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**The Morphology-Lexicon and Morphology-Syntax Interfaces:
Thematic Operations in Semitic Languages**

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requirements for the M.A. degree in Linguistics
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**by
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1. Introduction

This work examines the role of morpho-phonology with respect to the lexicon and the syntax, with reference to the morpho-phonology of thematic arity (valence changing) operations. It is commonly assumed that different thematic realizations of the same concept are derived from the same basic entry via various operations. I examine five such operations in the verbal systems of Modern Standard Arabic (hereafter MSA), Palestinian Arabic (hereafter PA) and Modern Hebrew (hereafter MH): passivization, decausativization, causativization, reflexivization and reciprocalization. These operations are illustrated in (1) for MH.

(1) Arity Operations in MH

Type of Operation	Examples	
Passivization	tipel → tupal	'took care of' → 'was taken care of'
Decausativization	hirgiz → hitragez	'upset' → 'became upset'
Causativization	xatam → hextim	'signed' → 'made X sign'
Reflexivization	serek → histarek	'combed' → 'combed oneself'
Reciprocalization	xibek → hitxabek	'hugged' → 'hugged each other'

I will shed light on three generalizations observed in the three verbal systems, involving morpho-phonological differences between passivization and the other four arity operations.

(2) Generalizations

- a. Passivization shows unidirectional relations between input and output forms, while the other operations demonstrate bidirectionality, with some templates serving both as a base and as a derived form.
- b. Passivization is performed mainly by changing the vocalic pattern of the verb, unlike other operations, which are manifested by different morpho-phonological processes, such as affixation and gemination.¹
- c. The morphological output of passivization can be easily predicted, in contrast to other operations that have more than one possible output form.

I argue for a correlation between arity operations and their morpho-phonological manifestation. Specifically, I will show that the difference in the component of the grammar where operations take place, lexicon vs. syntax, is what underlies the observed generalizations. This analysis is provided within the framework of the word-based theory (Aronoff 1976, Ussishkin 1999, 2005, Blevins 2005 among others) and the theory of the Lexicon-Syntax Parameter (hereafter Lex-Syn paramater) (Reinhart

¹ PA demonstrates a different patten of passivization. I will address this issue in §4.

& Siloni 2005). I will argue for a non-accidental correlation between the setting of this parameter and the morpho-phonological properties of the derivations, i.e. the variety of derivations which can take place, the predictability, and the directionality of such operations.

This thesis is organized as follows: In §2, I provide the theoretical basis for my analysis. I present two main theories within which my analysis is couched: Stem Modification and the Lexicon-Syntax parameter. In §3, I present the syntactic-semantic features determined by the Lex-Syn parameter. I present the features that are responsible for the cross-linguistic variation regarding predicates such as reflexives and reciprocals and add a new feature that has not yet been discussed. Section 4 deals with the verbal systems of MH, MSA and PA. Although the verbal systems of these three languages are the basis of my analysis, I believe it to hold universally. In §5, I discuss the morpho-phonological processes responsible for deriving one verbal form from another via arity operations. In §6, I analyze the morpho-phonological differences between syntactic and lexical operations based on the distribution of different predicates in the three languages and the processes which form them. I show that there are three morpho-phonological properties which distinguish between the two types of operations: intrusiveness of the process, directionality and predictability of the morphological output. My analysis supports the view of morphology as an independent component that interacts with both the syntax and the lexicon. In §7, I focus on one verbal pattern of MH, the *niCCaC* template which requires a further elaboration of the analysis I propose. In §8, I discuss the case of a relatively new binyan formation in MH and I propose an analysis of its formation from a both thematic and a morphological point of view. Section 9 consists of conclusions of my analysis and its implications with regard to the relations between three components of the grammar: lexicon, syntax and morphology.

2. Theoretical Framework

My analysis is couched within two theoretical frameworks, Aronoff's (1976) word-based model of morphology and the Lexicon-Syntax parameter (Reinhart and Siloni 2005).

2.1. The Word-based Approach

2.1.1 Words vs. Morphemes

The word-based approach, originally proposed in Aronoff (1976), is based on the notion that the lexicon consists of words rather than morphemes or roots. Aronoff's main thesis states that a new word is formed by applying Word Formation Rules (WFRs) to an already existing word. Both the new word and the existing word are members of a major lexical category. Every WFR specifies the following: (i) The properties of the words on which it can operate. (ii) A unique phonological process which is performed on the base. (iii) A syntactic label and subcategorization for the resulting word. (iv) A semantic reading, which is a function of the reading of the base, for the resulting word. Aronoff refers to these rules as once-only rules. These rules do not apply every time the speaker of a language speaks. They serve for producing new words, which may be added to the speaker's lexicon, and redundancy rules defining morphological relations. They are thus different from the rules of syntax and post-lexical phonology, which must apply in a derivation of a sentence.

2.1.2 Stem Modification

There are two main approaches to the relation between a consonantal root and a vocalic template in Semitic languages, such as MSA and MH. The traditional approach attributes the consonantal root, which consists of 2-4 consonants in a specific order, with the core meaning of the stem, thus expressing the semantic relations between stems. This view is structurally expressed by the multi-tiered representation proposed by McCarthy (1981), where the vocalic patterns are represented independently, on the basis of morphological categories. Deriving new forms involves the extraction of a consonantal root from the base form and associating it with a given template (Bat-El 1986). However, this approach invokes both a theoretical and empirical problem, known as the problem of transfer (Bat-El 1994). Recent research has revealed that the information transferred from the base to the derived form not only consists of the order of the consonants, but also which consonants occupy adjacent positions in the base, i.e. whether two or more consonants form a cluster. In addition, properties such as the quality of the base vowels and affixes are also transferred from the base. Such properties cannot be attributed to the consonantal root.

Stem Modification is an alternative theoretical model, which can account for generalizations about morpho-phonological alternations as it allows for internal stem adjustments. It was first introduced in Steriade (1988) in the analysis of reduplication and in McCarthy and Prince (1990) in the analysis of the formation of the MSA broken plurals and diminutives. MSA broken plurals cannot be derived by root-to-template morphology, as there are structural properties that are drawn from the singular base, which cannot be attributed to either the root or the template. This is attested when vowel length is transferred from the singular stem to the plural (3a, 3b) and when derivational morphemes survive derivational processes (3b).

(3) MSA broken plural

- a. qindiil → qanaadiil 'a lamp'
- b. miftaah → mafaatiih 'a key'
- c. funduk → fanaadik 'a hotel'

These examples show that lexical relations in MSA broken plurals involve more than just the root and are established over words or lexemes. All plural templates in (3) consist of a long vowel in the first syllable. However, the second vowel consists of a long syllable only when the second vowel of the singular form is long (3a,3b in comparison to 3c). In (3b), the /m/ consonants, which is not a part of a consonantal root, is transferred to the plural form.

Bat-El (1994) provides further support for this model within the analysis of the formation of denominative verbs in Modern Hebrew. Bases which contain five or more consonants arranged in clusters yield verbs containing the same clusters.

(4) Transferred Clusters

- praklit 'lawyer' → priklet 'practiced law'
- sandlar 'shoemaker' → sindler 'made shoes'

Moreover, denominative verbs whose vocalic pattern is the marked *o-e* can be derived only from nouns whose base contains the vowel /o/ (see Ussishkin 1999) (5).

- (5) tof 'a drum' → tofef 'played a drum'
- kod 'a code' → koded 'coded'

This provides further support for stem modification motivated by the need to keep the derived verb as faithful as possible to its base when a suitable vocalic pattern exists in a language.

The root extraction approach fails to explain why the CV structure is different for different verbs of the same template. Moreover, it does not explain why a multi-consonantal root should be arranged as its base, in addition to the order of the consonants. In stem modification, however, the relevant changes are made on the base itself and thus, it is not surprising that some of the base's properties survive in the derived form. Such an approach shows that the root does not exist as a morphological unit. The analysis proposed in this paper provides further support for the superiority of stem modification over root extraction.

2.2. The Lexicon-Syntax Parameter

2.2.1 Thematic Relations

The theta system is the system enabling the interface between the system of concepts and the computational system, the syntax and, indirectly, the semantic interface systems (Reinhart 2000). For each set of systems of the UG, one assumes the existence of some central system that gathers information, which may be accessible to other sets of systems and which enables the interface. The theta system can be viewed as the central system of the system of concepts. In this framework, the grammar includes an active lexicon (Siloni 2002), which is more than a mere list of items, and allows the application of derivational operations. This is also based on the lexicalist approach to word-formation (Chomsky 1970, Halle 1973) and Jackendoff's (1975) full-entry theory, according to which the lexicon is a repository of information about words.

The theta system consists of (at least) the following:

- a. **Lexical entries**, which are coded concepts that define the theta roles of verb entries.
- b. **A set of arity operations on lexical entries**, which may generate new entries, or just new options of realization.

Arity operations derive different instantiations of the same concept by changing the syntactic valence of a verb, forming predicates such as passive and reflexive verbs.

2.2.2. The Lexicon-Syntax Parameter

Although predicates such as reflexives and reciprocals are derived by the same kind of operation universally, the considerable cross-linguistic variation they exhibit results from the level in which these operations apply according to a parametric choice. Reinhart & Siloni (2005) suggest that UG arity operations, which affect the syntactic

valence of a verb are allowed to apply in the lexicon or in the syntax, as formulated in the following parameter.

(6) **The Lex-Syn Parameter** (Reinhart & Siloni 2005)

UG allows thematic arity operations to apply in the lexicon or in the syntax.

The syntactic component of the grammar is the engine that builds phrases from elements selected from the lexicon. The question arises as to whether the syntactic components can manipulate the thematic information of these elements. It has been suggested that the syntactic machine operates with the selected elements and the lexical-semantic information they bear and cannot change their basic properties (Siloni 2002). Once a theta role is part of the theta grid of a predicate in the structure, it must either be merged as an argument or have a residue in the syntax or at the level of interpretation. This is formulated in the following guideline.

(7) The Lexicon Interface Guideline (TLIG)

The syntactic component cannot manipulate theta grids: Elimination, modification or addition of a theta role are illicit in syntax

Whereas lexical operations apply to theta grids, operations in syntax apply to a syntactic structure, which is already associated with a semantic representation an event. The Lex-Syn parameter is applicable only if the grammar includes an active lexicon, an inventory of coded concepts, which intrinsically take participants (bear theta roles) and can undergo arity operations. The lexicon and the syntactic component are expected to be nonredundant systems, whose constraints and workings are different. The inventory of concepts does not contain a syntactic structure, as this would be superfluous reduplication of the syntactic component. Thus, there is no relation between distinct predicates; only a syntactic structure puts them together.

3. Thematic Arity Operations

3.1 Types of Arity Operations

I will discuss five types of thematic arity operations.

3.1.1 Passivization²

Passivization involves an operation labeled saturation, which saturates the external theta role by existential closure (Chierchia 1989/2004, Reinhart and Siloni 2005). The theta role is assigned to a variable bound by an existential operator. The external argument is no longer syntactically accessible, but it is still accessible on the level of interpretation. Passivization applies to predicates that bear both an external and an internal theta role. The passive verb loses the ability of assigning an accusative case and the internal argument moves to the subject position to receive a case. Passivization does not include manipulation of the theta grid. Horvath and Siloni (2005) provide evidence that verbal passivization is crosslinguistically syntactic. They base their argument on features such as semantic drifts, nominalizations and idioms (see §3.2).

3.1.2 Decausativization

Decausativization derives decausative predicates, by fully eliminating an external theta role of cause (Reinhart 2002). This arity operation is restricted to predicates whose external argument is a cause and their internal one is theme or experiencer.³ Similarly to passivization, the predicate's valence is reduced and the verb loses its accusative case. However, unlike passivization, the reduced argument is no longer accessible on the level of interpretation. It is possible to add a by-phrase or an agent-oriented adverb in case of passivization (8a,8b), while it is impossible to do so in the case of decausativization (8c,8d).⁴

(8) a. ha-kerax humas al-yedey dan.

‘The ice was melted by Dan’

b. ha-kerax humas bexavana.

‘The ice was melted on purpose’

c. * ha-kerax namas al-yedey dan.

‘The ice melted by Dan’

d. * ha-kerax namas bexavana.

‘The ice melted on purpose’

² I will address only the verbal system in this paper.

³ When the internal theta role is a theme, this operation derives unaccusative verbs (e.g. *nafal* ‘fell’), while it derives subject experiencer verbs when the internal theta role is an experiencer (e.g. *hitragez* ‘became upset’). These predicates exhibit a different syntactic behavior, but for the purpose of this paper I term them both decausatives.

⁴ See also Levin and Rappaport-Hovav (1994, 1995).

3.1.3 Causativization

The operation of causativization adds a theta role (agent) to the theta grid of the predicate. The external theta role of the basic entry can be either an agent (e.g. *rac* ‘run’) or a sentient (e.g. *yada* ‘know’). According to TLIG (6), both causativization and decausativization are lexical operations, as in both cases, the theta grid is manipulated. In addition to lexical causativization, languages also manifest analytic causatives, which are composed of two predicates, the first being the causing predicate. However, while lexical causativization can add only an agent (9), analytic causativization allows the realization of a cause (10).

(9) ha-more/ *ha-gešem heric et ha-yeled la-kita.

The teacher/ *the rain ran-CAUS the boy to class.

‘The teacher/ the rain made the boy run to class’.

(10) ha-more/ ha-gešem garam la-yeled laruc la-kita.

‘The teacher/ the rain made the boy run to class’

Pesetsky (1995) views the operation of causativization as having a much broader range. He derives the transitive alternate of decausative, transitive and unergative verbs from the one-place entry by causativization. This analysis raises some problems (Reinhart & Siloni 2005, Reinhart 2006). First, this operation adds a new role to the basic entry. This role alternates between an agent for transitive and unergative verbs and a cause as far as decausative verbs are concerned. If this is the same operation, why would it be a different role? Assuming that the same operation is involved in both cases would make it impossible to predict which new theta role is added. Second, the transitive-intransitive alternation is morphologically unsystematic, while the alternation of causativization is. This suggests that the two alternations are derived by two distinct operations. Third, following Pesetsky’s analysis, we would lose the definition of the set of decausative and unergative predicates, as they all undergo the same operation. Finally, languages such as French (Friedemann 2000) do not have lexical causativization. There is a lexical alternation between decausative and transitive verbs, while there is no such alternation between unergative and causative verbs. Again, if the two alternations were the result of the same operation, languages such as French would exhibit only a part of this predication for no obvious reason. These arguments lend support to the analysis that a different thematic operation is involved in the derivation of causative and decausative verbs.

3.1.4 Reflexivization and Reciprocalization

Reflexivization and reciprocalization do not eliminate a theta role. Rather, a theta role that is not mapped onto a syntactic argument position is present in the semantics of such predicates. Reinhart & Siloni (2005) argue that when these operations apply in the lexicon, they take two theta roles and form one complex theta role. They call this operation bundling, a prerequisite for which is that it operates on an external theta-role. This operation associates a bundle of two theta roles with the external argument.

(11) Lexical Reflexivization Bundling

$[\theta_i] [\theta_j] \rightarrow [\theta_i - \theta_j]$, where θ_i is an external θ -role.

The reciprocalization operation is similar to that forming reflexives but its semantics is different. While the reflexive denotes a reflexive event, the reciprocal denotes a reciprocal event. When reflexivization and reciprocalization apply in the syntax, the operation is different. Following TLIG (7), manipulation of the theta grid is only possible in the lexicon. Thus, bundling in the syntax does not apply to the theta grid of the verb, but to unassigned theta roles. An internal theta role is not mapped onto its canonical position due to the lack of case. The unassigned role retains the verbal projection until the external theta role is merged. Upon the merging of the external theta-role, the unassigned role is bundled with the external role, resulting in the assignment of two roles to the same syntactic argument.

3.2 Syntactic-Semantic Features of the Lex-Syn Parameter

While some operations are universally lexical (e.g. decausativization) or syntactic (e.g. passivization), there are operations such as reflexivization and reciprocalization, which demonstrate cross-linguistic variation. This variation can be explained on the basis of the component of the grammar where the operation takes place. There are languages such as MH, MSA, Hungarian and Russian whose parameter is set to 'lexicon', while there are other languages such as French and Romanian, whose parameter is set to 'syntax'. There is a cluster of syntactic-semantic features, which is determined by the value of the Lex-Syn parameter (Reinhart & Siloni 2005).

3.2.1 ECM Formation

Languages differ regarding the possibility of reflexivizing or reciprocalizing exceptional Case marking (ECM) predicates. Consider the French ECM construction in (12a) and its reflexive equivalent in (12b). The matrix predicate *considère* 'consider' does not take a DP as its internal argument, but rather a small clause. *Pierre* in (12a), to

which *considère* assigns accusative case, is the subject of the small clause, and receives its theta role from the adjective *intelligent*. As it is not an argument of *considère*, a lexical operation on the theta grid of the latter cannot affect it (Reinhart & Siloni 2003).

- (12) a. Jean considère Pierre intelligent
 ‘Jean considers Pierre intelligent’
 b. Jean se considère intelligent
 ‘Jean SE considers intelligent’

Languages that set the Lex-Syn parameter to "lexicon" do not allow ECM reflexives and reciprocals (13a). They must use a reflexive element to express the relevant meaning (13b). This is because a lexical operation is bound to the domain of a single predicate.

- (13) a. *dan mitxašev intilgenti.
 Dan considers-Refl intelligent
 b. dan maxšiv et acmo intilgenti.
 Dan considers ACC himself intelligent

This difference is expected in light of the Lex-Syn parameter. The lexicon contains lists of items that are combined into phrases by the syntax. In the lexicon, there is no relation whatsoever between distinct predicates; they are distinct items on a list. Only the syntax puts them together, merges them into a structure, thereby establishing a structural relation between them. It is thus straightforward that an operation in the lexicon is limited to a single predicate and its theta grid, and cannot involve two predicates, as in the lexicon they are distinct entries which nothing ties together. When the operation is syntactic it applies after the formation of syntactic structure, which establishes a structural relation between distinct lexical items. It is thus not surprising that a syntactic operation can affect the θ -roles of two distinct predicates that a structure has put in a local configuration.

3.2.2 Nominalization

Lexical settings allow nominalizations of the derived predicate, while syntactic settings disallow them. There are reflexive nominals showing reflexive morphology in MH (14a), MSA (14b) and Hungarian (14c), while there are no such instances in syntax languages.

- (14) a. hitraxcut ‘self-washing’
 b. $\text{?iyt}isal$ ‘self-washing’
 c. mos-akod-ás wash-*refl*-nom ‘self-washing’

Assuming that nominalization takes place in the lexicon (Siloni 1997, 2002), a predicate derived by a lexical operation can be used as the input of nominalization. Lexical operations can therefore feed the nominalization operation. However, when an arity operation applies in syntax, there is no input to nominalize.

3.2.3 Frozen Input

There are instances of outputs of lexical operations, whose input alternate does not exist in the vocabulary. For example, the MH reciprocal verb *hitvakeax* 'argued' (15) does not have a transitive counterpart. However, there are no instances of outputs of syntactic operations lacking an input.

- (15) dan ve-dina hitvakxu
 'Dan and-Dina argued'

The existence of an actual basic entry for a derived counterpart demonstrates cross-linguistic variation. The MH decausative verb *higia* 'arrived' has no transitive alternate in the sense of 'made X arrive'. However, the MSA verb *wasʕal* 'arrived' has a transitive alternate in *ʔawsʕal* 'made X arrive' as shown in (16).

- (16) haaḍa l-maxluuqu la yaʔrifu ma llaḍi: ʔawsʕalahu ʔila ḍaalika l-makaani⁵
 this Det-creature not know what which arrived-Caus to that Det-place
 'This creature does not know what brought him to that place'

It has often been suggested that the lexicon includes entries that are frozen in the sense that they exist in the lexicon but cannot be inserted into syntactic derivations, and hence are not part of the actual vocabulary of the language (Chierchia 2004, Horvath & Siloni 2005, Reinhart 2000, among others). If frozen entries are available in the lexicon, they can feed lexical operations. In contrast, frozen entries cannot feed syntactic operations as they are not accessible to the syntax.

3.2.4 Semantic drift

Lexical predicates can undergo semantic drift, thereby acquiring a new meaning, alongside the original meaning or replacing it. The meaning of a predicate is compositional when it is created by some kind of operation. A word can acquire an unpredictable idiosyncratic meaning, which is no longer derived from the operation by which it was created in the first place. Meanings of words can also be extended creatively, or their meaning can change through reanalysis, chiefly but not exclusively

⁵ This sentence is taken from a narrative text written by a native speaker of Algerian Arabic.

during language acquisition (Fortson 2003). For example, semantically drifted reciprocals are found in MH, Hungarian and Russian. The verb *vstrechat'sja* ('meet') in Russian also has the meaning 'to go out on a date', which is not shared by its transitive counterpart. Horvath & Siloni (2005) argue that items can undergo semantic drift only if they are present in the lexicon. It automatically follows that lexically derived predicates can drift, while syntactic predicates must keep the original meaning of the transitive verb, as they are not available in the lexicon. This is also attested with regard to lexical causativization. Causative predicates change in such a way that they undergo a semantic operation in which the agent of the basic alternate is no longer agentive, or at least not necessarily agentive. The new meanings, which these verbs receive, are many so that one cannot generalize a uniform operation. However, they all share the notion of an attempt to cause somebody to perform an act or help him/her do so.

Semantic drift is also attested in Arabic dictionaries, where most causative verbs in MSA have more than one meaning. The first is the pure causative meaning, where both arguments are agentive, while other meanings present different interpretations where the original demoted subject need not be agentive.

(17) Semantic drift of MSA causative predicates

Basic Entry	Meaning	Causative	Meanings
ḥamala	'carried'	ʔaḥmal	1) 'made someone carry' 2) 'helped someone carry'
xafar	'dug'	ʔaḥfar	1) 'made someone dig' 2) 'helped someone dig'
tabiʔ	'followed'	tabbaʔa, ʔatbaʔ	1) 'made someone follow someone' 2) 'joined two people together'
yaza	'invaded'	yazza, ʔayza	'equipped to invade' ⁶

3.2.5 Idioms

Horvath & Siloni (2005) observe that a predicate has to be present in the lexicon to give rise to an idiom. Predicates formed in the lexicon can give rise to idioms not shared by their transitive counterparts. The transitive alternate of the reciprocal verb (18a), for example, has only a literal meaning (18b).

⁶ I have not come across any evidence of a pure causative meaning of this verb.

- (18) a. *nipageš ba-sivuv*.
 will-meet(we) in-the-turn
 'Just you wait and see'
 b. *efgoš otxa ba-sivuv*.
 will-meet(I) you in-the-turn
 'I will meet you at the turn'

It is also possible, however, for an idiom that consists of a lexically derived predicate to give rise to an idiom that contains its basic entry. Observe the following Hebrew idiom and its alternates.

- (19) a. *šomer nafšo yirxak*.
 keeper soul-Poss stay-away-oneself
 'Shun it for dear life'
 b. *šomer nafšo yitraxek*
 keeper soul-Poss stay-away-oneself
 'He who looks after oneself will stay away'
 c. *šomer nafšo yarxik et acmo*
 keeper soul-Poss stay-away himself
 'He who looks after oneself will stay himself away'

In (19a), the idiom consists of the old Hebrew reflexive verb *yirxaq* 'stay away' in the future form. This verb has a morphological alternate in another prosodic template *hitraxek* without a change in its reflexive meaning (19b).⁷ In addition, the transitive alternate of this verb *yarxik* 'make X stay away' can feed the same idiom as demonstrated in (19c).⁸ This phenomenon is not attested with regard to syntactic operations. Syntactic predicates are not at all available in the lexicon. They are inserted as two place predicates and are formed in the syntax. It follows that lexical reciprocals can form their own idioms, but syntactic reciprocals can participate in an idiom only if their transitive alternate does, as only the latter is available in the lexicon.

3.2.6 Chain derivations

The output of lexical operations can feed further operations. Since the derived predicate is part of the lexicon, it is still accessible and can undergo thematic operations. The verb *hilbiš* 'dressed', for example, is derived from the transitive verb

⁷ See §6.3 for elaboration on the morphological alternation

⁸ Observe the following examples:

(1) *šomer nafšo yitraxek mi-burgman* 'he who looks after himself will stay away from Burgman' (<http://www.ynet.co.il/Ext/App/TalkBack/CdaViewOpenTalkBack/0,11382,L-3294349-2,00.html>).

(2) *šomer nafšo yarxik otam mimeno* 'he who looks after himself will make them stay away from him'. (<http://www.ynet.co.il/Ext/App/TalkBack/CdaViewOpenTalkBack/0,11382,L-3110832,00.html>).

lavaš ‘wore’ by causativation. The output form *hilbiš* is used as an input form for the derivation of the reflexive form *hitlabeš*.⁹ Anderson (1992) claims that a lexical rule might presuppose the application of another lexical operation, but it is not expected to presuppose the application of a syntactic rule, since such rules do not apply within the lexicon. The usual interpretation of such relations of informational presupposition is as the relative ordering of the rules in question. Lexical rules apply to one another’s output, but not to the output of syntactic rules. Applying this observation to the two kinds of thematic operations, lexical operations can apply in a chain, while syntactic operations cannot. This chain derivation is not very common with regard to the operations examined in this paper, but there are no instances of such chains with regard to syntactic operations. This is the same argument regarding nominalization as the latter is considered a lexical operation that can be fed only by the output of lexical operations and not syntactic ones. Once a predicate is formed outside the lexicon, it is no longer accessible to further arity operations.

(20) Chain Derivations in MH¹⁰

Base 1	Derived Form 1 Base 2	Derived Form 2
hikpic ‘made X jump’	kafac ‘jumped’	kipec ‘jumped repeatedly’
lavaš ‘wore’	hilbiš ‘dressed’	hitlabeš ‘dressed oneself’
nam ‘slept’	nimnem ‘took a nap’	hitnamnem ‘took a short nap’

⁹ *hitlabeš* could not be analyzed as derived from *lavaš*, as its reflexive meaning does not stem from *lavaš*, but from *hilbiš*. *hitlabeš* does not mean *lavaš et acmo* ‘wore himself’ but *hilbiš et acmo* ‘dressed himself’.

¹⁰ Some of the examples include the formation of repetitive and diminutive verbs. Although I do not account for their derivation in this paper, I believe them to be co-related via lexical operations (Laks 2004).

4. The Verbal Systems of MSA, PA and MH

4.1 Data Sources

The MSA data are taken from narrative and expository texts produced or written by native speakers of Arabic in the framework of a research project entitled “The impact of L1 on advanced learner language: A cross-linguistic study of spoken and written usage” funded by a grant from the German-Israel Research Foundation (GIF) to Ruth Berman, Tel Aviv University, and Christiane von Stutterheim, University of Heidelberg. Further data are taken from Wehr’s (1961) Dictionary of Modern Written Arabic, Wright (1889), Mahmoud (1991), Levin (1995), Badawi, Carter and Gully (2004), Holes (2004) and Jastrow (2004). The PA data in this paper are based on recordings of native speakers of Palestinian Arabic. One subject is a student from the Galilee village Rame, whom I recorded, asking her to tell about her life and to describe some events. In addition, I used recordings of two speakers from Jaffa and two speakers from Ramallah.¹¹ I am also relying on data provided by several speakers, whom I interviewed.

4.2 The Verbal Systems

The verbal systems of MSA, PA and MH consist of prosodic shapes called binyanim. The binyan indicates the phonological shape of the verb, i.e. its vowels, its prosodic structure and its affixes (if any).¹² The phonological shape of a verb, unlike that of a noun, is essential for determining the shape of the other forms in the inflectional paradigm (see Ornan 1971, 2003, Ben-Asher 1972, Blau 1972, Schwarzwald 1974, 1981, 2000, 2001, 2002, Berman 1975, 1978, 1987, Bolozky 1978, 1982, 1999, Bat-El 1989, 1994, Ravid 1990, 2003, 2004, Nir 1993, Aronoff 1994, Fassi Fehri 1994, Ephratt 1997, Doron 1999, 2003a,b, Borochofsky Bar-Aba 2001, Arad 2003, 2005, among many others). A verb that does not conform to one of the existing binyanim cannot enter the verbal system. Therefore, every new verb that enters the language must conform to one of the existing vocalic patterns.

¹¹ I would like to thank Uri Horesh for providing me the data.

¹² The system of binyanim names verbs according to the traditional practice of associating the consonantal root *p/f, ʔ, l* with a vocalic template.

(21) MSA Binyanim¹³

Perfect	Imperfect
faʕal	ya-fʕʕa/i/ul
faʕʕal	yu-faʕʕil
faaʕal	yu-faaʕil
ʔafʕal	yu-fʕil
tafaʕʕal	ya-tafaʕʕal
tafaaʕal	ya-tafaaʕal
ʔinfaʕal	ya-nfaʕil
ʔiftaʕal	ya-ftaʕil
ʔistaʕal	ya-staʕil

The verbal system of PA is morphologically less rich than the one of MSA. Some Binyanim, such as *ʔafʕal* and *ʔistaʕal* are not in great use. There are differences in the morphology of binyanim between PA and MSA. First, there is no vowel in the prefix of *tafaaʕal* and *tafaʕal* (e.g. *tharrak* vs. *taharrak* ‘moved’). Second, *ʔinfaʕal*, *ʔiftaʕal* and *ʔistaʕal* do not begin with a glottal stop but with a vowel as PA does not require an onset for every syllable.

(22) PA Binyanim

Perfect	Imperfect
faʕal	yi-fʕa/i/ul
faʕal	ye-faʕʕil
faaʕal	ye-faaʕil
afʕal	yu-fʕil
tfaʕʕal	ya-tfaʕʕal
Tfaaʕal	ya-tfaaʕal
infaʕal	ya-nfaʕil
iftaʕal	ya-ftaʕil
istaʕal	ya-staʕil

(23) MH Binyanim¹⁴

Perfect	Imperfect
paʕal	yi-fʕa/ol
nifʕal	yi-paʕʕel
hifʕil	ya-fʕil
piʕel	ye-faʕel
hitpaʕel	yi-tpaʕel

Following previous studies, I assume that passivization is syntactic (Horvath & Siloni 2005), while all other operations, in languages such as MH (Reinhart & Siloni 2005) MSA and PA (Laks 2004) are lexical. (24) demonstrates the possible lexical operations in MSA with their morphological manifestations.

¹³ This does not include inflectional pronoun suffixes, which are concatenated to the stem for subject agreement.

¹⁴ The relevant distinction between the two forms is past and future, rather than perfective and imperfective. However, I use the latter terms in order to keep the terminology consistent with MSA and PA forms.

(24) Lexical operations in MSA

Base	Derived form	
a. Causativization		
raqas ^ʔ	ʔarqas ^ʔ raqqas ^ʔ	'danced'
labis	labbas	'dressed'
b. Decausativization		
kasar	ʔinkasar	'broke'
ʔawqaʔ	waqaʔ	'fell'
c. Reflexivization		
maššat ^ʔ	tamaššat ^ʔ	'combed'
ʔaslam	ʔistaslam	'gave in'
d. Reciprocalization		
katab	kaatab	'wrote'
qaatal	taqaatal	'fought'

Passivization in MSA can apply to every transitive verb. A passive predicate is formed by changing the vocalic pattern of the transitive verb, regardless of its prosodic structure.

(25) MSA Passivization

Base	Derived form	
a. Perfective form		
kasar	kusir	'broke'
saaʔad	suuʔid	'helped'
ʔarsal	ʔursil	'sent'
tanaawal	tunuuwil	'handled'
ʔintaxab	ʔuntuxib	'elected'
ʔistaqbal	ʔustuqbil	'welcomed'
b. Imperfective form		
yaksur	yuksar	'break'
yusaaʔid	yusaaʔad	'help'
yursil	yursal	'send'
yatanaawal	yutanaawal	'handle'
yantaxib	yuntaxab	'elect'
yastaqbil	yustaqbal	'welcome'

All the lexical operations in MSA also exist in PA (26).

(26) Lexical operations in PA

Operation	Base	Derived form	
Causativization	mad ^ʔ a	mad ^ʔ d ^ʔ a	'signed'
Reflexivization	xabba	txabba	'hid'
Reciprocalization	qatal	qaatal	'fought'
Decausativization	farraḥ kasar	firiḥ inkasar	'made X happy' 'broke'

There is a difference between PA and MSA with regard to passivization¹⁵. The passive forms exhibited in MSA do not exist in PA. Passive verbs in PA are formed in the *infaʔal* and *tfaʔʔal* binyanim. The base form of *infaʔal* passive verbs are restricted to

¹⁵ See also Rosenhouse (1991/1992).

verbs of *faʃal* (27a) , while passive verbs in *tfaʃal* are restricted to forms of *faʃʃal* (27b). The morphological shape is used both for passive verbs and other predicates such as decausatives, as *infaʃal* and *tfaʃʃal* are also the output forms of lexical operations.

(27) PA Passivization

- a. baʃa → inbaʃa ‘sold’
 b. sʕallah → tsʕallah ‘fixed’

MH also demonstrates the four lexical operations.

(28) Lexical operations in MH

Base	Derived form	
a. Transitives/Unergatives → Causatives		
rakad	hirkid	‘danced’
xatam	hextim	‘signed’
b. Transitives → Decausatives		
šavar	nišbar	‘broke’
hirgiz	hitragez	‘upset’
hikpi	kafa	‘froze’
c. Transitives → Reflexives		
raxac	hitraxec	‘washed’
sirek	histarek	‘combed’
šataf	ništaf	‘washed’
d. Transitives → Reciprocals		
katav	hitkatev	‘wrote’
pagaš	nifgaš	‘met’

MH passive forms are productive in two prosodic shapes, *puʃal* and *hufʃal*.

(29) MH Passivization

- hišlix → hušlax ‘threw’
 tipel → tupal ‘handled’

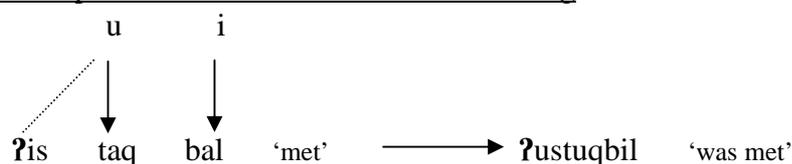
5. A Word-based Analysis of the Data

The derivation of one verb from the other can be divided into three types of morpho-phonological processes, which can co-occur in one derivation.

5.1 Melodic Overwriting

The syntactic operation of passivization is manifested segmentally by melodic overwriting. In MSA, the vocalic pattern of every transitive verb is changed into *u-i* in perfective forms and into *u-a* in imperfective forms. When the verb exceeds the minimal word size (a binaric foot), one of the vowels of the passive pattern spreads to the rest of the syllables. Melodic overwriting in MSA takes place in a different pattern with respect to perfective and imperfective forms. In the perfective form, the last vowel of the stem changes to /i/ and the preceding one to /u/. The /u/ spreads to the preceding syllable.

(30) MSA perfective forms: Melodic Overwriting



In the imperfective form, the first vowel turns into /u/ and the second one into /a/ which spreads to the rest of the word.

(31) MSA imperfective forms: Melodic Overwriting

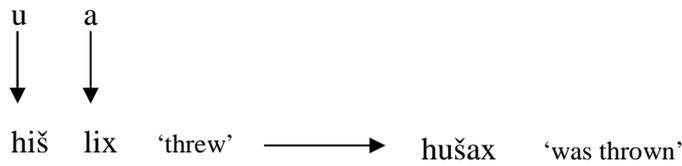


The data in (30) and (31) raise a question with regard to the different direction of spreading in the perfective form and in the imperfective form. I assume it stems from the difference between the imperfective prefixes (e.g. /ya-/ in *yustaqbil*) and the syllable added to some of the perfective forms (e.g. /ʔi-/ in *ʔustaqbal*). The occurrence of the former is not phonologically conditioned while the occurrence of the latter is (see §5.3), hence the syllables that are added to the perfective forms are not considered prefixes. The vocalic pattern of the passive voice associates with the first two inherent syllables of the form; the rightmost vowel of the vocalic pattern spreads to the right. The epenthetic syllable is not inherent, and thus the vocalic pattern skips it in its association, but then the leftmost vowel of the pattern spreads to the left.

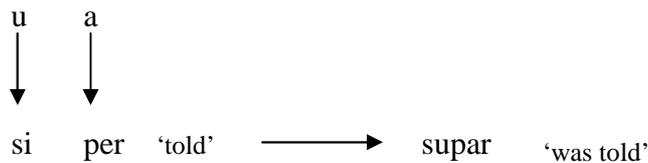
In MH, most passive verbs are in *hufʕal* and *puʕal* forms, which contain only two syllables.¹⁶ Thus, no spreading takes place.

(32) MH passivization

a.



b.



The relations between active predicates and their passive counterparts exhibit only melodic overwriting; the prosodic structure in both forms is identical and thus vacuously assigned. Melodic overwriting does not involve reference to the consonantal root (Bat El 2002) as it operates directly on the stem.

Melodic overwriting is also demonstrated in lexical operations. The MH *piʕel* form is formed by melodic overwriting of *paʕal*, where the vocalic pattern changes from *a-a* to *i-e* (e.g. the alternation *gadal-gidel* ‘grow-raise’).

5.2 Prosodic Circumscription

The most challenging morphological processes are those involving alternation in the prosodic structure, which amount to geminates vs. simple consonants and long vs. short vowels. McCarthy and Prince (1990) suggest an analysis, which circumvents the problem of transfer with regard to MSA broken plurals. To derive the plural from the singular, they posit a rule of positive prosodic circumscription that isolates the leftmost moraic foot of the singular base and maps the circumscribed material onto an iambic foot template. The residue is added to the iambic foot and melodic overwriting follows as well (33).

¹⁶ MH passive forms are also found in binyan *nifʕal*. The derivation of the latter does not demonstrate the same pattern as other passive forms. I claim that *nifʕal* passive forms were lexicalized and that their derivation with regard to new verbs is not productive (see §7)

(33) Derivation of broken plural in MSA

Singular Form:	maktuub ‘letter’
Prosodic Circumscription:	Base- mak (μμ) Residue- tuub
Mapping:	[makμμ]tuub
Melodic Overwriting {ai}:	makaatib ‘letters’

McCarthy (1993) extends the circumscription analysis to the verbal system. He suggests a rule of negative circumscription. This rule extracts a prosodic unit, which consists of a moraic syllable, from the simple verb *katab* ‘wrote’ and adds a mora prefix to the residue.

(34) Derivation of *kattab* from *katab*

Base:	katab ‘wrote’
Negative Circumscription:	<ka>tab
Prefix μ:	<ka>μ tab
Spread L:	<ka> ttab
Output:	kattab ‘wrote-Caus’

The reciprocal form is derived in a similar way. Instead of gemination, the first vowel is lengthened and occupies the position of a new mora. The distinction between the derived forms *kattab* (34) and *kaatab* (35) is attributed to the direction of spreading by which the inserted mora is filled.

(35) Derivation of *qaatal* from *qatal*

Base:	qatal ‘fought’
Negative Circumscription:	<qa>tal
Prefix μ:	<qa>μ tal
Spread R:	<qa> atal
Output:	qaatab ‘fought-Reciprocal’

The (ʔi)ftaʕal binyan is derived from faʕal by circumscription that is manifested by the infixation of the consonant /t/. As demonstrated in (36), the first consonant of the base /y / is extracted and a mora slot is added to the residue. The consonant /t/ is inserted and fills this slot. The vowel and the glottal stop are concatenated in order to prevent a word initial consonant cluster and a syllable without an onset (see §5.3).

(36) Derivation of ʔiytasal from yasal:

Base:	yasal ‘washed’
Negative Circumscription:	<y>asal
Prefix μ:	<y>μ asal
Insert /t/:	<y> tasal
Output:	(ʔi) ytasal ‘washed-Reflexive’

The circumscription analysis relies directly on the notion of a word and a lexeme (Aronoff 1976). Contrary to the root-and-template analysis, one can identify morpho-phonological elements which mark the derivation, e.g. a long vowel for reciprocal and a consonant for the causatives. Note that this analysis manifests a high degree of idiosyncrasy. The direction of spreading, the circumscribed unit and the affixation (to the circumscribed unit or the residue) are binyan specific. As I will show in §6.1, such idiosyncrasy is typical to processes that apply in the lexicon.

5.3 Affixation

Some binyanim are derived from others by adjoining a syllable or a mora to the left edge of the base. The addition can invoke a change in the internal prosodic structure of the base, in addition to the external one. MSA binyan *ʔafʔal* is derived by adding the prefix /ʔa-/ to the *faʔal* form. The first vowel of the stem is deleted in order to preserve the prosodic shape of a binary foot, or alternatively, to avoid the sequence of two light syllables, resulting in the *ʔafʔal* form (37).

(37) MSA affixation and vowel deletion

ʔa-šarab → ʔašrab ‘made X drink’

The *tafaʕal* and *tafaaʕal* binyanim are derived from *faʔal* and *faaʔal* respectively by adding the prefix /ta-/. In this case, a syllable is added to the stem but its internal prosodic structure does not change. As opposed to the formation of *ʔafʔal*, there is no vowel deletion as it would result in a tri-consonantal cluster (**tafʔal*). The *ʔinfaʔal* template is derived from *faʔal* by affixation of /n/. An epenthetic vowel is then inserted in order to prevent a consonant cluster in word initial position and a glottal stop is inserted preventing a vowel initial syllable. The *ʔistafʔal* template is derived by affixation of the prefix /sta-/. An epenthetic vowel and a glottal stop are inserted for the same reasons explained with regard to *ʔinfaʔal*. The first vowel of the stem is deleted as noted for *ʔafʔal*. Similar patterns occur in the derivation of some MH and PA forms.

5.4 Combination of Morphological Processes

The derivation of one verbal form from another can sometimes involve more than one morpho-phonological process. The reciprocal verb *tanaat'ah* 'thrusted each other', for example, is derived from the verb *nat'ah* 'thrusted'. In this case, the *faʕal* template, which lacks prefixes and long vowels or consonants, serves as the base for the derivation of the *tafaʕal* template. This derivation is performed both by affixation of /*ta-*/ and by prosodic circumscription, resulting in the lengthening of the first vowel of the base form. The derivation of the MH binyan *hitpaʕel* involves both affixation of the prefix /*hit-*/ and changing the first vowel of the stem if the base form is *piʕel* (e.g. *pileg* – *hitpaleg* 'split') and changing both stem vowels when the base is *paʕal* (e.g. *sagar* – *histager* 'closed').

6. The Morpho-phonology of Arity Operations

While some operations are universally lexical (e.g. decausativization) or syntactic (e.g. passivization), there are operations such as reflexivization and reciprocalization, which demonstrate cross-linguistic variation. This variation can be explained on the basis of the component of the grammar where the operation takes place. There are languages such as MH, MSA and Hungarian whose parameter is set to 'lexicon', while there are languages such as French and Romanian, whose parameter is set to 'syntax'. In §3, I presented a cluster of syntactic-semantic features, which is determined by the value of the Lex-Syn parameter (Reinhart & Siloni 2005). I argue that the Lex-Syn parameter has morpho-phonological consequences as well; once the parameter value is set, a cluster of three morpho-phonological properties follows: intrusiveness of the morpho-phonological process, directionality and predictability.

6.1. The Morpho-phonological Properties

6.1.1. Intrusiveness of the Morpho-phonological Process

In morpho-phonological terms, lexical and syntactic operations differ in the degree of intrusiveness of their morpho-phonological manifestation. Based on the observed morpho-phonological alternations, I define a hierarchy of intrusiveness for the observed processes.

- (38) a. Intrusiveness evaluation
- i. The higher the level of word structure manipulated, the greater the degree of intrusiveness
 - ii. The more levels manipulated in one operation, the greater the degree of intrusiveness.
- b. Hierarchy of Intrusiveness: (i) is more intrusive than (ii)
- i. Prosodic modification of the stem- (1) is more intrusive than (2)
 - 1) External modification: addition or deletion of syllables - affixation
 - 2) Internal modification: modification of the internal prosodic structure - prosodic circumscription
 - ii. Segmental modification of the stem: melodic overwriting

The hierarchy of intrusiveness correlates with the structure of the phonological word. The modification of the prosodic structure, including syllables and moras, is more intrusive. I thus consider processes, which add or delete moras or syllables, more intrusive than processes which only alter the segmental representation. Processes such as affixation and prosodic circumscription manipulate the structure of the prosodic word. Affixation adds syllables to the word, while circumscription turns one syllable

from light to heavy by adding a mora slot. This hierarchy is also perceptually grounded, since the prosodic structure is more perceptually accessible than the segmental structure, and thus an alternation in the prosodic structure is more intrusive. Studies in language acquisition suggest that prior to speech production, children can perceive prominence contrast among syllables within words (Sansavini et al. 1997) as well as among words within a phonological phrase. Christophe et al. (submitted) argue that children employ this capacity in setting the head-complement parameter in their target language, which later facilitates the acquisition of words. Perceptual studies with infants provide information about the psychological reality of prosodic information for infants by demonstrating their sensitivity and attentiveness to the prosodic organization of the speech input. Furthermore, prosodic packaging may provide the type of pre-categorization that allows the infant to segment the input in a way that makes the discovery of syntactic constituents more likely (Jusczk and Kemler Nelson 1996). In addition to the segmental–prosodic distinction, the number of changes that occur within the base plays a role as well. Derivations that involve more than one process, for example, affixation and circumscription, are also considered intrusive. This is because the more processes apply, the more dissimilar the input and the output are. Melodic overwriting applies to the segmental level only. It involves changing the quality of the stem vowels without changing its prosodic shape and is therefore considered less intrusive. The most prominent processes that characterize thematic operations in MSA and Hebrew are shown in (39).

(39) Types of morpho-phonological processes in MSA and Hebrew

Type of Operation	Base	Derived form	
a. Prosodic circumscription:			
MSA causativization	ħamal	ħammal	‘carried’
MSA reciprocalization	katab	kaatab	‘wrote’
b. Affixation:			
MSA decausativization	yalaq	ʔinyalaq	‘close’
MSA reciprocalization	qaatal	taqaatal	‘fought’
c. Affixation and Prosodic Circumscription:			
MSA reflexivization	jahil	tajaahal	‘was ignorant’
MSA reciprocalization	madaħ	tamaadaħ	‘praised’
d. Affixation and Melodic Overwriting:			
MH reflexivization	sirek/serek	histarek	‘combed’
	raxac	hitraxec	‘washed’
MH reciprocalization	nišek	hitnašek	‘kissed’
MH causativization	xatam	hextim	‘signed’
MSA decausativization	yaʔʔas	yaʔis	‘became desperate’
e. Melodic Overwriting			
MSA passivization	qaddam	quddim	‘handed’
	ʔintaxab	ʔuntuxib	‘elected’
	tanaawal	tunuuwil	‘handed’
MH passivization	hifkid	hufkad	‘deposited’

The correlation that emerges is that syntactic operations involve lower morpho-phonological intrusiveness than lexical operations. Passivization, which is syntactic, involves melodic overwriting (39e). In contrast, the other arity operations, which are lexical, also involve the addition of moras or syllables via prosodic circumscription or affixation or both. Moreover, passivization involves only one morpho-phonological process, while lexical operations can involve more than one process (39c-d). Each process, which applies in the syntax, can also apply in the lexicon, but there can be a process, the least intrusive one, which applies in the syntax but not in the lexicon. There is no evidence for the latter in MH, PA and MSA, but there is evidence for the former.¹⁷ Melodic overwriting, the least intrusive process (the lowest level in (38b)), applies in both the lexicon (40) as well as the syntax (41).¹⁸

(40) Melodic Overwriting in the lexicon¹⁹

lamad ‘studied’ → limed ‘taught’
 rakad ‘study’ → riked ‘danced repeatedly’

(41) Melodic Overwriting in syntax (passivization)

siper ‘told’ → supar ‘was told’
 hifkid ‘deposited’ → hufkad ‘was deposited’

Passivization in MH is manifested in the alternation of *hifʕil* and *piʕel* to *hufʕal* and *puʕal* respectively. The only change which occurs is changing the melodic pattern to *u-a* in both binyanim. The same pattern occurs in MSA, where every transitive verb can turn into a passive by changing its vocalic pattern. Note that the same vocalic pattern applies in all MSA passive forms regardless of the prosodic structure of the active base form, i.e. the number of syllables or their weight. When the base consists of a long vowel, e.g. *ʕaalaj* ‘took care of’, it remains long in the derived passive form and only changes to /u/ in *ʕuulij* ‘was taken care of’. When the base contains more than two syllables, e.g. *ʕiqtarah* ‘suggested’, one of the vowels of the passive melodic pattern spreads to the remaining syllable, forming *ʕuqturih* ‘was suggested’.²⁰

¹⁷ I assume there could be a language with a strict dichotomy between the morpho-phonology of the two types of operations.

¹⁸ There are several verbs in *piʕel* whose passive form is in binyan *hitpaʕel*, e.g. *kibel–hitkabel* ‘recieved/accepted’ and *gila–hitgala* ‘discovered’. For some reason, these verbs do not have a corresponding form in the *puʕal* template (**gula*). I view them as an idiosyncrasy and I believe that these passive *hitpaʕel* forms are lexicalized.

¹⁹ The *lamad* → *limed* derivation could be analyzed as causativization, while the *rakad* → *riked* one could be regarded as some modification of the thematic features (Laks 2004). Although I do not account for these specific operations in this paper, I believe that in both cases the theta grid is manipulated and they are therefore considered lexical.

²⁰ See §5.1 for discussion of the direction of spreading

It should be pointed out that I do not claim that there is a finite dichotomy between the morpho-phonology of lexical and syntactic operations. Rather, it is a matter of relativity that is dependent primarily on the morphological properties of a language. Passive forms in PA are less common compared to MSA, but the forms that do occur are only in the *infaʕal* and *tfaʕʕal* binyanim, derived only from *faʕal* and *faʕʕal* respectively. Affixation is considered relatively intrusive as it adds a syllable to the stem. PA passivization demonstrates the same level of intrusiveness as some lexical operations such as decausativization (42), as both operations involve affixation. I argue that there is an internal hierarchy of intrusiveness within the prosodic level (38b). Adding a prefix or a suffix is less intrusive than prosodic circumscription, as the latter is more intrusive to the structure of the stem of the base. In affixation, the internal structure of the stem remains intact, while in prosodic circumscription it does not; one of the syllables turn into a heavy one. Furthermore, the process of prosodic circumscription involves three stages: a circumscription of a unit, insertion of an empty mora slot and spreading of an adjacent vowel or consonant to this slot. The same pattern applies in degemination only in a different direction, which I account for in 6.1.2. Affixation, on the other hand, involves one stage only, i.e. adding an external syllable or mora, with its full segmental representation, to the base.

As PA does not demonstrate the least intrusive process of melodic overwriting, it applies the least intrusive level of prosodic interference to the base form. Moreover, some lexical operations in PA demonstrate a higher level of intrusiveness where their morpho-phonological manifestation is concerned. Similarly to MSA, causativization is performed via negative circumscription (42).

(42) Types of morpho-phonological processes in PA

Operation	Base	Derived form	
a. Prosodic circumscription:			
Causativization	daras	darrasy	‘studied’ → ‘taught’
Reciprocalization	katab	kaatab	‘wrote’
b. Affixation:			
Reflexivization	labbas yassal	tlabbas tyassal	‘dressed’ ‘washed’
Reciprocalization	qaatal	tqaatal	‘fought’
Passivization	katab	inkatab	‘wrote’
	sʕallah	tsʕallah	‘fixed’

As shown, the Lex-Syn parameter allows various kinds of processes to take place within the lexicon. In contrast, syntactic operations are restricted to less intrusive morpho-phonological processes.

Further evidence for this difference in intrusiveness is manifested in the productivity of some of the MH binyanim. *hifʕil*, *piʕel* and *hitpaʕel* are more productive than *paʕal* and *nifʕil*. Productivity here is measured on the basis of new coining (Bolzky 1978). According to Bat-El (2002), in *hifʕil*, *piʕel* and *hitpaʕel*, the phonological shape of the perfective (past) form is minimally but still sufficiently different from the imperfective (future) one. The future prefixes, recognized by speakers as limited to imperfective forms, are eliminated in the perfective form. When the perfective form has a prefix, it takes the position of the future prefix (*hifʕil* and *hitpaʕel*), otherwise the future prefix is ignored. The phonological simplicity of the inflectional relations within these binyanim is demonstrated via the absence of alternation in the prosodic structure. Moreover, the lack of prosodic alternation allows the stem consonants to occupy the same syllabic position in both perfective and imperfective forms. Such preservation of prosodic position is not found in *paʕal* and *nifʕal*.

6.1.2. Directionality

The syntactic operation of passivization is manifested mainly by changing the vocalic pattern of the active verb. Passive verbs demonstrate uniformity with regard to the quality of vowels, as they all share the same vocalic pattern. On the assumption that passivization is syntactic, the formation of passive verbs is post-lexical. The outputs of syntactic operations are not listed in the lexicon; hence they are not available as basic entries.²¹ Thus, the relationship between the active and passive forms is unidirectional. The morphological shape of the active verb is the base and the passive one is derived, followed by a regular change of the vocalic pattern. The picture is different with regard to some lexical operations presented in (43):

(43) MSA Causativization and Decausativization

Lexical Operation	Base	Derived form
a. Causativization	raqas ^s 'danced'	ʔa-rqas ^s 'made X dance'
b. Decausativization	ʔa-wqaʕ 'caused X to fall'	waqaʕ 'fell'

Following Reinhart & Siloni (2005), I assume that the unergative-transitive alternation (43a) and the transitive-decausative one (43b) are derived by two distinct lexical operations, as each is limited in a particular way (see §3.1.3). In (43a), the causative form is derived from *faʕal*, resulting in *ʔafʕal*, while in (43b) the output is *faʕal* and

²¹ By 'not listed in the lexicon' I refer to the notion that the output forms of syntactic operations are not stored in the same manner as the output forms of lexical operations. Passive verbs can be considered to be formed every time they are used, though it is possible that frequently used passive forms are stored. The issue of frequency-based storage is beyond the scope of this paper.

the input is *ʔafʔal*²². Both binyanim serve as a base form and as a derived form. The same pattern of bidirectionality can be found in MH (44).

(44) MH Causativization and Decausativization

Lexical Operation	Base	Derived form
a. Causativization	caʔad ‘marched’	hicʔid ‘made X march’
b. Decausativization	hitbia ‘caused X to drown’	tava ‘drowned’

In (44a), the *paʔal* form serves as an input, while in (44b) it is the *hifʔil* form. MSA and MH demonstrate bidirectionality in the *faʔal-ʔafʔal* and *paʔal-hifʔil* derivations respectively. How can one account for the two operations, using both forms as inputs and outputs?

This alternation can be explained in terms of paradigm accessibility. I will make a short digression in order to present this issue. Since the Neogrammarians’ work on sound change in the nineteenth century, it has been recognized that many exceptions to the regular phonological processes can be explained by proposing that paradigms of morphologically related words influence each other’s pronunciation (van Marle 1985, Dowing, Hall and Raffelsiefen 2005). A paradigm expresses the ways in which linguistic entities may be mutually connected. Languages demonstrate various cases, where a phonologically motivated alternation does not apply in order to achieve paradigm uniformity. For instance, many adjectives in English are formed by adding the suffix */-able/* to a verb. In some cases, stress shift is motivated in order to avoid a string of stressless syllables longer than two, e.g. the affixation of */-able/* to *discipline* should yield *disciplínable*. However, the prevalent form in actual use is *disciplinable* as it achieves paradigm uniformity with regard to stress. In the paradigm {*discipline, disciplinable*} stress is uniform as it is on the same syllable in both forms (Steriade 2000). The accessibility to other existing forms in a language plays a role in the derivations in (43) and (44). I argue that as long as the operation takes place in the lexicon, the morphological system has access to all lexical forms. Consequently, it can derive one form from the other, applying to the basic entry listed in the lexicon, in accordance with the relevant thematic operation. When acquiring a language, the speaker is exposed to the derivation of such paradigms, i.e. simple-to-complex form derivations and vice versa, s/he can implement these derivations on new predicates s/he encounters. Previous analyses of MH show that the *paʔal* forms are the least transparent semantically of all binyanim (Horvath 1981). This is the case with regard to MSA *faʔal* (McCarthy 1993) as well. Phonologically, both binyanim have a high

²² See also Hapelmuth (1987, 1993) for discussion of the issue of directionality and Bolozky & Saad (1983) and Saad & Bolozky (1984) for discussion of Arabic causativization.

degree of exceptionality and are therefore likely candidates for lexical specification (Horvath 1981, Ussishkin 2000, 2003). However, when taking into consideration the thematic relations between pairs of binyanim, such as *paʕal* and *hifʕil*, one has to assume that both forms can be lexically specified as well as lexically derived. Adopting this bidirectionality analysis entails that morpho-phonological processes such as affixation and prosodic circumscription can apply in the opposite direction as well, resulting in processes such as vowel shortening, degemination and deletion of affixes. In (44a), for example, the derived predicate is formed by the affixation of /hi-/ and the deletion of the first vowel of the stem, while in (44b) it is formed by the deletion of the prefix and the insertion of the vowel /a/ after the first consonant. Since speakers have lexical access to paradigms of such derivations, they use the morphological mechanism in both directions; they can construct the *paʕal* form by adding the vowel /a/ to the derived form.

To conclude, lexical operations demonstrate bidirectionality. Although this does not occur with regard to all operations, when it does occur, it is restricted to lexical operations. Passivization, in contrast, demonstrates unidirectional relations. This approach intertwines with Aronoff's (1976) view of the lexicon as a system of relations that can actively generate new words. This also supports the claim that there is no one-to-one relation between form and meaning with regard to prosodic templates.

6.1.3 Predictability

The derived forms of syntactic operations can be easily predicted, as the only change that occurs is the vocalic pattern. Each of the passive templates in both MH and MSA are restricted to a single corresponding binyan in which their transitive counterparts are formed. This is not true for the templates which feed lexical operations, as there is no one-to-one relation between pairs of binyanim. Templates such as MH *puʕal* and *hufʕal* do not have an independent existence; they serve only as the passive form of *piʕel* and *hifʕil* respectively. In contrast, the morphological output of lexical operations is unpredictable, as most operations have more than one possible input and output binyan.

(45) MSA possible input/output binyanim

Lexical Operation	Input Binyan	Output Binyan	Examples
a. Decausativization	faʿal	ʔinfaʿal ʔiftaʿal	kasar → ʔinkasar ‘broke’ naḡar → ʔintaḡar ‘scattered’
	faʿʿal	tafaʿʿal	farrāq → tafarrāq ‘separated’ ḡassan → taḡassan ‘improved’
	ʔafʿal	faʿal	ʔasqatʿ → saqatʿ ‘fell’
	faaʿal	tafaʿʿal	laaša → talaaša ‘became extinct’
b. Causativization	faʿal	faʿʿal ʔafʿal	šarab → šarrab ‘drank’ raqasʿ → ʔarqas ‘danced’
c. Reflexivization	faʿal	ʔiftaʿal	rafaʿ → ʔirtafaʿ ‘lifted’
	faʿʿal	tafaʿʿal	jammal → tajammal ‘made pretty’
	ʔafʿal	ʔistaʿʿal	ʔaʿadda → ʔistaʿadda ‘prepared’
d. Reciprocalization	faaʿal	tafaʿʿal	sʿaalāḡ → tasʿaalāḡ ‘made peace’
	faʿal	faaʿal	qatal → qaatal ‘fought’
	faʿal	tafaʿʿal	madaḡ → tamaadaḡ ‘praised’

(46) MH possible input/output binyanim

Lexical Operation	Input Binyan	Output Binyan	Examples
a. Decausativization	hiʿʿil	paʿal	hixʔis → kaʔas ‘angered’
		nifʿal	hivhil → nivhal ‘frightened’
		hitpaʿel	hirgiz → hitragez ‘became upset’
	piʿel	paʿal	simeax → samax ‘was happy’
		hitpaʿel	rigeš → hitrageš ‘excited’
	paʿal	nifʿal	haras → neheras ‘ruined’
b. Causativization	paʿal	hiʿʿil	xatam → hextim ‘signed’
		piʿel	lamad → limed ‘studied - taught’ šaxan → šiken ‘settled’
c. Reflexivization	paʿal	hitpaʿel	raxac → hitraxec ‘washed’ paras → hitpares ‘spread’
		nifʿal	šataf → ništaf ‘washed’
	piʿel	hitpaʿel	serek → histarek ‘combed’
	hiʿʿil	nifʿal	hiškiv → niškav ‘lay down’ hišʔin → nišʔan ‘leant’
	hiʿʿil	hitpaʿel	higniv → hitganev ‘sneaked’ herim → hitromem ‘lifted’
d. Reciprocalization	paʿal	hitpaʿel	laxaš → hitlaxeš ‘whispered’
		nifʿal	pagaš → nifgaš ‘met’
	piʿel	hitpaʿel	nišek → hitnašek ‘kissed’

As demonstrated in (45) and (46), there are several combinations of input and output forms for the same lexical operation. When the base form of MH decausativization is *hifʕil*, for example, its derived counterpart can be in *paʕal*, *nifʕal* or *hitpaʕel*. There is no phonological or semantic basis explaining why the decausative counterpart of *hirgiz* ‘made X upset’ is *hitragez* and not *nirgaz*, while the decausative counterpart of *hivhil* ‘frightened’ is *nivhal* and not *hitbahel* (46a). As stated in §6.2, the morphological system has access to paradigms of lexical operations. Once a speaker is exposed to a sufficient number of such paradigms, s/he can derive different input forms from different output forms. Such a mechanism involves additional morphological processes to the ones discussed in §5. Deriving binyan *nifʕal* from binyan *hifʕil*, for example, involves the changing of the prefix and melodic overwriting.

There are some common paradigms for each lexical operation, but these paradigms are not restricted to a single operation. The MH *hifʕil-hitpaʕel* paradigm serves for decausativization (46a) and reflexivization (46c). The MSA *faaʕal-tafaaʕal* paradigm serves both for reciprocalization (45d) and decausativization (45a). Although the former is much more common, these paradigms of binyanim are not restricted to one meaning and can feed several thematic operations.

There are several verbs in the MH binyan *hifʕil* which do not undergo any morphological change as a result of decausativization. The verb *hexmir* ‘make/become worse’, for example, is manifested both as a transitive (47a) and a decausative predicate (47b).

- (47) a. ha-raav hexmir et macavo
 ‘the starvation made his condition worse’
 b. macavo hexmir
 ‘his condition became worse’

Further examples for this pattern are presented in (48).

- (48) Non-alternating morphology of decausativization *hivri* ‘made/became healthy’,
hišmin ‘made/became fat’, *hitnia* ‘started a car’, *hišxir* ‘made/became black’,
ʔacar ‘stopped’²³

²³ The decausative meaning alternates with *neʔacar*.

The lack of morphological alternation provides further evidence for the variety of combinations of input-output relations resulting from lexical arity operations. Unlike passivization, which demonstrates one-to-one relations between bases and derived forms, lexical operations occur in different shapes. This also supports the claim that there is no complete match between form and meaning with regard to binyanim. Binyan *hifʕil*, for example, is traditionally regarded as a causative form (Gesenius 1910). While it is indeed the unmarked binyan for causativization (e.g. *hextim* ‘made X sign’), it does exhibit all kinds of predicates such as PP-taking verbs (*hikšiv* ‘listened’), transitive verbs (*hirgiz* ‘upset’) and decausatives (*hivri* ‘became healthy’).

Verbs that are derived via lexical operations can share more than one meaning, i.e. the same form is used as the output of more than one operation. This is rather common for *hitpaʕel* verbs (Siloni, to appear). For example, the transitive verb *ʔarbev* ‘mixed’ has both reflexive (49a) and (49b) decausative alternates, both sharing the same form *hitʔarbev*.

- (49) a. keday še-titʔarbev ba-kahal
 ‘you should mingle (mix yourself) within the crowd’
 b. ha-tavlinim hitʔarbevu
 ‘the spices became mixed’

The MH and MSA templates of passive verbs, however, are mostly restricted to their passive meaning.²⁴

Observing the verbal systems of the three languages, it is impossible to predict whether a particular stem will or will not occur in a given binyan. The systems have a large number of accidental gaps (Horvath 1981). This supports the claim that the alternation of binyanim is lexical as it represents lexical thematic operations. Such operations are subject to gaps and suppletion. It is important to point out that I do not claim the input-output possible forms of lexical operations are totally free. There is a limited set of forms for every operation, e.g. there would be no reflexive or reciprocal predicate in binyan *ʔinfaʕal* in MSA or in binyan *piʕel* in Hebrew. I do, however, argue that this set of options is much more varied in comparison with the one of syntactic operations.

²⁴ There is, however, a group of decausative verbs with a passive morphology, e.g. *huksam*, derived from *hiksim* ‘charmed’ and *hufta*, derived from *hiftia* ‘surprised’. Landau (2002) argues that they have only a decausative interpretation and labels them ‘fake-passives’, while Meltzer (2005) suggests that they are ambiguous and also share a passive meaning. As noted in §6.1.1, melodic overwriting is not restricted to syntactic operations.

6.2. Summary and Implications

The following table summarizes the differences between the morpho-phonology of the two kinds of operations as discussed above.

(50) Morpho-phonological properties of syntactic and lexical operations

Property	Syntactic Operations	Lexical Operations
Intrusiveness	Limited to less intrusive processes	All degrees of intrusiveness
Directionality	Unidirectionality	Bidirectionality, no regular template for a specific operation
Predictability	Predictable	Unpredictable, variation of forms

Lexical operations are characterized by bidirectionality, low predictability and a wide range of intrusive morpho-phonological processes. In contrast, syntactic operations are predicatable, unidirectional and are limited to relatively less intrusive morphological processes. The properties Directionality and Predictability are independent although the data examined in this paper show that they overlap. This overlapping results from the one-to-one relations between active and passive verbs. These relations in MSA and MH are both unidirectional and predictable, as each binyan has a single passive template. One could hypothesize, however, a language, where there would be no overlapping between these two properties. It could have been that lexical operation, which involve other morphological processes would be more predictable, so that one would know which binyan corresponds to which binyan (even if biderctionally), but this is not the case with regard to the three languages I observe. A single binyan may be derivationally associated with a few binyanim.

The syntactic morphology is always predictable and steady. The lexical morphology is less predicatable, but there are different degrees of productivity within the different thematic operations (Laks 2004); decausativization applies more frequently than reflexivization, while the latter is more productive than causativization.²⁵ I contend that the more productive the lexical operation is, the more it is exposed to low predictability and to variation. I suggest that this is because when an operation applies more frequently within a component that is subject to irregularities – the lexicon – there is a greater chance that alternations will take place and that different forms will emerge.

²⁵ See §8 for a separate discussion of productivity of operations.

Thus, decausative verbs appear in more binyanim than relexives, reciprocals and causatives as the latter three derivation is less common.

The analysis provides support for favoring stem modification over root extraction. If we assumed root extraction, there would be no way to explain morpho-phonological differences between lexical and syntactic operations. Root extraction would apply in all operations, mapping the consonantal root to different vocalic templates, which may consist of affixes. Root extraction could not explain, for example, why in many cases of syntactic operations, the root of the base is mapped to a template that differs from the base only in the quality of its vowels, while in the case of most lexical operations, a root is mapped to different templates that can also differ from the base in the weight and number of syllables, in addition to the quality of some of the vowels. Such an analysis gives further rise to a surface-based account, in which forms are derived from actually occurring words, rather than a system in which forms are derived by relating to an entity that never occurs in isolation on the surface (Ussishkin 1999, 2000, 2005).

The differences in the types of morphological processes that thematic operations manifest do not necessarily intertwine with regard to inflectional processes - e.g. tense - that apply in syntax. In the three languages I discuss, the morphology of passivization is not the same morphology of inflectional processes although both apply in syntax. Inflectional processes, which are relevant for syntax (Anderson 1981) are predictable in their morphological manifestation. There are, however, gaps and idiosyncrasies in syntax as well (e.g. English irregular past verbs) and there does not seem to be a complete dichotomy between the types of processes that apply in inflection and the ones that characterize lexical operations. Affixation, for example applies in both cases, e.g. perfective-imperfective derivation. Prosodic circumscription, on the other hand, applies only in the lexicon. Bat-El (2004) shows that MH reduplication applies only in the lexicon. Processes that involve only melodic overwriting apply mainly in syntactic operations, but only in thematic ones. The motivation for the differences I discuss is to distinguish between the two types of thematic operations. Such a distinction helps setting a parametric choice and facilitates acquisition. The morphology of inflectional processes is irrelevant for this choice.

The analysis proposed raises questions with regard to the role of morpho-phonology and its location and application with respect to other components of the grammar. The observed differences between passivization and other thematic operations challenge the theory of Distributed Morphology (hereafter DM). The framework of DM (Halle & Marantz 1993) postulates a theory of the grammar without an active lexicon (Contra to

Chomsky 1970). DM includes a number of distributed, non-computational lists as Lexicon replacements; the structure of grammar without a unified Lexicon contains three lists. The first list, termed the 'narrow lexicon', contains the atomic roots of the language and the atomic bundles of grammatical features. The sets of grammatical features are determined by UG and perhaps by language-particular (but language-wide) principles. This list most directly replaces the Lexicon as it provides the units with which the syntax operates. The second list is called 'Vocabulary', and provides the phonological forms for the terminal syntactic nodes. The Vocabulary includes the connections between sets of grammatical features and phonological features, and thus determines the connections between terminal nodes from the syntax and their phonological realization. The Vocabulary is non-generative but expandable. The Vocabulary items are underspecified with respect to the features of the terminal nodes from the syntax; they compete for insertion at the terminal nodes, with the most highly specified item that does not conflict in features with the terminal node winning the competition. The third list, called 'Encyclopedia' is the list of special meanings. The Encyclopedia lists the special meanings of particular roots, relative to the syntactic context of the roots, within local domains. As is the case with the Vocabulary, the Encyclopedia is non-generative but expandable. DM is widely correlated with the notion of Late Insertion (Marrantz 1993). Late Insertion is the hypothesis that the phonological expression of syntactic terminals is provided only during the mapping of elements to Phonological Form (PF). Syntactic categories are considered purely abstract, having no phonological content. Phonological expressions, i.e. Vocabulary Items, are inserted only after syntax in a process called Spell-Out. This process involves the association of phonological pieces (Vocabulary items) with abstract morphemes. Morphemes that make up words are manipulated by syntax and the actual lexical items are not inserted into the sentence until syntactic operations take place.

This approach stands in contradiction to the analysis presented in this section. Assuming that thematic arity operations can apply in a different locus of derivation, every different locus shows relatively different (though partially overlapping) morpho-phonological manifestations. Adopting late insertion would fail to explain these differences in form, as it predicts that the phonological material is always inserted after syntax, regardless of the component where arity operations take place. The analysis reveals that there is a split in the morpho-phonological behavior of arity operations which cannot be captured if all the phonological material is inserted after syntax. Aronoff (1976) shows that the domain of derivational morphology is governed by distinct principles that are essentially unrelated to those governing syntactic structures, by assigning derivational processes to the lexicon. From the point of view of syntax, the

structures produced in the lexicon are opaque. These structures may have internal structure, but it is not subject to manipulation by the rules of syntax. The latter treat lexical items as integral atomic units. This notion is parallel to the distinction between the two types of arity operations. As the syntactic component cannot manipulate the theta grid of predicates, it has a different kind of access to the structure of words, i.e. it can alter their structure applying a different mechanism than the lexicon. This provides partial support to the Lexicalist Hypothesis (Chomsky 1970), whose basic premise is the independence of syntax and word-structure. While there is evidence that the elements of morphological structure and elements of sentence structure can overlap (Anderson 1981), the content of the lexicalist hypothesis is represented by the separation of the syntactic and the lexical components. Morpho-phonology seems to be active in both parts of the grammar, the lexicon and the syntax (See Scalise 1984, 1988, Booij 1987, 1996). The manner in which it applies is different in every component with regard to the manipulation of word structure. The analysis intertwines with the notion of parallel morphology (Borer 1991). It supports the existence of an autonomous morphological component that interacts with both the lexicon and the syntax, to which it is not reducible. This model allows both components to be available for insertion. The analysis is also correlated with the framework of Lexical Phonology (Kyparsky 1982), in which phonology and morphology are the input of each other. The core of lexical phonology is that a subset of phonological rule application takes place in the lexicon in accordance with morphological operations, and another subset takes place post lexically. The output of a phonological process can undergo morphological processes as well as further phonological rules. The two types of morpho-phonology I propose demonstrate which types of morpho-phonological processes apply in the lexicon and which types apply post lexically with regard to thematic operations. The above observations point to the location of morphology with respect to other components of the grammar. Morphology can be found in more than one place; some of it is in the lexicon while another portion of it is in the syntax.

7. The MH Binyan *nifʕal*

7.1 Predicates of Binyan *nifʕal*

The MH binyan *nifʕal* demonstrates a different thematic manifestation from other binyanim. This binyan, as well as other binyanim (e.g. *hitpaʕel*), can surface as the output of several lexical operations.

(51) Lexical operations in binyan *nifʕal*

Lexical Operation	Examples
a. Decausativization	šavar → nišbar 'broke' hixnis → nixnas 'came in' hidhim → nidham 'amazed'
b. Reflexivization	šataf → ništaf 'washed' hišʕin → nišʕan 'leant'
c. Reciprocalization	pagaš → nifgaš 'met'

As shown in (51), the input of such operations is not restricted to one template only. There are few cases where this binyan serves as a basic entry in the lexicon, e.g. *nitpal* 'picked on somebody'.

However, many *nifʕal* verbs serve as the output of passivization, which is regarded as syntactic. This is not attested with regard to other binyanim. In this case, the input of such operations is restricted to the *paʕal* template.

(52) Nifʕal passive predicates

katav → nixtav 'wrote'
bala → nivla 'swallowed'
axal → neexal 'ate'

The morpho-phonology responsible for this derivation is different from the one of other passive verbs. It is performed by adding /ni-/ to the base. The first vowel of the stem is deleted to preserve the prosodic structure of a binary foot. This challenges the distinction I propose between the morpho-phonology of the two types or thematic operations; why should this template serve both syntactic and lexical operations? Moreover, why is the passive formation of other templates (e.g. *piʕel*, *hifʕil*) manifested via melodic overwriting, while the one of *paʕal* is manifested by affixation?

In §7.2, I present an experiment I conducted in order to shed light on the two different morphological patterns of passivization. I show that this irregular formation of passive forms has become unstable and less productive than melodic overwriting.

7.2 Passive Formation Experiment

7.2.1. Goal

The goal of this experiment is to examine the intuition of speakers with regard to the formation of passive predicates. It aims to test which prosodic templates subjects choose as a passive form of new transitive verbs they encounter.

7.2.2. Prediction

I predict that there would be no variation in the passive forms of *piʕel* and *hifʕil*, whose passive counterparts are expected to be *puʕal* and *hufʕal* respectively, while there would be a variation to some extent, with regard to the passive forms of *paʕal*. Speakers are expected to form the passive forms of *paʕal* as *puʕal*. Turning *paʕal* into *puʕal* involves only melodic overwriting without changing the prosodic structure of the verb, in contrast to a *paʕal-nifʕal* / *hufʕal* alternation, where the prosodic structure changes due to an addition of a prefix and a vowel deletion.

7.2.3. Method

Subjects were given nonce-verbs in their active form and had to choose their appropriate passive counterparts out of five possibilities. Subjects were 50 native speakers of MH between the ages of 12 and 47. The questionnaire consisted of 18 sentences, where each sentence contained two coordinated clauses. The first clause consisted of an event described by an active verb and the second contained a paraphrase of this event. This paraphrase was in the passive voice. The subject had to fill in the missing verb. The second clause contained a by-phrase in order to make subjects use the passive form and to prevent an alternation with the decausative form. Eight sentences contained a nonce verb of binyan *paʕal* and eight sentences contained a nonce verb of the *piʕel* and *hifʕil* binyanim (four of each). I also added two monosyllabic verbs which I discuss in §7.3.

Subjects had to fill in the passive form as demonstrated in (53).

- (53) rami **lasak** et ha-bayit, klomar ha- bait _____ al-yedey rami
'Rami **lasak** (**nonce-verb**) the house, i.e. the house _____ by Rami'

In order to avoid revealing the purpose of this questionnaire, I inserted ten other sentences, where subjects had to choose the output form of operations other than passivization, such as reflexives and causatives, as well as the formation of nouns.

7.2.4 Results

The results are almost unanimous with regard to the passive forms of *piʃel* and *hiʃil*. 94% of the subjects used *hufʃal* as the passive of *hiʃil* and 92% chose *puʃal* as the passive of *piʃel*. This points to the high productivity of melodic overwriting in forming the passive forms of *piʃel* and *hiʃil*.

(54) Distribution of the passive forms of binyan piʃel

Non-verb	puʃal		niʃal		hufʃal		hitpaʃel		paʃul		Total
	num.	per.	num.	per.	num.	per.	num.	per.	num.	per.	
gines	47	94%	1	2%	0	0%	2	4%	0	0%	50
dimer	46	92%	2	4%	1	2%	0	0%	1	2%	50
gixel	46	92%	1	2%	1	2%	2	4%	0	0%	50
giles	45	90%	1	2%	2	4%	2	4%	0	0%	50
Average	46.00	92%	1.25	3%	1	2%	1.5	3%	0.25	1%	
Standard deviation	0.82	2%	0.5	1%	0.82	2%	1.0	2%	0.5	1%	

(55) Distribution of the passive forms of binyan hiʃil

Non-verb	puʃal		niʃal		hufʃal		hitpaʃel		paʃul		Total
	num.	per.	num.	per.	num.	per.	num.	per.	num.	per.	
hilirin	1	2%	0	0%	48	96%	0	0%	1	2%	50
hiʃnit	1	2%	1	2%	48	96%	0	0%	0	0%	50
himrig	2	4%	1	2%	45	90%	2	4%	0	0%	50
hexgil	3	6%	0	0%	46	92%	1	2%	0	0%	50
Average	1.75	4%	0.5	1%	46.8	94%	0.75	2%	0.25	1%	
Standard deviation	0.96	2%	0.58	1%	1.5	3%	0.96	2%	0.50	1%	

The results for the binyan *paʃal* are significantly different. Each verb had different results for the formation of its passive counterpart. For each verb, there was a different alternation between the forms of *puʃal* and *niʃal* although the majority of subjects chose *puʃal* (56).²⁶ On average, 59% of the subjects chose *puʃal* as the passive form of *paʃal*, while 30% chose *niʃal* as its passive form.

²⁶ There were subjects who chose other forms for the passive verb, but their percentage is clearly insignificant.

(56) Distribution of the passive forms of binyan paʕal

Nonce-verb	puʕal		nifʕal		hufʕal		hitpaʕel		paʕul		paʕal		Total
	num.	per.	num.	per.	num.	per.	num.	per.	num.	per.	num.	per.	
palad	33	66%	12	24%	1	2%	3	6%	1	2%	0	0%	50
galas	38	76%	9	18%	0	0%	2	4%	1	2%	0	0%	50
kadaf	30	60%	14	28%	3	6%	3	6%	0	0%	0	0%	50
lasak	30	60%	12	24%	7	14%	1	2%	0	0%	0	0%	50
razal	33	66%	11	22%	4	8%	1	2%	0	0%	1	2%	50
kalam	20	40%	23	46%	5	10%	1	2%	0	0%	1	2%	50
gaxaš	24	48%	20	40%	5	10%	1	2%	0	0%	0	0%	50
gaxal	26	52%	17	34%	7	18%	0	0%	0	0%	0	0%	50
Average	29.25	59%	14.8	30%	4	9%	2	3%	0	0	0	0	
Standard deviation	5.73	11%	4.83	10%	2.56	6%	1.07	2%	0.5	1%	0.46	1%	

7.2.5 Discussion

The results in (54) and (55) point to the high productivity of melodic overwriting in forming passive predicates of *piʕel* and *hifʕil*. There is hardly any variation in forming these passive verbs as the process responsible for their formation is predictable and not intrusive morphologically. However, the results for the binyan *paʕal* verbs are significantly different. For each verb, there is a different variation between the forms of *puʕal* and *nifʕal* as shown in (56). On average, 59% of the subjects chose *puʕal* as the passive form of *paʕal*, while 30% chose *nifʕal* as its passive form. This difference requires an explanation. While the results reveal a tendency to use *puʕal* as the passive counterpart of *paʕal*, the gap in the results in comparison to the passive forms of *piʕel* and *hifʕil* should be accounted for.²⁷ Note that the results are different for every verb. This indicates that the same speaker can choose different forms as the passive of *paʕal*.

Note that there are two other factors that may have a considerable impact on the results; a phonological factor and psycho-linguistic factor. The former may determine that one form is preferred due the consonants that are involved and the way they are arranged, i.e. in a cluster or separated by a vowel. The latter states that similarity to an existing word or the context of the sentence can prime a choice of a template similar to a real word. Nonetheless, these two factors are expected to apply in all forms, not only within the *paʕal* nonce-words. In light of the results for passive forms of *piʕel* and *hifʕil*, it is clear that these considerations did not have a great affect. The results are rather similar within each binyan, regardless of the base consonants or the associations the sentence might raise.

A significant number of subjects chose *puʕal* as the passive counterpart of *paʕal*. I argue that the motivation for this choice is the parametric value of the Lex-Syn parameter. Since passivization is considered syntactic, its formation is expected to be morphologically less intrusive and more predictable. Moreover, paradigm uniformity with other passive forms, i.e. *puʕal* and *huʕʕal*, plays a role as well. Subjects who choose *puʕal* maintain the same vocalic pattern for all passive forms in the language.

The alternation between the *nifʕal* and *puʕal* forms can be explained by two factors. All passive forms of existing verbs in binyan *paʕal* are in binyan *nifʕal*. Speakers therefore have access to the *paʕal-nifʕal* paradigm of passivizations and, as a result, they analogously form new passive verbs in *nifʕal* as well. Speakers aim for paradigm uniformity with active-passive paradigms which they are already exposed to. Another possible explanation is paradigm contrast. Kenstowicz (2005) discusses several cases in which the phonology conspires to ensure that two phonologically distinct members of a paradigm remain phonologically distinct. He presents data where phonologically motivated processes fail to apply in order to maintain a paradigmatic contrast. In the Damascus dialect of Arabic, the third person object suffix demonstrates different behaviour with verbs in the first and third person feminine. Stress in Damascus Arabic falls on the rightmost heavy syllable, but never on the final syllable. When there is no heavy syllable, stress is antepenultimate. This dialect of Arabic has a constraint which prohibits a schwa in an unstressed open syllable. When adding the object suffixes to a verb, the stress might change. When the object suffix begins with a consonant, it closes the final syllable of the base to create a heavy syllable which attracts the stress (57a). When the suffix starts with a vowel, it should produce antepenultimate stress with syncope of the suffixal vowel (57b). However, such an input-output paradigm would merge this form of the paradigm with the first and second masculine (57c). Consequently, although the deletion of /e/ is phonologically motivated in both verbs, it occurs in one only.

(57) Object suffixes in Damascus Arabic

- a. ʕallamét-ni ‘she taught me’
- b. ʕallamét-o ‘she taught him’
- c. ʕallámt-o ‘I/you taught him’

The same suffix behaves differently in essentially the same phonological context in order to achieve paradigmatic contrast. (57c) is the chosen output as there is no other member of the perfective paradigm competing for the same phonetic output.

I argue that this paradigmatic contrast is also relevant for morphological processes. If passive counterparts of *paʕal* were in the *puʕal* form, they would be morphologically identical to the passive forms of *piʕel* verbs. Since speakers have access to the syntactic paradigms of passivization, there is a constraint prohibiting verbs of the *piʕel* and *paʕal* verbs to share the same passive counterparts. Thus, some speakers block the *puʕal* form as a passive form of *paʕal* in order to preserve a contrast. (58) demonstrates a case where transitive verbs with the same stem consonants are manifested in both *paʕal* and *piʕel*.²⁸ If melodic overwriting applied in (58a), there would be a merge of the passive forms of two semantically distinct verbs.

- (58) a. *parak* → *nifrak* / **purak* ‘unloaded’
 b. *perek* → *purak* ‘dismantled’

To conclude, paradigm uniformity on the one hand, and paradigm contrast on the other hand could be responsible for the occurrence of passive forms in binyan *nifʕal*. Speakers who form *puʕal* as the passive counterparts of *paʕal* verbs aim for a low level of morphological intrusiveness for a syntactic operation and, in addition, paradigm uniformity with regard to the *u-a* vocalic pattern of other passive forms in the language (*puʕal* and *hufʕal*). The interacting factors that affect the choice of passive forms are presented in (59).

²⁸ Other examples of such pairs are *yacar* ‘created’ - *yicer* ‘manufactured’, *lamad* ‘studied’ - *limed* ‘taught’ and *patar* ‘excused’ - *piter* ‘fired’.

(59) The puʕal - niʕal variation

Active Form	paʕal	
Passive Form	puʕal	niʕal
Motivation	<p>1. a low morpho-phonological intrusiveness</p> <p>2. passive paradigm uniformity: u-a vocalic pattern</p>	<p>1. active-passive paradigm contrast: paʕal → niʕal piʕel → puʕl</p> <p>2. paradigm uniformity: paʕal → niʕal passivization</p>

The results of this experiment point to a decrease in the productivity of *niʕal* as a passive form.²⁹ They also reveal the interaction among several factors, which are responsible for the observed variation in forming passive counterparts of *paʕal* verbs. In addition to the difference in the morpho-phonology of lexical and syntactic operations, other factors also play a role in determining the morphological shape of derived verbs.

7.3 Monosyllabic Verbs

There is a group of monosyllabic verbs in binyan *paʕal*. Many of them are intransitive verbs such as *rac* ‘ran’ and *šat* ‘sailed’, hence they have no passive counterparts. There is a small number of monosyllabic transitive verbs such as *cad* ‘hunted’. Binyan *niʕal* has a marginal pattern *nipol/napol*. This pattern occurs with verbs of two consonants, for example *nasog* ‘retreat’ and it can also be found as a passive form of monosyllabic verbs in *paʕal* (60):

(60) Napol/Nipol Passive forms

- cad → nicod ‘hunted’
- laš → naloš ‘kneaded’
- dan → nadon ‘discussed’

This template, however, is rather unproductive and the existing forms of its shape are few. I thus believe these passive forms are lexicalized and cannot be formed by a

²⁹ See §8.3 for discussion in the productivity of this binyan in general.

syntactic operation of passivization. The questionnaire presented in 7.2 also included two nonce monosyllabic verbs *lar* and *lat*. Subjects formed different passive counterparts for every verb as shown in (61) and (62).

(61) Passive Forms of *lar*

Passive form	number	percentage
hular	20	40%
lurar	6	12%
lurlar	1	2%
nilor	1	2%
nalor	1	2%
nilar	4	8%
nular	6	12%
larar	1	2%
nilran	1	2%
hulran	1	2%
luran	2	4%
hulrar	2	4%
nilra	1	2%
lar	3	6%
Total	50	100%
Total u-a forms	38	76%

(62) Passive Forms of *lat*

Passive form	number	percentage
hulat	25	50%
lutat	7	14%
nalot	1	2%
nilat	6	12%
lulat	2	4%
nulat	2	4%
nolat	1	2%
niltat	2	4%
nimlat	1	2%
lat	3	6%
Total	50	100%
Total u-a forms	36	72%

The *hupal* template is the most common passive form of both verbs. On average, 45% of the subjects used this form, while others formed the passive in many different templates using various strategies.³⁰ Apart from *hupal*, all forms have a rather low

³⁰ I do not address the strategies used for all passive forms as many of them have a very low and insignificant percentage. Some subjects used rather peculiar forms that I do not account for and others

percentage. This great variation in forming passive verbs from monosyllabic verbs shows that most speakers have not mastered the passive formation of monosyllabic verbs as they are rather rare and have an exceptional morphological shape. The *hupal* template clearly has a prominent advantage over each of the other forms used. The morpho-phonology responsible for its formation is relatively simpler in comparison to other forms. It involves adding the prefix /*hu-*/ to the base form that remains intact with regard to both the prosodic and the segmental level. Moreover, it resembles *hufʕal* phonologically, as well as the vocalic pattern of both *hufʕal* and *puʕal*. The formation of most of the other passive forms, in contrast, demonstrates a more intrusive morpho-phonology. Some are formed by reduplication of the last consonant, e.g. *lurar*. Although this form has the passive vocalic pattern *u-a*, its formation is morphologically complex as it is intrusive to the structure of the monosyllabic base.³¹ Other forms are created both by affixation and by a vocalic change of the stem vowel, e.g. *nalor* and *nilat*. Additionally, paradigm leveling plays a role here in determining the passive form of monosyllabic verbs. The *hupal* form has the same vocalic pattern *u-a* of other passive forms and is therefore more accessible for speakers to form. Interestingly, there are two existing monosyllabic transitive verbs, which actually have a passive alternate with the *u-a* pattern:

(63) u-a monosyllabic passive forms

sam → husam ‘put’
 šar → hušar ‘sang’

I argue that the verbs in (63) are in much have a higher token frequency than the ones in (60). As a result, their passive form is more common as well and it bears the morphological shape of the *u-a* pattern. The frequent use of the passive predicate increases the tendency to form the unmarked pattern of passivization, i.e. the *u-a* pattern. Examining the vocalic patterns of all the passive forms which subjects used in this case, there is a notable preference for preserving the *u-a* pattern, regardless of the strategy that was implemented on the base. 76% of the subjects preserved the vocalic pattern of *u-a* for the passive form of *lar*, while 72% of them did so for *lat*. It should be noted that the formation of nonce-verbs such as *nulat* demonstrate the same level of intrusiveness as the one of *hupal* as they only differ in the consonant of the suffix. Forms such as *nulat* were hardly used as there is no motivation for their formation.

simply did not change the nonce verbs. I assume that it results from a lack of acquaintance of such passive paradigms of monosyllabic verbs.

³¹ I do not discuss this formation within the scope of this paper (See Bat El 2004).

There are no existing analogous forms with the prefix */nu-/*, while there are many such forms that consist of the prefix */hu-/*.

The case of MH monosyllabic verbs provides further evidence for the central role of paradigm uniformity in determining the morphological shape of a word. The choice of the *u-a* pattern serves the desire for uniformity within passive forms. The choice of the specific *hupal* pattern points to the constraint that syntactic operation should exhibit minimal intrusiveness to the base form.

8. The Case of Hebrew *hitpuʕal*

Hebrew also has relatively new verbs in the shape of *hitpuʕal*. There are four two verbs in this form:

(53) *Hitpuʕal* forms

hitnudav 'was forced to volunteer'

hitputar 'was forced to resign/ caused himself to get fired'

hitpuna 'was forced to evacuate oneself'

hitpurak 'was forced to dismantle'

Bat-El (2002), in contrast to Berman (1982) and Aronoff (1994), argues that there is no justification for postulating an additional Binyan *hitpuʕal* for such cases, as a verb with the vocalic pattern *u-a* is recognized as a passive verb regardless of its prosodic structure. Indeed, this rare form seems to exhibit the pattern of melodic overwriting on the base form *hitpaʕel*, similar to the one in *puʕal* and *hufʕal*. However, I believe that such verbs are not formed by melodic overwriting. On the basis of my analysis of Arabic and Hebrew passivization, it seems that the vocalic pattern *u-a* consists of a passive meaning, given to a transitive verb. However, the *hitpuʕal* verbs are not passive ones. They have a new meaning, which can be regarded as a combination of passive and reflexive. The theta roles of such predicates is not yet defined in the linguistic literature, but it seems that there are two theta roles involved: an agent and a complex bundled theta role. Consequently, the operation forming this kind of verbs should be regarded as a lexical one. The semantics of these verbs provide evidence that they consist of the combination of the reflexive meaning of some verbs in *hitpaʕel* and the passive meaning of *puʕal*. I therefore claim that the *hitpuʕal* verbs are formed via blending of *hitpuʕal* and *puʕal* verbs. In this process, as shown in (54), the stem of *hitpaʕel* is deleted and its prefix /hit/ is combined with the *puʕal* form.

(54) Formation of *hitpuʕal*

hit[nadev] + nudav → hitnuvad 'was forced to volunteer'

Syntactic tests (Wosk 2005) reveal that the behavior of these verbs is different from that of passive verbs as well. As shown below, this binyan is far from being productive, as expected from predicates, which are formed by lexical operations. If we considered this morphological process as melodic overwriting, we would have anticipated it to be productive and apply to other verbs in *hitpaʕel*:

(55) Impossible *hitpuʕal* forms

hitkacer → * hitkucar

hitkarev → * hitkurav

However, analyzing these forms as a result of a lexical operation poses a problem. Since the *puʕal* form is derived in syntax, how is it blended with the *hitpaʕel* form which is derived in the lexicon? This derivation could be regarded as a derivation of an idiom. The syntactic output *puʕal*, combined with a *hitpaʕel* verb, enters the lexicon and is lexicalized as performed in phrases, which turn into idioms. Once it is lexicalized it is blended with a *hitpaʕel* form, sharing the same consonants, and the *hitpaʕal* verb is formed. It is important to point out that the *puʕal* verb alone is not lexicalized, but only together with *hitpaʕel*.

9. Conclusions

In this thesis, I revealed the correlation between morpho-phonology of thematic operations and their locus of application. I began by exhibiting the morpho-phonological processes, which Arabic and MH verbs undergo while deriving new predicates from existing entries in the lexicon. After dividing the thematic operations into lexical and syntactic ones, I demonstrated that these two kinds of operations consistently exhibit different patterns of morpho-phonological processes. It turns out that the Lex-Syn parameter is responsible for cross-linguistic variation exhibited by reflexives (Reinhart & Siloni 2005) and reciprocals (Siloni 2005). Moreover, it seems that languages are consistent regarding the setting of the parameter. This facilitates parameter setting during acquisition, since evidence from various sources (operations) converges to set the choice. The morpho-phonological features observed in this paper reveal another aspect of this parameter and strengthen this claim. It is important to point out that these differences are not manifested to the same extent in every language. Rather, it is a matter of relativity. The two kinds of thematic arity operations are expected to demonstrate differences for the features listed in (50). The extent of these differences may vary due to a bundle of phonological, semantic syntactic and pragmatic properties of a language.

The examination of verb innovation in MH shows that thematic and morpho-phonological considerations interact in the process of coining a new verb and choosing its binyan. As stated by Anderson (1992:5), 'word structure can only be understood as the product of interacting principles from many parts of the grammar: at least phonology, syntax and semantics in addition to the lexicon. As such, morphology is not a theory that deals with the content of one box in a standard flowchart-like picture of a grammar, but rather a theory of a substantive domain whose content is widely dispersed through the grammar'.

The analysis supports the existence of an interface between morphology and both the lexicon and the syntax (Borer 1991). I have shown that there are two types of morpho-phonology, each of which interact with a different component of the grammar. The analysis supports the Lex-Syn parameter and the Stem Modification approach. The former enables us to make a fundamental distinction between lexical and syntactic operations, while the latter paves the way to implement this distinction in the domain of morpho-phonology. In this respect, the root extraction approach is clearly inferior, as it does not discriminate between lexical and syntactic operations, making it virtually impossible to account for the observed generalizations. The analysis also supports the notion of an active lexicon, which seems to be properly construed as a component of

linguistic knowledge (parallel in this respect to syntax and phonology) rather than merely as a list of arbitrary items. In this respect the lexicon represents not only encyclopedic but also computational (linguistic) knowledge.

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Appendix - The *nifal* Experiment

שאלון

גיל: _____
מין: ז / נ _____
שפת אם: _____

- לפניכם 32 משפטים. בחלקו הראשון של כל משפט שובצה מילה מומצאת (באותיות בולטות). השלימו את חלקו השני במילה המבוססת על המילה המודגשת.

דוגמא:

הילד **סירק** את עצמו, כלומר הילד _____ (יש להשלים "**הסתרק**").

- ענו על השאלון במהירות (לא יותר מחמש שניות למשפט).
- אין לדפדף אחורה לשאלות קודמות.

1. דן **גילר** את עצמו, ודינה _____ את עצמה.
2. הילד **פלד** את היומן, כלומר היומן _____ על ידי הילד.
3. משה **גינס** את החדר, כלומר החדר _____ על ידי משה.
4. הילדים והילדות **תישמו** זה את זה כלומר הם _____.
5. המצב הקשה **המריל** את פליקס, כלומר פליקס _____ מהמצב.
6. הרופא **דימר** את החולה, כלומר החולה _____ על ידי הרופא.
7. אתמול קניתי **חקיש** קטן, כלומר קניתי _____.
8. הטבח **גלס** את הכרוב בתנור, כלומר הכרוב _____ על ידי הטבח.
9. הסטודנט **הלרין** את המחשב לתיקון, כלומר המחשב _____ לתיקון על ידי הסטודנט.
10. המורה **לר** את המבחן, כלומר המבחן _____ על ידי המורה.
11. דן **קדף** את הלחם בקרם שוקולד, כלומר הלחם _____ על ידי דן.
12. במהלך הטיול ביער, המטיילים ראו **שדיץ** ממין נקבה, כלומר הם ראו _____.
13. הנער **גיתל** את הבגד, כלומר הבגד _____ על ידי הנער.
14. יוסי גרם לדינה **לקרום**, כלומר יוסי _____ את דינה.
15. מקום שמוכרים בו **קסם** נקרא _____.
16. רועי **השניט** את מיכה, כלומר מיכה _____ על ידי רועי.

17. רמי לִסֵּק את הבית, כלומר הבית _____ על ידי רמי.
18. למרות החום הכבד, הנהג אילץ את דן לְהִתְקַלֵּשׁ, כלומר דן _____.
19. המורה קָנַל את השולחן, כלומר השולחן _____ על ידי המורה.
20. דן התבונן בקָלִים קטן, כלומר התבונן ב- _____.
21. דינה חִיגְלָה את עצמה מול הראי, כלומר דינה _____ מול הראי.
22. רן קָלַם את הספר אתמול, כלומר הספר _____ על ידי רן.
23. רינה קָלְטָה את התמונה בחוזקה, כלומר רינה _____ את התמונה.
24. שאלתי את לואיס אם מקס היה זה שֶגָחַשׁ את הסלט, כלומר רציתי לדעת אם הסלט _____ על ידי מקס.
25. ירון הִמְרִיג את המדף, כלומר המדף _____ על ידי ירון.
26. הילד דוּמַר לבד בבית, כלומר ההורים _____ אותו לבד בבית.
27. הנער גָחַל את הבגד, כלומר הבגד _____ על ידי הנער.
28. הילד לִט את הסרט, כלומר הסרט _____ על ידי הילד.
29. אדם העוסק בתיקון רִטְקוֹת נקרא _____.
30. השכן מדירת הגג הִתְגַּיַל את החתול, כלומר החתול _____ על ידי השכן מדירת הגג.
31. השוטר והשוטרת גָטְלוּ זה את זה, כלומר השוטר והשוטרת _____.
32. הטבח גִילַס את הכרוב בתנור, כלומר הכרוב _____ על ידי הטבח.

תודה על שיתוף הפעולה!