

Alternating 'smell' in Modern Hebrew

Bar Avineri, The Hebrew University of Jerusalem

Many studies within the literature devoted to perception verbs have dealt with typology of clausal complements and their semantic properties. From a lexical typology perspective, much literature has been concerned with typology of lexicalization, morphological patterns and polysemy of perception verbs. Bridging these two points of view, this work focuses on the Modern Hebrew verb 'smell', alternating in voice (active and middle), and in complement clause (finite (CP) and non-finite small clause (SC)), contrasting with respect to factivity, belief formation, indirect perception and non-literal use. Studying the morpho-syntactic alternation and semantic properties of Modern Hebrew 'smell', shared with 'see', 'hear' and 'feel', but not 'taste', coalesces into typological projects exploring sensory hierarchy and voice alternation within the field of perception.

1. Introduction

The article discusses the verb *le-hariax* 'to-smell' in Modern Hebrew (MH). Like other perception verbs, this verb is often used with a nominal complement, e.g. *smell the toast*. Yet the present article concentrates on the use of this verb and other perception verbs when they take clausal complements, e.g. *smell the toast burn*. This latter use is associated with alternation in diathesis (active vs. middle), the marking of the experiencer (nominative vs. dative) and the category of the clausal complement (finite clause (CP) vs. non-finite small clause (SC)).

Alternation of experiencer marking (nominative vs. dative) has already been discussed in the literature. In his typological study of perception verbs, Viberg (1983) refers to perception verbs taking a grammatical subject being animate with a certain mental experience as experiencer-based verbs, whereas source-based, or phenomenon-based verbs are such that take the experienced entity as a subject. The terminology of Levin (1993) distinguishes between *see*-verbs and stimulus-subject-perception-verbs. The two subclasses differ in whether the experiencer is expressed as the nominative subject or a dative object of the verb. The two subclasses contain different lexical verbs for the same sensory perception, e.g. English *see* vs. *look to*, *hear* vs. *sound to*, or homonymous verbs which differ in their syntax: *smell* vs. *smell to*, *feel* vs. *feel to*, *taste* vs. *taste to*. Most theoretical work only analyzes one of the two classes, either those perception verbs which take a nominative experiencer (Moulton 2009 a.o.), or those perception verbs which take a dative experiencer (Matushansky 2002, Kastner 2015). Yet the two classes of verbs have important characteristics in common. Syntactically, both classes allow both finite clausal complements and non-finite clausal complements, which differ in their semantic properties, as Dretske (1969) was the first to distinguish for *see*. These facts call for a unified analysis.

The morpho-syntactic alternation of the perception verb *le-hariax* 'to-smell' in diathesis, experiencer marking and category of the clausal complement, and the distinguished semantic properties of each construction, are discussed in section 2. The

alternation is shared by other perception verbs in MH, i.e. *li-r'ot* 'to-see', *li-šmo'a* 'to-hear', *le-hargiš* 'to-feel', establishing that the four constitute a small unified group among the diverse class of perception verbs in MH, listed in section 2.1. This unified, systematic alternation suggests that the different constructions do not consist of polysemous verbs. Rather, in section 2.7 I propose to account for the different semantic properties of the constructions by means of compositional semantics, assuming one basic lexical entry for 'smell', introducing two syntactic notions which compose with it: the component of *abduction*, and the thematic role *Perceiver*.

The morpho-syntactic alternation of *le-hariax* 'to-smell' in MH is discussed in section 3 with respect to typology of lexicalization patterns of perception verbs (Viberg 1983), and in section 4, from a historical perspective, expanding on how *le-hariax* 'to-smell' changed from Biblical Hebrew to MH. Associating between these two perspectives suggests that the alternation of MH 'smell' corresponds with the lexicalization of perception verb 'smell' with an experiencer argument.

2. Perception 'smell'

In the field of perception, smell is considered as one of the five sense modalities, together with sight, hearing, touch, and taste. An important distinction within the class of perception verbs is between activity, an unbounded process that is consciously controlled by a human agent, and an experience, a state or an inchoative achievement that is not controlled (Viberg 1983: 123). This section discusses the experiencer-subject perception verb *le-hariax* 'to-smell' and its morpho-syntactic alternation, distinguishing it from its activity-'smell' variant and from verbs which are exclusively activity-smell, i.e. *le-raxreax* 'to-sniff out' and *le-hasniḅ* 'to-sniff', with which section 3.1 is concerned.

2.1. MH perception verbs: an overview

Perception verbs in MH constitute a heterogeneous class of verbs, with respect to their morphological, syntactic, and semantic properties. A (non-exhaustive) list of verbs is given in Table 1, adapted for MH from Viberg (2008: 124, Table 1).^{1,2} The perception verbs in Table 1 are classified by sensory modality, and by the distinction between activity and experience. *Activity* refers to an unbounded process that is consciously controlled by a human agent, whereas *experience* refers to a state or an inchoative achievement that is not controlled (Viberg 1983: 123).

¹ The adapted Table does not include the third horizontal category in Viberg's (2008) original Table, i.e. *phenomenon-based* verbal forms.

² Hebrew verbal morphology marks tense, gender (feminine/masculine), person and number (singular/plural) (but only gender and number in the present tense). Pronominal morphology marks person, gender and number, and nominal and adjectival morphology marks gender and number. The fricatives corresponding to *b, g, d, k, p, t* are represented as *ḅ, ḡ, ḏ, ḵ, ṗ, ṭ*, respectively (in post-Biblical stages of Hebrew, only *b, k, p* have corresponding fricatives, *ḅ, ḵ, ṗ*).

The non-spirantizable *k* will be transcribed as *q*. The transcription ' stands for the common variants of the glottal stops ʔ and ʕ in fluent speech.

In my glosses, ACC = accusative, GEN = genitive, MID = middle voice, NEG = negation, PREF = prefix. I only gloss verbs for person, gender and number (or only gender and number for adjectives) when the subject is null, i.e. 1/ 2/ 3 = 1/ 2/ 3 person, M = masculine, F = feminine, S = singular, P = plural, ^w – example originating from the www.

Activity	Experience		
	<i>la-sim leḥ</i> 'to-notice, to pay attention', <i>le-galot</i> 'to-discover', <i>le-hakir</i> 'to-recognize', <i>le-hitvade'a</i> 'to-become acquainted with', <i>le-hitrašem</i> 'to-get an impression'		
	<i>li-ḥxon</i> 'to-examine', <i>li-sqor</i> 'to-survey', <i>le-damyen</i> 'to-imagine', <i>le-damot</i> 'to-visualize'	<i>le-haḥxin</i> 'to-notice', <i>li-tpos</i> 'to-grasp, to-perceive', <i>li-qlot</i> 'to-catch, to-perceive', <i>la-xvot</i> 'to-experience'	
Sight	<i>le-habit</i> 'to-look at', <i>li-cpot</i> 'to-watch', <i>le-tacpet</i> 'to-view', <i>le-hacic</i> 'to-peek', <i>le-šašqip̄</i> 'to-overlook', <i>le-hitbonen</i> 'to-observe', <i>la-xazot</i> 'to-look at', <i>le-'ayen</i> 'to-study', <i>li-ḥhot</i> 'to-stare', <i>li-šzop̄</i> 'to-gaze'	<i>li-r'ot</i> 'to-see'	
Hearing	<i>le-ha'azin</i> 'to-listen', <i>le-haqšib</i> 'to-listen', <i>le-cotet</i> 'to-eavesdrop'	<i>li-šmo'a</i> 'to-hear'	
Touch	<i>le-mašeš</i> 'to-grope', <i>la-ga'at</i> 'to-touch', <i>le-gašeš</i> 'to-grope', <i>le-mašmeš</i> 'to-finger'	<i>le-hargiš</i> 'to-feel'	<i>la-xuš</i> 'to-sense'
Smell	<i>le-raxreax</i> 'to-sniff out', <i>le-hasniḥ</i> 'to-sniff'	<i>le-hariax</i> 'to-smell'	
Taste	<i>li-t'om</i> 'to-taste'		

Table 1: Basic classification of perception verbs in Modern Hebrew

Table 1 shows that only 'smell' and three other perception verbs in MH, i.e. *li-r'ot* 'to-see', *li-šmo'a* 'to-hear', and *le-hargiš* 'to-feel', are all experience verbs specified for a sensory modality, having lexicalized activity perception verbs counterparts. These four verbs, which I call *alternating perception verbs*, share a morpho-syntactic alternation, described for *le-hariax* 'to-smell' in subsection 2.2.

2.2. The morpho-syntactic alternation of MH 'smell'

MH 'smell' reveals an intricate array of syntactic and semantic alternations. Morpho-syntactically speaking, the experiencer argument of 'smell' alternates between nominative and dative marking. The alternation between nominative and dative experiencer for 'smell' is accompanied by a voice alternation between active and middle voice. In Hebrew, a Semitic language, all verb stems, and also many noun and adjective stems are derived from (tri-)consonantal roots by different intercalations, called *templates*, of CV skeleta, vowel sequences and affixes (Doron 2003). Diathesis, both the passive and the middle voice, is morphologically marked by the choice of template (Doron 2003, 2008). It so happens, however, that the verb 'smell' is derived in the causative template *hiḥ'il*, a template which does not morphologically mark the middle voice. Rather, its active form also serves for the middle voice. I will refer to 'smell' accompanied by a dative experiencer as middle.³ The alternation between

³ Among the alternating perception verbs in MH, beside 'smell', *le-hargiš* 'to-feel' is also derived in the causative template *hiḥ'il*. The perception verbs *li-r'ot* 'to-see' and *li-šmo'a* 'to-hear' are derived by the simple active template in the active voice, and in the simple middle template in the middle voice: *ra'a* (active)-*nir'a* (middle); *šama* (active)-*nišma* (middle). It might be worth mentioning that these two patterns for the middle-voice forms correlate with the divergence of these sense-perception verbs in

active voice *cum* nominative experiencer and middle voice *cum* dative experiencer is illustrated in (1)-(2). In example (1), 'smell' in the active voice takes a nominative experiencer, Gaddy, and a direct object – the pastry. In examples such as (1) where the complement of the verb is nominal rather than clause, 'smell' can be interpreted as a dynamic verb, in addition to its stative reading, i.e. involving agentivity (Doron 2013), when the smelling by Gaddy is intentional.

- (1) *gadi heriax et ha-ma'aḗe*
 Gaddy **smelled** ACC the-pastry
 'Gaddy smelled the pastry.'

Middle voice 'smell' with a dative experiencer is illustrated in (2).

- (2) *ha-ma'aḗe heriax le-gadi tari*
 the-pastry **smelled.MID** to-Gaddy fresh
 'The pastry smelled fresh to Gaddy.'

In addition to alternation in voice, the verb 'smell' and the other alternating perception verbs, both in the active and middle voice, can embed two categories of clauses, a non-finite small clause (SC) (Chomsky 1981), and a finite clause (CP). Together, the alternation in voice (diathesis), accompanied by alternation in experiencer marking, and embedded clause category, yields four constructions: I. active-SC, II. active-CP, III. middle-CP, IV. middle-SC. In all these constructions, 'smell' is stative, unlike its dynamic readings in other constructions, e.g. example (1), and of non-alternating perception verbs in Table 1.

I. Active-SC - active voice and a non-finite small clause

The experiencer of the active voice 'smell' appears as a nominative argument, which is unmarked in MH.

- (3) *ha-so'adim herixu [et ha-bacal mitagen]*
 the-diners **smelled** [ACC the-onion being.fried]
 'The diners smelled the onion being fried.'

II. Active-CP - active voice and a finite clause

As in active-SC, the experiencer of active-CP 'smell' appears in as a nominative argument. Embedding a CP, the ordinary *še* 'that' sentence complementizer is the subordinator (4).

- (4) *ha-menahel heriax [še-'išnu ba-xacer]*
 the-principal **smelled** [that-had.smoked.3P in.the-yard]
 'The principal smelled that people had smoked in the yard.'

In the active-CP 'smell', the complementizer may also be *eik* 'how' (5).^{4, 5}

English: While *see* and *hear* have different forms as unaccusatives (*seem* and *sound*), *smell* and *feel* have the same forms.

⁴ I will not attempt to account here for the use of *eik* 'how' as a complementizer of perception verbs in MH. The reader may refer to accounts proposed in the literature for English and German, see Legate (2010), Nye (2013) and Kratschmer (2013), and see also footnote 9.

- (5) 'ayala **herixa** [eik ha-gešem ha-rišon marve
 Ayala **smelled** [how the-rain the-first saturates
 et ha-'adama]
 ACC the-soil]
 'Ayala smelled how the first rain saturated the soil.'

III. Middle-CP - middle voice and finite clause

While the active voice 'smell' takes a nominative subject experiencer, which is unmarked in MH, the middle voice 'smell' is accompanied by a dative experiencer. The dative is marked by the prefixal preposition *le-* 'to'. To express a pronominal experiencer, the dative preposition is inflected for person and number. The dative experiencer is optional rather than obligatorily overtly expressed. When not explicitly expressed, the experiencer is interpreted deictically (or universally). The verbal form of the perception verb in both III (middle-CP) and IV (middle-SC) is the middle voice, and the main-clause subject, then, is assumed to be non-thematic. In the middle-CP construction, the main-clause subject can be null, as in (6).

- (6) **meriax** l-i [še-ha-xalab mequlqal]
smells.MID to-me [that-the-milk spoiled]
 'It smells to me that the milk is spoiled.'

The main-clause subject can also be overtly expressed as the expletive pronoun *ze* 'it' (7). In addition to the ordinary *še* 'that' sentence complementizer, the complementizer for middle-CP can also be *ke'ilu* 'like' (7).⁶

- (7) *ze* **meriax** l-i [ke'ilu harega qircaḗtem et
 it **smells.MID** to-me [like just.now scrubbed.2P ACC
 ha-bayit]
 the-house]
 'It smells to me like you have just scrubbed the house.'

IV. Middle-SC - middle voice and non-finite small clause

As already stated, the main-clause subject position in the middle-CP and middle-SC constructions is non-thematic. The subject of the non-finite small clause (SC) raises to

⁵ One prominent use of active-CP 'smell' with the complementizer *eik* 'how' and the adverb *kḥar* 'already', is a forecasting meaning, anticipating a probable scenario, as illustrated in (i). This reading will not be discussed here further.

(i) *ve-'ani kḥar heraxti eik 'ani holeket lipol ba-pax*
 and-I already smelled.1s how I go to fall in.the-trap
 'And I could already smell how I was going to fall for it.'^w

⁶ 'Like' as a complementizer in Hebrew - in particular in the case of perception verbs - requires comprehensive research in order to reveal the systematic nature of its distribution. The present work will abstract away from the contribution of 'like' and its optionality, and leave its status in Hebrew for further research. Lasersohn (1995), for example, proposes that *like* in the *sound like* construction in English is an empty operator that only shifts IPs and NPs into APs. Brook (2014) conducted a corpus study in Canadian English on the perception verbs *seem*, *appear*, *look*, *sound*, and *feel*, which she calls Ostensibility Verbs, that can be linked to the lower clause by one of five complementizers: *as if*, *as though*, *like*, *that*, and null. Her research shows that "although *like* is the newest of these variants it is overwhelmingly the predominant one in vernacular Canadian English and *as if* and *as though* have become negligible".

the nominative subject position of the main clause. Hence, the argument we find in the matrix subject position is thematically the subject of the embedded clause (8).

- (8) *ha-pasta merixa l-i [pasta mebušelet]*
 the-pasta **smells.MID** to-me [~~pasta~~ cooked]
 'The pasta smells cooked to me.'

It is important to mention that when the embedded predicate is an adjective, it may not agree with its subject. Example (9) illustrates the contrast in between the adjective 'good', not agreeing with the plural subject 'ingredients' (9a), and 'good' which agrees with the subject 'egg' (9b).

- (9) a. *xelēq me-ha-micraxim še-pa'am 'ahabti hayom*
 part of-the-ingredients that-once loved.1S today
lo merixim l-i tob
 NEG smell.MID to-me good
 'Part of the ingredients that I once loves, no longer smell good to me.'^W
- b. *ha-beyca merixa l-i lo toba*
 the-egg smell.MID to-me NEG good
 'The egg doesn't smell good to me (smells rotten).'

This contrast is found for all the four alternating perception verbs in MH. In what follows, the examples for middle-SC construction are only such that the adjectives agree with their subject.⁷

The complementizer for middle-SC, as for the middle-CP construction, can also be 'like' (10), when the embedded predicate is a noun phrase.⁸

- (10) *kol ha-maim ha-rexaniim merixim l-i kmo*
 all the-water the-fragrant **smell.MID** to-me like
metaharey 'avir
 purifiers.GEN air
 'All those body mists smell to me like air purifiers.'^W

The four constructions of sense-perception 'smell' in MH are summarized in Table 1.

Construction	Case of the Experiencer Argument	Diathesis	Category of the Embedded Clause
1. active-SC	nominative	active voice	non-finite (SC)
2. active-CP	nominative	active voice	finite (CP)
3. middle-CP	dative	middle voice	finite (CP)
4. middle-SC	dative	middle voice	non-finite (SC)

Table 2: the morpho-syntactic alternation of perception 'smell'

⁷ I will not attempt to give here an explanation for the contrast. Aynat Rubinstein (p.c.) proposed that the adjectives may modify either an individual or a perceived situation. I thank Edit Doron, Malka Hovav and Aynat Rubinstein for valuable examples and insights about this issue.

⁸ The complementizer 'like' is expressed as *ke'ilu* with CP, and *kmo* with SC.

To sum up the description in this section, MH sense-perception 'smell' which takes a clausal complement shows the following semantic properties and morpho-syntactic variation:

- i. Stative verb with an experiencer argument.
- ii. A diathesis alternation between an active verbal form and a middle verbal form, which correlates with an alternation between a nominative and dative experiencer argument respectively.
- iii. The clausal complement alternates between CP and SC.

The morpho-syntactic alternation of perception *le-hariax* 'to-smell' in diathesis, experiencer marking and category of the clausal complement, reveals systematic differences in semantic properties, which I discuss in the following subsections: factivity (2.3), belief formation (2.4), indirect perception (2.5), and non-literal uses (2.6). While the latter three are sensitive to the clausal alternation in the active voice, the property of factivity is determined by voice alternation. After pointing out the different semantic contributions of voice alternation and clausal complement alternation, I propose in section 2.7 a compositional account for the semantic properties of each one of the four constructions of perception 'smell'.

2.3 Factivity

Within the class of attitude verbs, *factivity* is the property of a predicate which entails the truth of its complement (Kiparsky & Kiparsky 1970, Karttunen 1971). The property of factivity shows sensitivity to voice alternation: active voice 'smell' is factive with CP and SC, while middle voice 'smell' is non-factive with both.⁹ The entailment of the complement can be tested by the contradiction test (Moulton 2009: 128), applied in (11) for active-SC 'smell'. In a context in which Ronen comes to perceive Danny as perfuming himself by the smell sense, for example, by smelling sprinkles of Danny's signature perfume scent, the truth of the SC complement in the first sentence in (11) follows from factivity, hence the contradiction resulting from the second sentence.

- (11) *ronen heriax* *et dani mitbasem,*
 Ronen smelled ACC Danny perfumes.himself,
 #ak lema'ase dani biqlal lo sam bosem
 #but in fact Danny at.all NEG put perfume
 'Ronen smelled Danny perfume himself, #but in fact Danny didn't
 spray any
 perfume.'

Factivity holds for the active voice 'smell', with both SC, and CP, as shown in (12) for active-CP.

⁹ As has been described in section 2.2, only active-voice 'smell' can embed 'how' questions. Alternating perception verbs in MH can embed a variety of question words, only in the active voice. This section shows that active-voice 'smell', but not middle-voice 'smell', is factive, a contrast which is shared with 'see', 'hear' and 'feel'. For a theoretical linguistic discussion about the correspondence between the grammaticality of embedded questions and factive matrix verbs, see Egré (2008), Spector and Egré (2015) and Mayr (2018).

- (12) *ronen heri'ax še-dani šikor,*
 Ronen smelled that-Danny drunk,
#aḳ lema'ase dani biḳlal lo šata
 #but in fact Danny at.all NEG drank
 'Ronen smelled that Danny is drunk, #but in fact Danny didn't drink at all.'

Factivity, however, does not hold for middle voice 'smell'. The clausal complement for the middle voice 'smell' is interpreted as a probable or an evaluated statement, but not necessarily true. In (13), illustrating middle-CP 'smell', Danny can evaluate Danit as drunk based on some sensory impression, even if she is perfectly sober. Sentence (13), then, is not a contradiction.

- (13) *heri'ax le-dani še-danit šikora,*
 smelled.MID to-Danny that-Danit drunk,
aḳ le ma'ase hi klal lo šateta
 but in fact she at.all NEG drank
 'It smelled to Danny that Danit is drunk, but in fact she didn't drink at all.'

Similarly to middle-CP, middle-SC 'smell' is not factive, as shown in (14) by applying the contradiction test, which does not result in a contradiction.

- (14) *danit heri'xa le-dani šikora,*
 Danit smelled.MID to-Danny drunk,
aḳ le-ma'ase hi klal lo šateta
 but in-fact she at.all NEG drank
 'Danit smelled to Danny drunk, but in fact she didn't drink at all.'

2.4 Belief formation

Unlike factivity, the property of belief formation, or mental apprehension, reveals sensitivity for alternation both in voice and in the clausal complement, i.e. SC or CP. Active-SC is the only construction in which belief is not necessarily formed. Belief formation, as a property of perception verbs with syntactically different complement clauses, was discussed extensively in the linguistic literature, in particular about the English *see*. Moulton (2009: 2-3), referring to Jespersen (1940: 280-281), Higginbotham (1983) and Kroch et al. (1988), contends that syntactically larger complement clauses of *see* implicate an attitude on the part of the subject toward the content of the complement, i.e. *see* describes an epistemically non-neutral perception.

To illustrate this property, we start with the active-SC 'smell' construction (15), in which the verb is epistemically neutral, i.e. belief is not necessarily formed. In order for (15) to be true, it has to be the case that Ronen senses some fumes of smoke from the burning soup, but not necessarily grasping that scenario.

- (15) *ronen heriax et ha-maraq nisraḫ̄*
 Ronen smelled ACC the-soup burn
 'Ronen smelled the soup burn.'

Taking SC as its complement, no belief is necessarily acquired; 'smell' denotes an epistemically neutral perception, i.e. a physical perception of smell, without the experiencer's apprehension of the event. Belief formation can be tested by a test for epistemic non-neutral perception, adapted from Moulton (2009: 128, example (2), attributed to Barwise 1981) for active-SC 'smell' in (16).

- (16) *ronen heriax et ha-maraq nisraḇ,*
 Ronen smelled ACC the-soup burn,
aḇal hu xašab še-hu raq meriax
 but he thought that-he just smells
cnimim triim
 toasts fresh
 'Ronen smelled the soup burn, but he thought that he had simply smelled fresh toast.'

Taking a SC as the complement of 'smell', (16) reports a physical experience, a perception of smell without apprehending the content of the complement clause, hence (16) is not a contradiction. Though apprehension is not obligatory in active-SC 'smell' constructions, it may be inferred. The active voice 'smell' reveals an epistemic contrast between SC and CP complements. Unlike active-SC, in active-CP 'smell', as in (17), a belief is necessarily formed.

- (17) *ronen heriax še-dani šikor,*
 Ronen smelled that-Danny drunk,
#aḇal hu xašab še-hu raq hitiz
 #but he thought that-he just sprayed
'al acmo bosem muzar
 on himself perfume strange
 'Ronen smelled that Danny was drunk, #but he had simply sprayed himself with a strange perfume.'

In (17), it is not only that Ronen physically perceives the smell of Danny's drunkenness - he apprehends that situation by noticing the smell. For (17) to be true, Ronen must form a belief with respect to the content of the CP complement. The same is true for the middle-CP construction in (18). In (18) as well, the test for epistemic non-neutral perception results in a contradiction.

- (18) *heriax le-ronen še-dani šikor,*
 smelled.MID to-Ronen that-Danny drunk,
#aḇal hu xašab še-hu pikeax laxalutin
 #but he thought that-he sober completely
 'It smelled to Ronen that Danny was drunk, #but he thought that he was completely sober.'

The sentence in (18) is a contradiction, indicating that in middle-CP 'smell', belief is formed. Middle-SC 'smell' reveals the same result, as shown in (19).

- (19) *dani heriax le-ronen šikor,*
 Danny smelled.MID to-Ronen drunk,
#aḇal hu xašab še-hu pikeax laxalutin

#but he thought that-he sober completely
 'Danny smelled to Ronen drunk, #but he thought that he was
 completely sober.'

Belief, then, is not formed in active-SC, though may be implied, whereas apprehension is obligatory acquired in active-CP and middle voice 'smell', embedding either SC or CP. It is also shown that belief formation is not only determined by clause category (or size, in finiteness terms), but also by voice alternation.

2.5. Indirect perception

The contrast between direct and indirect perception has been extensively discussed in the linguistic literature, starting from Dretske (1969). This property of 'smell' aligns with belief formation: Only active-SC 'smell' obligatorily describes direct perception, whereas the three other constructions report an indirect perception. Direct and indirect perception associate with the semantic type of predicate that may be embedded in a small-clause: active-SC, requiring direct perception, allows only for stage-level predicates, whereas middle-SC, reporting indirect perception, can only embed individual-stage level.

Direct perception is illustrated in (20a) with active-SC 'smell', contrasted with active-CP 'smell' in (20b), which can report indirect perception.

- (20) a. *dani heriax mašehu nisraḇ*
 Danny smelled something burn
 'Danny smelled something burning.'
- b. *dani heriax še-mašehu nisraḇ*
 Danny smelled that-something burn
 'Danny smelled that something was burning.'

Sentence (20a) can only be felicitous in a context where Danny smelled directly the scent of something burning. Sentence (20b) can also be felicitous in a context where Danny did not smell the smoke from the burning substance itself, but the smell of the spray of the sprinklers in the kitchen.

The property of indirect perception is not equal to belief formation with respect to active-CP and active-SC: active-SC 'smell' may or may not involve an apprehension of a scene, but obligatorily reports a direct olfactory perception of it. The active-CP 'smell' necessarily entails apprehension; However, smelling in the case of active-CP may be direct acquisition of knowledge base on olfactive evidences, or indirect, inferring the content of the complement given olfactive evidence. As was noted by Barwise and Perry (1983: 194) for *see*, following Dretske (1969), and was referred to in the typological literature by Dik and Hengeveld (1991: 239-240), "perception verbs with *that* clause complement can report either direct acquisition of knowledge via perception", or a "report of an acquisition of knowledge based on perception augmented by what one knows must be the case based on what one sees", or perceived by other sensory modalities. Hence, while we can state that indirect perception entails belief formation, the generalization does not apply the other way around, i.e. direct perception does not entail lack of belief formation.

The differences of the requirements of the embedded predicates have been discussed in the literature in terms of perceivable states of affairs (Dik and Hengeveld 1991: 240-242). I address the distinctions between the properties of the embedded predicates in terms of stage level predicate (SLP) and individual level predicate (ILP) (Kratzer 1995). Active-SC 'smell' expresses direct perception, requires the embedded predicate to be a SLP, which describes a temporary state, and not an ILP, describing more of a permanent property. Example (21) shows that active-SC is grammatical when embedding the SLPs 'approach' and 'near' (21a), but infelicitous when embedding the ILP 'expensive' (21b).¹⁰

- (21) a. *noga herixa et ha-bosem mitqareb/ qarob*
 Noga smelled ACC the-perfume approach/near
 'Noga smelled the perfume approach/ near.'
- b. **noga herixa et ha-bosem yaqar*
 Noga smelled ACC the-perfume expensive
 '*Noga smelled the perfume expensive.'

No such restriction regarding the embedded predicate applies for active-CP 'smell'. In (22), both the SLPs 'approach' and 'near' (22a) and the ILP 'expensive' (22b) are grammatical.

- (22) a. *hi herixa še-ha-bosem mitqareb/ qarob*
 she smelled that-the-perfume approach/ near
 'She smelled the perfume approach/ near.'
- d. *hi herixa še-ha-bosem yaqar*
 she smelled that-the-perfume expensive
 'She smelled that the perfume was expensive.'

Middle voice 'smell' expresses indirect perception both with CP and SC complements. In a context where Raffy perfumes the room with a scent dispenser, and Shir directly smells the sprinkles of the perfume, the middle-CP 'smell' in (23) is infelicitous:

- (23) *#heriax le-šir še-raḗi bisem*
 smelled.MID to-Shir that-Raffy perfumed
et ha-xeder
 ACC the-room
 'It smelled to Shir that Raffy perfumed the room.'

Middle-SC 'smell', as well, reports indirect perception. Moreover, as illustrated in (24), this construction requires the embedded predicate to be describing a property of an individual, i.e. an ILP, which can only be perceived indirectly.

- (24) a. **ha-tabšil heriax le-dani nisraḗ*
 the-stew smelled.MID to-Danny burning
 'The stew smelled to Danny burning.'
- b. *ha-tabšil heriax le-dani tiv'oni*
 the-stew smelled.MID to-Danny vegan

¹⁰ As discussed by Kratzer (1995) and Mittwoch (2005), predicates can be ambiguous, and can be either SLP or ILP, depending on context. Some predicates can function either as SLPs or ILPs, and can be embedded in active-SC 'smell' or middle-SC 'smell', respectively.

'The stew smelled to Danny vegan.'

The SLP 'burning' (24a) is a dynamic predicate, i.e. changing over time. It can be perceived directly through smell by sensing burning particles of the stew. Being vegan (24b) is an ILP, a property which can only be perceived inferentially. As was shown for active-CP, no such restriction applies for middle-CP 'smell'.

To conclude this section, active voice 'smell' can report either direct perception (SC), or indirect perception (CP), while the middle voice 'smell' obligatorily reports indirect perception. Embedding a SC, the alternation of 'smell' in voice determines the semantic type of predicate that may be embedded: SLP in active voice, and ILP in middle voice.¹¹

2.6. Non-literal uses

The non-literal meaning goes hand in hand with indirect perception and belief formation, occurring with active-CP and middle voice 'smell'.¹² Non-literal 'smell' attributes to the experiencer a mental apprehension that is not inferred through the sense of smell. The non-literal use is illustrated in (25), with active voice 'smell' and a nominal direct object.

- (25) *'ani meriax kan qombina*
 I smell here shady.business
 'I smell here some shady business.'^W

In (25), the speaker expresses suspicion, which has no olfactory base. The non-literal meaning of 'smell' is very common for 'smell' in MH in all the constructions revealing belief formation and indirect perception: Active-CP, middle-CP and middle-SC.

In (26), 'smell' expresses a suspicion that turns out to be justified:

- (26) *ka'ašerayaš biqeš ha'ala'a šel 50 axuz*
 when Ayash asked raise of 50 percent
 me-xoze-hu ha-noḳexi hem herixu še-ze
 of-contract-his the-current they smelled that-it
 holeḳ le-kivun šel aziḳa,
 goes to-a direction of leaving,
 ve-šam lema'ase heḳinu še-hu kḳar
 and-there in.fact understood.3MP that-he already
 mexuyab le-qḳuca axeret
 committed to-group different

¹¹ The sensitivity to the type of predicate embedded in a clause, SLP and ILP, only applies for SC complements, whereas active-CP and middle-CP 'smell' do not reveal similar restrictions. I will not attempt to give a proper account for this distinction. Following a comment of one anonymous reviewer, I suggest that this may be related to differences between the inner structures of SCs and CPs, i.e. SCs having less structure, presumably also related to the difference between control and raising constructions.

¹² This is not a peculiarity of 'smell', but is shared with all other three alternating perception verbs in MH, 'see', 'hear' and 'feel'. Relevant examples for 'see', 'hear' and 'feel' can be found in Avineri (2017).

'When Ayash asked for a raise of 50% of his current contract, they smelled that it was going towards a direction of leaving, and there, in fact, they understood that he had already committed to a different group.'^W

Middle-CP 'smell' can be used non-literally both with the ordinary complementizer *še* (27a) and with the complementizer *ke'ilu* 'like' (27b):

- (27) a. *mi-kol ha-pirsumim, heriax l-i*
 from-all the-publications, smelled.MID to-me
še- yeš l-o inyan iši
 that-exist to-him interest personal
ba-gbiya, ve-lo raq yicug
 in.the-collection, and-NEG just representation
ragil šel laqoax
 standard of client
 'From all the publications, it smelled to me that he had a personal interest in the collection, and not just standard representation of a client.'^W
- b. *ze meriax l-i ke'ilu hem rocim lixxot*
 it smells.MID to-me like they want to extort
'od ve-od 'amalot
 more and-more commissions
 'It smells to me like they want to extort more and more commissions.'^W

Middle-SC 'smell' can be used non-literally, as illustrated in (28).

- (28) a. *ze lo eyze 'aḇera, kbodo? lo*
 it NEG some felony, your.honor? NEG
meriax le-ka eyze xoser 'emet
 smells.MID.3S to-you some lack.GEN truth
ba-pirsum?
 in.the-advertising?
 'Isn't it a felony, your honor? Doesn't it smell to you like dishonest advertising?'
 (Grossman, *A Horse walks into a bar*, 126)
- b. *ze meriax l-i kmo hatrasa keneḡed*
 it smells.MID to-me like rebellion against
ha-haxlata
 the-decision
 'It smells to me like an opposition against the decision.'^W

The non-literal meaning of 'smell' can be treated in terms of a metaphorical extension (Ibarretxe-Antuñano 1999, attributed to Sweetser 1990). Following Ibarretxe-Antuñano (1999), I propose that the lexical contribution of MH 'smell' to the non-literal meaning is by imposing 'property selection processes' (34-40). I suggest that the metaphorical use of 'smell', namely 'suspect', can be derived through the prototypical properties of the sense of smell that Ibarretxe-Antuñano identifies: internal, related to detection, underspecified, subjective and emotional.

Table 3 summarizes the properties of perception 'smell' in MH with respect to the four-way alternation.

	factivity	belief formation	indirect perception	non-literal use
active-CP	✓	✓	✓	✓
active-SC	✓	✗	✗	✗
middle-CP	✗	✓	✓	✓
middle-SC	✗	✓	✓	✓

Table 3: summary of the properties of perception 'smell'

Table 3 shows that factivity is a semantic property which is sensitive to the alternation in voice; active voice 'smell' is factive in the active voice with the two categories of clausal complements, SC and CP, and middle voice 'smell' is non-factive with both. Belief formation aligns with indirect perception. In the active diathesis, the category of the embedded clause determines these properties: the active-SC 'smell' expresses direct perception, a physical olfactory experience which does not necessarily involve belief formation, whereas the active-CP construction describes the formation of a belief and allows indirect perception. In the middle diathesis, however, belief formation and indirect perception are obligatory, independently of the clausal complement. Non-literal uses are available only in those construction in which belief is obligatorily formed and olfactory perception is indirect.

An additional issue is the nature of the embedded predicate. Embedded predicates are sensitive to the category of the clausal complement: restricted with SC complement but not restricted with CP. Active-SC can embed only SLPs, and middle-SC can only embed ILPs. This suggests that active voice 'smell' can take either an event type complement (SC), or a proposition (CP), while the middle voice 'smell' obligatorily takes a propositional complement.

In section 2.7, I propose an account for the semantic properties of alternating 'smell' in MH.

2.7. An account for the alternating perception 'smell' in MH

The current account builds on two notions, represented syntactically: *abduction* and *Perceiver*. It proposes one basic entry for perception 'smell' – $smell_{SIT}$, where the subscript *SIT* stands for *situation*. $Smell_{SIT}$ is exemplified in the active-SC construction, requiring direct perception. Active-CP, middle-CP and middle-SC 'smell', characterized by belief formation, indirect perception and non-literal uses, are derived compositionally from $smell_{SIT}$ with the component of *abduction*. Factivity, which arises in the active voice 'smell' is attributed to the nominative argument *Perceiver*. Together, the different combinations of $smell_{SIT}$ with *abduction* and *Perceiver* yield, in a compositional manner, the semantic properties of the four constructions attested with 'smell'. The compositional semantic account will be described here informally.

The suggested basic lexical entry for perception 'smell' in MH, as well as for the three other alternating perception verbs, is a relation between two situations, the situation in which perception takes place, and a situation or a set of situations which are

perceived.¹³ The active-SC 'smell' corresponds to *smell_{SIT}*, which, as a basic lexical entry is purely a relation between two situations. To illustrate this entry, consider example (3), exemplifying active-SC 'smell', repeated here as (29). In (29), the verb 'smell', i.e. *smell_{SIT}*, encodes the relation between the situation of olfactory perception and the situation in which the onion is fried.

(29) *ha-so'adim* *herixu* *et* *ha-bacal* *mitagen*
 the-diners smelled ACC the-onion being.fried
 'The diners smelled the onion being fried.'

Smell_{SIT} does not encode the experiencer argument, namely the 'smeller'. The exclusion of the 'smeller' from the basic entry of 'smell' may seem counterintuitive, since the smeller is conceptually part of the event of olfactory perception.¹⁴ This semantic representation is based on Kratzer's (1996) severing of the external argument. Effectively, what it means within the current analysis is not that the 'smeller' is not part of the event of smelling, but rather that it composes with the verb, syntactically and semantically, in a later stage of the derivation.

While *smell_{SIT}* is a relation between situations, 'smell' in active-CP and the middle construction is more complex. It is not simply a relation between a smell-perceiving situation and a situation that is smelled, but a relation between a belief holder and a propositional complement, which is defined by Dik and Hengeveld (1991: 246) as "not the state of affairs itself, but a the proposition concerning this state of affairs that is (mentally) perceived." The current proposal derives this 'smell' from *smell_{SIT}* via its composition with a modal component which I refer to as *abduction*.

The term "abduction" as used by Peirce (1934: 94-131), refers to reasoning from data to the "best fit" explanation of the data (Krawczyk 2012: 199-207). According to Krawczyk (2012: 199):

Reasoning can be commonly categorized into three basic types: deduction, induction, and abduction. The latter two reflect [...] defeasible reasoning, reasoning to a conclusion that goes beyond the logical premises (that is, the addition of new information [...] may render inference invalid).

Adapting Krawczyk's example for English *see* (2012: 199) to fit the case of smell perception, abductive reasoning occurs when I have reasoned that it has rained based on a strong scent of wet soil. When I look outside, I see that the gardener has been spraying water as he walks around the garden. In this case, my inference that it rained has been defeated due to the fact that I now also know there is a different cause for the wet soil.

I propose that the notion of abductive reasoning is manifested as a null, syntactic component, i.e. *abduction*, applying to the basic lexical entry for 'smell', *smell_{SIT}*,

¹³ Following Barwise and Perry (1981: 668), I treat *situations* as basic, primitive concepts in language, "in terms of objects having attributes and standing in relations to one another at locations-connected regions of space-time." For further discussion about the semantics of situations, see Kratzer (2007).

¹⁴ According to Kratzer's (1996), the external argument, unlike internal arguments, is not an argument of the verb, but is introduced by a functional head - the Voice head - that syntactically adjoins to the verbal predicate, the VP node.

deriving the active-CP and middle voice 'smell': *Abduction* takes *smell_{STT}* as its argument, and returns a predicate that takes a proposition and an individual argument, a belief holder. In addition, it adds a requirement that the belief is based on reasoning from perceptual evidence, olfactive in the case of 'smell'. *Abduction*, then, incorporates both belief formation and an inference based on olfactive evidence, i.e. indirect perception. Non-literal uses of 'smell' could be understood as denoting a belief, in this case a suspicion inferred on the basis of perception which is metaphorically olfactive.

The second basic notion of the proposal is the thematic role of a perceiver. The term 'perceiver' as a label for a verb-specific semantic role, along with labels such as *cognizer* and *emoter* as sub-types of experiencers, is discussed in the lexical semantic literature with respect to thematic and grammatical relations between the arguments of predicates (Van Valin 1993, 2004, a.o.). Within the current proposal, 'smell' is recognized as requiring an experiencer participant, i.e. the 'smeller'. In addition, I propose that in the active voice, the experiencer of 'smell' (and of the other three alternating verbs in MH), as a nominative argument, is a special kind of an experiencer, which I refer to as *Perceiver*. The denotation of *Perceiver* introduces the presupposition that the situation perceived - through smell in the case of 'smell' - holds in the actual world.

The four constructions of perception 'smell' can be now represented as different combination of *smell_{STT}* with the concepts of *abduction* and *Perceiver*, as shown in Table 4.

	<i>abduction</i>	<i>Perceiver</i>
active-CP	✓	✓
active-SC	✗	✓
middle-CP	✓	✗
middle-SC	✓	✗

Table 4: combinations of *abduction* and *Perceiver*

After laying out the basic notions of the proposal, I now return to the four constructions of 'smell', accounting for their different semantic properties by using the new concepts of *smell_{STT}*, *abduction* and *Perceiver*.

In active-SC, the complement clause is assumed to be a set of situations. In (30), for example, the SC is a set of situations in which the cake gets burned.

(30)	<i>moti heriax</i>	<i>et</i>	<i>ha-uga</i>	<i>nisreṗet</i>
	Motty smelled	ACC	the-cake	burning
	'Motty smelled the cake burning'			

Active-SC 'smell' is composed of *smell_{STT}* and *Perceiver*, the nominative experiencer. The presupposition introduced by *Perceiver* requires that the perceived situation be smelled by Motty in the actual world. **Factivity** of active-SC follows under this proposal from the presupposition introduced by *Perceiver*. No epistemic component is involved, and this results in the lack of a **belief formation**. Since *smell_{STT}* encodes a relation between a situation of smell perception and a set of perceived situations,

direct perception also follows. This is supported by the infelicity of ILPs in active-SC, as shown above in (21b).

In the active-CP construction, as in active-SC, the nominative experiencer is assumed to be *Perceiver*. I will treat CP (consisting of a finite clause and complementizer) as a unit denoting a proposition, or a set of worlds. Active-CP 'smell' takes a propositional CP as its complement, and is thus assumed to incorporate *abduction*, applying to *smell_{SIT}*. **Factivity** is accounted here too by the presupposition of *Perceiver*. **Belief formation** follows from the *abduction* component, which introduces a belief holder, identified with *Perceiver*. *Abduction* results also in **indirect perception**, since the belief is supposed to be formed based on reasoning from perceptual evidence.

In the middle-voice constructions, middle-CP and middle-SC, there is no nominative experiencer, thus *Perceiver* is not introduced, and **factivity** does not arise. An additional assumption is that, embedded under middle voice 'smell', the SC complement is propositional, and not a set of situations. This accounts for the infelicity of SLPs in middle-SC, as shown above in (24a). Both middle-CP and middle-SC are claimed here, then, to take a propositional complement, thus 'smell' is interpreted as *smell_{SIT}* composed with *abduction*. The properties of **belief formation** and **indirect perception** are explained here by the *abduction* component, which introduces a belief holder, whose belief is formed on the basis of reasoning from perceptual evidence. When explicitly expressed, the belief holder in the middle voice constructions is realized as the dative argument.

Taking stock, the properties of belief formation and indirect perception shared between active-CP and middle voice 'smell' are derived by the composition of *smell_{SIT}* with the component of *abduction*. The non-literal uses of 'smell', aligning with these properties, are also due to the semantic contribution of *abduction*. Factivity of the active voice 'smell' is accounted through the nominative argument *Perceiver*, introducing the presupposition that the situation perceived through smell holds in the actual world. While *Perceiver* is restricted to active voice 'smell', *abduction* is restricted to propositional complements. In the active voice, SC indicates a set of situations, whereas CP is propositional; in the middle voice, both CP and SC are propositional. The current proposal differs from previous accounts for different semantic properties of perception verbs with variety of complements, such as Dik and Hengeveld's (1991), by attributing the inferential perception and belief, not to the semantics of the complement, but to the *abduction* component: *Abduction* shifts 'smell' into propositional attitude predicate which can only take a proposition as its complement.

The current proposal treats 'smell' in the four different constructions as derived compositionally from a single basic lexical entry. This ties together two subclasses of perception verbs discussed in the literature, e.g. Viberg's (1983) classification of experiencer-based verbs and source-based, or phenomenon-based verbs, and Levin's (1993) terminology, distinguishing between *see*-verbs and stimulus-subject-perception-verbs, differing in whether the experiencer is expressed as the nominative subject or a dative object of the verb. The different semantic properties of perception verbs embedding finite and non-finite clauses that were discussed vastly in the theoretical and typological literature, e.g. Dik and Hengeveld's (1991) typology of

Perception verb complements, Dretske (1969), discussing belief formation of *see*, Barwise and Perry's (1981, 1983) discussion of indirect perception for *see*, and Kirsner and Thompson (1976: 211-215) pragmatic account the factivity of *see*, *hear* and other related perception verbs, are accounted here by introducing the syntactic components *Perceiver* and *abduction* and specifying their semantic contribution.¹⁵

The systematic combinations of *Perceiver* and *abduction* apply to the other sensory modalities (with visual, auditory and tactile perceptual evidence), since the morpho-syntactic and semantic alternation of 'smell' is shared with 'see', 'hear' and 'feel'. In the following section, I distinguish the perception 'smell' discussed above, which has an experiencer, from agentive smell perception verbs in MH, namely *le-raxreax* 'to-sniff out', *le-hasniḅ* 'to-sniff' (section 3.1), the middle voice 'smell', reporting odor emission (section 3.2), and *lit'om* 'to taste' (section 3.3).

3. Smell and taste verbs in MH

As listed in Table 1, in addition to the the perception verb *le-hariax* 'to-smell', MH lexicalized activity smell perception verbs, namely, *le-raxreax* 'to-sniff out', *le-hasniḅ* 'to-sniff'. MH also has smell emission verbs, and taste perception verb, i.e. *li-t'om* 'to-taste'. All these verbs differ syntactically and semantically from the experience perception verb *le-hariax* 'to-smell' discussed above.

I propose that the distinctions between these verbs and *le-hariax* show that the morpho-syntactic properties of clause embedding and voice alternation correspond with the lexicalization of a sensory modality perception verb, e.g. smell, with an experiencer. This generalization with respect to the data in MH, will confirm Viberg's (1983) sensory hierarchy.

3.1. 'sniff out' and 'sniff'

In addition to 'smell', MH has two other common verbs which are related to smell - *le-raxreax* 'to-sniff out' and *le-hasniḅ* 'to sniff' - which are both innovations of MH. As noted by Kirsner and Thompson (1976: 225-231) for perception verbs such as *see* and *watch*, and *hear* and *listen*, 'sniff out' and 'sniff' differ from 'smell' in the degree of agency of the experiencer, and its control over the perception process. In line with Van Valin's (1993: 42) statement about the difference between verbs like *listen to* and *hear*, we can say that is that the subject of 'sniff out' and 'sniff' is an experiencer which is also an agent, while the subject of 'smell' is simply an experiencer. According to Van Valin, this differentiation is "an example of how languages often have pairs of verbs, with one being a volitional and the other being a non-volitional perceiver" (1993: 42).

Le-raxreax 'to-sniff out' is a verb derived in the Hebrew intensive template *pi'el*. What semantically characterizes *pi'el* verbs is that their external argument denotes an agent

¹⁵ Kirsner and Thompson (1976) use the term 'implicativity', attributed to Karttunen (1970). Karttunen (1970, 1971) distinguishes between 'factive' predicates and 'implicative' ones with respect to differences in their presuppositions. The use of the term 'factivity' here corresponds with the term 'implicativity' as discussed by Kirsner and Thompson (1976).

of action (Doron 2003). More specifically, *le-raxreax* is one among *pi'els* subclass of quadrilateral reduplicated binary roots. The consonantal root of *le-raxreax* is a reduplication to the root consonants of *le-hariax* 'to-smell'. This class of verbs with reduplicated binary roots verbs has been claimed to express event internal pluractionality, meaning that the event in the denotation of the verb is, in some sense, pluralized (Greenberg 2010, relying on the classical notion of pluractionality proposed by Cusic 1981). According to Greenberg (2010: 138), *le-raxreax* is pluractional in terms of 'distribution in time'. *Le-raxreax*, thus, is taken to denote plural events which have subevents of smelling with non-overlapping running times, performed by a single agent.

Le-hasniḅ 'to-sniff' has a root borrowed from English (*to sniff*). The verb *le-hasniḅ* in MH is transitive, meaning 'to inhale a substance through the nose', mostly drugs, such as cocaine. As an extension, it can also mean 'to strongly inhale vapors emitted by a substance or an entity in order to experience their smell'. *Le-hasniḅ* is derived in the causative template *hiḅ'il*, same as *le-hariax* 'to-smell'. However, the verbal template, apparently, is phonologically, rather than semantically, motivated.¹⁶ Unlike *le-hariax* 'to-smell', both *le-raxreax* 'to-sniff out' and *le-hasniḅ* 'to-sniff' are eventive, and have an agent as their subject.

Similar to 'smell', *le-raxreax* too has metaphorical extensions, namely 'to tail' or 'to lurk' (31a), and 'to pry' (31b).

- (31) a. *gormim* *rabey* *koax* *šalxu* *xoqrim*
 bodies full.GEN power sent investigators
le-raxreax *šbiḅ* *ha-xoqrim* *ha-mit'asqim*
 to-sniff.out around the-investigators that-handle
ba-parašot
 in.the-affairs
 'Powerful authorities sent agents to sniff around the investigators involved in the affairs.'^W
- b. *nituaḅ* *kritat* *rexem* *šel* *selebriḅa'it*
 surgery removal.GEN uterus of celebrity
'amerika'it *hu* *behexlet* *lo* *ha-hizdamnut*
 American is absolutely NEG the-occasion
ha-yexida *še-ba* *'anašim* *moḅ'im*
 the-only which-in.3F people find
le-naḅon *le-raxreax* *rexamim*
 to-right to-sniff.out uteri
 'Hysterectomy of an American celebrity is most definitely not the only occasion in which people find it appropriate to pry in women's uteri.'^W

However, unlike the extension of 'smell' (i.e. 'suspect'), the metaphorical extension of 'sniff' is agentive.¹⁷ 'Sniff out' and 'sniff' do not participate in the active-middle

¹⁶ This was claimed about other verbs in *hiḅ'il*, derived from borrowed monosyllabic nouns that contain onset clusters, such as *ḅliq-lehaḅliq* 'slap-to slap' and *špric-lahašpric* 'squirt-to squirt' (Bat-El 1994: 579).

¹⁷ A similar contrast between the metaphorical extensions of 'smell' verbs is found in English between *smell* and *sniff*, and in Spanish between *oler* 'smell' and *husear* 'sniff' (Ibarretxe-Antuñano 1997: 116,

alternation, and are both ungrammatical in the middle voice. In addition, they do not take clausal complements, either SC or CP. Hence, 'sniff out' and 'sniff' contrast with 'smell' with respect to stativity and morpho-syntactic alternation.

3.2 Odor emission 'smell'

As described in section 2, the verb *le-hariax* 'to-smell' in MH is used as a perception verb, in active and middle voice. The middle voice 'smell' is also used as an odor emission verb, with a supplementary PP source. The 'emission' use of 'smell' is unique within the group of alternating perception verbs in MH. This use of MH 'smell' is illustrated in (32).

- (32) *ha-mašqe* *meriax* *mi-tapuzim*
 the-drink smells.MID from-oranges
 'The drink smells of oranges.'

The odor emission 'smell' with a source PP is infelicitous with an overt experiencer, either nominative (33a) or dative (33b).

- (33) a. **sasi meriax et ha-mašqe mi-tapuzim*
 Sassy smells ACC the-drink from-oranges
 'Sassy smells the drink of oranges.'
 b. **ha-mašqe meriax le-sasi mi-tapuzim*
 the-drink smells.MID to-Sassy from-oranges
 'The drink smells to Sassy of oranges.'

Note that the middle voice emission 'smell' is homophonous with middle voice perception 'smell', which appears with a dative experiencer. Example (33b), then, can be felicitous when the PP *mi-tapuzim* 'from-oranges' is parsed as the SC predicate, embedded by middle voice perception 'smell'. Example (34) illustrates an unambiguous supplementary PP source, which is grammatical with emission 'smell' (34a), but not with perception 'smell' with a dative experiencer (34b).

- (34) a. *kol ha-bait meriax me-ha-pica*
 all the-house smells.MID from-the-pizza
 še-ba-tanur
 that-in.the-oven
 'All the house smells of the pizza in the oven.'^w
 b. **kol ha-bait meriax l-i me-ha-pica*
 all the-house smells.MID to-me from-the-pizza
 še-ba-tanur
 that-in.the-oven
 'All the house smells to me of the pizza in the oven.'

MH has three other verbs expressing odor emission, namely *le-hasriax*, *le-hacxin* and *le-hab'iš* 'to-smell bad, to-stink'. All three are middle voice verbs derived in the

119). Another contrast that Ibarretxe-Antuñano found between 'smell' and 'sniff' is that only the former can express odor emission, both for Spanish and English. The odor emission use of 'smell' in MH is discussed in section 3.2.

causative template, similarly to *le-hariax* 'to-smell'. As in the case of 'smell', they can all appear with a PP adjunct, as illustrated in (35) for *le-hasriax* 'to-stink'.

- (35) *ha-meqarer masriax mi-ḡbina kxula*
 the-fridge smells-bad.MID from-cheese blue
 'The fridge stinks of blue cheese.'

All three can also be used as transitive verbs, as shown in (36) for *lehab'iš*.

- (36) *caxanat-o hiḡ'iša et ha-gan kulo*
 stench-his stinked ACC the-garden whole
 'His stench stinked the whole garden.'^W

Le-hasriax, *le-hacxin* and *le-hab'iš* can also be used metaphorically, meaning 'raising a suspicious of dishonesty', illustrated in (37) with *lehacxin*.

- (37) *kim'at kol ma še-qašur le-'iriyatenu*
 almost all which that-connected to-municipality.our
macxin mi-šxitut
 stinks from-corruption
 'Almost everything concerning about our municipality stinks of corruption.'^W

To my knowledge, there is no MH verb meaning 'to smell good'. There is, however, a verb expressing the action or causation of good smell, *le-basem* 'to-perfume', from which the adjective *meḡusam* 'perfumed' is derived.¹⁸ Smell related adjectives in MH can also be denominal, such as the adjective '*aromati* 'aromatic', derived from the noun *aroma*, and *reyxani* 'fragrant' derived from the noun *reax* 'smell'. Hence, the parallel of *smelly* in Hebrew is a positive rather than negative attribute. In the nominal domain, the noun *nixoax* 'fragrance' is associated with good smell.

This section has shown that the middle voice *le-hariax* 'to-smell' expresses neutral smell emission, i.e. not inherently evaluated as good or bad. There are particular verbs specified for emission of good smell, and others for the emission of bad smell.

3.3. 'Taste'

Unlike the verbs 'see', 'hear' and 'feel', the MH perception verb *li-t'om* 'to-taste', is absent from the alternation shown for 'smell' – it cannot embed a clausal complement, and does not alternate in voice.

In MH, *li-t'om* 'to-taste' seems to express more of a physical action rather than a stative, perceptual experience, somewhat like 'sample', as illustrated in (38).

- (38) *dudu ta'am et ha-yain*
 Dudu tasted ACC the-wine
 'Dudu tasted the wine.'

¹⁸ *Meḡusam* also means 'tipsy' (literary).

In addition, 'taste' cannot embed a clausal complement, neither SC (39a), nor CP (39b):

- (39) a. **dudu ta'am et ha-xalaḅ maxmic*
 Dudu tasted ACC the-milk get.sour
 'Dudu tasted the milk get sour.'
- b. **dudu ta'am še-ha-xalaḅ maxmic*
 Dudu tasted that-the-milk sours
 'Dudu tasted that the milk was souring.'

Active 'taste' can have a non-literal use, i.e. not sensorial, in the sense of 'to experience', only with the cognate object *ta'am* 'taste', the nominalized form of the verb, as illustrated in (40).¹⁹

- (40) *raq mi še-ta'am et ta'am ha-ha'apala*
 only who that-tasted ACC taste the-illegal.immigration
yode'a 'ad kama lo 'enošim hayu
 knows.3MS to how.much NEG human were
ha-tna'im še-ba'hem ne'elacnu le-haplig
 circumstances that-in.which forced.1P to-sail
 'Only those who tasted the taste of illegal immigration knows how
 inhuman were the circumstances in which we were forced to sail.'^W

The middle voice verbal form with a dative argument is ungrammatical, embedding either CP (41a), or SC (41b).

- (41) a. **nit'am l-o še-ha-milqšeq xamuc*
 tasted.MID to-him that-the-milkshake sour
 'It tasted to him that the milkshake was sour.'
- b. **ha-milqšeq nit'am l-o xamuc*
 the-milkshake tasted.MID to-him sour
 'The milkshake tasted sour to him.'

'Taste', then, is shown to differ from 'smell' with respect to stativity and the alternation in voice and clausal complement.

Yet 'taste' does co-occur with a dative experiencer, in its adjectival form *ta'im* 'tasty', both with CP (42a) and SC (42b).²⁰

- (42) a. *ta'im l-o še-ha-milqšeq xamuc*
 tasty to-him that-the-milkshake sour
 'It is tasty to him that the milkshake is sour.'

¹⁹ But also with a direct object without the cognate object *ta'am* 'taste', in idiomatic phrases, such as *ta'am et naxat zro'o*, literally 'tasted (= experienced) the blow of arm.' I thank an anonymous reviewer for this example.

²⁰ The active voice 'taste', as an agentive sense verb, appears already in Biblical Hebrew. The adjective 'tasty' was innovated in MH, derived in the adjectival template CaCiC. The classical use of the template expresses a static property, such as *ca'ir* 'young' and *nadiḅ* 'generous'. In MH, this adjectival template acquired the meaning of a potential property, such as *šaḅir* 'breakable' and *qari* 'readable' (Gadish 2007).

- b. *ha-milqšeq ta'im l-o xamuc*
 the-milkshake tasty to-him sour
 'The milkshake is tasty to him sour.'

The adjective *ta'im* 'tasty' is derived from the root of the verb 'taste' in MH, has the positive meaning of 'tasting good'.²¹ This parallels the adjective *reyḥani* 'fragrant', which as a positive meaning though derived from the neutral *reaḥ* 'smell'.

Still, MH reveals an asymmetry between 'smell' and 'taste' with respect to stativity and morpho-syntactic alternation. The asymmetry between the linguistic expressions of the five sensory modalities were discussed extensively in the typological literature (Kyrk 1979, Viberg 1983, Saydon 2009 for Hebrew, San Roque et al. 2018, a.o.). In his typological study, Viberg (1983) discusses lexicalization patterns of perception verbs and presents a sensory hierarchy, shown in (43), that predicts which meanings, namely *experience* (as opposed to *agentive*) perception verbs are lexicalized by a special lexical item (1983: 136, 147).

- (43) sight -> hearing -> touch -> smell
 taste

As was shown in Table 1, and discussed in further detail in section 3.1, MH lexicalized experience perception verb for 'smell', distinguished from the agentive 'smell' verbs, and so for 'feel', 'hear' and 'see', but not for 'taste'. This confirms Viberg's hierarchy, and also proposes that in MH, 'smell' ranks above 'taste'.

Table 1 also showed that the verb *la-xuš* 'to-sense' lexicalizes an experiencer, but is underspecified for sensory modality: it denotes a perception of a physical stimulus, either tactile, olfactive or gustatory. *La-xuš* 'to-sense' cannot alternate in voice, i.e. it cannot appear in the middle voice. However, unlike *li-t'om* 'to-taste', it can embed a complement clause, SC or CP. The current work may suggest a correlation between lexicalization and morpho-syntactic behavior, i.e., it suggests that only lexicalized experience perception verb, distinguished from agentive perception verbs of the same sensory modality, can take clausal complements and alternate in voice.

Section 4 shifts the discussion to from the synchronic view to the historical perspective, and attempts to trace the emergence of the morpho-syntactic alternation of 'smell'.

4. From Biblical 'smell' to Modern Hebrew 'smell'

In this section, I discuss the morpho-syntactic properties of *le-hariax* 'to-smell' in Biblical Hebrew, and how they changed from Biblical Hebrew to MH. I propose to attribute the diachronic changes, which led to *le-hariax* as is used today, mostly to the influence of European languages during the emergence of MH, and to Yiddish in particular.

²¹ There are, however, deverbal adjectives which are related to food consumption, that have a negative meaning, such as *mabxil* 'nauseating'.

In Biblical Hebrew, the verb appears in the active voice with a nominative 'smeller', a null 3MP pronoun in the case of (44).²²

- (44) *wə-lō* *yōklūn* *wə-lō* **yərīhxun**
 and-NEG eat.3MP and-NEG **smell.3MP**
 'They neither eat nor smell.'
 (Deuteronomy 4:28)

The complement of 'smell' can be expressed either as a nominal, direct object, as *bəgādāw* 'his garments' in (45a) or indirect, as the prepositional phrase *bāh* 'in it' in (45b).

- (45) a. **way-yārah** *ʔet rēah bəgādāw*
and-smelled.3MS ACC smell garments.his
 'And he smelled the smell of his garments.'
 (Genesis 27:27)
- b. *ʔiš ʔāšer yaʔāše kāmōhā, ləhārīah*
 whoever that do.3MS like.that, **to.smell**
bāh, wə-niḳraʔ mē-ʕammāw
 in.it, shell-be cut off from-people.his
 'Whoever makes any like it, to smell it, he shall be cut off from his people.'
 (Exodus 30:38)

In Biblical Hebrew, 'smell' carries either a physical meaning (44)-(45), or a cognitive one, which could be interpreted as 'noticed',²³ as shown in (46).

- (46) *u-mē-rāhōq, yārīah milhāmā*
 and-from-far, **smell.3MS** battle
 He smells the battle from afar.'
 (Job 39:25)

Note that in (46), 'smell' has an abstract direct object *milhāmā* 'battle', and has a non-literal sense. As we showed above (25), the same is true for MH.

Unlike in MH, odor emission in Biblical Hebrew is expressed by the verb 'smell', but periphrastically, e.g. *nātnū rēah* 'gave smell', as in (47).²⁴

- (47) *had-dūdāʔīm nātnū rēah*
 the-mandrakes **give.3MP** **smell**
 The mandrakes give off a fragrance.'
 (Song of Solomon 7:14)

²² I remain agnostic as to whether the thematic role of the nominative argument in Biblical Hebrew, the 'smeller' is an experiencer or an agent.

²³ According to Even-Shoshan's (1977-1980) concordance of the Bible.

²⁴ The smell emission verb *le-hab'is* 'to-smell bad, to-stink' in MH appears already in Biblical Hebrew. In Biblical Hebrew, the verb has a non-literal meaning of 'to become obnoxious in one's eyes' (Sadan 1956 (286), Kaddari 2006 (85)), with which the experiencer can be expressed as a PP.

To conclude the data presented here for Biblical Hebrew, perception 'smell' is only found in the active voice, with a nominative smeller, and with direct or indirect objects as complements. Odor emission is expressed periphrastically, and not through the middle-voice form of 'smell'. Thus, 'smell' taking a clausal complement and 'smell' in the middle voice with a dative experiencer or with a PP source emerged in post-Biblical Hebrew.

The Post-Biblical Hebrew stages prior to MH reveal only very few examples of middle voice 'smell'. In a corpus search of the The Historical Dictionary, accessed online through Ma'agarim,²⁵ only two examples for middle 'smell' with a dative argument were retrieved. The first token is shown in (48).²⁶

- (48) *še-reaḥ* *ʔaron ha-brit* *lo* *haya meriaḥ*
 that-smell Ark the-Covenant NEG **was** **smell.MID**
 le-iśraʔel *ʔela gimel yamim*
 to-Israel but three days
 'That the smell of Ark of the Covenant only reached Israel for three days.'
 (Midrash Samuel, Paraša 23)

The sentence in (48) is the commentator's interpretation for the following verse in Numbers.

- (49) *wa-ʔārōn* *bərīt* *YHWH nōsēʕa*
 and-ark.GEN the.covenant God went.IPFV.3MS
 lipnēhem *dereḳ* *šalōšet yāmim*
 before.them journey three days
 'and the ark of the covenant of the LORD went before them for the three days' journey.'
 (Numbers 10:33)

According to Yalon (1971: 113-114), the sentence from the Midrash exemplifies 'smell' in an odor emission meaning. He states that the commentators of this text treated the dative argument as the goal of the scent, reaching the people of Israel, and interpreted the smell as compared to the protection provided by the Ark of the Covenant from a distance for three days. The second token is shown in (50), from a medieval liturgical hymn:²⁷

- (50) *reaḥ ḥaniṭeyhem heriaḥ* *l-i*
 smell ripening.fruits **smelled.MID** to-me
 'The smell of the ripening fruits smelled to me.'
 (Qroḇa le-pesaḥ, hymn Kḇodo ʔereṣ temale)

²⁵ Ma'agarim features the corpus of Hebrew texts of the Historical Dictionary Project of the Academy of the Hebrew Language. Ma'agarim contains a vast corpora from Post-Biblical Hebrew texts until the 11th century, and from the 18th century to the 20th century.

²⁶ The text is dated to earlier than the mid-12th century.

²⁷ The text is dated to the 9th century CE, written by Shlomo Suliman.

Grammarians of Modern Hebrew discuss two other pre-revival occurrences of middle voice 'smell'. The first one (Yalon 1971, Sadan 1956 (267)) is found in Rabbi Shlomo Itzhaki's (RASHI)²⁸ commentary for the Bible:

- (51) *kol bgadaik merihim ke-reaḥ bśamim*
 all garments.your **smell.MID** like-smell perfumes
 'All your garments smell of perfume scent.'

The sentence in (51) is RASHI's interpretation for the following verse in Psalms, which treats smell emission:

- (52) *mōr wa-ḡāḥlōt qəṣīfōt, kol biḡdōtēekō*
 myrrh and-aloes cassias all garments.your
 'All Your garments are [scented with] myrrh and aloes and cassia.'
 (Psalms 45:9)

The second occurrence, discussed by Sadan (1956: 269) is taken from the poetry of Samuel Hanagid²⁹:

- (53) *sḡarim merihim be-zeḡer yešufot*
 books **smell.MID** in-memory salvations
ḡelohim le-naḡši ke-zeḡer kḡarim
 God to-soul.my like-memory villages
 'Books smell in memory of salvations, God to my soul like the memory of villages'.

The verb 'smell' in (53) was interpreted by the commentator of the poem as 'spreading good scent'.

Le-hariax 'to-smell' in the middle voice, then, is attested in Hebrew already in medieval texts, used mainly to express odor emission. Grammarians of Modern Hebrew, however, view the middle voice 'smell' expressing smell emission in MH as resulting from Yiddish influence (Dalmatzky-Fischler 2000: 148-149). A great part of the first speakers Hebrew in the 19th century was of native speakers of Yiddish. In Yiddish, the verb *šmekḡ* expresses smell perception, as in *šmekḡ tabiq* 'smell tobacco', and also expresses odor emission. Sadan (1956: 269) exemplifies smell emission *šmekḡ* occurrences in Yiddish texts:^{30, 31}

- (54) a. *in hoyz šmekḡ maščen un medicinen*
 in house **smell** ointments and medications
 'In the house, the ointments and medications spread scent.'
 b. *in uḡrayne šmekḡ šoyḡ bez*
 in Ukraine **smells** already lilac
 'In Ukraine, the lilac already spreads scent.'

²⁸ RASHI lived in the 11th century.

²⁹ Samuel Hanagid lived in the 11th century.

³⁰ Yiddish is written in Hebrew letters, thus the transcriptions follows the MH transcriptions, as stated in footnote 2.

³¹ Sadan (1959) cites from Yiddish texts which were published proximately prior to his book (Berish Weinstein. *Lider un poemes*, 1949 (54a); Mordechai Rotenberg. *Shabbat un voch*, 1951 (54b)).

Hence, though middle verb 'smell', expressing smell emission, is attested already in Medieval Hebrew, the increase of its use in MH could be attributed to the influence of Yiddish.

The data from pre-MH stages of Hebrew suggests that most of the syntactic innovation involving *le-hariax* 'to-smell' occurred in MH. Apparently, MH innovated in two ways with regard to *le-hariax*. The first innovation is the addition of clausal complements, alternating between SC and CP, for both active and middle 'smell'. A corpus search in Ma'agarim, reveals that the earliest attested example of active-CP 'smell' is (55), where the complementizer is *ki* 'that'.³²

- (55) *u-mesinise meleḵ numidie heriāx ki nib'aša*
 and-Mesinise king Numidia **smelled** **that** stank
qartage be-roma
 Carthage in-Rome
 'And Mesinise, the king of Numidia, smelled that Carthage was repulsive to Rome.'
 (Mordechai Aharon Ginzburg. *Toldot Bney Ha-adam*, 1935)

The second innovation is concerned with *lehariax* in the middle voice with a supplementary source PP adjunct, when 'smell' expresses odor emission. These two innovations, clausal complements (SC and CP) and the extended middle voice 'smell', seem to emerge under the influence of Yiddish. Yiddish lexicalizes a variety of 'smell' verbs, in different constructions, as exemplified in the sentences in (56)-(57), retrieved from the Historical Jewish Press website.³³ Example (56) illustrates active-CP 'smell'.

- (56) *der alter šiker hot der-šmekť az ik hob*
 the old drunk has **PREF-smelled** that I have
etlike p̄ranq in taš
 some francs in pocket
 'The old drunk detected that I had some francs in my pocket.'
 (*Der Tog*, January 2, 1915)

In (56), the verbal prefix *der-* precedes the verbal stem *šmekť* 'smell'. The affixed verb means 'to detect by smell'. The middle voice smell emission 'smell' supplemented by a PP adjunct is illustrated in (57).

- (57) *es šmekť mit pulver*
 it **smells** with dust
 'It smells of dust.'
 (*Yiddishes Togeblat*, November 21, 1915)

Attributing the innovations of 'smell' in MH to Yiddish requires comprehensive, future, research. Such investigation should consider other possible influences by

³² The complementizer *ki* 'that' embeds content clauses, as opposed to *ašer* 'that' which embeds relative clauses. The general complementizer *še* embeds both types of clauses (Kuzar 1991).

³³ The corpus contains Jewish newspapers published between the 18th to the 21st centuries.

language contact during the emergence of MH, such as Russian and other Slavic languages, which were also prominent native languages of the MH first speakers.

This section has suggested that middle voice 'smell' in the odor emission sense appeared much earlier than the perception 'smell' (active and middle) embedding a clause. The latter seems to be an innovation of Modern Hebrew, as is the innovation of the agentive perception 'smell' verbs *le-raxreax* 'to-sniff out' and *le-hasniḅ* 'to-sniff'.

5. Conclusions

The verb *le-hariax* 'to-smell' in MH, expressing an olfactive perceptual experience, reveals an intricate array of syntactic and semantic alternation. The systematic alternation of 'smell' in voice and embedded clause category is shared with the perception verbs 'see', 'hear' and 'feel', and distinguishes 'smell' from agentive smell perception verbs in MH, namely *le-raxreax* 'to-sniff out', *le-hasniḅ* 'to-sniff', and also from the perception verb that lexicalizes gustatory sense modality *li-t'om* 'to-taste'. The current work suggests an account for the alternation based on two notions. The first is the notion of *abduction*, shifting the basic lexical entry for 'smell' into epistemic-non-neutral perception 'smell'. The second is the thematic role *Perceiver*, which inserts factivity.

MH innovated several constructions for *le-hariax* 'to-smell' beyond Biblical Hebrew. Middle voice 'smell' expressing odor emission is already attested in Medieval Hebrew texts. However, most of the syntactic innovations involving *le-hariax* seems to originate in MH. These innovations were attributed here to the influence of Yiddish during the period of the emergence of MH.

The present work can hopefully be a modest contribution to a comprehensive typological study of semantic and syntactic perception verbs with respect to their voice alternation, prompted by Aikhenvald and Storch (2013: 20):

[...] seemingly different semantics of verbs of perception is a corollary of their transitivity [voice] patterns [...] It would be a worthwhile task to provide a cross-linguistic investigation of transitivity of verbs of perception [...]

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