Voice That Feels Modern: Alternations of Perception Verbs in Hebrew[1]

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1 Introduction

This work discusses a sub-class of perception verbs in Modern Hebrew, namely *li-rʾot* 'see', *li-šmoʾa* 'hear', *le-hargiš* 'feel' and *le-hariax* 'smell'. These verbs reveal an intricate array of alternations: morphological, syntactic, and semantic. Morpho-syntactically, their experiencer argument alternates between nominative and dative marking. This alternation is accompanied by a voice alternation between active and middle voice, which is morphologically marked by the verbal form. In addition, all these verbs can embed two types of clauses, a small clause and a finite clause. Together, the alternation yields four different constructions, which might seem redundant. Semantically, however, each construction shows different properties, arising systematically for all the verbs in the class.

From a diachronic perspective, the systematic alternation for this group of verbs emerged in Hebrew gradually, with respect to the sensory modality lexicalized by the verbs. The examination of the synchronic alternations of this class of perception verbs in Modern Hebrew and their historical development throws light on the interrelations between morphology, syntax and semantics, and in particular – on the function of voice in the field of perception.

The literature on perception verbs typically divides perception verbs into two subclasses and describes them separately. Viberg (1983) classifies perception verbs into experiencer-based verbs and source-based or phenomenon-based verbs, and the terminology of Levin (1993) for English 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 *x see* vs. *look to x*, *x hear* vs. *sound to x* (*x* stands for the experiencer argument), or homonymous verbs which differ in their syntax: *x smell* vs. *smell to x*, *x feel* vs. *feel to x*. Most theoretical work only analyzes one of the two classes, either those perception verbs which take a nominative experiencer (such as Moulton 2009, who refers to Jespersen 1940), or those perception verbs which take a dative experiencer (Matushansky 2002, Kastner 2015). Yet the two classes of verbs have important characteristics in common. Semantically, both are perception verbs. 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.

In Modern Hebrew, the verbs of the two classes are voice alternants of each other, i.e. they actually constitute a single class of verbs which alternate in voice. Other perception verbs in Modern Hebrew do not systematically alternate in the same way. In addition to the morphological alternation in voice, the duality found in these verbs has an important semantic dimension. As has already been shown for other languages, when perception verbs take a non-finite small clause complement (see Barwise 1981, Barwise & Perry 1983, Higginbotham 1983 for the semantics of non-finite complement of *see*, and Clark & Jäger 2000, Declerck 1983 for their syntax), they denote a sensory experience not necessarily connected to any mental apprehension. When they take finite complements, they denote a sensory experience that gives rise to mental apprehension. Moreover, it is shown for English *see* (Moulton 2009), and for perception verbs in some other languages (Kirsner & Thompson 1976), that with certain clause complements they can entail the truth of their complement.

This work presents a unified view of the four perception verbs, *li-rʾot* 'see', *li-šmoʿa* 'hear', *le-hargiš* 'feel' and *le-hariax* 'smell', as a joint group, with respect to the two dimensions, voice and clausal complements, and to their semantic regularities, and examines the development of their shared alternation in voice in Hebrew. The discussion will be as follows: Section 2 first presents the morpho-syntactic alternation of the verbs in voice (active vs. middle) & experiencer marking (nominative vs. dative) and the type of the clausal complement (finite clause (CP) vs. non-finite small clause (SC)), and later describes its semantic properties, namely: (i) factivity, (ii) belief formation, (iii) indirect perception; (iv) non-literal uses. Section 3 proposes a compositional account for the alternation and its array of semantic properties, as a combination of a basic lexical entry and the notions *perceiver*, the nominative experiencer, and *abduction*, a modal component. Section 4 examines the emergence of the shared voice alternation in Hebrew, suggesting that both a sensory hierarchy and language contact are at play. Section 5 will conclude. Through the examination of voice alternation of perception verbs in Modern Hebrew, synchronically and diachronically, this work wishes to participate in the typological project put forward 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 […].

2 Morpho-syntactic and Semantic Regularities

This section will first present the voice alternation of the verbs *li-rʾot* 'see', *li-šmoʾa* 'hear', *le-hargiš* 'feel' and *le-hariax* 'smell' when their complement is a clause (Section 2.1), and continue with their semantic regularities (Section 2.2).

2.1 The Morpho-syntactic Paradigm

When the complement of these verbs is a clause, they alternate in three dimensions, the first two cluster together: (i) voice:[2] active vs. middle; (ii) experiencer marking: nominative vs. dative; (iii) clausal complement: finite clause (CP) vs. non-finite small clause (SC). The four combinations are illustrated in (1a)-(1d) for the verb *li-šmoʾa* 'hear':[3]

(1) a.   active-CP
        ha-dayarim   *šamʾu*   *še-ha-šḵenim*   *šarim*   *qaryoqi*
        DEF-residents hear   that-DEF-neighbors   sing   karaoke
        'The residents heard that the neighbors were singing karaoke.'
    b.   active-SC
        ha-dayarim   *šamʾu*   *ʾet*   *ha-šḵenim*   *šarim*   *qaryoqi*
        DEF-residents hear   ACC   DEF-neighbors sing   karaoke
        'The residents heard the neighbors sing karaoke.'
    c.   middle-CP
        nišma   *la-dayarim*   *še-ha-šḵenim*   *šarim* *qaryoqi*
        hear.MID.3MS to.DEF-residents   that-DEF-neighbors   sing   karaoke
        'It sounded to the residents that the neighbors were singing karaoke.'
    d.   middle-SC
        ha-šḵenim   *nišmeʾu*   *la-dayarim*   *smexim*
        DEF-neighbors hear.MID.3P   to.DEF-residents   happy
        'The neighbors sounded happy to the residents.'

Table 1 summarizes the morpho-syntactic alternation of the four perception verbs as a four-constructions-paradigm.

Construction	Case of the Experiencer Argument	Voice	Category of the Embedded Clause
I. active-CP	nominative	active	finite (CP)
II. active-SC	nominative	active	non-finite (SC)
III. middle-CP	dative	middle	finite (CP)

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[2] The term *voice* will be used here throughout, aside for in Section 3.1, in the descriptive sense, as *diathesis*.

[3] The work is based on attested examples from spoken, broadcasted and electronic communication, presented in simplified versions. Cited examples attested in written speech online are marked by [W]. All further illustrated constructions apply for all four perception verbs, unless mentioned otherwise. The transcription of the fricatives corresponding to *b, k, p* are represented as *b̠, k̠, p̄*, respectively. The non-spirantizable *k* will be transcribed as *q*. The transcription ʾ stands for the common variants of the glottal stops ʔ and ʕ in fluent speech.

IV. middle-SC	dative		middle	non-finite (SC)

Table 1: the alternation paradigm

Other perception verbs in Modern Hebrew cannot alternate both in voice (active vs. middle) and the type of the clausal complement (CP vs. SC). For example, the verb *la-xuš* 'sense', which can embed both CP (2a) and SC (2b), cannot alternate in voice (2c). Attitude verbs which express beliefs and take clausal complements, such as *la-xšoḇ* 'think', do not alternate in voice, as well (3).

(2) a.　*ha-nasiḵ　　xaš　še-liba　　　šel　　ha-nesiḵa　　poʾem*
　　　　DEF-prince　　sensed that-heart.her of　　DEF-princess　beat
　　　　'The prince sensed that the heart of the princess was beating.'

　　 b.　*ha-nasiḵ　　xaš　ʾet　　liba　　　šel　　ha-nesiḵa　　poʾem*
　　　　DEF-prince　　sensed ACC　heart.her　　of　　DEF-princess　beat
　　　　'The prince sensed the heart of the princess beat.'

　　 c.　* *xaš　　　la-nasiḵ　　še-liba　　šel　　ha-nesiḵa　　poʾem*
　　　　* sensed　　to.DEF-prince that-heart.her of　　DEF-princess　beat
　　　　'[Intended:] It felt to prince that the heart of the princess was beating.'

(3) a.　*ha-saṗran　xašaḇ še-ha-seṗer　　　nadir*
　　　　DEF-librarian　think　that-DEF-book　　　rare

　　 b.　* *nexšaḇ　　la-saṗran　　　še-ha-seṗer　　　nadir*
　　　　* think.MID　　to.DEF-librarian　　that-DEF-book　　　rare
　　　　'The librarian thought that the book was rare.'

The complementizer of a CP complement of the verbs *li-rʾot*, *li-šmoʾa*, *le-hargiš* and *le-hariax* is broadly *še*, as in (1a).[4] The non-finite complement clause of perception verbs is not infinitival, but is headed by a participle (as in 1b). The participle in Hebrew is marked for number and gender, but bears no inflection for tense. This non-finite clause will be referred to as Small Clause (SC) (Chomsky 1981). As in English, the embedded subject is marked for accusative case, which, in Hebrew, is overtly marked by the morpheme *ʾet* when the direct object is definite NP. In Hebrew, nominative is not marked morphologically, hence a nominative experience subject is not marked for case.[5]

　　The dative experiencer of the middle voice is marked by the 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 unpronounced, the experiencer is interpreted deictically (or even universally).

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[4] In a formal register, the comlementizer *ki* is used as well. See Kuzar (1991) for further discussion on Hebrew complementizers, I thank Miri Bar-Ziv Levy for this note. Complement clauses of the verbs which open with *keʾilu* 'like' will not be considered here as part of the alternation. For an account of their distribution with perception verbs in Hebrew see Landau 2011; for a diachronic study of different complementizers of perception verbs in English see Brook 2014. The complementizer *eiḵ* 'how' can also be used, only in the active-CP construction. Its limited distribution may be attributed to the property of factiviy, discussed in the subsequent subsection, footnote 13.

[5] In different languages, active voice perception verbs may appear with different types of non-finite complements. Moulton (2009: 2, example (1)) presents an inventory for English of meanings for *see*, and the different non-finite clausal complements it appears with. All these constructions exhibit 'exceptional case marking' (ECM) of the embedded subject, and an infinitive / gerundive form of the embedded verb.

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). Voice is morphologically marked by the choice of template (Doron 2003, 2008): the active voice is expressed by the simple active *qal*, the intensive active *piʾel* and the causative active *hip̄ʾil*, whereas the middle voice (MID) is expressed by the simple middle *nip̄ʾal* and the intensive middle *hitpaʾel*. All the verbal forms with nominative experiencers are in the active voice, and all the verbal forms with dative experiencers are in the middle voice, though the morphology does not always reflect this. The voice alternants are derived from the same consonantal root, i.e. *r.ʔ.y* 'see', *š.m.ʕ* 'hear', *r.g.š* 'feel' and *r.y.x* 'smell'.[6] The verbs *li-rʾot* 'see' and *li-šmoʾa* 'hear' are derived by the simple active template in the active voice, and in the simple middle template in the middle voice: *raʾa* (3S.PAST) – *nirʾa* (MID.3S.PAST); *šama* (3S.PAST) – *nišma* (MID.3S.PAST). The verbs *le-hariax* 'smell' and *le-hargiš* 'feel' are both derived in the causative template *hip̄ʾil*, a template which does not mark morphologically the middle voice. Rather, its active form also serves for the derivation of unaccusative verbs denoting internal causation. For the sake of simplicity, let us call the active forms of *le-hariax* and *le-hargiš* with a dative experiencer also middle.[7]

The middle voice forms of *li-rʾot* and *li-šmoʾa* can function as passive, as do many simple middle verbs. But when interpreted as passive, they are ungrammatical with dative experiencer, either with a SC complement (4a) or an object complement (4b).

(4) a. *nirʾata*   (* *la-šomer*)   *ʾiša*   *holeḵet ba-rexoḇ*
         seen.3FS   (* to.DEF-guard)   woman   walk   in.the-street
         'A woman was seen (to the guard) walking in the street.'
    b. *nišmeʾa*   (* *la-šomer*)   *ceʾaqa me-raxoq*
         heard.3FS   (* to.DEF-guard)   shout   from-distance
         'A shout was heard (to the guard) from distance.'

The main-clause subject position of the middle constructions is assumed to be non-thematic. The main-clause subject of the middle-CP construction can be either null, or overtly expressed by the expletive pronoun *ze* 'it'. The subject of the non-finite small clause (SC) must raise to the nominative subject position of the main clause, since the middle verb cannot assign it accusative case. Hence, the argument we find in the highest subject position is thematically the subject of the embedded clause. The pronoun *ze* 'it' is the referential demonstrative pronoun, which is homonymous to the expletive *ze* in middle-CP construction. The expletive demonstrative has a single form *ze*, whereas the referential demonstrative has a gender contrast: *ze* / *zot* 'it.MS / it.FS'.[8] In middle-CP, *ze* is obligatorily expletive and cannot be replaced by an argument, while in construction middle-SC, it is necessarily referential, and has undergone raising from the subject position of the embedded clause. Example (5) illustrates the contrast between the expletive *ze* in middle-CP and the referential *ze* in middle-SC: in (5a), *ze* is expletive, can be

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[6] The consonantal root realization is subjected to morpho-phonological constraints (McCarthy 1981, Bat-El 1994 and Ussishkin 2000 a.o).

[7] It might be worth mentioning that these two patterns for the middle forms correlate with the divergence of these sense-perception verbs in English: while *see* and *hear* have different forms as unaccusatives (i.e. *seem* and *sound*), *feel* and *smell* have the same forms. A possible path to explain this might be that only feelings and smells can emerge from within the experiencer, somewhat like *le-haḇšil* 'ripen' and *le-haʾadim* 'redden'.

[8] It is not completely clear whether *ze* 'it' in Hebrew is purely expletive even when it occurs in the non-thematic subject position. This will be left here as an open issue.

null, and does not co-refer to the first conjunct; in (5b), *ze* is obligatorily overt and co-refers to the first conjunct.[9]

(5) a.
  dani siper l-i še-hi xazra ʾetmol lip̄not
  Danny told to-me that-she returned yesterday before
  boqer, ve-(*ze*) *nišma l-i še-hu mudʾag*
  morning, and-(it) hear.MID.3MS to-me that-he worried
  'Danny told me that she returned yesterday before sunshine, and it sounds to me that he is worried.'

  b.
  dani siper l-i še-hi xazra ʾetmol lip̄not
  Danny told to-me that-she returned yesterday before
  boqer, ve-*(*ze*) *nišma l-i mušune*
  morning, and-*(it) hear.MID.3MS to-me peculiar
  'Danny told me that she returned yesterday before sunshine, and it sounds peculiar to me.'

The embedded predicate in middle-SC complement, which is a raising construction, agrees with the raised subject in gender and number.[10]

(6) *kap̄.regel yamin margiša l-i* [*k̶a̶p̶̄.̶r̶e̶g̶e̶l̶ y̶a̶m̶i̶n̶ reduma*]
  foot.FS right feel.FS to-me [f̶o̶o̶t̶ r̶i̶g̶h̶t̶ numb.FS]
  'my right foot feels numb.'[W]

To complete the morpho-syntactic description, a final remark regarding the embedded predicate of SC complement is in order. For the active-SC only stage level predicates (SLP) (Kratzer 1995), which describe a temporary state, are felicitous. This restriction is illustrated in (7a), where the SLPs *ʾayep̄a* 'tired.FS' and *roqedet* 'dance.FS' are grammatical, but not the individual level predicates (ILP), which describe more of a permanent property, as *gḇoha* 'tall.FS' and *šep̄it* 'chef.FS'.[11] The middle voice, in contrast, is felicitous with both SLPs and ILPs, but the

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[9] This generalization, however, does not necessarily exclude cases in which the raised subject of the SC is both null and, so it seems, expletive, as in the following examples from naturally occurring discourse:

(i) *margiš l-i bul ha-zman le-miḇzaq taqti*
  feel.3MS to-me spot.on the-time to-news.flash tactic
  'It feels to me exactly the right time for a tactic news flash.'

[10] The middle voice verb can also appear with an adverbial adjunct, syncretic with MS adjectives, as in (ii):

(ii) *kše-xozrim ʾal ha-mila harbe peʾamim hi nismaʾat muzar*
  when-repeat.MP on DEF-word many times she hear.MID.FS weird.MS
  'when you repeat a word many times, it sounds weird.'[W]

The middle voice verb can also appear with the prepositional adjunct which opens with *ke / kmo* 'like', as in: *ha-šinuy hirgiš l-i kmo trup̄a* 'the change felt like a medicine to-me'. These constructions are not included within the current work (see Lasersohn 1995 for the analysis of *like* in the *sound like* construction in English as an empty operator that only shifts IPs and NPs into APs).

[11] 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 or middle-SC constructions, respectively. An exception for the ungrammaticality in this construction is with an envisioning / imaginative reading for the verb *li-rʾot* 'see', which is discussed further in Section 2.2.4. Another exception is with for the active voice *le-hargiš* 'feel' as a reflexive verb. Consider the contrast in (i)-(ii), from Saydon (2009: 390), that shows that the predicate *xaḵama* 'smart.FS' is grammatical in active-SC construction of *le-hargiš* only with a reflexive pronoun subject.

embedded predicate can only be non-verbal (as shown by Doron 2014: 168 for *nirʾa* 'see.MID.MS'), as illustrated in (7b), where *roqedet* 'dance.FS' is infelicitous.

> (7)   a.   *dani   raʾa   ʾet   danit   * gḇoha /   * šep̄it /   ʾayep̄a /*
>   Danny   see   ACC   Danit   * tall /   * chef /   tired /
>   *roqedet*
>   dance
>   'Danny saw Danit tired / chef/ tall / dance.'
>   b.   *danit   nirʾata   le-dani   gḇoha /   šep̄it /   ʾayep̄a /*
>   Danit   see.MID.3FS   to-Danny   tall /   chef /   tired /
>   * *roqedet*
>   * dance
>   'Danit seemed to Danny to be tall / (as) a chef / tired / dance.'

These seemingly structural differences of the two types of SCs are discussed under semantic terms in Section 3.2.

The four constructions exhibit distinct semantic properties, which are systematic across the four verbs, presented in the following section: (i) factivity, (ii) belief formation, (iii) indirect perception; (iv) non-literal uses. An account for the semantic regularities is proposed in Section 3.

2.2 The Semantic Regularities of the Paradigm

The examination of the perception verbs *li-rʾot* 'see', *li-šmoʾa* 'hear', *le-hargiš* 'feel' and *le-hariax* 'smell' as a group, and their shared four constructions, summarized above in Table 1, allows to reveal the particular semantic properties of each of the four morpho-syntactic forms. These semantic regularities, in turn, enable to point out the semantic and syntactic interplay between voice and type of complement clause, and the special semantic contribution of voice within perception verbs. This will be followed in Section 3 by a compositional account for the systematic alternations in form and meaning. The semantic properties to be examined below are: (i) factivity; (ii) belief formation; (iii) indirect perception; (iv) non-literal uses.

2.2.1 Factivity

Factivity is a salient sematic property which is sensitive to the alternation in voice. Within the class of attitude verbs, *factivity* is the property of a predicate which entails the truth of its

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(i)   *hi   margiša ʾet   acma   xaḵama*   (ii)   * *david   margiš   ʾet   yaʾel   xaḵama*
      she   feel   ACC   herself smart   * David   feel   ACC   Ya'el   smart
      'She feels herself smart.'   'David feels Ya'el smart.'

As suggested by Saydon (2009: 390), the sentence in (i) probably does not involve an embedded SC [herself smart], but rather the phrasal verb 'feel oneself'. This phrase may have emerged in Hebrew under Slavic influence (Agranovsky 2017: 79-80).

complement (Kiparsky & Kiparsky 1970, Karttunen 1971).[12] By applying the contradiction test (Moulton 2009: 128), example (8) illustrates that *realize*, but not *think*, is factive; therefore, the conjunct in (8a), which negates the content of the complement clause, yields a contradiction.

(8) a. The newspaper's editor realized that there was a typo on page 16,
          # but in fact there was none.
     b. The newspaper's editor thought that there was a typo on page 16,
          but in fact there was none.

The active voice constructions are factive, whereas the middle voice constructions are non-factive. The truth of the complement in the first sentence in (9a)-(9b) follows from factivity, hence the contradiction resulting from the second conjunct. [13] The truth of the complement in the first sentence in (9c)-(9d) does not follow, hence no contradiction arise.

(9) a. active-CP
         ha-maʾazinim šamʾu še-ha-šadran   hitʾateš,
         DEF-listeners   hear that-DEF-radio.host   sneezed
         # ʾaḇal hu   stam   hištaʾel
         # but   he   just   coughed
         'The listeners heard that the radio host sneezed, but he just coughed.'
     b. active-SC
         ha-maʾazinim šamʾu ʾet   ha-šadran   hitʾateš,
         DEF-listeners   hear ACC   DEF-radio.host   sneezed
         # ʾaḇal hu   stam   hištaʾel
         # but   he   just   coughed
         'The listeners heard the radio host sneeze, but he just coughed.'
     c. middle-CP
         la-maʾazinim   nišma   še-ha-šadran   hitʾateš,
         to.DEF-listeners   hear.MID.3MS   that-DEF-radio.host   sneezed
         # ʾaḇal hu   stam   hištaʾel
         # but   he   just   coughed
         'It sounded to the listeners that the radio host sneezed, but he just coughed.'
     d. middle-SC
         ha-šadran   nišma   la-maʾazinim   mecunan,
         DEF-radio.host   hear.MID.3MS   to.DEF-listeners   has.a.cold
         # ʾaḇal hu   stam   hištaʾel
         # but   he   just   coughed
          'The radio host sounded to the listeners like he had a cold, but he just coughed.'

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[12] Karttunen's (1970, 1971) definition distinguishes between factive predicates from implicative ones with respect to differences in their presuppositions. The use of the term *factivity* here corresponds with the term *implicativity*.
[13] As has been mentioned in footnote 4, only verbs in the active-voice construction can embed *how*-questions. For a discussion about the correspondence between the grammaticality of embedded questions and factive matrix verbs, see Egré (2008), Spector & Egré (2015), and Mayr (2019).

Factivity, then, shows sensitivity to voice alternation, but not to the type of complement clause, as summarized in Table 2.

Construction Contrast	Active Voice		Middle Voice	
	CP	SC	CP	SC
(i) factivity	✓	✓	✗	✗

Table 2: factivity regularities

2.2.2 Belief Formation

Perception can be either epistemically neutral or non-neutral, i.e., it may be only sensorial, or include, in addition, an apprehension of the perceived event or state. Belief formation, as a property of perception verbs with syntactically different complement clauses, has been discussed extensively in the linguistic literature, in particular regarding the English *see* (Jespersen 1940, Higginbotham 1983, Kroch et al. 1988, Moulton 2009 a.o.). In order to test whether or not belief is formed, we can use the test for epistemic non-neutral perception (Moulton 2009, attributed to Barwise 1981), resulting in a contradiction when a belief is acquired. Example (10) illustrates the contrast between *hallucinate* and *fantasized*, when only with the former, belief is obligatorily formed; hence the contradiction in (10a).

> (10)   a.   The girl hallucinated that she met her favorite author,
> # but she did not believe it really happened (during the hallucination).
>   b.   The girl fantasized that she met her favorite author,
> but she did not believe it really happened.

The property of belief formation reveals sensitivity to alternation both in voice and in the type of the clausal complement: in the middle constructions, belief is obligatorily formed; in the active voice, only with finite clausal complement belief is necessarily formed. Active-SC is the only construction in which the verb is epistemically neutral. As illustrated in (11), in a context where Gal notices Maor performing dance moves in the living room, *li-rʾot* in active-SC (11b) can denote an epistemically neutral perception, i.e. a physical perception of the dancing through sight, without the recognition of the Salsa dance. Hence, (11b) does not result in a contradiction, while (11a), (11c) and (11d) do.

> (11)   a.   active-CP
> *gal   raʾa   še-maʾor   roqed salsa ba-salon,*
> Gal   see   that-Maor   dances Salsa in.DEF-living.room
> *# ʾaḇal hu   xašaḇ   še-hu roqed hip-hop*
> # but   he   thought   that-he dance Hip-hop
> 'Gal saw that Maor was dancing Salsa in the living room, but he thought that he was dancing Hip-hop.'
>   b.   active-SC
> *gal   raʾa   ʾet   maʾor roqed salsa ba-salon,*

	Gal	see	ACC	Maor	dances Salsa	in.DEF-living.room
	ʾaḇal	*hu*	*xašaḇ*	*še-hu*	*roqed*	*hip-hop*
	but	he	thought	that-he	dances	Hip-hop

'Gal saw Maor dancing Salsa in the living room, but he thought that he was dancing Hip-hop.'

c. middle-CP

	nirʾa	*le-gal*	*še-maʾor*	*roqed*	*salsa*	*ba-salon,*
	see.MID.3MS	to-Gal	that-Maor	dances	Salsa	in.DEF-living.room
#	*ʾaḇal hu*	*xašaḇ*	*še-hu*	*roqed*	*hip-hop*	
#	but he	thought	that-he	dance	Hip-hop	

'It seemed to Gal that Maor was dancing Salsa in the living room, but he thought that he was dancing Hip-hop.'

d. middle-SC

	maʾor nirʾa	*le-gal*	*muḵšar*	*be-riqud*	*ha-salsa,*
	Maor see.MID.3MS	to-Gal	talented	in-dance	DEF-Salsa
#	*ʾaḇal hu*	*xašaḇ*	*še-hu*	*roqed*	*hip-hop*
#	but he	thought	that-he	dance	Hip-hop

'Maor seemed like a talented Salsa dancer to Gal, but he thought that he was dancing Hip-hop.'

The regularities of belief formation along the paradigm are summarized in Table 3.

Construction / Contrast	Active Voice		Middle Voice	
	CP	SC	CP	SC
(ii) belief formation	✓	✗	✓	✓

Table 3: belief formation regularities

2.2.3 Indirect Perception

The contrast between direct and indirect perception has been extensively discussed in the linguistic literature, starting from Dretske (1969). This property aligns with belief formation, and is sensitive to both voice and type of complement clause: only the active-SC structure obligatorily describes direct perception, whereas the three other constructions report an indirect perception, as illustrated in example (12). Sentence (12a) can be true in a context where Renana feels that her hair gets frizzy, an unfortunate side effect she experiences every time that it starts raining. In such case, sentence (12a) can be true even if she has no direct perception of the rain. For (12b) to be true, it must be the case that Renana directly felt the rain drops. Embedded by active voice verbs, then, the active-SC requires direct perception of the event described. The active voice with CP enables, but does not necessarily require, indirect perception, or sensation. The middle constructions (12c)-(12d) are felicitous only in such context of indirect perception of the rain, and infelicitous in a context where Renana feels rain drops.

(12)   a.   active-CP

> *renana* *hirgiša še-yored* *gešem*
> Renana feel that-descends rain
> 'Renana felt that it was raining.'
>
> b. active-SC
> *renana* *hirgiša ʾet* *ha-gešem* *yored*
> Renana feel ACC the-rain descend
> 'Renana felt it rain.'
>
> c. middle-CP
> *hirgiš* *le-renana* *še-yored* *gešem*
> feel.3MS to-Renana that-descends rain
> 'It felt to Renana that it was raining.'
>
> d. middle-SC
> *ha-boqer* *hirgiš* *le-renana* *gašum*
> DEF-morning feel.3MS to-Renana rainy
> 'The morning felt rainy to Renana.'

The property of indirect perception is not equal to belief formation with respect to active-CP and active-SC: active-SC may or may not involve an apprehension of a scene, but obligatorily reports a direct sensory perception of it. The active-CP constructions necessarily entail apprehension; however, in the case of active-CP, the acquisition of knowledge may be based on sensory evidence, or indirect, inferring the content of the complement given such evidence. 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 belief formation, and also does not exclude it. The regularities of the indirect perception property are summarized in Table 4, where the tick signs represent either possible or obligatory indirect perception.

Construction	Active Voice		Middle Voice	
Contrast	CP	SC	CP	SC
(iii) indirect perception	✓	✗	✓	✓

Table 4: indirect perception regularities

2.2.4 Non-literal uses

Non-literal uses of perception verbs attribute to the experiencer a mental apprehension that is not inferred through the sensory modality which the verb encodes. Non-literal uses, also treated as *metaphorical meanings*, of perception verbs, are extensively discussed in the literature: Sweetser 1990, San Roque et al. 2018 and Ibarretxe-Antuñano 2019 (a.o.) attribute to each one of the perception verbs, with respect to their sensory modality, a universal range of non-literal uses. Saydon 2009 shows for the Hebrew verbs for *li-rʾot* 'see', *li-šmoʾa* 'hear' and *le-hargiš* 'feel' how they differ in their range of non-literal uses. However, while perception verbs differ from one another in their non-literal uses, the availability of such uses is restricted, to some extent, by their construction. This will be demonstrated here by two non-literal uses: (i) seeing as envisioning; (ii) smelling as suspecting.

The envisioning, or 'imaginative', reading is one among several meanings discussed in the literature for the active voice verb *see* in English (Moulton 2009), also found in Hebrew for *li-r'ot* (Cohen 2015). This meaning is available in Hebrew only in the active-SC construction. Example (13) illustrates this meaning of *li-r'ot*. In a context where a famous actor is interviewed about his new girlfriend and his prospects for their relationship, only the active-SC (13b) is felicitous as describing his envisioning his girlfriend as the mother of their future offspring.

(13) a.   active-CP
           * *ha-saxqan   ra'a   še-hi   'ima   l-iladav*
           * DEF-actor   see   that-she   mother   to-his.children
           '[Intended:] The actor saw her to be the mother of his children.'
      b.   active-SC
           ha-saxqan   ra'a   'ota   'ima   l-iladav
           DEF-actor   see   her   mother   to-his.children
           'The actor saw her to be the mother of his children.'
      c.   middle-CP
           * *nir'a   la-saxqan   še-hi   'ima   l-iladav*
           * see.MID.3MS to.DEF-actor   that-she   mother   to-his.children
           '[Intended:] The actor saw her to be the mother of his children.'
      d.   middle-SC
           * *hi   nir'ata   la-saxqan   'ima   l-iladav*
           * she see.MID.3FS   to.DEF-actor   mother   to-his.children
           '[Intended:] The actor saw her to be the mother of his children.'

One of the non-literal uses of the verb *le-hariax* is 'suspect'. This non-literal reading is available for the constructions active-CP, middle-CP and middle-SC, as shown in (14) with examples retrieved from the WWW.[14]

(14) a.   active-CP
           mišehu   heriax še-'ep̄šar   la-'asot   hon
           someone   smell   that-possible   to-do   fortune
           tiqšorti   me-ha-'inyan
           commercial   from-DEF-issue
           'Someone suspected that it was possible to gain press coverage from this situation.'[W]
      b.   middle-CP
           hu   pasut qara   xomarim   še-katab̄ti,   ve-'ek̄sehu
           he   simply read   materials   that-wrote.1S   and-somehow
           heriax   l-o   še-yeš   hat'ama
           smell.3MS   to-him that-there.is match
           'He simply read some stuff that I had written, and somehow he had the sense that there was a match (between us).'[W]
      c.   middle-SC
           haca'at   ha-xoq   merixa   l-i   lo   demoqratit

---

14 The grammatical sentences in (14)-(15) use pronouns to denote the experiencer. In my judgments, they are somewhat degraded when the experiencer is expressed with a full DP.

proposal   the-law   smell.FS   to-me NEG   democratic
'The bill smells undemocratic to me.'[W]

The active-SC cannot express the non-literal meaning of suspicion, i.e, it must report a sensory experience. Example (15) illustrates the contrast between the active-CP sentence, and the ungrammatical constructed parallel in the active-SC construction.

(15)   a.   active-CP
              hu   heriax še-ze   holeḵ   le-hoʾil   l-o
              he   smell that-it is.going   to-help   to-him
              ba-bxirot
              in.DEF.elections
              'He$_1$ sensed that it was was going to help him$_2$ in the elections.'[W]

        b.   active-SC
              * *hu   heriax ʾet   ze   holeḵ   le-hoʾil   l-o*
              * he   smell ACC   it   is.going   to-help   to-him
              ba-bxirot
              in.DEF.elections
              '[Intended:] He sensed that it was going to help him in the elections.'

Table 5 summarizes the regularities of the non-literal uses discussed above.

Construction / Contrast		Active Voice		Middle Voice	
		CP	SC	CP	SC
(iv) Non-literal uses	seeing as envisioning	✗	✓	✗	✗
	smelling as suspecting	✓	✗	✓	✓

Table 5: non-literal uses of *li-rʾot* and *le-hariax*

While the two non-literal uses *seeing as envisioning* and *smelling as suspecting* demonstrate a mirror image regarding their availability in the four constructions, the division between the constructions with respect to the properties of belief formation and indirect perception is maintained. Table 6 summarizes the four semantic properties discussed in this section, and their regularities along the paradigm.

Construction / Contrast		Active Voice		Middle Voice	
		CP	SC	CP	SC
(i) factivity		✓	✓	✗	✗
(ii) belief formation		✓	✗	✓	✓
(iii) indirect perception		✓	✗	✓	✓
(iv) Non-literal uses	seeing as envisioning	✗	✓	✗	✗
	smelling as suspecting	✓	✗	✓	✓

Table 6: summary of semantic regularities

As Table 6 shows, all the properties are obtained obligatorily in the middle voice, independently of the type of clausal complement. The following section proposes a compositional representation for the four-way alternation in voice and complement clause of the four verbs, by using two notions: the role of *perceiver*, and the *abduction* reasoning. The combination of these two notions will account for the semantic regularities.

3 Compositional Account for the Regularities

3.1 Compositionality of the Paradigm

The present account builds on two notions, represented syntactically: *abduction* and *perceiver*. It proposes one basic entry for each of the perception verbs *li-rʾot* 'see', *li-šmoʾa* 'hear', *le-hargiš* 'feel' and *le-hariax* 'smell', from which all the four constructions are derived compositionally through *abduction* and *perceiver*. The compositional semantic account will be described here informally (For an elaborated formal representation, see Avineri 2017).

The suggested basic lexical entry for the perception verbs in Modern Hebrew, as well as for the three other alternating perception verbs, is a purely relation between two situations: the situation in which perception takes place, and a situation or a set of situations which are perceived.[15] For example, in the active-SC construction in (16), the verb *le-hargiš* encodes the relation between the situation of tactile perception and the situation in which the tooth wobbles.

> (16)   *ha-yalda   hirgiša ʾet   ha-šen   mitnadnedet*
>   DEF-girl   feel   ACC   DEF-tooth   wobble
>   'The girl felt her tooth wobble.'[W]

The basic entry does not encode the experiencer argument, according to Kratzer's (1996) severing of the external argument.[16] Effectively, what it means within the current analysis is that the experiencer is not part of the event of perception, but rather that it composes with the verb, syntactically and semantically, in a later stage of the derivation. The nominative experiencer, namely the external argument of the active-voice constructions, is proposed here to be *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 present proposal, *perceiver* is crucially a nominative argument, and its denotation introduces the presupposition that the situation perceived holds in the actual world. Adopting Kratzer 1996, *perceiver* is introduced by a functional head – *Voice*, marked as active (as opposed to middle or passive), and combined through the operation of *Event Identification*.
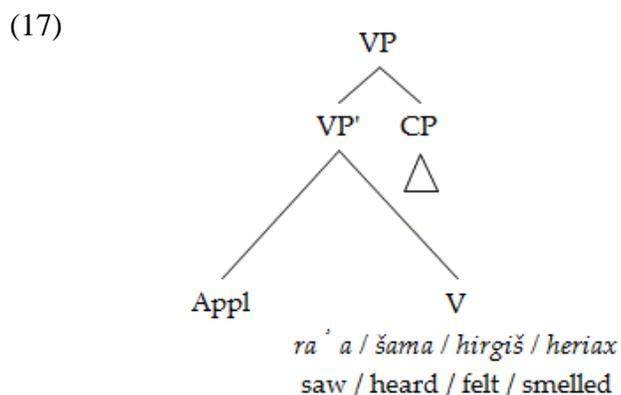
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[15] Following Barwise & Perry (1981: 668), I treat *situations* as basic, primitive concepts in language, "in terms of objects having attributes and standing in relations to one another at locations-connected regions of space-time." For further discussion on the semantics of situations, see Kratzer (2007).

[16] According to Kratzer (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.

While the perception verbs in the active-SC construction denote a relation between situations, the verbs in the active-CP and middle construction take a proposition as their complement. The proposal here derives this interpretation from the basic entry of the verbs via their composition with a modal component of *abduction*. The term "abduction" describes a non-logical, defeasible reasoning [cf. (logical) deduction and induction], inferring the "best fit" explanation out of evidence (Krawczyk 2012: 199-207, following Peirce 1934). Krawczyk gives an example for this kind of reasoning (2012: 199):

> I have reasoned that it has rained based on a sensory evidence, that the street is wet. When I turn the corner, I see that a street sweeper has been spraying water as it drives down the streets. In this case, my conclusion that it rained has defeated my inference that it rained due to the fact that I now also know there is another cause for the wet street.

Adopting from Pylkkänen 2008, *abduction* is introduced by an epistemic applicative head (*Appl*), which 'type-shifts' the perception verb to take a propositional complement. *Appl* applies to the basic lexical entry of the verbs to derive the active-CP and middle voice constructions: it takes the basic entry 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. The application of *Appl* is illustrated in (17), which represents the compositional derivation of the VP of the active-CP construction.

(17)


```
                        VP
                       /  \
                    VP'    CP
                    /\      △
                   /  \
                  /    \
               Appl     V
               raʾa / šama / hirgiš / heriax
               saw / heard / felt / smelled
```

In the active-CP, the belief holder is identified with *perceiver*, and in the middle constructions - as a dative argument, when explicitly expressed. The four constructions of *li-rʾot*, *li-šmoʾa*, *le-hargiš* and *le-hariax* can be now represented as different combinations of the basic lexical entry with the concepts of *abduction* and *perceiver*, as shown in Table 7.

	abduction	*perceiver*
active-CP	✔	✔
active-SC	✘	✔
middle-CP	✔	✘
middle-SC	✔	✘

Table 7: combination of *abduction* and *perceiver*

After having laid down the basic notions of the proposal, we now return to the the different semantic properties of the four constructions, using the concepts of *abduction* and *perceiver*.

3.2 Derivation of Semantic Properties

Table 8 converge the semantic regularities summarized in Table 6, together with the combinations of *abduction* and *perceiver* in Table 7.

Construction	Components		factivity	belief formation	indirect perception	non-literal uses	
						seeing as envisioning	smelling as suspecting
active voice	CP	*+ abduct* / *+ perc*	✓	✓	✓	✗	✓
	SC	*- abduct* / *+ perc*	✓	✗	✗	✓	✗
middle voice	CP	*+ abduct* / *- perc*	✗	✓	✓	✗	✓
	SC	*+ abduct* / *- perc*	✗	✓	✓	✗	✓

Table 8: semantic properties and semantic notions

As shown by the correlation between factivity and *perceiver*, this property is proposed here to source from the presupposition introduced by the nominative experiencer of the perception verbs, according to which the perceived situation occurs in the actual world. Thus, only the active-voice constructions are factive. 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.

 The properties of belief formation and indirect perception originate from the epistemic component, with the special requirement for an abductive inference – *abduction*. Since the verb in the active-SC construction encodes a relation between a situation of sensory perception and a set of perceived situations, the construction's properties of the lack of a belief formation and direct perception follows, and so does the ungrammaticality of predicates other than SLPs, as shown above in (7a). In the other three constructions, active-CP, middle-CP and middle-SC, the verb take a proposition as its complement, and is assumed to incorporate *abduction*, composed by *Appl*. Belief formation follows from the *abduction* component, which introduces a belief holder. *Abduction* results also in indirect perception, since the belief is supposed to be formed based on reasoning from perceptual evidence. However, while ungrammatical in the middle constructions, direct perception is felicitous in the active-CP construction. Within the current account, direct perception is suggested to be tolerable in the active-CP construction due to the *perceiver*, which presupposes a perception situation in the actual world. The middle constructions, which lack a *perceiver*, do not tolerate direct perception.

 According to the current assumption, as a complement of middle voice perception verbs, the SC complement is propositional, and not a set of situations, with a special requirement for an epistemic modal base for the proposition. Returning to the infelicity of SLPs in middle-SC, illustrated above in (7b), the requirement for non-stative verbs in raising modal constructions with epistemic reading is shown to be a broader phenomenon in Modern Hebrew; according to Boneh 2013, epistemic reading of modal predicates arises only if the underlying proposition involves a stative VP, as illustrated in (18a) (originally (21)) with the modal *yaḵol* 'can'; to be

compared with the sentence in (18b) (originally (26)), which contains a non-stative VP, and "cannot be interpreted as an epistemic modal stating that it is necessarily / possibly the case that Tali is winning. It must be interpreted either as a Deontic modal, stating that Tali has the obligation / permission to win, or as an Ability modal in the case of *yaḵol*." The ungrammaticality of non-ILPs in middle-SC construction is thus assumed here to source from the epistemic modal base of the matrix predicate in a raising construction.

(18)　a.　*tali　　yeḵola li-hyot ba-bayit　　be-šaʾa　　ka-zot*
　　　　　　　Tali　　can.FS to-be　in.DEF-house　in-hour　　　like-this
　　　　　　　'Tali can be home at such an hour.'
　　　b.　*tali　　xayeḇet /　　yeḵola le-naceax*
　　　　　　　Tali　　must.FS /　　can.FS to.win
　　　　　　　'Tali must / can win.'

The two non-literal uses are shown to differentiate between the active-SC construction, and the active-CP, middle-CP and middle-SC constructions. We propose that non-literal uses for the active-CP, middle-CP and middle-SC are only those which are compatible with a meaning of a belief which is based on an inference out of evidence: that includes smelling as suspecting but not seeing as envisioning. Though we would not attempt here to give an account for the different non-literal uses of perception verbs (see Cohen 2015 for an account of the imaginative reading of *li-rʾot*),[17] it is shown here that the range of non-literal uses of perception verbs is structurally restricted, by the component of *abduction* composed by *Appl* in the above two discussed uses. This suggests that non-literal uses of perception verbs are not purely a case of polysemy, but can be derived compositionally from the verbal construction.

　　To conclude this section, the present work ties together the alternation of the four perception verbs *li-rʾot* 'see', *li-šmoʾa* 'hear', *le-hargiš* 'feel' and *le-hariax* 'smell' in two dimensions: type of the complement clause and voice *cum* experiencer argument. Together, the two dimensions yield four constructions, different in their semantic properties, in which all the four verbs in Modern Hebrew participate. The paradigm and its semantic regularities show that the syntactic and semantic properties of the voice dimension are orthogonal to those of the second dimension, the type of the embedded clause. Nevertheless, it is shown in the current work that general principles of sentence structure in natural language give rise to a priority of the voice over the second dimension. This is revealed by the property of belief formation, indirect perception and non-literal uses. In the active voice, the type of the embedded clause determines the distinction between belief formation, indirect perception, and the (un)availability of non-literal uses. But in the middle voice, which is marked morphologically in Modern Hebrew in the verbal form, the meaning of belief formation and indirect perception are obtained obligatorily, independently of the clausal complement. The conclusion to be drawn is that voice bleeds clausal category with respect to the properties of belief formation, indirect perception and the availability of some non-literal uses (Avineri 2017).

　　In the following section, the emergence of the shared voice alternation in Hebrew is examined, suggesting that it follows a universal hierarchy and is affected by language contact.

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[17] See Avineri (to appear) for a further discussion about account of smelling as suspecting.

4 The Composition of the Paradigm – a Historical Perspective

As a continuation to the presentation of the voice alternation of *li-rʾot* 'see', *li-šmoʾa* 'hear', *le-hargiš* 'feel' and *le-hariax* 'smell', when their complement is a clause, and its semantic contribution, this section shifts to a historical view on the voice alternation's development. Converged with a typological view, the data suggests that while routed by a universal hierarchy, the consolidation of the voice alternation for these verbs is strongly affected by language contact.

This section addresses the gradual emergence of the voice alternation (active vs. middle) for each of the four perception verbs, when their complement is a clause. For reasons of simplicity, only the constructions with CP complements are considered, i.e. active-CP and middle-CP. The data concerns only first occurrences of the constructions, and not their continuous use through different layers of Hebrew. Given that the dative experiencer of the perception verbs in Modern Hebrew is optionally expressed, its emergence as part of the paradigm is not examined here, as well as the use of the expletive *ze* 'it' in the middle constructions.[18]

The verbs *li-rʾot* 'see' and *li-šmoʾa* 'hear' show an early development of the alternation in voice, when their complement is a clause. In Biblical Hebrew, occurrences of *li-rʾot* and *li-šmoʾa* with a CP complement are attested, with several complementizers (as has been discussed by Joüon 1991, Zewi 2014, Doron 2018 and Fassberg 2019, a.o.): the subordinators *kī*; (*ʔēṯ*) *ʔăšɛr*; *šə* 'that'; or a question word.[19]

The first occurrence of middle voice *li-rʾot* with a CP complement is found in Rabbinic Hebrew, and later early examples are found in Medieval Hebrew.[20] The first occurrence of middle voice *li-šmoʾa* with a CP complement is found in Medieval Hebrew.[21, 22] As Hebrew in the Medieval period served for the composition of different types of works by writers operating in different places and times, who spoke and were in contact with an array of different languages (Doron et al. 2019: 7), this emergence of the alternation of *li-rʾot* and *li-šmoʾa* in voice may be due to language contact.

The verb *le-hargiš* 'feel' appeared in Rabbinic Hebrew.[23] The first occurrence retrieved in Maʾagarim for active-CP *le-hargiš* is from early Rabbinic Hebrew.[24] The middle-CP *le-hargiš* seems to appear in Modern Hebrew not earlier than the 70s, probably under the influence of

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[18] The search was conducted by referring to Even-Shoshan's *New Concordance of the Bible*, and consulting the Historical Jewish Press website, a corpus which contains Jewish newspapers published between the 18th to the 21st centuries, and *Maʾagarim*, the website of the Historical Dictionary Project of the Academy of the Hebrew Language, which contains vast corpora from Biblical Hebrew texts through the 11th century, and from the 18th century to the early 20th century, and is being updated regularly.

[19] For example: Gen 3:6, Gen 26:28, Exod 4:31, Josh 14:12; 1 Sam 18:15, Josh 2:10; Eccl 2:13; Judg 7:11, respectively.

[20] The earliest occurrence is found in *t. ʾAḇod. Zar.* 1:5, according to one of several versions of the paragraph. Later, early, occurrences are from the work of Menachem ben Saruq, who lived in the 10th century.

[21] In *Mizraḥ u-Maʾaraḇ*, earlier than 1050, from Geonic Responsa.

[22] It is not clear to me whether the verbs *li-rʾot* and *li-šmoʾa* in these sentences are in middle voice or passive. Given the benefit of the doubt, I consider them as middles. One occurrence of, seemingly, middle voice *li-rʾot* is found already in Dan 1:15. This verse may exemplify either a middle-SC sentence, passive verb, or of the construction mentioned in footnote 10.

[23] According to Even-Shoshan's dictionary (1993). Its tri-consonantal root appears in the simple template already in Biblical Hebrew in Ps 2:1, meaning 'be in tumult', according to ALHATORAH.ORG concordance and dictionary.

[24] *m. Nid.* 5:2.

English.[25] Based on the data from corpora, a similar conclusion is to be drawn for middle-CP *le-hariax* 'smell' as well.[26]

The perception verb *le-hariax* appears already in Biblical Hebrew. In Biblical Hebrew, *le-hariax* appears only in active voice and takes only direct or indirect objects.[27] A corpus search in *Maʾagarim* reveals that the two earliest attested examples of active *le-hariax* embedding a CP are documented in Medieval Hebrew and Pre-Modern Hebrew,[28] in which the complementizer is *ki* 'that'. The subordination of a CP complement of *le-hariax* may have developed under the influence of Yiddish, which lexicalizes a variety of smell verbs in different constructions.[29]

Table 9, which presents the Hebrew layers in a chronological order, summarizes the emergence of the voice alternation in Hebrew for the four verbs.

Verb / Layer	*li-rʾot* 'see'	*li-šmoʾa* 'hear'	*le-hargiš* 'feel'	*le-hariax* 'smell'
Biblical Hebrew	active-CP	active-CP		
Rabbinic Hebrew	middle-CP		active-CP	
Medieval Hebrew		middle-CP		active-CP
Pre-Modern Hebrew				
Modern Hebrew			middle-CP	middle-CP

Table 9:[30] the emergence of the alternation of the verbs in Hebrew

According to the data collected, the middle voice construction emerged only after the emergence of the active-CP construction for each one of the verbs. This may suggest that the middle-CP construction: (i) builds on the abductive component at hand; (ii) is a result of language contact. In addition, the emergence of the active-CP construction, as well as the voice alternation, suggests a hierarchy between the four verbs with respect to their first occurrence. This diachronic hierarchy fits the sensory hierarchy of perception verbs from a synchronic perspective. Asymmetry between the linguistic expressions of the five sensory modalities has been discussed extensively in the typological literature (Kyrk 1979, Viberg 1983, Saydon 2009 for Hebrew, San Roque et al. 2018, a.o.). Viberg (1983) discusses lexicalization patterns of perception verbs and presents a sensory hierarchy, shown in (19).

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

The historical change in the morpho-syntactic alternation of the perception verbs in Hebrew proposes a diachronic implication of the sensory hierarchy:[31] higher ranked perception verbs will

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[25] This is the conclusion drawn from a corpus search in the Historical Jewish Press website, in which no occurrences of the construction where found earlier than the 70s. I thank Elon Gilad and Ruth Stern for their help in the search.

[26] Middle voice occurrences of *le-hariax* appeared already in Medieval Hebrew, in a smell emission meaning (Yalon 1971, Sadan 1956: 267).

[27] For example, in verse Gen 27:27.

[28] In *Maʾor ʾEnayim*, from 1573, by Azariah min-Haʾadumim, and in *Toldot Bney Ha-ʾadam*, from 1835, by Mordechai Aharon Ginzburg, respectively.

[29] For an elaborated discussion about developments in constructions of *le-hariax* in Hebrew, see Avineri (to appear).

[30] The collection of the data summarized in the table was conducted as a work as part of the EMODHEBREW project at The Hebrew University of Jerusalem, studying the emergence of Modern Hebrew.

[31] I thank Omri Doron for the suggestion to consider this implication.

precede lower ranked verbs in subordination of clausal complements, and subsequently – in voice alternation. The present data confirms Viberg's hierarchy and shows that in addition to lexicalization, it is applicable to morpho-syntactic properties. Diachronically, while the development of clausal complements and their alternation seem to be a natural path of change for perception verbs, which fits the sensory hierarchy proposed by Viberg, voice alternation in Hebrew may evolve due to language contact: under the influence of different languages in Medieval Hebrew for *li-rʾot* 'see' and *li-šmoʾa* 'hear', and later of English, for *le-hargiš* 'feel' and *le-hariax* 'smell'.

One might wonder why *li-tʾom* 'taste'*,* which *is* a sense verb, is absent from the morpho-syntactic alternation in Modern Hebrew, and subsequently from the examination of its development in Hebrew. In Modern Hebrew, *li-tʾom* cannot embed a clausal complement, neither in active voice (20a), nor in middle voice (20b).[32]

(20) a.   * *ha-misʾadan taʾam še-ha-xaḇita   tiḇʾonit*
          * DEF-caterer taste   that-DEF-omelet   vegan
          'The caterer tasted that the omelet is vegan.'
      b.   * *taʾam   la-misʾadan   še-haxaḇita   tiḇʾonit*
          * taste.3MS   to.DEF-caterer that-DEF-omelet   vegan
          'It tasted to the caterer that the omelet is vegan.'

In Modern Hebrew, *li-t'om* expresses a volitional action rather than a perceptual state, somewhat like "sample", as illustrated in (21). This particularity of *li-t'om* may suggest that clausal complement of perception verbs can occur only when they are lexicalized as stative verbs, which denote an *experience*, i.e. a state or inchoative achievement that is not controlled (Viberg 2008: 123), rather than denoting an activity.

(21) *nica   taʾamaʾet   ha-yain*
      Nitza tasted ACC   the-wine
      'Nitza tasted the wine.'

According to Viberg (2008), precedence in the sensory hierarchy corresponds with precedence in the lexicalization of a sensory experience. The present work proposes that in Modern Hebrew, olfactory perception ranks above gustatory perception.

Historically, however, in Biblical Hebrew (Prov 31:18) there is one occurrence of the verb *li-t'om* that has a CP as its complement. The meaning of the verb is interpreted by commentators as 'acknowledge (the value of)' (i.e. no actual sensory experience). This construction is not maintained productively in Hebrew. Crucially, the middle-CP for *li-t'om* does not seem to be developed.[33] It may be that this meaning of *li-t'om* 'taste, eat' as 'know' is a case of polysemy that was not bridged by a sensory-evidence inference. This suggestion may be supported typologically (Steinbach-Eicke 2019: 159): In ancient Egyptian, the verb *'m* 'swallow' demonstrates a diachronic change from 'swallow' to 'know, understand', a meaning preserved in Coptic. In addition, the Latin verb *sapere* means 'taste' and 'know'. In Modern Romance, the

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[32] Both forms *taʾam* and *nitʾam* can be used for the intransitive 'taste.3MS', and both are ungrammatical in (20b).

[33] One occurrence of *li-t'om* as an intransitive perception verb with a dative experiencer, without a clausal complement, is found in Biblical Hebrew (Job 12:11).

Spanish *saber* means both 'taste' and 'know', whereas French *savoir* is restricted to the meaning of 'know'.

Typological data on lexicalization of perception verbs (Viberg 1983, 2008), together with the alternation in Modern Hebrew presented may suggest the following sensory hierarchy, applicable both synchronically and diachronically:

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

This hierarchy, suggested to be applicable historically, proposes an additional dimension for the typological study, as prompted by Aikhenvald and Storch (2013: 20).

5 Conclusion

This work has analyzed the morpho-syntactic alternation of the perception verbs *li-rʾot* 'see', *li-šmoʿa* 'hear', *le-hargiš* 'feel' and *le-hariax* 'smell' in Modern Hebrew with respect to voice and clausal complement, revealing unified syntactic alternations and an array of semantic contrasts. The current discussion counters the common objection of speakers, who object to the use of *le-hargiš* as when stating an opinion or an assertion in conversation,[34] instead of *la-xšoḇ* 'think' for example. The account proposed here for the four perception verbs provides support for the special need of speakers to use *le-hargiš*, which has been shown here to be a perception verb, and also includes a special epistemic flavor, i.e. sensory based.

le-hargiš also raises objections among present day prescriptivists of Hebrew, who consider its middle voice constructions having developed as a result of the influence of English, and therefore foreign to Classical Hebrew.[35] Though the data in Section 4 does seem to support the purist claim regarding the English influence, it also suggests that these constructions of *le-hargiš* are extensions of the classical parallel constructions of *li-rʾot* 'see' and *li-šmoʿa* 'hear', which also seem to emerge under conditions of language contact,[36] and their modern development follows a trait that coincides with the universal sensory hierarchy.

The work suggests that exploring the contribution of voice typologically can benefit from a historical perspective on the emergence of the voice alternation of perception verbs. One central part of the paradigm, the development of which was not examined here, is the dative experiencer in the middle constructions. Dative experiencers in a variety of modal constructions developed and disappeared in different stages of Hebrew. Several prominent cases are the development of bouletic and deontic uses of motion verbs (Tzuberi 2018), and the disappearance of the dative with the modal *carix* 'need' (Doron 2019) and of the meaning of ability of the existential element *yeš* with the dative experiencer (Rubinstein 2019). A comprehensive examination of the

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[34] See for example, the discussion in https://www.haaretz.co.il/magazine/theword/.premium-1.2533521 for Hebrew, and https://www.nytimes.com/2016/05/01/opinion/sunday/stop-saying-i-feel-like.html for English. I thank Tamar Lan for the reference to the latter.

[35] Present day prescriptivists now consider the two ancient stages of Hebrew Biblical Hebrew and Rabbinic Hebrew acceptable as models of correct Hebrew, and view them together as Classical Hebrew (Doron et al. 2019: 7).

[36] For other predicates in similar constructions in Classical Hebrew see Dubnov 2005 and Mor and Pat-El 2016.

developments of dative experiencers in Modern Hebrew with a range of modal flavors, as well as with psych verbs, and possible influence of language contact, is left for valuable, further study.[37]

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[37] As suggested by Edit Doron.

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