form is null.<sup>14</sup>

As in Abney’s analysis, the nominalising affix is attached to different levels of projection. Note that if the affix had an overt phonological form, the syntactic structure could not be mapped onto a phonological structure without violating either Input Correspondence or Linear Correspondence. Suppose, for example, that the AFFIX attaches to VP, creating a Poss-ing construction:<sup>15</sup>

<sup>14</sup>The same conclusion is reached by Yoon (1996).

<sup>15</sup>Ackema & Neeleman do not specify to which levels of projection the AFFIX attaches in English, they only do this for Dutch nominal infinitives. I simply assume that English behaves the same. Note, by the way, that Ackema & Neeleman only discuss Ing-of and Poss-ing, not Acc-ing. I assume the reason for this is that Acc-ing is more likely a participial structure than a nominal one, as argued also by Reuland (1983).



Note that the nominalising affix is assumed to be a suffix, hence the right adjunction in (18).

The AFFIX in (18) attaches to a projection of category V. If its corresponding /affix/ were overt, Input Correspondence would require the /affix/ to attach to the /word/ that the head of this projection is mapped onto, i.e., *singing*. That, however, would violate Linear Correspondence: in the syntactic structure AFFIX is external to the VP, and therefore Linear Correspondence requires its phonological form to be external to /vp/. However, in a phonological realisation such as /John's/ /singing/ /affix/ /the Marseillaise/, this would not be the case: *the Marseillaise* here follows the /affix/, meaning that the /affix/ is inside the /vp/.<sup>16</sup>

A realisation with the /affix/ after the object DP would comply with Linear Correspondence, but would violate Input Correspondence, because the /affix/ can no longer attach to /singing/.<sup>17</sup> However, on the assumption that the /affix/ has no overt form, neither Input Correspondence nor Linear Correspondence applies (or they apply vacuously), and hence no mapping principle is violated.<sup>18</sup>

## 4 Arabic masdars

### 4.1 The data

Let us now turn to the Arabic masdar. First, as observed by Fassi Fehri (1993) and Kremers (2003), Arabic masdars are typical mixed categories. They can assign (overt) accusative to their objects, as in (19a), but the object can also be licensed through a preposition, as in (19b):

- (19) a. 'aqlaqa-nī -ntiqād-u -l-rağul-i -l-mašrūf-a  
 annoyed-me criticising-NOM the-man-GEN the-project-ACC  
 'the man's criticising the project annoyed me'

<sup>16</sup>Note that this situation would obtain if we were to assume that *-ing* is the nominalising affix.

<sup>17</sup>Note, by the way, that it is really immaterial whether we assume that the AFFIX adjoins to the left or the right of the VP. First, trees are hierarchical, not linear, and second, we would run into the same problems with the adverbial *constantly*.

<sup>18</sup>The analysis makes a strong prediction: if the nominalising suffix is overt, a deverbal noun cannot assign accusative to its object if this object follows the verb. Ackema & Neeleman show facts from Norwegian and Quechua that suggest this prediction is borne out.



- b. 'aqlaqa-nī -ntiqād-u -l-rağul-i li -l-mašrūf-i  
 annoyed-me criticising-NOM the-man-GEN to the-project-GEN  
 'the man's criticising of the project annoyed me'

I will refer to constructions of the type in (19a) as *masdar+acc*, and to constructions of the type in (19b) as *masdar+li*. Note that in both cases, the subject of the masdar is marked with genitive case, making the structures in (19) equivalent to the Poss-ing and Ing-of constructions, respectively. Furthermore, (19a) allows an adverbial expression, while (19b) allows an adjective:

- (20) a. 'aqlaqa-nī -ntiqād-u -l-rağul-i bi -stimrār-in hādā  
 annoyed-me criticising-NOM the-man-GEN with persistence-GEN this  
 -l-mašrūf-a  
 the-project-ACC  
 'the man's persistently criticising the project annoyed me'  
 b. 'aqlaqa-nī -ntiqād-u -l-rağul-i -l-mustamirr-u li -l-mašrūf-i  
 annoyed-me criticising-NOM the-man-GEN the-persistent-NOM to the-project-GEN  
 'the man's persistent criticising of the project annoyed me'

In contrast, *masdar+acc* cannot be modified by an adjective:

- (21) \*'aqlaqa-nī -ntiqād-u -l-rağul-i -l-mustamirr-u -l-mašrūf-a  
 annoyed-me criticising-NOM the-man-GEN the-persistent-NOM the-project-ACC  
 'the man's persistently criticising the project annoyed me'

Somewhat unexpectedly, however, *masdar+li* can be modified by adverbial phrases:

- (22) 'aqlaqa-nī -ntiqād-u -l-rağul-i bi -stimrār-in li -l-mašrūf-i  
 annoyed-me criticising-NOM the-man-GEN with persistence-GEN to the-project-GEN  
 'the man's persistent criticising of the project annoyed me'

As suggested in Kremers (2003), however, this may be due to the fact that the adverbial in (22) is a PP. The assumption there is that English adverbs with *-ly* need some form of syntactic licensing, while a PP adverbial only requires semantic licensing. This division would be similar to that between arguments marked with structural case and PP arguments: the former require syntactic licensing, while the latter do not. If this idea is on the right track, it stands to reason that syntactic licensing of adverbs is only possible inside a VP/vP (or a TP), while PP adverbials only require a complex event nominal, but not necessarily a VP, to be licensed.

Fassi Fehri (1993) analyses *masdars* much along the lines of Abney (1987). He argues that there is an (abstract) *masdar* affix that can attach at the V level or at the VP level, turning the verbal projection into an N or an NP. In Kremers (2003), I present a somewhat different analysis. Instead of having an affix attach to a verbal projection at different levels, I argue that during the derivation, a nominal functional category can take a verbal category as its complement. This analysis is based on the idea that there are certain parallels in the nominal and the verbal projection lines. Essentially, I argue that at any point in the verbal projection line, a verbal functional head can be replaced by its nominal counterpart, thus deriving the mixed nature of the construction.

However, as remarked above, neither of these approaches take into account the morphology of *masdar* forms. Within Ackema & Neeleman's framework, however, we can do better: it becomes possible to see how *masdar* formation works given the syntactic analysis. Before we go into that question, I will first discuss the morphology of *masdars*.

## 4.2 Masdar formation

Arabic lexical items generally have a root and a stem. The stem is a pronounceable form, which is subject to further conjugation (e.g. case, tense) by means of pre- and suffixes, and by means of prosodic morphological processes, as the discussion of Arabic plural formation by McCarthy & Prince (1990a) shows. The root, however, is a sequence of (usually) three consonants, that in itself is not pronounceable.<sup>19</sup> It is important to note that unlike much derivational morphology in Arabic, which is often prosodic in nature, a root consists of just three consonants, and does not have any prosodic specification. That is, the root does not specify in which positions in the syllable the consonants appear. For example, the initial consonant can appear in the onset (23a) or in the coda (23b):<sup>20</sup>

- (23) root: /ktb/  
a. ka.ta.b ‘to write’  
b. ?ak.ta.b ‘to dictate’

The same goes for the second consonant, although it rarely happens in the verbal system that it appears in a coda. In the nominal system, this is not uncommon, however:

- (24) root: /fʕl/  
a. fa.ʕa.l ‘to do’  
b. fiʕ.l ‘action, act’

Note that (24b) shows that a root does not even specify whether two consonants appear in the same syllable or not. This is solely specified by the syllabic template of the particular stem formed from the root in question.

From a single triconsonantal root, Arabic verbal morphology can in principle derive fifteen different verb stems. Few roots, if any, show all fifteen possibilities (in fact, stems IX and XI–XV are quite to extremely rare), but it is not uncommon for a root to display half a dozen or more different verb stems. In general, the different verb stems are associated with specific semantics (intensive, causative, applicative, reflexive, passive, etc.) but this association is not strict. Many verb stems have been lexicalised with a non-derivable meaning, rendering the system at best semi-productive.<sup>21</sup>

Each verb stem has its own masdar form. For stems II–XV, this formation is regular, for stem I it is irregular.<sup>22</sup> They are all listed in table 1 (see also McCarthy & Prince 1990b).

In this table, a colon indicates a long vowel or consonant. The capitalised consonants KTB belong to the root, any other non-capitalised consonants are stem affixes. The vowel patterns indicate the verb form: the /a/ (duly spread out to all vowel positions) indicates a tensed perfective stem. Note that the word-initial /i/ in the forms VII–XV is epenthetic, and not part of any morpheme.

Stem I masdars are irregular, but not entirely so. There are about half a dozen common templates, which account for most of them. There are, however, no rules that associate a specific stem I verb with its masdar, and many verbs actually have more than one possible masdar.

Looking at table 1, one quickly notices that one particular vowel pattern dominates the masdar forms: /i<sub>σ</sub>a:σ/, although on some occasions (when the corresponding verb stem has a long vowel,

<sup>19</sup>There are some quadriconsonantal roots, and there are categories that can be considered biconsonantal roots. These will not be discussed here.

<sup>20</sup>Note that the final consonant is generally extrametrical in Arabic. In most cases a word will have additional endings (agreement and mood markers for verbs, case markers for nouns) with which the final consonant resyllabifies.

<sup>21</sup>Though it should be noted that the system is certainly not unproductive either.

<sup>22</sup>As Wright (1981) shows, Classical Arabic had alternative forms for most verb stems. Nonetheless, the forms listed in table 1 are the common ones, even in Classical Arabic.

stem	perfective stem	masdar
I	KaTaB	(irregular)
II	KaT:aB	taKTi:B
III	Ka:TaB	muKa:TaBa(t)
IV	?aKTaB	?iKTa:B
V	taKaT:aB	taKaT:uB
VI	taKa:TaB	taKa:TuB
VII	inKaTaB	inKiTa:B
VIII	iKtaTaB	iKtiTa:B
IX	iKTaB:	iKTiBa:B
X	istaKTaB	istiKTa:B
XI	iKTa:TaB	iKTi:Ta:B
XII	iKTawTaB	iKTiwTa:B
XIII	iKTawwaB	iKTiwwa:B
XIV	iKTanBaB	iKTinBa:B
XV	iKTanBay	iKTinBa:y

Table 1: Arabic masdars

such as in III and XI), the /i/ is also long, yielding /i: $\sigma$ a: $\sigma$ /.<sup>23</sup>

Some more analysis is possible, though. McCarthy & Prince (1990*b*) argue that the last vowel in a verbal form is always short in finite forms and often long in non-finite forms (masdars, but also passive participles of stem I, and some deverbal instrumental nouns). They therefore analyse vowel quantity of the final vowel as a template suffix indicating (non-)finiteness. With that modification, the masdar is no longer marked by /i(:) $\sigma$ a: $\sigma$ /, but simply by /i: $\sigma$ a: $\sigma$ /, with vowel length determined by other factors. We can therefore say that the Arabic masdar contains two morphemes: a nominaliser with the form /i: $\sigma$ a: $\sigma$ /, and a non-finite suffix  $-\sigma_{\mu\mu}$ .

This template suffix,  $-\sigma_{\mu}$  for finite form and  $-\sigma_{\mu\mu}$  for non-finite forms, combines with a base stem template, which is monosyllabic.<sup>24</sup> So the stem I template for finite forms exists of the stem base  $\sigma_{\mu}$ - plus the finite suffix, which happens to take the same form. The stem II template is formed from the stem base  $\sigma_{\mu\mu}$ - plus the finite suffix. In addition to these morphemes, stems can also have a prefix, such as the *ta-* in stems V and VI, *n-* in stem VII and *st-* in stem X, etc.<sup>25</sup>

We can now analyse a form such as /infi $\eta$ a:l/, the masdar of stem VII of the root /f $\eta$ l/, as containing four distinct morphemes: the consonantal root, and three templatic elements: the stem VII marker, the non-finite marker and the nominaliser:

$$(25) \quad \begin{array}{l} \text{root: } /f\eta l/ \\ \text{stem VII: } (\sigma_{\mu}) \sigma_{\mu} \text{ , [nominaliser: ] } \end{array} \quad \begin{array}{cc} \sigma & \sigma \\ | & | \\ i & a \end{array}$$

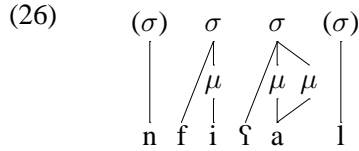
<sup>23</sup>The sigma  $\sigma$  indicates that each vowel is in a separate syllable. This information is probably not part of the morpheme, because Arabic does not allow two vowels in one syllable. Diphthongs and some long vowels are the result of a semiconsonant (/w, j/) in the coda, other long vowels result from vowel lengthening or spreading.

<sup>24</sup>Although it may contain a detransitivising prefix, which consists of an extrametrical consonant that resyllabifies into a coda position. The extrametrical /n/ in the example in (25) is such a prefix, one of several that exist in the Arabic verbal paradigm.

<sup>25</sup>The stem VIII infix *-t-* is analysed as a prefix as well, after which a metathesis rule swops the initial consonant and the prefix.

non-finite:  $-\sigma_{\mu\mu}$

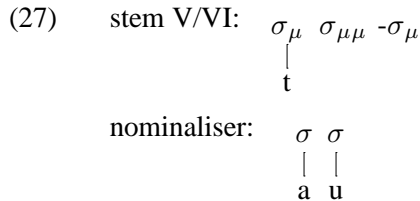
Putting these together yields the following form:



Adding the non-finite suffix to the stem base yields the stem's non-finite template. The root and the nominaliser are then intercalated into this template. The first two root consonants are associated with the onsets of the two template syllables, and the vowels of the nominaliser with their peaks. The final root consonant /l/ is added in a final extrametrical syllable.<sup>26</sup>

Most of the masdar forms can, *mutatis mutandis*, be analysed in this manner: for the masdar forms of stems IV and VII-XV, all that needs to change in (25) is the stem template.<sup>27</sup> As is clear from table 1, however, things are different for the remaining forms: they appear to be quite idiosyncratic. In spite of the apparent complexity, however, we can show that they all make use of the same stem template that the corresponding verb forms use. Where they differ from other masdars is the form of the nominaliser and the non-finite morpheme, which is sometimes absent.

Let us look at the various forms. First, masdars V and VI have an idiosyncratic nominaliser, that takes the form /a<sub>σ</sub>u<sub>σ</sub>/ rather than /i<sub>σ</sub>a<sub>σ</sub>/. They also lack the non-finite morpheme  $\sigma_{\mu\mu}$ , since the forms are not /taKaT:u:B/ and /taKa:Tu:B/. Here, we can either say that they have an idiosyncratic non-finite marker  $-\sigma_{\mu}$ , or that the lack of a second syllable in the template causes not just the stem affix but the entire verbal stem template to be used as a basis for the masdar. Either way, we obtain the same result:



I will assume that the nominaliser does not associate with the prefixed syllable in the stem template. Therefore, the /a/ of the nominaliser associates with the second (heavy) syllable of the stem template, and the /u/ with the third. Presumably, the /a/ of the first, prefixed, syllable is a copy of the /a/ of the second syllable.<sup>28</sup>

Stem II masdars can be dealt with in a similar way. On the face of it, the stem II masdar does not seem to be formed on the template of the stem II verb, as it contains a prefix /ta-/ which the verbal template lacks, and its vowel pattern is /a<sub>σ</sub>i<sub>σ</sub>/, not /i<sub>σ</sub>a<sub>σ</sub>/, as the default nominaliser specifies. Furthermore, it does not show gemination of the second consonant, which seems typical for the verbal template.

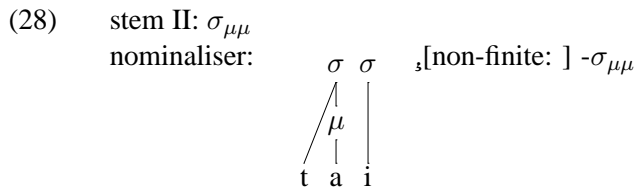
<sup>26</sup>As McCarthy & Prince (1990b) argue, the final consonant of an Arabic stem is always extrametrical.

<sup>27</sup>Note that the masdar of stem IX /iKTaB:/ is formed on the base of the underlying form /iKTaBaB/. The gemination of the third root consonant is the result of deletion of the /a/, a common process in this context. (reference)

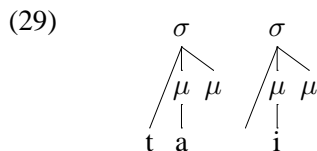
<sup>28</sup>One fact that supports this assumption is that Classical Arabic had an alternative masdar form for stem V verbs, namely /tiKiTTa:B/. On the assumption that the vowel in the prefix is a copy of the vowel in the next syllable, this form is completely regular: it contains the masdar morpheme /i<sub>σ</sub>a<sub>σ</sub>/ and the non-finite suffix  $\sigma_{\mu\mu}$ , as indicated by the fact that the final vowel is long.

However, McCarthy & Prince (1990*b*) observe that Arabic phonology does not distinguish between CVV and CVC syllables: all that counts is their prosodic status as heavy syllables. McCarthy & Prince therefore assume that the templates of stems II and III (and likewise stems V and VI) are identical: their first syllable is  $\sigma_{\mu\mu}$ , without any specification how the heaviness of the syllable is obtained. An additional gemination rule operates on stem II and V verbs, but not on stem III and VI.

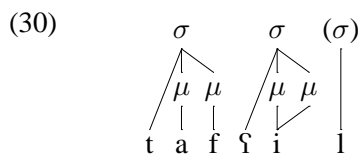
Suppose now that we say that the gemination rule does not apply in stem II masdars (unlike stem V masdars), and that the nominaliser of stem II is also idiosyncratic. We then obtain the following:



Here, the stem II template is not specific to the masdar, it is the same template that forms finite verb forms of stem II. In order to see how these morphemes yield the masdar form /taffʔi:l/, let us see how the morphemes are applied to the template. First, we add the non-finite suffix to the stem base, and associate the nominaliser with the resulting template:



The first syllable here has two morae because this is specified in the stem II template, and the second syllable has two morae because it is the non-finite suffix. When the root is intercalated into the template, the second mora of the first syllable can be associated with the first root consonant. The second root consonant can be associated with the onset of the second syllable, and, as usual, the last consonant is associated with a (newly created) extrametrical syllable. At the same time, the second mora of the second syllable is associated with the vowel of the first mora, creating a long vowel:



In this way, we can derive the stem II masdar by just assuming an idiosyncratic nominaliser, in the same way that we have analysed stem V and VI masdars.<sup>29</sup>

The stem III masdar is quite idiosyncratic as well. Its form is /muKa:TaBa(t)/, where the final /-a(t)/ is the regular feminine ending. This masdar is a so-called *maṣḍar mīmīy* or ‘m-masdar’, named after its first letter. The m-masdar is an alternative masdar formation found in Classical Arabic, in which the feminine form of the passive participle is used as masdar. This masdar formation has mostly disappeared, but in stem III, it is the dominant one.<sup>30</sup> I will not go into the details of partici-

<sup>29</sup>Note that the /ta-/ element in the masdar morpheme is not a prefix, contrary to the /t-/ element in stem V and VI forms. If it were, a form /taKaT:i:B/ would result.

<sup>30</sup>Classical Arabic had three other stem III masdars, /KiTa:B/, /Ki:Ta:B/ and /KiT:a:B/, but none of these were as common as the m-masdar of stem III.

ple formation in Arabic (see McCarthy 1981 for some discussion), but like masdar formation, it is templatic, with an /m-/ prefix that marks the participial form and a vowel pattern that indicates voice.

Summarising, we can say that there is a regular nominaliser /i<sub>σ</sub>a<sub>σ</sub>/, which applies in the majority of cases. This affix is combined with a non-finite suffix σ<sub>μμ</sub>. Stems II, V, and VI have an idiosyncratic nominaliser, and stem III has an idiosyncratic masdar formation. Stems III, V, and VI lack the non-finite suffix, and instead get a default σ<sub>μ</sub> as second syllable. Lastly, stem I masdars are all idiosyncratic. In the next section, I will discuss the syntactic and phonological processes that underlie the masdar formation in more detail, and discuss the mapping rules needed to account for them.

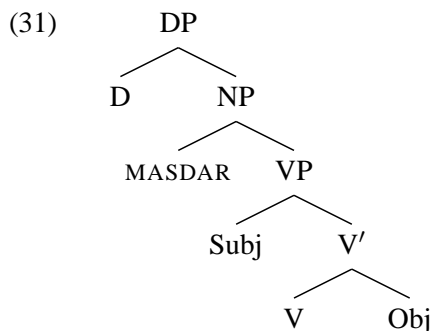
### 4.3 The masdar affix

As we have seen, the syntactic properties of masdars are essentially identical to those of gerunds. Therefore, the starting point for the analysis should be that the syntactic structure of masdars is identical: there is a syntactic MASDAR affix that attaches to V or to a projection of V.

If MASDAR attaches to V, we obtain the equivalent of the English Ing-of construction: masdar+*li*. Mapping of such a structure to phonology is unproblematic in any event, as we have seen above, because V and MASDAR are sisters in the tree. Input and Linear Correspondence are easily satisfied.

However, Linear Correspondence is only apparently satisfied. As we will see, there is no way in which MASDAR in a masdar+acc construction can adhere to Linear Correspondence. We must therefore assume that MASDAR is not subject to it at all, so that even in masdar+*li* constructions, adherence to Linear Correspondence is only apparent.

(31) shows the tree of a masdar+acc construction. MASDAR attaches to VP, which yields a structure in which the object can be assigned accusative case:



However, on the assumption that MASDAR is subject to Linear Correspondence, the mapping to phonology would violate at least one mapping principle. The reasoning is identical to the one discussed in 3.2 for the English gerund constructions. MASDAR attaches to the VP, so Input Correspondence requires that /masdar/ attaches to /v/. Doing so would violate Linear Correspondence, however: MASDAR is external to the VP, but having /masdar/ attach to /v/ leaves it internal to it, as it then occupies a position between /subject/ and /v/.

The analysis that made this configuration unproblematic for English, saying that the nominalising /affix/ is phonologically null, is not available for Arabic. As we have seen above, the Arabic masdar formation uses an overt nominalising morpheme. Another possible solution that easily comes to mind is to adjust the structural relations in the tree in such a way that MASDAR and its intended host V are adjacent, so that /masdar/ can attach to /v/ without violating Linear Correspondence.

Such structural rearrangement obviously implies movement. As argued in many works (e.g., Ritter 1991, Kremers 2003 others), in possessive constructions in Arabic and Hebrew (of which (31) is one,

because the subject is assigned genitive case), N moves to D. If we apply this movement to (31), the V head<sup>31</sup> and MASDAR would end up adjacent.

Such an analysis might seem attractive at first sight, because the order in masdar constructions is always NSO. Therefore, the V head must move to a higher position: the tree in (31) could not derive the correct order. Moving V to a position adjacent to MASDAR in (31) would enable Linear Correspondence to be adhered to while at the same time deriving the correct word order.

There are some problems with this analysis, however. There is no real consensus that N-to-D movement really takes place: Borer (1999) argues against it, for example. Furthermore, N does not always move to D in the Arabic noun phrase. If there is no genitive-marked DP in the noun phrase, N-to-D movement presumably does not take place. Therefore, it cannot be guaranteed that /masdar/ and /v/ will *always*, under any conceivable construction, end up adjacent.

The root of these problems, however, is the tacit assumption that MASDAR is a prefix.<sup>32</sup> The phonological shape of the masdar affix, however, suggests that this assumption is incorrect: as argued for in much work on Arabic morphology (see, e.g. the various papers in Eid & McCarthy 1990, McCarthy & Prince 1990a), much of Arabic morphology is prosodic: morphemes consist of a template of prosodic elements. Such templates map onto an autosegmental tier (see, e.g. McCarthy 1981). The masdar affix is such a prosodic template, as we have seen in section 4.2. It is neither a prefix nor a suffix, and hence does not appear before or after the verbal root. Rather, one would say it appears *simultaneous* with it.

At first sight, this seems a problematic conclusion. MASDAR is attached to a syntactic structure, and syntactic structures are at some point linearised. The common assumption is that linearisation is total: it applies to every terminal element in the tree. That is, the linear structure that results from a syntactic tree contains all the terminal elements in that tree, and for any pair of distinct elements x,y, a linear order is defined, either x>y or x<y (Kayne 1994). Linear Correspondence is basically a formalisation of this assumption.

However, given the phonological status of the masdar affix as a prosodic morpheme, we cannot maintain that it is subject to Linear Correspondence, for the simple reason that it is not linearised, at least not in the normal sense.. What happens is that /masdar/ associates with /v/, and the resulting complex is then linearised. The position of the /masdar+v/ complex is determined by the position of V in the syntactic structure, which is essentially what it means to say that /masdar/ takes /v/ as its host.

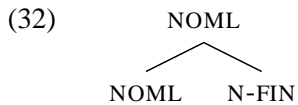
Having said that, let us look at how masdar formation takes place in detail. In section 4.2 I have argued, following McCarthy & Prince (1990b), that the morphosyntactic process of masdar formation involves two morphemes: a nominaliser, which I will indicate with NOML, and a non-finite suffix N-FIN. Above in this section, on the other hand, I have assumed a MASDAR affix that must be able to attach to a structure in phrasal syntax, in order to derive the Arabic equivalent of Poss-ing constructions. The question we must ask, then, is what is the relation between MASDAR on the one hand, and NOML and N-FIN on the other.

Obviously, NOML and N-FIN in some way make up MASDAR. I propose the following: the affixes N-FIN and NOML merge in morphosyntax (i.e., the morphological submodule of the syntax macro-module): either or both of them are specified for morphological merger. The resulting structure is (32):

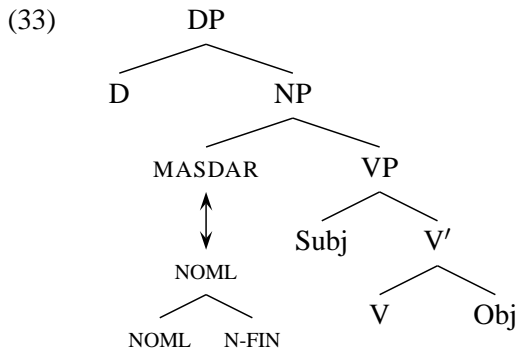
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<sup>31</sup>Of course, there *is* no N head in (31), so we would have to assume that V moves to D.

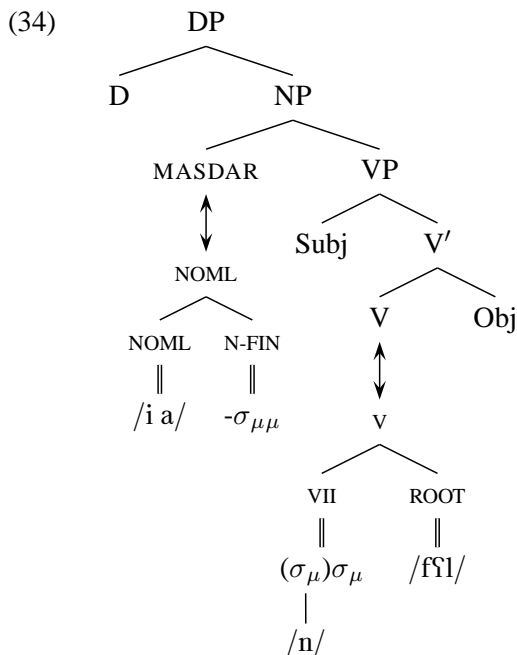
<sup>32</sup>Note that the entire solution would be impossible if /masdar/ were a suffix: the object would then *always* end up between /v/ and /masdar/, no matter where V moves to.



This is a morphological structure, which is then inserted into the syntactic structure at the position of the MASDAR affix:



In other words, MASDAR itself is not mapped onto morphophonological material. Instead, it is associated with the complex  $[_{NOML} \text{ NOML } N\text{-FIN}]$ , which is mapped onto phonology. Let us again look at the standard case, taking the derivation of the stem VII masdar /infiʔa:l/ as an example. The syntactic tree, with only the relevant morphophonological material indicated, is (34):



I assume that the syntactic terminal V is associated with a morphological structure that consists of the verb stem base and the verb root. The former is mapped onto  $(/n/)\sigma_\mu$ , the latter onto /fʔl/. Note that the stem base does not contain sufficient syllabic structure to accommodate the entire root. The necessary finiteness suffix is provided by another head, e.g., T, when the structure is verbal, or in the case of masdar structures, by MASDAR, as discussed above.

As stated above, the MASDAR suffix is subject to Input Correspondence, and hence must attach



to F(V). This is now unproblematic, because the templatic nature of F(MASDAR) means that it is not subject to Linear Correspondence. It therefore does not have to be adjacent to F(V) in order to attach to it.

Note that whether a syntactic element is subject to Linear Correspondence is not a function of its morphological form alone. F(V) itself consists of autosegmental morphemes, but cannot be exempt from Linear Correspondence: the entire masdar form consist of autosegmental morphemes, and at least one of them must be subject to Linear Correspondence, otherwise the form could not be linearised with respect to the other terminal elements in the structure. The natural assumption is that the root, which is not a syntactic AFFIX, unlike all the other morphemes, is this element.<sup>33</sup> As a result, the masdar form is composed in the manner explained in section 4.2, yielding the form /ɪnfiʔa:l/, which is linearised according to the position that the head V takes in the syntactic structure.<sup>34</sup>

Stem V/VI and stem II masdars differ very little from regular masdars. All that is required is to assume idiosyncratic mapping rules of the following forms:

$$(35) \quad \begin{array}{l} \text{stem V: NOML/V} \leftrightarrow /a_{\sigma}u_{\sigma}/ \\ \text{N-FIN/V} \leftrightarrow \sigma_{\mu} \\ \text{stem II: NOML/II} \leftrightarrow /ta_{\sigma}i_{\sigma}/ \end{array}$$

That is, NOML in the context of a stem V template is mapped onto /a<sub>σ</sub>u<sub>σ</sub>/, and N-FIN onto σ<sub>μ</sub>.<sup>35</sup> Furthermore, when attached to a stem II template, NOML is mapped onto /ta<sub>σ</sub>i<sub>σ</sub>/ rather than the default /i<sub>σ</sub>a<sub>σ</sub>/.

The system can also account for the stem III masdar. Recall that this masdar is a so-called *m-masdar*, i.e., it is not formed with some genuine masdar affix. Rather, a more or less suppletive strategy is used, which employs the feminine passive participle. Let us say that there is an idiosyncratic mapping rule of the following form:<sup>36</sup>

$$(36) \quad [{}_{\text{NOML}} \text{ NOML N-FIN}]/\text{III} \leftrightarrow \text{F(PRT.PASS.f)}$$

I will not go into the formation of the participle here. What is relevant is the fact that an idiosyncratic

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<sup>33</sup>Note that one could argue that the root is a *phonological* affix, because it cannot form a stem of its own. Syntactically, however, it is not, because it does not require adjunction to a structure of a specific category. This syntactic difference may be the result of a semantic difference: the root is a lexical item (in the traditional sense of the word) and as such member of an open semantic class. All the other morphemes are functional or derivational, and part of closed semantic classes. It may well be the case that members of open classes must always be mapped onto the segmental tier in some way, and are thus always subject to Linear Correspondence.

<sup>34</sup>Note that this means that V must move, because masdar constructions have the order NSO. At first sight, it might be tempting to argue that the NSO order is derived by spelling out the masdar in the position of MASDAR, but this would not work for masdars that license their objects with the preposition *li*: the analysis states that in such masdars the MASDAR affix attaches to V rather than VP, which would predict a surface order of SNO for such constructions. The actual surface structure is NSO, however, the same as for masdars that assign accusative.

<sup>35</sup>The stem V rules obviously also apply to stem VI, and, although not discussed here, to the second quadrilateral stem as well. The rule may in fact refer not to the stem templates but to some other property: as McCarthy & Prince (1990b) discuss, these three verb stems share properties with each other that are not found in other verb stems, indicating that they form a class of their own. Presumably, the mapping rules refer to this class.

<sup>36</sup>I mentioned in footnote 10 that Ackema & Neeleman's formulation of idiosyncratic mapping rules cannot be read as a two-way equivalence in all cases. (35) is one such case. Ackema & Neeleman's rules differ in that they mention the phonological form of the host as well as of the affix. But doing that in (35) would still not establish that a form consisting of F(PRT.PASS.f)+F(III) is equivalent to a stem III masdar, as it could also be a feminine passive participle of a stem III verb. Note that this is indicative of a general asymmetry between syntax and phonology: a syntactic structure is always mapped onto one particular phonological structure, but a phonological structure may have more than one syntactic equivalents. In other words, the mapping between syntax and phonology is not one-to-one. In yet other words: phonological structures can be ambiguous.

mapping rule of the form in (36) can exist. Rather than specifying the phonological material that the syntactic structure under consideration is mapped onto, the rule specifies a different (morpho)syntactic form whose phonological mapping must be applied.

## **5 Conclusions**

Ackema & Neeleman's (2004) theory on word formation can give a straightforward account of so-called mixed categories in languages where morphology is concatenative. Non-concatenative morphology, such as that of Arabic masdars, at first sight does not yield to an analysis in terms of Ackema & Neeleman. If, however, we adopt the common analysis of non-concatenative morphology in terms of autosegmental tiers, we find a natural way to exclude the masdar morpheme from Linear Correspondence, which is the greatest obstacle to the application of Ackema & Neeleman's analysis to masdars: Linear Correspondence only applies to syntactic elements that are mapped onto the same tier in phonology.

At the same time, Input Correspondence still applies to the masdar morpheme, accounting for the fact that it takes the verb as its host, and not some random root in the rest of the clause.

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