

The syntax and semantics of Persian modality and perception

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1 Background¹

- Persian is an SOV Indo-European language with ‘*pro-drop*’.
- Verbal morphology follows a two-stem system, traditionally called
 1. *Present stem*: no overt present tense marker; and
 - (1) *xor* ‘eat’
 2. *Past stem*: modulo suppletive patterns, the past tense is regularly marked with *-d* and its allomorphs (Anoushe 2018).
 - (2) *xord* ‘eat’
- The present stem always occurs with either aspectual or mood markers; *mi-* for imperfective aspect (3a) and *be-* for subjunctive mood (3b).^{2,3}
- The unprefixd past stem with agreement suffixes is used to show the perfective aspect (3c).
- Past imperfective, progressive and perfect are also derived from the past stem with agreement suffixes; for example, past imperfective is formed with the same prefix as present imperfective, *mi-* (3d).⁴
 - (3) a. Nika be madrese mi-rav-ad.
Nika to school IPFV-go.PRES-3SG
‘Nika goes to school.’
b. Nika šāyad be madrese be-rav-ad.
Nika may to school SBJV-go.PRES-3SG
‘Nika might go to school.’
c. Nika be madrese raf-t.
Nika to school go-PAST.3SG
‘Nika went to school.’
d. bače-hā har ruz be madrese
child-PL every day to school
mi-raf-t-and.
IPFV-go-PAST-3PL
‘The kids used to go to school every day.’

*This presentation has not been prepared in consultation with Setayesh and Siavash. I accept sole responsibility for any errors.

¹The dialect reported on here is colloquial spoken Persian, not the written standard.

²Glosses are abbreviated as follows: AUX–auxiliary, IPFV–imperfect, INF–infinitive, PP–past participle, PRES–present tense, PAST–past tense, SBJV–subjunctive mood, SG–singular, PL–plural, DO–direct object.

³What we have glossed as IPFV–imperfective is sometimes glossed as DUR–durative. We prefer to gloss it based on its morphological form rather than its typical morphosyntactic function.

⁴Past imperfective also functions as a fake past to convey counterfactuality, regardless of tense Bjorkman and Halpert (2017).

- Persian contains several adverbial and complex predicate modals, but there are two main simplex verbal modal auxiliaries, *bāyestan* (necessity/□) and *šodan* (possibility/◇).⁵

- These modals always appear in the default third person singular form: *bāyad* (□.PRES)/*bāyest* (□.PAST) and *mi-še* (IPFV-◇.PRES)/*mi-šod* (IPFV-◇.PAST).

- They can either occur with:

1. a finite complement (4), marked with subjunctive mood in present tense (4a) or imperfective aspect in past tense (4b); or
2. a non-finite complement (5)

– In the second case, the verb in the complement has a simple past stem, which *resembles* the third person singular past inflection, but is historically an *apocopated infinitive* (short infinitive); importantly, it is interpreted as an impersonal (5).

- | | | | | |
|-----|----|---|-----|-------------------------------------|
| (4) | a. | <i>bāyad be xune be-rav-am.</i> | (5) | <i>bāyad zood be xune raf-t.</i> |
| | | □.PRES to home SBJV-go.PRES-1SG | | □.PRES early to home go-?? |
| | | ‘I have to go home.’ | | ‘It’s necessary to go home early.’/ |
| | b. | <i>bāyad bačehā be xune mi-raf-t-and.</i> | | ‘One must go home early.’ |
| | | □.PRES child-PL to home IPFV-go-PAST-3PL | | |
| | | ‘The children had to go home.’ | | |

- When the modal occurs with a finite complement, it is possible to topicalize the embedded subject to the left:⁶

- | | | | | |
|-----|----|---|----|--|
| (6) | a. | <i>bāyad bačehā be xune mi-raf-t-and.</i> | b. | <i>bačehā bāyad be xune mi-raf-t-and.</i> |
| | | □.PRES child-PL to home SBJV-go-PAST-3PL | | child-PL □.PRES to home SBJV-go-PAST-3PL |
| | | ‘The children had to go home.’ | | ~‘As for the children, they had to go home.’ |

- A major class of other simplex/complex predicates in Persian distribute syntactically similarly to the simplex verbal modals above, although their semantic function is to denote various kinds of perceptual relations, not sentential necessity or possibility operators.

- (7) exemplifies the aural paradigm, which has both complex (7a,c) and simplex cells (7b).

- | | | | | |
|-----|----|------------------------------------|----|----------------------------------|
| (7) | a. | Active ⟨ACTOR,STIMULUS⟩ | c. | Percept ⟨STIMULUS,(EXPERIENCER)⟩ |
| | | <i>guš kard-an</i> | | <i>sedāh dād-an</i> |
| | | ear do-INF | | sound give-INF |
| | | X listen to Y | | Y emitted a sound (to X) |
| | b. | Experiencer ⟨EXPERIENCER,STIMULUS⟩ | | |
| | | <i>šenid-an</i> | | <i>be guš āmad-an</i> |
| | | hear-INF | | to ear come-INF |
| | | X hear Y | | Y was heard (by X) |

- A verb that works very similarly to the perception paradigm is *be nazar āmad-an* (lit. ‘to opinion come-INF’/‘to seem’), which is the equivalent of *seem*.

⁵There is some debate over the status of the modal *šāyestan*. Some literature, such as Karimi (2005) and Taleghani (2008), treats it as another modal auxiliary, while other literature, such as Labbafankhosh and Darzi (2015), treats it as a modal adverb.

⁶The subjunctive in the past tense has the same form as the imperfective.

- Unlike *bāyad* (necessity), which never inflects for agreement, some speakers allow both the non-agreeing/default form (8b) and the agreeing form (8c); all speakers allow the first, non-agreeing form:

- (8) a. be nazar mi-ā-d ke bače-hā xaste šo-d-an.
to opinion IPFV-come.PRES-3SG that child-PL tired become-PAST-3PL
'It seems that the children have gotten tired.'
- b. bače-hā be nazar mi-ā-d ke xaste šo-d-an.
child-PL to opinion IPFV-come.PRES-3SG that tired become-PAST-3PL
'As for the children, it seems that they have gotten tired.'
- c. % bače-hā be nazar mi-ā-n ke xaste šo-d-an.
child-PL to opinion IPFV-come.PRES-3PL that tired become-PAST-3PL
'The children seem to have gotten tired.'

- Note that in (8) we are emphasizing the colloquialness of the reported example by using certain spoken-only forms, such as the contracted 3PL in (8c): *-an* rather than *-and*.

2 Puzzles/questions

1. How should we account for the complement in (5)?

- (5) bāyad zood be xune raf-t.
□.PRES early to home go-??
'It's necessary to go home early.' / 'One must go home early.'

Is it a past tense form or a short infinitive (synchronically as well as diachronically)?

2. How can we capture the impersonal and personal readings of modals like (5) vs. (4)?

- (4) a. bāyad be xune be-rav-am. b. bāyad bačehā be xune mi-raf-t-and.
□.PRES to home SBJV-go.PRES-1SG □.PRES child-PL to home IPFV-go-PAST-3PL
'I have to go home.' 'The children had to go home.'

3. What is the syntactic structure of simplex modal constructions?

4. How should the variable agreement displayed in (8) be explained?

- (8) b. bače-hā be nazar mi-ā-d ke xaste šo-d-an.
child-PL to opinion IPFV-come.PRES-3SG that tired become-PAST-3PL
'As for the children, it seems that they have gotten tired.'
- c. % bače-hā be nazar mi-ā-n ke xaste šo-d-an.
child-PL to opinion IPFV-come.PRES-3PL that tired become-PAST-3PL
'The children seem to have gotten tired.'

5. How can we give a consistent semantics for (the relevant) Persian light verbs that covers both perceptual constructions like (7), and possibly (8), as well as their uses in physical contexts, like (9–10)?

- (9) Max ketab-ra be Sam da-d. (10) Max be madrese ama-d.
Max book-DO to Sam give-PAST.3SG Max to school come-PAST.3SG
'Max gave the book to Sam.' 'Max came to school.'

3 The syntax of modals

- The main challenge is the impersonal construction with an impersonal complement, as in (5) or (11a).

- This complement is not, at least synchronically, the productive Persian infinitive:

1. It lacks the final *-an* marker (*raftan* ‘go-INF’ vs. *raft* ‘go.??’).
2. It looks superficially like the simple third person singular past form; see (3c).

- (3) c. Nika be madrese raf-t.
Nika to school go-PAST.3SG
‘Nika went to school.’

- However, there is an important reason to believe that the form in the complement in (5) and (11a) it is not an agreeing past form, unlike the form in (3c):

- The past finite complement of the modal should bear imperfective marking, but adding this marking to the sort of complement under discussion renders an impersonal reading unavailable and requires it to have a personal reading instead (11b):⁷

- (11) a. bāyad šab-hā hašt sâ’at xāb-id.
□.PRES night-PL eight hour sleep-PAST.??
‘It’s necessary to sleep for eight hours a night./One must sleep for eight hours a night.’
- b. bāyad šab-hā hašt sâ’at mi-xāb-id.
□.PRES night-PL eight hour SBJV-sleep-PAST.3SG
#‘It’s necessary to sleep for eight hours a night./One must sleep for eight hours a night.’
✓ ‘*pro*.3SG had to sleep for eight hours a night.’

- Persian is sometimes assumed to lack a non-finite clause (Darzi and Kwak 2015), exactly because of the similarity in morphological form between the third singular past form, which is unmarked for agreement morphology (e.g., *raf-t* go-PAST.3SG) and the simple stem form in question (e.g., *raft* go.??).

- But, as we have just seen, this does not account correctly for the impersonal readings.

- We instead assume that this verbal form is infinitival and thus unmarked for TENSE/ASPECT/MOOD.

- The future construction, shown in (12), provides further evidence for non-finiteness of this verbal form, now glossed INF.

- This builds on Lowe’s (2019) claim that non-finite forms generally appear in periphrastic constructions as the lexical content of the clausal predicate.

- (12) Ali farda be madrese xāh-ad raft.
Ali tomorrow to school want-3SG go-INF
‘Ali will go to school tomorrow.’

- In the analysis section §4, a template (Dalrymple et al. 2004, Asudeh et al. 2013) is used to generate this defective/infinitival verbal form.

⁷Sentence (11b) can have another interpretation in which the subject of the verb is *pro*-dropped, which will translate to ‘*pro*.3SG should have slept eight hours a night’. This is a different construction than the one in question; most importantly, the alternative construction is never impersonal.

Summary

- The first question posed in §2 above was *whether the morphologically ambiguous form in the impersonal modal construction is a past tense form or a short infinitive (apocopated infinitive)*.
- We argue that the form in question, just as in (12), is *still* an infinitival form (synchronically), and that the apocopated infinitive is morphologically formed by referral to the past stem, which explains their identity of form.
- However, the agreeing past tense form and the non-agreeing short infinitive have different functions.⁸

4 An LFG analysis of Persian modal syntax

- The syntactic theory assumed here is Lexical-Functional Grammar (Kaplan and Bresnan 1982, Bresnan et al. 2016, Dalrymple et al. 2019).
- LFG assumes a separation of syntax into levels, c(onstituent)-structure and f(unctional)-structure.
 - C-structure represents syntactic distribution, via categories, constituency, hierarchy, and linear order.
 - F-structure represents relational aspects of syntax, such as grammatical functions, agreement, case-marking, as well as local (control/raising) and non-local (unbounded dependencies) relations.
- The following examples illustrate the c-structure position of the modal and the general structure of the CP and IP:

- (13) a. Mariam goft
 Mariam said
 $[_{CP} \quad [_{C'} \quad [_{C} \text{ ke}] \quad [_{IP} \text{ kodoom ketab-ha-ro} \quad [_{IP} \quad [_{I'} \quad [_{I} \text{ bayad}] \quad [_{VP} \text{ bache-ha be-xun-and} \quad]]]]]]$
 that which book-PL-DO must child-PL SBJV-read-3PL
 ‘Mariam said that the children must read WHICH BOOKS?’
- b. Mariam goft
 $[_{CP} \quad [_{C'} \quad [_{C} \text{ ke}] \quad [_{IP} \text{ kodoom ketab-ha-ro} \quad [_{IP} \quad [_{I'} \text{ bache-ha} \quad [_{I} \quad [_{I} \text{ bayad}] \quad [_{VP} \text{ be-xun-and} \quad]]]]]]]]$
 that which book-PL-DO child-PL must SBJV-read-3PL
 ‘Mariam said that the children must read WHICH BOOKS?’
- c. Mariam goft $[_{CP} \quad [_{C'} \quad [_{C} \text{ ke}] \quad [_{IP} \text{ kodoom ketab-ha-ro} \quad [_{IP} \text{ bache-ha} \quad [_{I'} \quad [_{VP} \text{ xun-d-and} \quad]]]]]]$
 that which book-PL-DO child-PL read-PAST-3PL
 ‘Mariam said that the children read WHICH BOOKS?’

- Example (13a) shows that there is a position for the top of an unbounded dependency below C, since the C position is occupied by an overt complementizer.
 - We assume that this position is an IP-adjunct, since otherwise the *wh*-phrase would be in regular subject position in SpecIP.
- Example (13b) shows that there is a position for an internal topic below this IP-adjunct position.
 - We postulate that this is an I'-adjunct.

⁸The insight that the so-called past stem in these constructions is the apocopated infinitive is not novel (especially in the context of the future construction; Windfuhr 1979), but the theoretical literature seems largely to have taken it to be the PAST.3SG form of the verb (for instance, Karimi 2008, Mirrazi 2022).

- Thus, in (13b), *bacheha* is in a non-agreeing topic position, reflected by the lack of plural agreement on the modal (which is generally not possible).
- Example (13c) shows that when an agreeing subject is present, in a simple case without a modal, it can be assumed to occur in the standard SpecIP subject position.
- The following rules license the left periphery in the c-structures in (13):⁹

$$\begin{array}{ll}
 (14) \text{ a. } CP \rightarrow & \begin{array}{c} XP \quad C' \\ (\uparrow \text{ DIS}) = (\uparrow \text{ DISPATH}) \quad \uparrow = \downarrow \end{array} & \text{d. } I' \rightarrow & \begin{array}{c} I \quad VP \\ \uparrow = \downarrow \quad \uparrow = \downarrow \end{array} \\
 \text{b. } C' \rightarrow & \begin{array}{c} C \quad IP \\ \uparrow = \downarrow \quad \uparrow = \downarrow \end{array} & \text{e. } IP \rightarrow & \begin{array}{c} XP \quad IP \\ (\uparrow \text{ DIS}) = (\uparrow \text{ DISPATH}) \quad \uparrow = \downarrow \end{array} \\
 \text{c. } IP \rightarrow & \begin{array}{c} XP \quad I' \\ (\uparrow \text{ SUBJ}) = \downarrow \quad \uparrow = \downarrow \end{array} & \text{f. } I' \rightarrow & \begin{array}{c} XP \quad I' \\ (\uparrow \text{ DIS}) = (\uparrow \text{ DISPATH}) \quad \uparrow = \downarrow \\ (\uparrow \text{ DIS})\sigma \in (\uparrow \sigma \iota \text{ TOPIC}) \end{array}
 \end{array}$$

- We assume the following lexical entry for *bāyad* (□.PRES):

$$(15) \text{ bayad } \quad I \quad \left. \begin{array}{l} (\uparrow \text{ PRED}) = \text{'must}\langle \text{CF} \rangle \text{SUBJ}' \\ (\uparrow \text{ TENSE}) = \text{PRES} \\ \left\{ \begin{array}{l} @\text{EXPL-SUBJ} \\ (\uparrow \text{ COMP MOOD}) =_c \text{SUBJUNCTIVE} \end{array} \right\} \left| \begin{array}{l} (\uparrow \text{ SUBJ}) = (\uparrow \text{ XCOMP SUBJ}) \end{array} \right\}
 \end{array}$$

- This lexical entry is for both the personal and impersonal present modal construction, so some information is shared, but the information needs to diverge at some point.
- The modal in both constructions occupies an identical position, hence the category I is shared.
- The modal in both constructions is present tense, hence the specification of [TENSE PRES].
- The two modal are also forms of the same basic predicate, so have the same PRED value.
 - * The distinction is that the personal construction takes a closed sentential complement, COMP, which can realize its own subject, whereas the the impersonal construction is a kind of subject raising construction, taking an open sentential complement, XCOMP, which cannot realize its own subject.
 - * The personal construction also requires that its complement independently have subjunctive mood.¹⁰
- The lefthand side of (15) calls a template, EXPL-SUBJ.
 - * A template call is marked by @.
 - * The semantics of template invocation is very simple (Dalrymple et al. 2004): the template just defines a bundled of lexical information and gives it a name; when the template is invoked, the corresponding information it encodes is substituted in.
 - * Note that a template may call other templates, so there may be multiple such substitutions; this is also exemplified by EXPL-SUBJ.

⁹The equation regarding DIS connects the top and bottom of the unbounded dependency in the corresponding f-structure (Dalrymple et al. 2019). The set statement regarding TOPIC states that the top of the unbounded dependency encodes a TOPIC at i(nformation)-structure (Dalrymple and Nikolaeva 2011).

¹⁰The fact that the subjunctive mood requirement is information that is checked by the modal, rather than information that is actually contributed by it, is modelled by the *constraining* equation, marked =_c rather than simply =.

(16) EXPL-SUBJ := $\neg(\uparrow \text{SUBJ PRED})$
@3SG

(17) 3SG := $(\uparrow \text{SUBJ PERS}) = 3$
 $(\uparrow \text{SUBJ NUM}) = \text{SG}$

– The righthand case in (15) is for the nonfinite-complements containing apocopated infinitives, such as (5).

* We define the following templates for apocopated infinitives:

(18) APINF(P) := $(\uparrow \text{PRED}) = \text{P}$
@NO-TAM
@IMPERS-SUBJ

(19) NO-TAM := $\neg(\uparrow \text{TENSE})$
 $\neg(\uparrow \text{ASPECT})$
 $\neg(\uparrow \text{MOOD})$

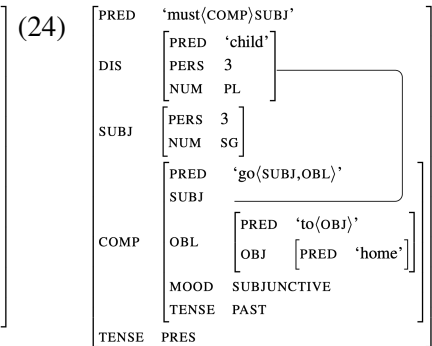
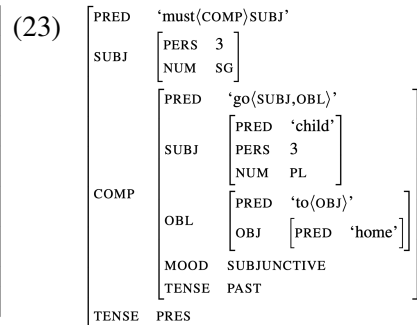
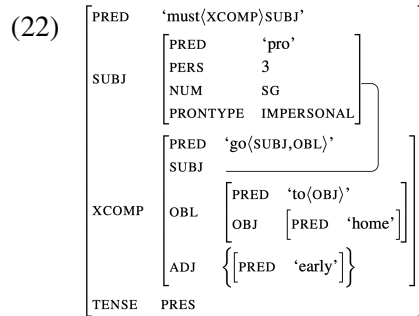
(20) IMPERS-SUBJ := $(\uparrow \text{SUBJ PRED}) = \text{'pro'}$
 $(\uparrow \text{SUBJ PRONTYPE}) = \text{IMPERSONAL}$
@3SG

* Note that the APINF template is one that takes an argument: whatever is passed in as the argument becomes the value of PRED.

* The lexical entry for a sample apocopated infinitive, *raft*, is:

(21) *raft* V @APINF('go(SUBJ,OBL)')

• The f-structures for examples (5), (6a), and (6b) respectively are shown in (22)–(24); the corresponding examples are repeated in (25)–(27).



(25) *bāyad zood be xune*
□.PRES early to home
raft.
go.INF
'It's necessary to go home
early.'
'One must go home early.'

(26) *bāyad bačehā be xune*
□.PRES child-PL to home
mi-raf-t-and.
SBJV-go-PAST-3PL
'The children had to go
home.'

(27) *bačehā bāyad be xune*
child-PL □.PRES to home
mi-raf-t-and.
SBJV-go-PAST-3PL
'The children had to go
home.'

Interim summary

- We are now in a position to answer the second and third questions in §2.
- The second question asked, *What is the syntactic structure of simplex modal constructions?*
 - Persian modals occupy the category I; this is unsurprising from an LFG-theoretic perspective, since modals in general are base-generated in this category or C (depending on distribution).
 - This interacts with the general structure of the left periphery that we have provided, see (13) and the c-structure rules in (14), such that all and only the valid orderings are captured.
- The third question asked, *How can we capture the impersonal and personal readings of modals like (5) vs. (4)?*
 - The lexical entry for the modal *bāyad* (□.PRES) in (15) explains the differences by treating the personal as a subcategorized subjunctive COMP and treating the impersonal as a raising predicate which allows the requirements of the apocopated infinitive, as captured in template (18), to control the reading, with the modal simply wrapping necessity around this.

4.1 Capturing the variation

- The fourth question in §2 asked, *How should the variable agreement displayed in (8) be explained?.*

- (8) b. bače-hā be nazar mi-ā-d ke xaste šo-d-an.
child-PL to opinion IPFV-come.PRES-3SG that tired become-PAST-3PL
'As for the children, it seems that they have gotten tired.'
- c. % bače-hā be nazar mi-ā-n ke xaste šo-d-an.
child-PL to opinion IPFV-come.PRES-3PL that tired become-PAST-3PL
'The children seem to have gotten tired.'

- Our proposal may have been anticipated by now:
 1. Speakers who only allow the non-agreeing form (8b) maintain an analysis of the preposed nominal, *bačehā* ('children'), as a TOPIC.
 - It is a general fact about Persian (and perhaps universally), that topichood is not sufficient to directly trigger agreement.
 2. Speakers who do allow the agreeing form have instead analyzed the preposed nominal as a SUBJ, which robustly triggers agreement in Persian.
 - The light verb, *āmadan* ('to come'), in this construction, unlike the modals, is a fully agreeing form.
 - For these speakers, *be nazar āmadan* 'seems', when it shows agreement with a preposed element, is akin to English copy raising (Rogers 1973, Postal 1974):

(28) Harry seems like he is tired.
 - However, since Persian is pro-drop, the embedded pronominal does not surface.¹¹
 - When it does not show agreement, it is akin to English *seems that* with topicalization; i.e., there is an (in Persian, unrealized) expletive subject with the bare-topicalized nominal occurring in only apparent subject position:

(29) As for Harry, it seems that he is tired.

¹¹In fact, one could possibly get it to surface given enough discourse support, but it is difficult because of opposing discourse forces.

Summary

- I hope to have shown that a fairly simple LFG analysis of Persian modal syntax is possible using standard tools of the framework.
- This analysis lends further support to the view that synchronic Persian grammar indeed does contain an apocopated infinitive, and that this short infinitive's formal resemblance to the past stem/zero-marked PAST.3SG form is misleading.
- We have answered the following questions from §2:
 1. How should we account for the complement in the impersonal modal construction?
⇒ It is a (short/apocopated) infinitival which is formally but not functionally identical to the past stem. The formal identity can be captured by standard means, such as rules of referral or their alternatives in other frameworks.
 2. How can we capture the personal vs. impersonal readings of the modals.
⇒ The distinction is governed by the lexical entry for the modal and the templates that it uses.
 3. What is the syntactic structure of the simplex modal constructions?
⇒ The modal is in I. There is a topic position above this, but below C.
 4. How should the variable speaker agreement displayed for the subject of the raising/perception verb *be nazar āmadan* lit. ('to opinion come')/~('to seem like/that') be captured?
⇒ The light verb that anchors this predicate, *amadan*, is a fully agreeing predicate, unlike the modals. Some speakers have reanalyzed the preposed topic as a subject, since the position it occupies is in many cases string-identical to subject position. On this analysis, the verb must agree with the subject, as is the case overall in Persian grammar. However, the other analysis, in which the preposed nominal is actually a topic, is also available, but does not trigger agreement.
- The last remaining question from §2 is:
 5. How can we give a consistent semantics for (the relevant) Persian light verbs that covers both perceptual constructions like (7), and possibly (8), as well as their uses in physical contexts?
 - In order to answer this question, we must consider lexical semantics, not just syntax or aspects of semantics clearly reflected in the syntax, such as the personal/impersonal distinction.

5 The semantics of perception verbs

- Sensory perception verbs (e.g., *hear, listen, sound*) have been an ongoing topic of research in linguistics and philosophy of language (see Dretske 1969, Akmajian 1977, Barwise 1981, Viberg 1984, Evans and Wilkins 2000, Jackendoff 2007, Gisborne 2010, Asudeh and Toivonen 2012, Poortvliet 2018, among others).
- In terms of syntax, defining what types of grammatical arguments these verbs take and how and why the types of these arguments vary among perception verbs have been the main topics of discussion.
- In terms of semantics, one of the main questions has been to determine the sorts of macro-roles (e.g. ACTOR; Foley and Van Valin 1984) and thematic roles (e.g., EXPERIENCER, AGENT, STIMULUS) to assign the subjects and complements of perception verbs and to determine what relationship they have to the event or situation described by the clause that the perception verb heads.

- Consider (30):

(30) a. Max listened to the music.	c. Context: Max is heard coughing badly.
b. Max heard the music.	Max sounds ill.

 - In (30), the subjects of the perception verbs play different roles.
 - In (30a), Max is the ACTOR in the predication,¹² whereas in (30b), Max is the EXPERIENCER.
 - Indeed, in (30a) Max is both the ACTOR and EXPERIENCER. In (30c), Max is a STIMULUS.
- Table (31) categorizes English perception verbs based on the thematic roles of their arguments (following Viberg 1984):

(31) Active (ACTOR,STIMULUS)	Experiencer (EXPERIENCER,STIMULUS)	Percept (STIMULUS,EXPERIENCER)
listen — X listen to Y	hear — X hear Y	sound — Y sound P to X
look — X look at Y	see — X see Y	look — Y look P to X
smell — X smell Y	smell — X smell Y	smell — Y smell P to X
taste — X taste Y	taste — X taste Y	taste — Y taste P to X
touch/feel — X touch/feel Y	feel — X feel Y	feel — Y feel P to X

- This table illustrates that paradigm cells can be filled by the same form.
 - Take the verb *smell*, whose form is three-ways ambiguous between Active, Experiencer and Percept, which have distinctive conceptual/argument structures.
 - Similarly, a verb may be distinguished in a single cell, but not be distinguished in two others, such as *look*, whose form is ambiguous between Active and Percept, but cannot correspond to an Experiencer argument structure, since there is a dedicated verb, *see*, in that cell.
 - It is therefore useful to refer not to particular verbs but rather to the underlying sensory modalities: respectively, *aural*, *visual*, *olfactory*, *gustatory*, *tactile* (following Asudeh and Toivonen 2012); this will also be a feature in our analysis, in order to capture semantic entailments.
- Sensory perception verbs in Persian have not received sustained formal linguistic analysis to the same extent as physical predication.
 - As noted previously, Persian verbal constructions in general are of two main kinds: simplex/fully lexicalized verbs and complex predicates (CPREDS) as shown in (32) and (33) respectively.

(32) Max mādar-aš-rā mi-bin-ad Max mother-POSS.3S-OM DUR-see.PRES-3S ‘Max sees her/his/its mother.’	(33) Max be mādar-aš [negāh mi-kon-ad] _{CPRED} Max to mother-POSS.3S look DUR-do.PRES-3S ‘Max looks at her/his/its mother.’
--	--
- The sentence in (32) illustrates the use of a simplex verb, whereas (33) contains a CPRED, consisting of a noun, *negāh*, as its Preverbal Element (PVE) and a Light Verb (LV), *kard-an* (‘do’, which can also be a main verb in some cases).
- Persian CPREDS can be made of various PVEs of bare predicative category, including nouns, adjectives, and verbal stems, or oblique-marked nouns in the form of prepositional nouns.

¹²We treat this as an ACTOR not an AGENT, because the verb that introduces the role in Persian, *kardan* (‘do’), is compatible with predications that are non-agentive, e.g. *Max gerye kard* (‘Max cried.’)

- The verbal element, LV, in CPREDS can vary, since several lexical verbs contribute to forming CPREDS, making such constructions very productive (for sample accounts of Persian CPREDS, see Barjasteh 1983, Khanlari 1986, Bateni 1989, Mohammad and Karimi 1992, Ghomeshi and Massam 1994, Goldberg 1996, Karimi-Doostan 1997, Müller 2010, Megerdooomian 2012, Nash and Samvelian 2016, and Rafiee Rad 2019, among others).
- The particular simplex verbs that contribute to the formation of the principal CPRED perception verbs, with informal glosses of their meanings, are presented in (34):¹³

- (34) a. *kardan*: to do/cause c. *zadan*: to hit e. *residan*: to arrive
 b. *dādan*: to give d. *āmadan*: to come

- Table (35) presents a somewhat simplified list of Persian perception verbs (both simplex and CPREDS).^{14,15}

(35)

Active (ACTOR,STIMULUS)		Experiencer (EXPERIENCER,STIMULUS)	Percept (STIMULUS,EXPERIENCER)	
guš kard-an ear do.INF X listen to Y		šenid-an hear.INF X hear Y	sedāh dād-an sound give.INF Y emitted a sound to X	be guš āmad-an/resid-an to ear come.INF/arrive.INF Y was heard by X
negāh kard-an look do.INF X looked at Y		did-an see.INF X see Y	be češm āmad-an to eye come.INF Y was seen by X	
bu kard-an smell do.INF X smell Y		(bu) hes kard-an (smell) sense do.INF X smell Y	bu dād-an smell give.INF Y emitted a smell to X	
maze kard-an taste do.INF X taste Y		maze hes kard-an taste sense do.INF X taste Y	maze dād-an taste give.INF Y emitted a taste to X	
lams kard-an touch do.INF X touch Y (◇ inadvertently)	dast zad-an hand hit.INF X feel Y (intentionally)	ehsās kard-an sense do.INF X feel Y	hes dād-an sense give.INF Y emitted a (physical) feel to X	

- This table shows that the use of complex predicates is prevalent in Persian perception constructions.

6 Analysis: A general semantics for light verbs

- Space restrictions preclude inclusion of our full compositional analysis.
- The Glue meaning constructors for the five LVs in table (35) are show in (38).
- The main intuition to keep in mind is that each LV has a meaning constructor that has been factored out of its physical and perceptual guises, such that it applies to either as a modifier.
- The resulting interpretations for corresponding sample physical light verb constructions and perceptual light verb constructions involving these LVs are shown in (39).
- Before turning to these, let’s also specify the following entailment relations between thematic roles and macro-roles, in (36), and between different perceptual predicates, in (37).

¹³See footnote 14.

¹⁴ There are many other verbal constructions used to express perception in Persian, such as *be guš āmad-an* ‘sound’, *be guš resid-an* ‘sound’, *be mašām resid-an* ‘smell’, among others.

¹⁵This table is based on the one provided by (Viberg 1984: 131, table 6). Note that Viberg uses *be nazar resid[-]an* in the cell for visual percept, but this is actually closer to the English verb *seem*.

- (36) a. AGENT, EXPERIENCER, SOURCE \subseteq ACTOR & AGENT \cap EXPERIENCER \cap SOURCE = \emptyset SUBJ roles
b. THEME, STIMULUS \subseteq UNDERGOER & THEME \cap STIMULUS = \emptyset OBJ roles
c. GOAL, EXPERIENCER \subseteq LOCATION & GOAL \cap EXPERIENCER = \emptyset OBL roles

(37) $\mathbf{P}_{(a)ural}, \mathbf{P}_{(v)isual}, \mathbf{P}_{(o)lfactory}, \mathbf{P}_{(g)ustatory}, \mathbf{P}_{(t)acticle} \subseteq \mathbf{P}_{sense} (= \mathbf{P})$

- A consequence of the entailments in (36) is that something can be, e.g., an AGENT and and ACTOR or an EXPERIENCER and an ACTOR without inconsistency.
- Similarly, the entailments in (37) allow particular verbs to control which perceptual verbs they are compatible; combinations that don't support the modality in question are blocked pragmatically.

(38) a. *kardan* (\uparrow PRED) = 'do'

$$\lambda \mathcal{R} \lambda x \lambda v. \mathcal{R}(y)(x)(v) \wedge \text{UNDERGOER}(v) = y \wedge \text{ACTOR}(v) = x :$$

$$[(\uparrow \text{OBJ})_{\sigma} \multimap (\uparrow \text{SUBJ})_{\sigma} \multimap ((\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma})] \multimap$$

$$[(\uparrow \text{OBJ})_{\sigma} \multimap (\uparrow \text{SUBJ})_{\sigma} \multimap ((\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma})]$$

$$\left(\left\{ \begin{array}{l} \lambda y \lambda x \lambda v. \mathbf{do}(v) \wedge \text{PATIENT}(v) = y \wedge \text{AGENT}(v) = x : \\ (\uparrow \text{OBJ})_{\sigma} \multimap (\uparrow \text{SUBJ})_{\sigma} \multimap (\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma} \\ \lambda y \lambda x \lambda v. \mathbf{P}(v) \wedge \text{STIMULUS}(v) = y \wedge \text{EXPERIENCER}(v) = x : \\ (\uparrow \text{OBJ})_{\sigma} \multimap (\uparrow \text{SUBJ})_{\sigma} \multimap (\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma} \\ @\text{CAUSE-BECOME} \\ @\text{CAUSE-EVENT} \end{array} \right\} \right)$$

b. *dādan* (\uparrow PRED) = 'give'

$$\lambda \mathbb{R} \lambda z \lambda y \lambda x. \mathbb{R}(z)(y)(x)(v) \wedge \text{LOCATION}(v) = z \wedge \text{UNDERGOER}(v) = y \wedge \text{ACTOR}(v) = x :$$

$$[(\uparrow \text{OBL})_{\sigma} \multimap (\uparrow \text{OBJ})_{\sigma} \multimap (\uparrow \text{SUBJ})_{\sigma} \multimap ((\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma})] \multimap$$

$$[(\uparrow \text{OBL})_{\sigma} \multimap (\uparrow \text{OBJ})_{\sigma} \multimap (\uparrow \text{SUBJ})_{\sigma} \multimap ((\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma})]$$

$$\left(\left\{ \begin{array}{l} \lambda z \lambda y \lambda x \lambda v. \mathbf{give}(v) \wedge \text{GOAL}(v) = z \wedge \text{THEME}(v) = y \wedge \text{AGENT}(v) = x : \\ (\uparrow \text{OBL})_{\sigma} \multimap (\uparrow \text{OBJ})_{\sigma} \multimap (\uparrow \text{SUBJ})_{\sigma} \multimap (\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma} \\ \lambda z \lambda y \lambda x \lambda v. \mathbf{P}_{\rightarrow v}(v) \wedge \text{EXPERIENCER}(v) = z \wedge \text{STIMULUS}(v) = y \wedge \text{SOURCE}(v) = x : \\ (\uparrow \text{OBL})_{\sigma} \multimap (\uparrow \text{OBJ})_{\sigma} \multimap (\uparrow \text{SUBJ})_{\sigma} \multimap (\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma} \end{array} \right\} \right)$$

c. *zadan* (\uparrow PRED) = 'hit'

$$\lambda y \lambda x \lambda \mathcal{R} \lambda v. \mathcal{R}(y)(x)(v) \wedge \text{UNDERGOER}(v) = y \wedge \text{ACTOR}(v) = x :$$

$$[(\uparrow \text{OBJ})_{\sigma} \multimap (\uparrow \text{SUBJ})_{\sigma} \multimap ((\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma}) \multimap ((\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma})] \multimap$$

$$[(\uparrow \text{OBJ})_{\sigma} \multimap (\uparrow \text{SUBJ})_{\sigma} \multimap ((\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma}) \multimap ((\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma})]$$

$$\left(\left\{ \begin{array}{l} \lambda y \lambda x \lambda v. \mathbf{hit}(v) \wedge \text{PATIENT}(v) = y \wedge \text{AGENT} = x : \\ (\uparrow \text{OBJ})_{\sigma} \multimap (\uparrow \text{SUBJ})_{\sigma} \multimap (\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma} \\ \lambda y \lambda x \lambda v. \mathbf{P}_t(v) \wedge \text{STIMULUS}(v) = y \wedge \text{EXPERIENCER}(v) = x : \\ (\uparrow \text{OBJ})_{\sigma} \multimap (\uparrow \text{SUBJ})_{\sigma} \multimap (\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma} \end{array} \right\} \right)$$

d. *āmadan* (\uparrow PRED) = 'come'

$$\lambda y \lambda R \lambda x \lambda v. R(x)(v) \wedge \text{LOCATION}(v) = y \wedge \text{UNDERGOER}(v) = x \wedge$$

PROXIMAL(v, y, \mathbf{origo}) :

$$(\uparrow \text{OBL})_{\sigma} \multimap [(\uparrow \text{SUBJ})_{\sigma} \multimap ((\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma})] \multimap [(\uparrow \text{SUBJ})_{\sigma} \multimap ((\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma})]$$

$$\left(\left\{ \begin{array}{l} \lambda x \lambda v. \mathbf{arrive}(v) \wedge \text{THEME}(v) = x : (\uparrow \text{SUBJ})_{\sigma} \multimap (\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma} \\ \lambda x \lambda v. \mathbf{P}_{a \vee v}(v) \wedge \text{STIMULUS}(v) = x : (\uparrow \text{SUBJ})_{\sigma} \multimap (\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma} \end{array} \right\} \right)$$

e. *residan* (\uparrow PRED) = 'arrive'

$$\lambda y \lambda R \lambda x \lambda v. R(x)(v) \wedge \text{LOCATION}(v) = y \wedge \text{UNDERGOER}(v) = x :$$

$$(\uparrow \text{OBL})_{\sigma} \multimap [(\uparrow \text{SUBJ})_{\sigma} \multimap ((\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma})] \multimap [(\uparrow \text{SUBJ})_{\sigma} \multimap ((\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma})]$$

$$\left(\left\{ \begin{array}{l} \lambda x \lambda v. \mathbf{arrive}(v) \wedge \text{THEME}(v) = x : (\uparrow \text{SUBJ})_{\sigma} \multimap (\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma} \\ \lambda x \lambda v. \mathbf{P}_a(v) \wedge \text{STIMULUS}(v) = x : (\uparrow \text{SUBJ})_{\sigma} \multimap (\uparrow_{\sigma} \text{EVENT}) \multimap \uparrow_{\sigma} \end{array} \right\} \right)$$

- (39) a. i. Max in kār-rā kard.
Max this work-OM do.PAST.3SG
'Max did this work.'
*Physical (main verb or light verb)*¹⁶
 $\exists v.\mathbf{do}(v) \wedge \text{UNDERGOER}(v) = \mathbf{this.work} \wedge \text{ACTOR}(v) = \mathbf{max} \wedge \text{PATIENT}(v) = \mathbf{this.work} \wedge \text{AGENT}(v) = \mathbf{max}$
- ii. Max ghazā bu kard.
Max food smell do.PAST.3SG
'Max smelled food.'
Perceptual (light verb; experiencer type)
 $\exists v.\mathbf{P}(v) \wedge \text{UNDERGOER}(v) = \mathbf{*food} \wedge \text{ACTOR}(v) = \mathbf{max} \wedge \text{STIMULUS}(v) = \mathbf{*food} \wedge \text{EXPERIENCER}(v) = \mathbf{max}$
- b. i. Max be Sam ketāb-rā dād.
Max to Sam book-OM give.PAST.3SG
'Max gave Sam the book.'
*Physical (main verb or light verb)*¹⁷
 $\exists v.\mathbf{give}(v) \wedge \text{LOCATION}(v) = \mathbf{sam} \wedge \text{UNDERGOER}(v) = \mathbf{the.book} \wedge \text{ACTOR}(v) = \mathbf{max} \wedge$
 $\text{GOAL}(v) = \mathbf{sam} \wedge \text{THEME}(v) = \mathbf{the.book} \wedge \text{AGENT}(v) = \mathbf{max}$
- ii. Max bu-ye xub mi-dād.
Max smell-EZ good DUR-give.PAST.3SG
'Max smelled good.'
Perceptual (light verb; percept class)
 $\exists v\mathbf{G}x.\mathbf{P}_{\rightarrow v}(v) \wedge \text{LOCATION}(v) = x \wedge \text{UNDERGOER}(v) = \mathbf{N(good(smell))} \wedge \text{ACTOR}(v) = \mathbf{max} \wedge$
 $\text{EXPERIENCER}(v) = x \wedge \text{STIMULUS}(v) = \mathbf{N(good(smell))} \wedge \text{SOURCE}(v) = \mathbf{max}$
- c. i. Max Sam-rā zad.
Max Sam-OM hit.PAST.3SG
'Max hit Sam.'
Physical (main verb or light verb)
 $\exists v.\mathbf{hit}(v) \wedge \text{UNDERGOER}(v) = \mathbf{sam} \wedge \text{ACTOR}(v) = \mathbf{max} \wedge \text{PATIENT}(v) = \mathbf{sam} \wedge \text{AGENT}(v) = \mathbf{max}$
- ii. Max lebās-rā dast zad.
Max clothes-OM touch hit.PAST.3SG
'Max felt the clothes.'
Perceptual (light verb; active class)
 $\exists v.\mathbf{P}_t(v) \wedge \text{UNDERGOER}(v) = \mathbf{the.clothes} \wedge \text{ACTOR}(v) = \mathbf{max} \wedge$
 $\text{STIMULUS}(v) = \mathbf{the.clothes} \wedge \text{EXPERIENCER}(v) = \mathbf{max}$
- d. i. Max be madrese āmad.
Max to school come.PAST.3SG
'Max came to school.'
Physical (main verb or light verb)
 $\exists v.\mathbf{arrive}(v) \wedge \text{LOCATION}(v) = \mathbf{school} \wedge \text{ACTOR}(v) = \mathbf{max} \wedge$
 $\text{PROXIMAL}(v, \mathbf{school, origo}) \wedge \text{THEME}(v) = \mathbf{max}$
- ii. nur-i az dur be češm āmad.
light-INDEF from afar to eye come.PAST.3SG
'A light was seen from afar.'
Perceptual (light verb; percept class)
 $\exists v\exists x\exists y.\mathbf{P}_{a \vee v}(v) \wedge \mathbf{light}(y) \wedge \text{UNDERGOER}(v) = y \wedge \text{ACTOR}(v) = x \wedge$
 $\text{STIMULUS}(v) = y \wedge \text{EXPERIENCER}(v) = x$
- e. i. Max be madrese resid.
Max to school arrive.PAST.3SG
'Max arrived at school.'
Physical (main verb or light verb)
 $\exists v.\mathbf{arrive}(v) \wedge \text{LOCATION}(v) = \mathbf{school} \wedge \text{ACTOR}(v) = \mathbf{max} \wedge \text{THEME}(v) = \mathbf{max}$
- ii. Sedā-ye ajib-i az ānjā be guš resid.
sound-EZ strange-INDEF from there to ear arrive.PAST.3SG
'A strange sound was heard from there.'
Perceptual (light verb; percept class)
 $\exists v\exists x\exists y.\mathbf{P}_a(v) \wedge \mathbf{sound}(y) \wedge \mathbf{strange}(y) \wedge \text{UNDERGOER}(v) = y \wedge \text{ACTOR}(v) = x \wedge$
 $\text{STIMULUS}(v) = y \wedge \text{EXPERIENCER}(v) = x$

¹⁶Space reasons preclude us from addressing the third part of the lexical entry for *kardan*. We will address this in the talk.

¹⁷In the second example below, we assume a nominalizing function that maps the object common noun of type $\langle e, t \rangle$ to the type e entity in question. In other word, \mathbf{N} is just the ι function. This would be associated with another modifying meaning constructor, which we leave aside here to avoid (even more) clutter.

7 Conclusion

- We have now answered all five questions from §2.
 1. How should we account for the complement in the impersonal modal construction?
⇒ It is a (short/apocopated) infinitival which is formally but not functionally identical to the past stem. The formal identity can be captured by standard means, such as rules of referral or their alternatives in other frameworks.
 2. How can we capture the personal vs. impersonal readings of the modals.
⇒ The distinction is governed by the lexical entry for the modal and the templates that it uses.
 3. What is the syntactic structure of the simplex modal constructions?
⇒ The modal is in I. There is a topic position above this, but below C.
 4. How should the variable speaker agreement displayed for the subject of the raising/perception verb *be nazar āmadan* lit. ('to opinion come')/~('to seem like/that') be captured?
⇒ The light verb that anchors this predicate, *amadan*, is a fully agreeing predicate, unlike the modals. Some speakers have reanalyzed the preposed topic as a subject, since the position it occupies is in many cases string-identical to subject position. On this analysis, the verb must agree with the subject, as is the case overall in Persian grammar. However, the other analysis, in which the preposed nominal is actually a topic, is also available, but does not trigger agreement.
 5. How can we give a consistent semantics for (the relevant) Persian light verbs that covers both perceptual constructions like (7), and possibly (8), as well as their uses in physical contexts?
⇒ We can provide lexical semantics for the required predicates in Glue Semantics such that they can be used in both physical and perceptual contexts. This approach also builds on previous work on perception verbs more generally and work on macroroles and thematic roles. Although it may not be obvious from our presentation, our ultimate touchstone for the kind of lexical semantics we are doing is the work of Andrew Koontz-Garboden and John Beavers.

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¹⁸Please note that these references are selective and do not contain the full set of background references on various larger topics that have been touched on, such as raising and complex predicates.

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