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Roberts, Thomas de Haven

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**THE SEMANTICS OF RESPONSIVE PREDICATES AND THEIR
COMPLEMENTS IN ESTONIAN**

A thesis submitted in partial satisfaction
of the requirements for the degree of

MASTER OF ARTS

in

LINGUISTICS

by

Thomas de Haven Roberts

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The thesis of Thomas Roberts
is approved:

Assoc Professor Pranav Anand, Chair

Professor Donka Farkas

Professor James McCloskey

Tyrus Miller
Vice Provost and Dean of Graduate Studies

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The semantics of responsive predicates and their complements in Estonian

Thomas de Haven Roberts

Abstract

Responsive Predicates (ResPs)—those clausal-embedding predicates which permit both declarative or interrogative complements, like *know* and *say*—pose a puzzle for compositional semantics. If declarative clauses denote propositions and interrogative clauses denote questions, it is difficult to explain how ResPs may select both types of clauses. Prior accounts diverge on how to best rectify this inconsistency, from reducing interrogatives to propositions (Karttunen 1977, Ginsburg 1995, Spector & Egré 2015, a.o.), to reducing declaratives to questions (Uegaki 2016) or dispensing altogether with the assumption that the denotations of declaratives and interrogatives are of different types, as in Inquisitive Semantics (e.g. Theiler et al 2016).

In this thesis I bring novel data from Estonian to bear on this theoretical debate. In Estonian, a class of ResPs whose denotations concern contemplation, such as *mõtleva* ‘think, consider’, convey what radically different meanings depending on the type of complement it takes: When paired with a declarative complement, *mõtleva* canonically indicates representational belief like English *think*, but with an interrogative complement, it indicates ignorance toward the true answer to the embedded question, like English *wonder*.

I demonstrate that a proposition-embedding denotation for *mõtlema* is not compatible with its full range of meanings. Instead, I propose a question-embedding semantics for *motlema*, which relates an individual to the set of issues they are contemplating. I show how this denotation, combined with standard Gricean reasoning, can naturally derive the superficially distinct interpretations of *mõtlema* across contexts. Building upon the analysis by Uegaki (2016), I argue that a proposition-embedding semantics for ResPs is not sufficient to capture the Estonian facts, whereas a question-embedding semantics is. Furthermore, I suggest that this approach is also compatible with the uniform treatment of declaratives and interrogatives of Inquisitive Semantics.

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1 Introduction

Much ink has been spilled on the selectional properties of clausal-embedding predicates. It's a well-established fact, for instance, that such predicates differ in the types of complements they may embed. **Rogative** predicates like *wonder* and *ask* only permit interrogative complements (terminology after Lahiri 2002), **anti-rogative** predicates like *think* and *believe* only permit declarative complements, and **responsive** predicates (ResPs) like *know* and *say* permit either type of complement. The three predicate classes are exemplified in (1).

- (1) a. Prudence thinks {that/*why} wombats are herbivores. ANTI-ROGATIVE
b. Prudence wonders {*that/why} wombats are herbivores. ROGATIVE
c. Prudence knows {that/why} wombats are herbivores. RESPONSIVE

These three categories are robustly attested cross-linguistically. In Estonian, just as in English there are indeed clausal-embedding verbs of all three selectional categories:

- (2) a. Kirsi usub, {et/*miks} lapsed on vanglas.
Kirsi believes that/why children are prison.INESS
'Kirsi believes that/why the children are in prison.' ANTI-ROGATIVE
b. Kirsi küsib, {*et/miks} lapsed on vanglas.
'Kirsi asks that/why the children are in prison.' ROGATIVE
c. Kirsi teab, {et/miks} lapsed on vanglas.
'Kirsi knows that/why the children are in prison.' RESPONSIVE

However, it is this third category, the ResPs, about which there is more than meets the eye. The Estonian ResP *mõtleva* 'think, consider' canonically indicates **belief** with an embedded declarative, and **ignorance** with an embedded interrogative:

- (3) a. Liis mõtleb, et sajab vihma.
 Liis thinks that falls rain
 ‘Liis thinks that it’s raining.’ BELIEF
- b. Liis mõtleb, kas sajab vihma.
 Liis thinks Q falls rain
 ‘Liis wonders whether it’s raining.’ IGNORANCE

These two uses of *mõtlem* in ((3)) seem at odds with one another, given that belief and ignorance are extremely different ontological beasts. Belief requires some kind of doxastic commitment on the part of the attitude holder, while ignorance entails the absence of any such commitment. Cross-linguistically, verbs that encode representational belief (in the sense of Hintikka 1962) when taking a declarative complement typically do not allow interrogative complements (Egré 2008, Spector & Egré 2015). Certainly it seems to be the case that no representational belief verbs in English do, modulo the doxastic factives like *know*. *Mõtlem* is clearly unlike *know* in that it does not presuppose its complement (i.e., *mõtlem* is nonfactive). Hence, although (4) is judged to be contradictory, (5) is not:

- (4) #Ambrose knows that today is Thursday, but it isn’t Thursday.
- (5) Liis mõtleb, et sajab vihma, aga ei saja.
 Liis thinks that falls rain but NEG fall.NEG
 ‘Liis thinks that it’s raining, but it isn’t raining.’

Given the standard assumption that there exists only one entry for each of these predicates in the lexicon, ResPs pose a puzzle for compositional semantics. According to the so-called “s-selectional theory” of argument selection, arguments are selected by semantic, not syntactic, category (Grimshaw 1979, Pesetsky 1982, 1991). While this analysis straightforwardly accounts for the behavior of anti-rogatives and rogatives—which select questions and propositions as complements, respectively—s-selection has

a difficult time dealing with ResPs, as declarative and interrogative clauses are often taken to denote objects of fundamentally different types. If each ResP is indeed a single entry in the lexicon, its chimerical embedding behavior is then surprising.

Mõtlema adds an additional layer to this puzzle: it appears to be a ResP whose interpretation varies dramatically with the type of its complement, and is quite unlike the doxastic ResPs of English, which tend to be factive. And *mõtlema* is not alone in this trait among Estonian verbs. Other verbs, which I broadly label *contemplatives*, exhibit a similar belief/ignorance pattern with different complement types. These verbs include *mõtisklema* ‘consider’, *vaatlema* ‘observe,’ and *meelisklema* ‘muse.’

Relatedly to the contemplatives, Estonian emotive doxastic predicates like *põnevillema* ‘be excited’, *ahistama* ‘agonize’, and *imestama* also encode belief with embedded declaratives, and some kind of ignorance with embedded interrogatives. However, unlike *mõtlema*, these predicates are factive with propositional complements. For instance, (6) presupposes that our students had heard something about Dante:

- (6) Üks itaalia õpetaja sügavalt imestas, et meie gümnasistid on midagi
one Italian teacher deeply marveled that our students are something
Dantest kuulnud.
Dante.ELA heard
‘An Italian teacher was deeply surprised that our students had heard anything
about Dante.’

These predicates also behave unlike their approximate English counterparts, which are forbidden from taking interrogative complements. Several representative examples are included below for illustrative purposes, with declarative complements in (7), and interrogatives in (8)-(9):

- (7) Naine ahastas, et kurivaim on teda ära vahetanud.
woman agonized.3SG that demon is her.PART up changed

‘The woman grieved that the demon changed her.’

- (8) *Context: A group of children is in a workout program. They’re going to start fencing soon instead of just doing calisthenics.*

Nad on nii põnevil, millal päris relvad tulevad.
they are so excited when real weapons come.3PL
‘They’re so excited about when the real weapons are coming.’

- (9) *Context: an excited reader of a dessert recipe blog eagerly anticipated the latest entry, which was announced in advance as being for sugar-free snacks. They post as a comment:*

Olin väga põnevil, millised need suhkruvabad ampsud ka
was.1SG very excited what.kind.3PL them sugar-free snacks also
tulevad.
come.3PL
‘I was very excited about what kind of sugar-free snacks were coming!’

Again, these predicates behave decidedly unlike English: they are factive ResPs, but with embedding questions they tend to (at the very least) imply ignorance toward the true answer to an embedded question. (9), for instance, is uttered in a context where the attitude holder has no prior beliefs about the sort of snacks that were going to be announced on the blog.

In total, a puzzle has emerged: there are a good number of Estonian ResPs that don’t seem to fit into the established typological pattern with respect to their behavior in question-embedding, and moreover, indicate radically different interpretations. In determining a semantics for these sorts of predicates, it is useful to consider what other properties they might have in common.

The structure of the paper will be as follows: in section 2, I introduce existing accounts of the semantics of ResP complements, paying particular attention to the

differential reductive strategies employed in the literature. In section 3, I lay out the properties of different kinds of Estonian ResPs, more English-like ResPs like *teadma* ‘know’ and *üttelema* ‘say’ to the more ‘exotic’ contemplative and emotive factive ResPs. Then, in section 4, I argue that a question-embedding semantics for contemplatives is necessary, and extend the question-embedding semantics for ResPs of Uegaki (2016) to put forward a semantics for the predicates that takes these new facts into account. In section 5, I combine this proposed semantics with standard Gricean reasoning to derive the interpretations in various contexts, with a careful eye towards seeing how the resolution of the issue bears on the debate about the proper denotation for ResP complements. Finally, I will conclude by discussing implications of the analysis for theories of Responsive Predicates and question-embedding more generally, and discuss outstanding questions that still linger.

2 Existing Theories of ResPs

The main claim I aim to put forth in this paper is that a question-embedding view of Responsive Predicates is preferred. But in order to get there, an excursus of sorts is in order: we must survey the landscape of possible analyses of responsive predicates, in order to better understand where they break down with the Estonian data.

2.1 Polysemy

It is not a trivial assumption to make that each ResP is instantiated by a single lexical entry. Were there instead two homophonous lexemes for ResPs like *know* with two different subcategorization frames—or at the least, two different potential polysemic readings of each predicate—there is no puzzle. One entry selects declarative complements, the other interrogative, and there we have it.

This approach has an intuitive appeal. Polysemy, or something like it, clearly exists in many domains of natural language. Rather than perform any gymnastics or posit null operators to preserve a compositional typed semantics, the facts are simply as they appear: the *know* that appears with an embedded interrogative is the *know* that selects them.

However, there are some obvious disadvantages to this approach, chief among them the lack of explanatory power. It does not provide any explanation for why only the verbs with the sorts of meanings that ResPs tend to have exhibit this polysemic pattern, but other verbs do not: it is merely stipulated. A satisfactory analysis of ResPs would provide an account for not only the technical denotation of ResP complements, but it would capture generalizations about all three classes of clausal-embedding predicates. For this reason, the polysemic/ambiguous approach is generally discarded *prima facie*.

Additionally, a prediction (though not an entailment) of a polysemous account is that if ResPs in a language like English were systematically polysemous, we might be able to find a language in which this polysemy is instantiated with non-homophonous lexemes. That is to say, we might expect there is a language with lexical pairs like *know* and *shnow*, where one verb means roughly what English *know* means with a declarative complement, and the other means roughly what *know* means with an interrogative complement. To my knowledge, no such language exists.

2.2 Reducing questions to propositions

A prolific line of work, one which comprises the lion's share of literature on the topic, tackles the issue of how to characterize ResP arguments by taking complements of ResPs to be propositions, accomplished by reducing interrogative meaning to declarative

meaning. Accounts which reduce interrogative ResP complements to declaratives have proliferated in recent decades (Karttunen 1977, Groenendijk & Stokhof 1984, Heim 1994, Dayal 1996, Lahiri 2002, Egré 2008, Spector & Egré 2015, a.o.).

The motivations for this approach are, at first brush, incredibly appealing. George (2011) and Spector & Egré (2015) articulate a key intuition about the relationship between the meanings of responsive predicates with declarative complements (10a) and interrogative complements (10b). Namely, that in worlds where the handmaiden is the true chalice thief, (10a) and (10b) mean essentially the same thing:

- (10) a. Gertrude knows that the handmaiden stole the chalice.
- b. Gertrude knows who stole the chalice.

To put it more plainly, to *know* an embedded interrogative means, for some *p*, to be in a *know*-relationship to *p*. To see why this is meaningful, first note that rogative verbs like *ask* do not similarly encode a relationship between an individual (namely the 'attitude holder') and a proposition.

- (11) a. Agatha asked what Vlad added to the tripe.
- b. *Agatha asked that Vlad added polonium to the tripe.

However, while this analysis succeeds in ensuring that responsive predicates can embed both declaratives and interrogatives without a type mismatch, there are two chief explanatory hurdles for a proposition-reduction account. One, there must be an operator or other mechanism which does the clausal type-shifting of ResP complements to begin with, which in the absence of independent motivation seems unwarranted. And two, additional stipulations are required to explain the ungrammaticality of sentences like (12), where an anti-rogative verb appears with an embedded interrogative:

(12) *Shirley thinks whether she will win the lottery.

If type-shifting of embedded interrogatives is an available option for ResP complements, an independent reason for ruling out sentences like (12) is required. Accounts vary on how precisely they achieve this, though many problems arise from the various approaches. While a full-throated examination of each and every one of these proposals could be a paper unto itself, a brief examination of some representative papers will lay bare the problems with this approach. More extensive argumentation about the inadequacies of a question-to-proposition complement approach can be found in Uegaki (2016).

A prototypical solution in the question-to-proposition vein is that of Groenendijk & Stokhof (1984), who argue that embedded interrogatives inherently denote two kinds of semantic objects: a question *intension* and a propositional *extension*. *Know* then selects the extension of an embedded interrogative, whereas *wonder* selects for an embedded interrogative's intension. Unfortunately, the major flaw in this solution is precisely in its inability to prevent anti-rogatives from embedding interrogatives. It seems apparent that commonalities among the lexical semantics of anti-rogatives must be leveraged in building a generalization about their behavior, rather than merely stipulating their selectional restrictions.

The reduction of Ginzburg (1995) also shares similarities with the propositional reduction case. He makes an ontological distinction between propositions and 'facts,' which prove propositions and resolve questions. The complements of ResPs like *know* are then facts, unlike the anti-rogatives which select for propositions. It is less clear how well, if at all, Ginzburg's account can handle the behavior of nonfactive (and non-veridical) ResPs like *say*. Ginzburg is also forced to stipulate coercion of embedded declaratives and interrogatives to facts, which itself carries an explanatory burden.

2.3 Reducing declaratives to questions

The inverse tack from the 'standard' approach of the previous section is to yield question denotations from superficial embedded declaratives, a position articulated most completely by Uegaki (2016). Uegaki's primary motivation for this approach comes from contrasts between anti-rogatives and ResPs with regards to their entailment patterns with content DP complements:

- (13) a. John believes the rumor that Mary left.
 \models John believes that Mary left.
- b. John knows the rumor that Mary left.
 $\not\models$ John knows that Mary left. (Uegaki 2016: 626)

Uegaki argues that only a propositional-embedding predicate can yield the entailment in (13a), and if *know* were also embedding propositions, the distinction between (13a) and (13b) could not be derived. There is no way, he claims, for *the rumor that Mary left* to denote a proposition without yielding the entailment of (13b).

Instead, Uegaki proposes that ResPs, including *know*, are question-embedding. He assumes questions to denote sets of propositions which comprise complete answers to that question, following Hamblin (1973), and employs a range of (independently motivated) type-shifters to ensure the internal argument of a ResP like *know* is always a question. The precise technical details of Uegaki's implementation are best examined in his own words.

In order to prevent a type mismatch with ResPs and embedded declaratives, Uegaki invokes the type-shifting operator *ID*, which takes a proposition and returns the singleton set containing that proposition:

$$(14) \quad \llbracket \text{ID} \rrbracket = \lambda p[\lambda q.q = p]$$

Thus, the interpretation of a sentence with a ResP would be like the following:

(15) John knows [ID [that Mary left]].

Like the other reductive analysis, Uegaki's account requires additional stipulations for non-responsive clausal-embedding verbs: a story is needed for why rogatives like *wonder* cannot embed declaratives. To this, Uegaki's solution is to stipulate that rogative verbs come packaged with a presupposition that their complement is a non-singleton set of propositions. There is no type-mismatch in this account, but **wonder that* is derived from the inability of a proposition to denote a set of propositions with cardinality of greater than 1. In particular, he claims rogative ('inquisitive') verbs have the following presupposition:

$$(16) \quad \llbracket \text{wonder/ask/inquire} \rrbracket^w(Q)(x) \text{ is defined only if the following proposition is compatible with } x\text{'s beliefs: } \lambda w.\exists p \in Q[p(w)] \wedge \exists p \in Q[\neg p(w)] \quad 647:(51)$$

By this definition, a *wonder*-sentence, for instance, is only defined if there is some p that is an answer to Q such that both p and $\neg p$ are compatible with the attitude holder's beliefs.

I will note here that although the intuition behind this presupposition is appealing—it does not make sense to 'wonder' a question to which there are not multiple epistemically possible answers—this presupposition cannot explain the behavior of all rogatives. There are uses of *ask*, for instance, where the asker is merely uttering a particular speech act, to say nothing of their own beliefs (an objection noted by Theiler et al. (2016)):

(17) The teacher asked what the capital of East Timor was.

It's perfectly natural to utter (17) to describe an ordinary pedagogical scenario, where the teacher knows the answer to the question which she poses to the class. Taking Uegaki's definition at its word, (17) is incorrectly predicted to induce a presupposition failure. However, this is no reason to throw out the baby with the mostly clean bathwater that comprises the question-embedding account of ResPs. Compared to the proposition-reductive accounts, Uegaki's analysis achieves greater empirical coverage of the behavior of responsive predicates and rogatives, even if some wrong predictions are generated by the precise implementation of his presupposition for rogatives.

2.4 The Inquisitive perspective

The challenges posed by the reductive accounts are ambitiously tackled by a recent line of work in Inquisitive Semantics, which challenges the assumption that declaratives and interrogatives are objects of different types to begin with (Ciardelli et al. 2013, Theiler et al. 2016, Roelofsen 2017, Roelofsen et al. to appear). Within this framework, propositions and questions both denote *sets of propositions* with (possibly zero) inquisitive and informative content. One reason why adopting Inquisitive Semantics for responsive predicates might be appealing is that the existence of Responsive Predicates becomes wholly unsurprising, and is in some sense the 'default' sort of clausal-embedding predicate: no type-shifting gymnastics are required to yield a proper compositional derivation.

The explanatory challenge for this account lies instead in providing reasons for why both rogative and anti-rogative predicates are restricted to embedding complements of a particular type, whereas the reductive analyses only needed to account for the existence of one type of predicate or the other.

The most full-throated Inquisitive Semantics account of ResPs, which tackles the

selectional restrictions of (anti-)rogatives is that of Theiler et al. (2016). Their story for rogatives is similar, though not identical, to that of Uegaki (2016). For Theiler et al., rogative verbs like *wonder*, by virtue of their lexical semantics, cannot embed declaratives: they require the subject's information state to not resolve the issue raised by their complement, and the subject desiring to enter a state in which the issue is resolved. This yields a contradiction when applied to the meaning of a declarative clause. Lexical semantics are also leveraged to account for the rogativity of *depend on* and *ask*. The specifics of the account are less important here than is the general approach: the *lexical meanings* of rogative verbs are responsible for their selectional restrictions, rather than a general fact about the semantic type of complements they select.

For anti-rogatives, Theiler et al. present a more unified story, though still very much in the same spirit. They argue that inability of anti-rogatives to take interrogative complements can be derived from their neg-raising properties. Based on the assumption that neg-raising predicates are packaged with an excluded middle presupposition: a sentence like *x believes p* has a presupposition that *x believes p* or *x believes ¬p*. So a sentence like *x does not believe p* then entails that *x believes ¬p*. A negated *p* in their system is the set of all propositions inconsistent with every member of *p*. If *p* is interrogative, *¬p* is empty, because *p* forms a partition over all worlds à la Groenendijk & Stokhof (1984). So when *p* is interrogative, the presupposition of a verb like *believe* is satisfied only when *x believes p*—the only possible way to satisfy the disjunctive excluded middle presupposition—which is identical to the at-issue content of *believe*. In other words, with an interrogative complement, when *believe* is defined, it is true. This trivial meaning is taken to be the source of its ungrammaticality. And while the neg-raising story is also not fully generalizable for anti-rogative verbs (for instance, *be certain* is anti-rogative but not neg-raising), the burden of selectional restriction

comes not from a different denotation for different clause types, but rather independent properties of the verb itself.

A closer comparison between the Inquisitive semantics for ResP complements and reductive approaches is necessary, although I believe the analysis presented in this paper to be compatible both with a question-embedding semantics for ResPs and the more radical Inquisitive view, without requiring the adoption of the much more generalized Inquisitive Semantics framework. The predictions generated for each hypothesis differ in the domain of (anti-)rogative verbs, but as ResPs are the main focus here, I leave that question to future work.

2.5 Summary of possible accounts

In total, there are three primary live possibilities for the semantics of responsive predicates: they could be proposition-embedding, question-embedding, or that distinction could be eliminated altogether.¹

Because the behavior of ResPs is not as uniform as is typically assumed, it would behoove us to take a closer look at the lexical semantics of ResPs. This approach is particularly fruitful in light of the observation that the meanings of clausal-embedding verbs are tightly linked to the syntactic frames in which they appear (White et al. 2014, Anand & Hacquard 2014, White & Rawlins to appear, *inter alia*). The lion's share of the investigation of ResP properties in the literature has concerned English, so it is

¹One hidden assumption in both of these views is that it is taken for granted that all ResPs uniformly select arguments of the same type. This seems like a logical conclusion, given that selection is semantic rather than syntactic, and predicates with the same selectional properties tend to share many semantic similarities. However, the true picture is more nuanced. ResPs do not behave uniformly in many respects. For instance, a predicate like *doubt* may embed *whether*-interrogatives but is quite deprecated with constituent interrogatives for many speakers, whereas *know* is free to embed either:

- (18) a. Hortense {doubts/knows} {that/whether} Millie will win the bake sale.
b. Hortense {??doubts/knows} who will win the bake sale.

natural to ask whether the typology of clausal-embedding predicates outlined above is robustly attested across languages.

3 Classes of Estonian ResPs

Understanding the theoretical landscape of the treatment of ResP complements, let us now turn to the Estonian data and how it fits into the larger picture. We have two primary desiderata for an account of all ResPs that require explanation for contemplative and emotive doxastic ResPs: 1) Unified lexical entries for each verb, 2) Proper treatments of their complements such that there is no type mismatching. In this section, we will attempt to do just that—and even if we fall a bit short, understand where those shortcomings are and how to rectify them.

The data in this paper come primarily from independent fieldwork conducted with Estonian speakers in Washington, DC, and Tallinn and Haapsalu, Estonia. Certain examples are modified from Google searches or the eTenTen web corpus, compiled by Lexical Computing Ltd. in 2013, though all example sentences are vetted by native speakers of Estonian.

3.1 Doxastic factives

The doxastic factive ResPs, whose meaning encodes belief and a presupposition of factivity, are among the most-studied for languages like English. A long-standing observation which dates back to at least Hintikka (1962) is that verbs which encode belief tend to be proposition-embedding, like *think*. This is also true in the ResP domain in Estonian: *teadma* ‘know’ indicates belief in an embedded proposition in the declarative complement cases. And just as Spector & Egré (2015) note for English, *teadma* indicates that same doxastic relationship between an attitude holder and a particular answer

to an embedded question in the interrogative case. More concretely, for an embedded question q , *teadma q* entails *teadma p* for some p that comprises a complete answer to q .

- (19) a. Ma tean, et sajab vihma.
 I know that falls rain
 'I know that it's raining.'
- b. Ma tean, kas sajab vihma.
 I know Q falls rain
 'I know that it's raining.'
- $\exists p[p \in \{\text{'It's raining'}, \neg\text{'It's raining'}\}]$ and **know**(I, p)]
- c. Eestlased teavad, mis kohv on Ladina-Ameerikast.
 Estonians know what coffee is Latin-America.ELA
 'Estonians know which coffee is Latin American.'
- $\exists p[p = \text{'x coffee is Latin American'}]$ and **know**/(Estonians, p))]

ResPs of this sort are *prima facie* identical to their English counterparts like *know*, which similarly entail attitudinal relationships between agents and propositions when they appear with embedded questions. The additional empirical coverage afforded by the study of these verbs, therefore, is relatively minimal, aside from surface-level validation of cross-linguistic generalizations about responsive predicates.

As a point of comparison, I will quickly revisit the properties of *teadma* (and, by extension, communicative verbs, among others). Much like the emotive doxastics, *teadma p* presupposes p , as *teadma* is factive. We can see this in cases where there is matrix negation, but the complement of *teadma* is nonetheless still presupposed. Since presuppositions project through negation, we predict an embedded declarative under a negated *teadma* to yield infelicity if followed up with an assertion that contradicts that embedded declarative. This prediction is borne out:

- (20) Nad ei tea, et täna on esmaspäev (#sest täna on teisipäev).
 they NEG know.NEG that today is Monday (#because today is Tuesday)
 ‘They don’t know that today is Monday (#because today is Tuesday).

3.2 Speech acts

Speech act ResPs specify events of contentful utterances, like *üttelema* ‘say’ and *rääkima* ‘tell’. They share many superficial similarities to the doxastic factives; a great many speech act verbs are ResPs, and moreover, they exhibit similar behavior with embedded questions, in which the attitude holder is taken to have a particular attitudinal relationship with an answer to the embedded question. Thus, the first sentence of (21), in which the speech act ResP *teatama* ‘announce’ embeds an interrogative, indicates that the true answer to the question the embedded interrogative specified was part of the speech act content.

- (21) USA meedia teatas, kes olid kaks esimest Dallases hukkunud
 American media announced who were two first Dallas.INESS deceased
 politseinikku. #Aga ei teadnud, kes olid politseinikku.
 police.officers but NEG knew who were police.officers
 ‘American media announced who the first two police officers killed in Dallas
 were. #But they didn’t know who the police officers were.’

Unlike the doxastic factives, however, there is no factive presupposition associated with the speech act ResPs, so a sentence like (22) is deemed to be perfectly felicitous:

- (22) Nad ei ütle, et täna on esmaspäev, sest täna on teisipäev.
 they NEG say.NEG that today is Monday because today is Tuesday
 ‘They don’t say that today is Monday, because today is Tuesday.’

Again, the patterns observed with *üttelema* and its complements appear quite similar to English speech act verbs like *say*.

3.3 Contemplatives

As alluded in §1, contemplative verbs like *mõtlema* pose a semantic challenge for reasons beyond the thorny compositional issues bundled with responsiveness; they also have two distinct, seemingly contradictory interpretations, depending on the type of their complement. It should also be noted that such predicates exist in closely related Finnish, at the least, among them *mieltiä* ‘think, ponder’, exemplified in (23):

- (23) a. Mietin, olisiko nyt hyvä hetki myydä.
think.1SG would.be-Q now good moment sell.INF
‘I wonder whether now would be a good time to sell.’
- b. Mietin, että nyt voisi olla hyvä hetki myydä.
think.1SG that now might be.INF good moment sell.INF
‘I think that now might be a good time to sell.’²

Furthermore, unlike the doxastic factive and speech act ResPs, contemplatives seem to fit the generalization of Spector & Egré (2015), that the meaning *ResP Q* is essentially *ResP P* for some P that is an answer to Q. However, as we will see, this generalization does not of all responsive predicates in Estonian, which raises some doubt about the validity of the conclusions derived from it.

3.3.1 With declarative complements

The existence of predicates that can indicate belief or ignorance dependent upon merely the type of complement they embed should exist may seem surprising. Although *mõtlema* can be used to indicate belief in an embedded proposition, there exists also a suite of anti-rogative predicates such as *arvama* ‘think’, *pakuma* ‘guess’, and *uskuma* ‘believe’ which may also indicate belief in embedded propositions. How does a verb like *mõtlema* differ from a verb like *arvama* such that the former is responsive and the

²Thank you to an anonymous reviewer for these examples.

latter is not? In order to do our due diligence in developing a semantics for *mõtlema* it would behoove us to make explicit comparison between it and the verbs that are superficially synonymous, like *arvama*.

As it turns out, both *mõtlema* and anti-rogative belief verbs can be used to indicate an individual's belief in an embedded declarative:

- (24) Inimesed {mõtlevad/arvavad/usuvad}, et olla tugev tähendab mitte
 people think/think/believe that be.INF strong means NEG
 kunagi tunda valu.
 never feel.INF pain
 'People think that being strong means never feeling pain.'

There is also no factive entailment associated with *mõtlema* (cf. English *know*: a speaker may use *mõtlema* to describe a third party's beliefs they think to be false.

- (25) Aarne mõtleb, et Helsingi on Rootsis. Ta on nii loll!
 Aarne thinks that Helsinki is Sweden.INESS he is so dumb
 'Aarne thinks that Helsinki is in Sweden. He's so dumb!'

Another class of ResPs, including verbs of pontification like *mõtlema* 'think', *mõtisklema* 'consider', *vaatlema* 'observe,' and *meelisklema* 'muse,' display different semantic patterns. On one hand, they are like the *teadma* class of ResPs: the core component of their meaning when combined with a declarative complement is one of representational belief. However, when these predicates embed interrogatives, they indicate ignorance on the part of the listener with respect to the true answer to the embedded question:

- (26) a. Ma mõtlen, et sajab vihma.
 I think that falls rain
 'I think that it's raining.'
- b. Ma mõtlen, kas sajab vihma.
 I think Q falls rain
 'I wonder whether it's raining.'

$\rightarrow \exists p[p \in \{\text{'It's raining'}, \neg\text{'It's raining'}\}]$ and **think**(I, p)]

That *mõtlema* can be used in situations in which the attitude holder does not hold any commitment to a particular proposition, as (26b) suggests that it does not, in fact, entail commitment at all, in the same way that *teadma* does. We see other cases in which *mõtlema* appears allergic to commitment. For instance, while *arvama* can be used to embed predicates of personal taste, *mõtlema* is infelicitous in the same context:

- (27) Mu õde {arvab/#mõtleb}, et šokolaad on maitsev.
 my sister thinks that chocolate is delicious
 'My sister thinks that chocolate is delicious.'

When a predicate of personal taste is embedded under a belief verb, the understood interpretation is that the 'judge' against whom the truth of the embedded predicate (following Stephenson (2007)) is evaluated is the attitude holder. In the intended interpretation of (27), the speaker's sister is the one who judges chocolate to be delicious. There is a felicitous use of *mõtlema* here, under the somewhat anomalous reading where the speaker's sister is asserting chocolate to be delicious as an objective truth, rather than merely her opinion, which is a bizarre assertion to make under ordinary circumstances.

The truth of a predicate of personal taste is, implicitly or explicitly, evaluated relative to a 'judge,' such as the speaker's sister in (27). Because of the egocentric nature of having opinions, this judge is the highest epistemic authority on the truth of such a proposition: no one can know better than themselves what their opinion of something is. To put it more informally, one must be committed wholesale to their opinion to felicitously utter *I think taste pred p*. If we say that *mõtlema p* does not entail commitment to *p*, or at least indicates less commitment than *arvama*, (27) seems logical; the maximal degree of commitment of the attitude holder to the truth of the taste predicate cannot be expressed by *mõtlema*.

As it turns out, the non-committal use of *mōtlema* is more widespread than just taste predicates. Simons (2007) points out that verbs like *think* can be used as not-at-issue matrix verbs in cases where speakers wish to distance themselves from commitment to an embedded *p* or indicate the weakness of their evidence for *p*. Should this be true, *mōtlema* is predicted to be preferred to *arvama* in cases where speakers intend to hedge. This is borne out in (28).

(28) *Context: My coworker asks where Mary is. I heard a rumor that she was on vacation in Boston, but I don't really know her well enough to be really sure.*

Ma {mōtlen/?arvan}, et Mary on Bostonis.
 I think that Mary is Boston.INESS
 'I think that Mary is in Boston.'

If a speaker uses *arvama* in (28), they indicate they have good evidence for knowing Mary's whereabouts, rather than hearsay or conjecture which might negatively impact their confidence in the assertion. When compared side by side in the same context, *arvama* is always judged to indicate that the attitude holder has greater commitment towards an embedded proposition than does *mōtlema*.

Surprisingly, *mōtlema* need not indicate commitment at all. Recall the vanilla *mōtlema p* case, where *mōtlema* means something along the lines of *think*: it indicates that the embedded proposition is compatible with the attitude holder's doxastic state in the world of evaluation. But this isn't quite right. A speaker can, for instance, assert *mōtlema p* even if they know *p* to be false, in situations where they are imagining *p* or entertaining it as true for some rhetorical purpose. With *arvama*, this is judged to be contradictory:

(29) *Context: I am discussing with my friend what life would be like if an asteroid*

had not collided with the earth at the end of the late Cretaceous period.

Ma {mõtlen/#arvan}, et dinosaurused on ikka elus, kuigi ma tean, et
 I think that dinosaurs are still alive although I know that
 ei ole.
 NEG be.NEG
 ‘I’m thinking about dinosaurs still being alive, even though I know that they
 aren’t.’

(29) makes one point clear: $m\tilde{o}t\text{lema } p$ does not entail commitment to p . But the default interpretation for $m\tilde{o}t\text{lema } p$ still seems to strongly implicate that the attitude holder at least tentatively holds the belief that p . But if this is not something that is a *sine qua non* of the denotation of $m\tilde{o}t\text{lema}$, then from where does the belief interpretation arise? Is it an implicature? The preferred interpretation of $x m\tilde{o}t\text{lema } p$ where x is the subject seems to relate in principled ways to the speaker’s doxastic state. In cases where p is believed by x , $m\tilde{o}t\text{lema}$ is taken to indicate belief. If p is compatible with but not entailed by x ’s beliefs, x is merely considering the possibility of p . And if p is incompatible with x ’s beliefs, then $m\tilde{o}t\text{lema}$ indicates that x is pontificating on a p -situation. This pattern is schematized in the table in Table 3.1.

	$DOX_x^w \subseteq p$	$DOX_x^w \cap p \neq \emptyset$	$DOX_x^w \cap p = \emptyset$
$x m\tilde{o}t\text{lema } p$	‘x thinks p’	‘x thinks about the possibility p’	‘x imagines p’

Table 3.1: Interpretations of $m\tilde{o}t\text{lema}$ with embedded declarative

3.3.2 With interrogative complements

The commitment question can also, in part, be explored by asking a similar but distinct question: where does the ignorance component of $m\tilde{o}t\text{lema } q$ come from? Recall that a sentence like (30) indicates ignorance on behalf of the attitude holder to the true answer to the embedded question:

- (30) Ma mõtlen, kes ukse taga on.
I think.1SG who door.GEN behind is
'I wonder who is at the door.'
- (31) Mõtisklen, et kuidas teie ärimudel skaleeruvale startupile
contemplate that how your business.model scalable.ALL startup.ALL
vastab?
satisfies.3SG
'I'm wondering how your business model succeeds as a scalable startup.'

Again, however, we should ask whether this ignorance is part and parcel with *mõtlemas* (i.e. entailed or presupposed by it), or if the inference is more pragmatic in nature.

Indeed, we also find that the ignorance inference is again cancelable in the proper context. While (32) is quite bizarre to utter out of the blue, it is nevertheless felicitous in a situation where the speaker makes abundantly clear that Liis is weighing rain-worlds against hypothetical non-rain-worlds:

- (32) Liis mõtleb, kas sajab vihma, kuigi ta teab, et sajab.
Liis thinks Q falls rain although she knows that falls
'Liis is thinking about whether it's raining (and what it might be like in situations where it is or isn't), even though she knows that it is.'

Contrived though (32) may be, it nonetheless demonstrates that ignorance is not entailed by use of *mõtlemas* with an embedded interrogative. However, the contextual gymnastics that must be applied in order to license an utterance like (32) indicate that the ignorance implicature is strongly associated with a *mõtlemas*-utterance.

The use of *mõtlemas* here can be thought of as idle pondering (the 'musing questions' of (Northrup 2014)), which can be done even if the matter is settled in the actual world. The attitude holder instead situates herself in a world in which the question is not settled, one in which she can consider the merits and characteristics of the various outcomes. Such 'imagination' cases obviously don't entail anything one way or the

other about how the speaker feels about the question in the actual world. Again, just as with declarative complements, *mõtlema q* seems to variably implicate ignorance depending on the relationship between the doxastic state of the attitude holder and the potential answers to the embedded question. These are summarized in Table 3.2:

	$\exists p_n \in q[DOX_x^w \subseteq p_n]$	$\nexists p_n \in q[DOX_x^w \subseteq p_n]$
x <i>mõtlema q</i> ($q = \{p_1, p_2, \dots\}$)	‘x thinks about Q’	‘x wonders Q’

Table 3.2: Interpretations of *mõtlema* with embedded interrogatives

For completeness’s sake, it should also be noted that declarative and interrogative clauses can be felicitously conjoined under a single matrix-level use of *mõtlema*. In such cases, the approximate meaning of the sentence is *mõtlema p and mõtlema q*, where the ‘think’ and ‘wonder’ meanings are both compatible, which is at least suggestive that *mõtlema* is a single lexical item:

- (33) *Context: Your computer won’t turn on. You think the problem is the hard drive, but you aren’t completely sure so you take it to a computer repair shop. You also don’t know if your computer is beyond the point of saving. Later, you tell your friend:*

Ma mõtlen, et mu kõvaketas on katki ja kas nad saavad selle
 I think.1SG that my hard.disk is broken and Q they can.3PL it.GEN
 korda.
 fix.INF
 ‘I think that my HDD is broken and I wonder if they can fix it.’

In sum: *mõtlema* entails neither ignorance nor commitment towards embedded questions/propositions, but can implicate one or the other depending on the context and the relationship between the complement and the attitude holder’s doxastic state.

3.3.3 With other complements

A final potentially relevant point of contention about *mõtlema*'s embedding behavior concerns non-clausal complements. Allative case-marked NPs are grammatical complements of *mõtlema*:

- (34) Ta mõtles Suurele Vennale.
he thought big.ALL brother.ALL
'He thought about Big Brother.'

The existence of such complements of attitude verbs that denote a broad, abstract notion of 'content' is nothing new (Rawlins 2013). The data here are orthogonal to the primary point of this paper, and will not be discussed in further detail—however, the question of why many ResPs seem to permit PP or DP complements is itself worthy of investigation.

3.4 Emotive doxastics

The descriptive facts about emotive doxastics with declarative complements are largely the same as English. Like *know* and *teadma*, this class of predicates is universally factive with a declarative complement in Estonian. More succinctly, these predicates tend to be *know* plus some sort of emotive attitudinal component. Anand & Hacquard (2013) treat emotive doxastics like *hope* and *fear*, which have both (dis)preference and belief components, as having a hybrid semantics reflecting both of these facts. While verbs like *imestama* 'be surprised/amazed' and *ahistama* 'agonize' do have both emotive and belief sides, they lack the inherent future-orientedness of *hope* and *fear* in a way that suggests they need not appeal to some kind of preferential ordering source as Anand & Hacquard do.

The precise generalization to be made about emotive doxastics with interrogative

complements is considerably more difficult to come up with. We must ask ourselves what exactly it means, conceptually, to be ‘excited’ or ‘surprised’ about a question. Is it the investigation, the resolution of the question, or the possibility of a particular answer to that question being true what precisely excites or surprises the attitude holder? Consider this use of *põnevil olema* ‘be excited’:

(35) *Context: I was returning to my village for the first time in many years, and my family, who I really want to see, might be there.*

Olin põnevil, kas nad on ikka kõik kodus.
was.1SG excited Q they are still all home.INESS
‘I was excited about whether they were still at home.’

In (35), the embedded question is polar, and thus has two alternatives in its denotation. Clearly, the speaker prefers one outcome over the other, namely, the one in which his family is at home. In fact, the other outcome is likely to be a source of disappointment. So it would not be fair in this case to say that it is merely resolving the question that is exciting, but rather that a particular possible resolution is still live. Contrast (35) with (36):

(36) *Context: The presidential election, which lasted a long time, has finished. I didn’t like any of the candidates so I didn’t really care who won, but I’m excited that the election is over in any case.*

Ma olen põnevil, kes valimised võitis, sest kampaania on lõpuks läbi.
I am excited who election won because campaign is finally finished
‘I’m excited about who won the election because the campaign is finally over.’

An explicit element of the context in (36) is the speaker’s lack of (dis)preference among the possible answers to the embedded question. And though they are speaking about a

past event—an election victory—(36) may be uttered in a case where the speaker doesn't actually know who won the election, but the question is nonetheless exciting to them.

Finally, there are other cases still where the attitude holder doesn't have any particular horse in the race of how they feel about the embedded question, but find the fact that the question is being posed at all a source of their emotive behavior:

(37) *People live such unhealthy lifestyles these days...*

Ja siis imestavad miks haiged.
and then marvel.3PL why sick.PL
'And then they wonder why they're sick.'

Here, the speaker sarcastically indicates that people who don't take care of themselves are surprised at why they are sick, because they are ignorant of how their lifestyle choices are leading them to become ill. Again, like *mõtlemata q*, emotive doxastics seem to implicate—at least in many cases—ignorance toward the answer to the embedded question.

3.5 Summing up

In total, we have a four-way classification of ResPs in Estonian which cleave across three semanto-pragmatic categories. On one hand, we have *mõtlemata* and emotive doxastics, which tend to implicate ignorance with embedded interrogatives; and on the other, we have factive belief verbs like *teadma* and speech act verbs like *ütlemata*, which with embedded questions entail an attitudinal relationship between the subject and a specific answer to that question (and indeed, often if not always the true answer, as noted by Egré (2008) and Spector & Egré (2015)). A crucial observation: both factive and nonfactive predicates exist in both categories of question-embedding behavior,

which is also a necessary ingredient for a fully satisfactory denotation for Estonian ResPs.

	<i>Mõtlema</i>	<i>Imestama</i>	<i>Teadma</i>	<i>Ütlema</i>
Factive	✗	✓	✓	✗
<i>ResP Q</i> entails <i>ResP P</i> for some $P \in Q$	✗	✗	✓	✓
<i>ResP Q</i> implicates ignorance	✓	?	✗	✗

Table 3.3: Properties of Estonian ResP classes

4 A semantic analysis of Estonian ResPs

In this section, I will provide semantic denotations for the various categories of ResPs in Estonian that attempt to capture the facts outlined in §3. The crucial claim I will make is that only an interrogative denotation (i.e., a set of propositions) for contemplative complements can account for the full range of data, and such a denotation may be preferred for Estonian ResPs wholesale.

The last two lines of the previous table are of particular importance for motivating an analysis: we want the appropriate entailments with embedded interrogatives to fall out of the semantics of *teadma* and *üttelema* and not for the other predicates. Impressionistically, the lack of necessary commitment to p in *mõtlema p* sentences indicates that we may not want the semantics of *mõtlema*'s complements to be propositional. With *teadma q*, on the other hand, there is a sense in which the extension of the question complement is a proposition.

Recall that the two major camps for the denotation of ResP complements are propositions and questions (sets of propositions). There are merits to both approaches—the former certainly has some intuitive appeal based on the apparent ‘proposition-like’ meaning of many embedded questions, but relies heavily on ad-hoc stipulations for

why pure-declarative embedders like *think* are barred from appearing with embedded questions. As alluded above, the same problem exists for Uegaki’s (2016) attempt to reduce ResP complements to questions. His semantics for pure rogative predicates (those which may only take question complements like *wonder* and *ask*) treats ignorance on behalf of the attitude holder as presuppositional. While this may work for *wonder*, the frequently-used speech act uses of verbs like *ask* certainly do not **presuppose** subject ignorance. (One can surely ask a question that she knows the answer to.) The intuitive appeal of ignorance being presuppositional for those cases is clear, but unless we want to posit polysemy, we know *mõtlemä* does not presuppose ignorance of any sort because of its plain *think*-like uses.

The specifics of each proposal aside, Estonian appears to cause problems for both them. Verbs like *teadma* entail commitment to an embedded proposition, whereas *mõtlemä* does not—the latter seems particularly unpalatable for an embedded proposition account, because the denotation of *mõtlemä* cannot simply assume the subject’s doxastic state to be a subset of an embedded proposition (as belief in the proposition in w_0 is not actually part of what it means to *mõtlemä*). In the coming sections, I will demonstrate that the entailment behaviors for both classes of predicates can be straightforwardly derived if *teadma/ütlemä* embed propositions, and *mõtlemä/imestama* embed questions. This proposal does leave some questions unanswered, but does offer empirical coverage that existing accounts do not get, as well as more satisfactorily capturing the intuitions about the meanings of sentences containing ResPs.

4.1 Contemplatives

Attitude verbs specify relationships between attitude holders and propositions in a variety of different ways. For instance, some verbs, make reference to an individual’s

beliefs, such as the many attitude verbs which relate propositions to the doxastic states of individuals like *think* and *believe* (Hintikka 1962, Kratzer 2006, Anand & Hacquard 2013, 2014, *inter alia*).

Estonian speakers report informally that *mõtlema* describes the mental process of thinking, rather than indirectly indicating one's beliefs. This is a difficult intuition to characterize. A contemplator can think 'about' something that she does not believe, such as counterfactual possibilities in the abstract, but nonetheless she still has a cognitive relationship of some kind with those possibilities that is distinct from more familiar cognitive processes like belief or desire. One way to model this is by formally introducing the notion of *contemplation* which encapsulates these intuitions. Rather than linking a proposition to a doxastic state, contemplative verbs specify that there is some set of propositions under *contemplation* by the speaker. More specifically, these propositions constitute a set of alternatives, which characterize different ways the world could be with respect to a particular question under discussion (Roberts 1996). They may or may not actually believe one of these alternatives, but there is a higher-order cognitive process taking place than merely situating a particular proposition in their doxastic state. Because there is no *entailment* of belief with a verb like *mõtlema* unlike interrogative belief verbs like *arvama* and *uskuma* or other ResPs like *teadma*, a doxastic semantics for *mõtlema* is descriptively insufficient.

4.1.1 Contemplation states

Instead of articulating beliefs, the *mõtlema* attitude holder merely holds a particular set of alternatives as being 'on the table'—that is to say, worthy of consideration, regardless of whether these alternatives are epistemically available to them in the actual world. But what sort of formal object is a 'contemplation state'? It must be distinct from an individual's doxastic state, since it does not entail belief, and it must make reference to

sets of alternatives. The model I will be adopting is given in (38), with the caveat that nothing crucial hinges on this particular implementation of the idea.

- (38) A **contemplation state** of an individual x CONTEM_x^w is the set of pairs of sets of worlds and issues $\{\langle Q_1, W_1 \rangle, \langle Q_2, W_2 \rangle, \dots, \langle Q_n, W_n \rangle\}$ such that for all $\langle Q_m, W_m \rangle$, Q_m is a partition of W_m and Q_m is under consideration by x in w .

In prose, a contemplation state consists of pairs of sets of worlds of evaluation W and ways of carving up that set of worlds Q , much like the partition semantics for questions of (Groenendijk & Stokhof 1984). The precise W may vary: a potential default W might be the set of world's compatible with x 's beliefs, since frequently people are tasked with situating themselves in (and uncovering truths about) the actual world modeled by their beliefs. There are, of course, many possible partitions over the same domain of worlds; multiple questions may in principle be in an agent's contemplation state simultaneously.

As for why we should complicate the picture with multiple possible W 's, as opposed to merely partitioning over the same W with every question under consideration, take the following example, where conjoined questions embedded under *contemplate* may be interpreted dynamically. Let's say that I am planning on hosting a dinner for a professor, where I will cook a meal for my invited guest. When I'm trying to decide on the specifics of the event, I might utter a sentence like (39):

- (39) I am contemplating which professor is coming to dinner and what I will cook.

There are two questions under consideration when I utter (39): which professor is coming to dinner (call this Q_1) and what I will cook (Q_2). It is natural to think of a situation in which the answer to the latter might be dependent on the former. if the answer to one question is contingent upon the other. Assume for the sake of simplicity that the con-

textually restricted domain of possible dinner guests contains two individuals, Cuthbert and Minerva. The Hamblin denotation of Q_1 is then a set of two propositions, given in (40):

$$(40) \quad \llbracket Q_1 \rrbracket = \{\text{Cuthbert comes to dinner, Minerva comes to dinner}\}$$

Also for the sake of simplicity, assume that I can only cook one of three meals: eggplant parmesan, steak tartare and lutefisk. Now, Cuthbert is a voracious eater, and will devour anything placed in front of him. Minerva, on the other hand, is rather picky. While she has a great affinity for the carnal satisfaction of eating raw meat or foods soaked in lye, she cannot stand to be in the same room as anything with even a hint of eggplant. Therefore, if Minerva is my guest, I would be quite inhospitable to prepare the eggplant parmesan, and can only make steak tartare or lutefisk. However, if I invite Cuthbert instead, I'm free to cook any meal and still please my guest.

In this way, my contemplation of Q_2 is actually conditional upon the answer to Q_1 ; I have a greater number of possible meals to think about if my guest is Cuthbert. There are then, two versions of Q_2 under contemplation: Q_{2C} , the question of what I cook given that Cuthbert comes, and Q_{2M} , the analogous version of Q_2 for the Minerva case.

$$(41) \quad \llbracket Q_{2C} \rrbracket = \{\text{I cook steak tartare, I cook lutefisk, I cook eggplant parmesan}\}$$

$$(42) \quad \llbracket Q_{2M} \rrbracket = \{\text{I cook steak tartare, I cook lutefisk}\}$$

Despite the conditional relationship between the questions, an utterer of (39) nonetheless explicitly indicates that the totality of the situation is under contemplation. Let W_{CUTH} be the set of worlds where Cuthbert comes, and W_{MIN} the set of worlds in which Minerva comes. The sum total of the speaker's contemplation state is then the follow-

ing:

$$(43) \quad \text{CONTEM} = \{ \langle \{ \{ \text{C comes, M comes} \}, \text{W} \rangle, \langle \{ \text{cook EP, cook ST, cook L} \}, \text{W}_{\text{CUTH}} \rangle, \langle \{ \text{cook ST, cook L} \}, \text{W}_{\text{MIN}} \rangle \}$$

Let's say there are 9 worlds in W , the set of worlds compatible with the speaker's beliefs. I invite Cuthbert in worlds w_1 - w_5 , and Minerva in worlds w_6 - w_9 . I cook eggplant parmesan in worlds w_1 and w_2 , lutefisk in worlds w_3 , w_6 , and w_9 , and steak tartare otherwise. Only Cuthbert-worlds are candidates for evaluation of Q_{2C} , and similarly for Minerva-worlds and Q_{2M} , so each of those questions partitions a different subset of W .

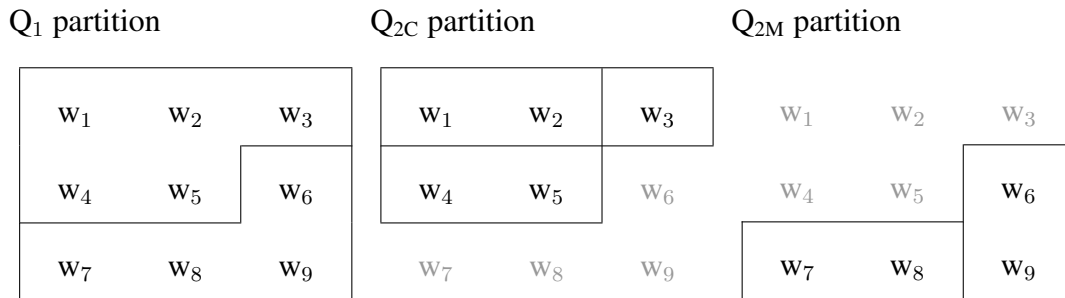


Figure 4.1: Possible partitions of W in the dinner scenario

The key takeaway here is that contemplation permits speakers to consider sets of alternatives while crucially not committing themselves to believing any one of these alternatives in particular. Applying this formal concept to Estonian ResPs like *mõtlema* permits us to fully characterize their pattern of behavior.

4.1.2 Comparison with Rawlins (2013)

The idea of non-representational ways of reasoning about alternatives is not completely new. Rawlins (2013), for instance, references the related but distinct concept of abstract ‘content.’ Content, in the sense of Hacquard (2006, 2010), is a property of eventual-

ities: the content of a belief eventuality, for instance, is the intersection of all of the propositions that the relevant individual believes.

Rawlins's notion of content is slightly different. For him, content is a curried equivalence relation on worlds, which partitions \mathbb{W} into sets of worlds which satisfy this equivalence relation, intuitively partition the space of possible worlds as a set of alternatives.

Unlike Rawlins's content, the idea of contemplation introduced here is inherently cognitive and agent-oriented, like belief or desire. The primary empirical focus of Rawlins is English PPs headed by the preposition *about*, which is highly promiscuous in the sorts of complements it may appear in. The motivation of contemplation as I have defined it is a relatively small class of attitude verbs which resist analysis as proposition-embedding despite their frequent use in representational contexts.

Rawlins proposes that attitude predicates like *think* denote content-bearing properties of eventualities in the vein of Kratzer (2006) and Moulton (2009). But a reason we might wish to have a distinct notion of contemplation apart from content is precisely the fact that we see verbs like *mõtlema* and *contemplate*, which appear with declarative and interrogative complements without the crutch of a content-selecting PP head like *about*.

As for why not just assume that *mõtlema* takes content-complements, note also that whereas questions and NPs may be the complement of *about*, propositions may not. So the types of semantic object that may constitute an argument of an Estonian contemplative versus *about* may also differ in a more ontologically robust way³:

³It is also worth mentioning that NPs marked with allative case in Estonian are also permissible as complements of *mõtlema*:

- (44) Ta mõtles Suurele Vennale.
he thought big.ALL brother.ALL
'He thought about Big Brother.'

(45) *Joyce thought about (that) it was raining.

In short, Rawlins’s content and my contemplation states broadly share similarities in describing relatively vague notions of kind of largely conceptual semantic objects as partitions over sets of worlds. Contemplation is a tool of characterizing particular mental states, namely the internal consideration of a question which may or may not be resolved. Content is also a general way of describing the content of an attitude as an equivalence relation over sets of worlds. One way in which contemplation is perhaps more flexible is in the ability of different elements in the contemplation state to partition different sets of worlds with different contextual domain restrictions; it is not clear how such cases might be tackled in Rawlins’s system.

4.2 Contemplation in Estonian

In order to capture the ”contemplative” nature of a *mõtlema* utterance, I propose that contemplatives like *mõtlema* straightforwardly denote a relationship between an individual and her contemplation state, and as I will argue, this denotation captures *mõtlema*’s intuitive range of meanings combined with relatively fundamental pragmatic principles. This denotation is given in (46).

(46) $[[mõtlema]]^w = \lambda x_e. \lambda Q_{\langle st, t \rangle}. \exists W_{st} [\langle W, Q \rangle \in \text{CONTEM}_x]$

Informally speaking, the definition here of *mõtlema* states that one of the elements in x ’s contemplation state includes the issue (a set of propositions characterized by the complement of *mõtlema*) defined by the embedded clause, and the set of worlds covered

It might be tempting for this reason to throw up our hands and simply treat *mõtlema* as *think* and the allative case as *about* here—however, the allative case marking is not licensed in other complements of *mõtlema*, nor does this observation help us understand why *mõtlema* can embed declaratives but *about* cannot. But the connection certainly merits further investigation.

by that issue.

Consider the vanilla question-embedding *mõtlema* case of the unknown visitor at the door in an out-of-the-blue context, reprinted below as (47).

- (47) Ma mõtlen, kes ukse taga on.
I think.1SG who door.GEN behind is
'I wonder who is at the door.'

The embedded clause, *kes ukse taga on*, is a Hamblinian set of propositions which denote the various possibilities for who is at the door. The full denotation of (47) is given in the following, with appropriate contextual domain restriction.:

- (48) $\llbracket(47)\rrbracket = 1$ iff the speaker s has in their contemplation state CONTEM_s the pair $\langle \bigcup Q_s, Q_s \rangle$ where $Q_s = \{x_1 \text{ is at the door, } x_2 \text{ is at the door, } x_3 \text{ at the door, } \dots\}$ for the contextually salient domain of individuals $D = \{x_1, x_2, x_3, \dots\}$

In this example, the speaker is contemplating a suite of alternative possibilities in which varying individuals are at the door. She has, according to the strict semantics of the sentence, no necessary commitment to the truth of any one of those possibilities. However, (47) is still *compatible* with a situation in which the speaker has a concrete belief about the identity of her visitor, although the pragmatic effects of an utterance like (47) will be discussed in greater detail in §4.

Now, consider a case where *mõtlema* appears with a declarative complement. Because of *mõtlema*'s requirement that its complement be a question, recall that the invocation of the type-shifter ID is required. The interpretation of a *mõtlema*-p sentence is then like the following:

- (49) Ma mõtlen, et [ID [Jaan ukse taga on]].
I think.1SG that Jaan door.GEN behind is

‘I think that Jaan is at the door.’

The denotation of the complement, then, is the singleton set containing the ID-complementary proposition: {‘Jaan is at the door.’}. We then yield, straightforwardly, truth conditions for (49):

(50) $\llbracket(49)\rrbracket = 1$ iff the speaker s has in their contemplation state CONTEM_s the pair $\langle \bigcup Q_s, Q_s \rangle$ where $Q_s = \{\text{‘Jaan is at the door.’}\}$.

In this case, because Q_s is a singleton set, $\bigcup Q_s = Q_s$. The speaker then has, in their complementation state, all worlds in which Jaan is the door, and no worlds where Jaan is not at the door.

4.3 Emotive factives

Estonian emotive factive predicates share some of the crucial interpretive properties of contemplatives like *mõtlema*: they indicate belief with an embedded proposition, and indicate ignorance (or are at least compatible with ignorance) with an embedded question.

However, the emotive factives differ in other dimensions. While *mõtlema* and contemplatives do not presuppose the truth of their complements, emotive factives do. Moreover, emotive factives, as the label suggests, encode an emotive relationship between an agent and the verbal complement, such as apprehension or excitement; no such emotivity is present with a verb like *mõtlema*.

A full-fledged analysis of the emotive factive predicates is beyond the purview of this paper. However, an attempt to provide a denotation for these predicates may prove elucidating to our other central question: namely, just what the semantics of responsive predicate complements is more generally, as well as what lexical properties

of responsive predicates give rise to their responsibility in the first place.

Because of the factive nature of emotive factives, that they lexically encode belief seems highly likely, very much unlike *mõtlema*. Otherwise, it would be quite strange to utilize an emotive doxastic predicate with a first-person subject, as it would require the speaker to employ a presupposition that they themselves do not believe, which is not felicitous in a cooperative discourse. Emotive factives proliferate with first-person subjects, however, so the belief component is something we would like to account for.

We could then try to develop a semantics for these verbs that meshes with our existing account of Estonian ResPs, in having a question-like denotation for their complements. Unlike the contemplatives, though, it seems reasonable to lexically encode the doxastic and emotive components of emotive factives. A first pass at such a denotation might look like the following for *imestama* 'be amazed':

(51) First-pass denotation of *imestama*

$$[[\textit{imestama}]]^w = \lambda x. \lambda Q. \exists P \in Q [P \wedge \forall w' [DOX_x^{w'} \subseteq P \rightarrow \mathbf{amaze}(P, x)^{w'}]]$$

In prose, *imestama* takes a question (i.e., a set of sets) as its internal argument. A particular answer to the embedded question must be true in w , and for every epistemically accessible world w' compatible with the agent's doxastic state, if P is true, then the agent is amazed by P . These uses of *imestama*, where the true answer to an embedded question amazes the subject, are not uncommon:

(52) Eesti ajalugu lugedes aina imestad mis selles siis nõuka
 Estonian history reading always marvel.2SG what it.INESS then Soviet
 ajal nii keelatud oli.
 time.ALL so forbidden was
 'Reading Estonian history, you're always surprised by what was prohibited
 during the Soviet era.'

The appeal of this conjunctive analysis is twofold: one, the factive presupposition with embedded declaratives is gotten for free. *Imestama* requires a p in its complement to be true, and if the cardinality of its complement is 1, this requirement is vacuously satisfied. Thus, it is a consequence of the truth of p which allows for ignorance inferences to arise with embedded interrogatives. But whatever the true answer to an embedded interrogative may be, (51) indicates it is that answer to the embedded interrogative that (potentially) surprises the subject, even if the subject themselves is unaware of what the true answer is.

But generalizing this denotation generates some incorrect predictions for other emotive factives. recall that with embedded interrogatives, it is not always the case that the *true* answer to the embedded question is the source of the subject’s emotivity. The use of an emotive doxastic with an embedded interrogative is licit even when the attitude holder clearly prefers one outcome, though they are not certain that outcome is true:

(53) *I was going to my home village for the first time in a long time, and I wanted to see my family.*

Olin pōnevil, kas nad on ikka kōik kodus.
 was.1SG excited Q they are still all home.INESS
 ‘I was excited about whether they were still at home.’

To see why this is a problem, consider a denotation of *pōnevil olema* ‘be excited’ that is minimally different from *imestama*, differing only in the emotive content it provokes, as in (54):

(54) First-pass denotation of *pōnevil olema*

$$\llbracket p\tilde{o}nevil\ olema \rrbracket^w = \lambda x. \lambda Q. \exists P \in Q [P \wedge \forall w' [DOX_x^{w'} \subseteq P \rightarrow \mathbf{excite}(P, x)^{w'}]]$$

Assume a situation in which the true state of affairs for the speaker of (53) is one in which his family is no longer at home, having fled long ago because of war. There is nothing exciting about this prospect to him; he would find it devastating. In this situation, the only true answer to the question denoted by the embedded interrogative is, roughly, 'They are not still at home.' We would predict (53) to be false in this situation, because there is no proposition that is both true and would excite the speaker if he believed it.

On the one hand, we want to capture the factive presupposition of emotive factives with declaratives, but on the other, we do not want the true answer to an embedded question to function to necessarily be the *provocateur* of an emotive response.

A simple modification that would alleviate this worry would simply be to remove the requirement that the true answer to the question and the answer that excites the subject be the same proposition:

(55) Second-pass denotation of *põnevil olema*

$$\llbracket p\tilde{o}nevil\ olema \rrbracket^w = \lambda x. \lambda Q. \exists P_1, P_2 \in Q [P_1 \wedge \forall w' [DOX_x^{w'} \subseteq P_2 \rightarrow \mathbf{excite}(P_2, x)^{w'}]]$$

For sentences in which the complement of the emotive factive is an embedded declarative, this is functionally identical, since P_1 will always be the same as P_2 . But we've now made it possible for (53) to be true in situations where the speaker's family is not at home. Note that the first conjunct in this denotation will always be true with an embedded interrogative—again, adopting the usual assumption that a question partitions a contextually restricted domain of worlds—so *x põnevil olema Q* will be true whenever there is at least one exciting answer to the embedded question, as far as the subject is concerned.

This denotation too is too restrictive for reasons that the previous examples may

not make immediately clear. second primary bonus is understanding why a *question* might itself be exciting, amazing, or otherwise emotion-provoking: it is exciting precisely because there is a(t least one) potential answer to this question that would instigate that same emotion in an agent. Consider the election example, reprinted below, noting that the context is still one in which none of the actual election winners are particularly desirable as far as the speaker is concerned.

(56) *Context: The presidential election, which lasted a long time, has finished. I didn't like any of the candidates so I didn't really care who won, but I'm excited that the election is over in any case.*

Ma olen põnevil, kes valimised võitis, sest kampaania on lõpuks läbi.
I am excited who election won because campaign is finally finished
'I'm excited about who won the election because the campaign is finally over.'

A possible explanation that could keep (58) intact is that (56) is licit precisely because the answers to the question are still exciting from the speaker's perspective, not *qua* their semantic content but rather merely because the truth of any of the answers to the question entails the question's resolution. The speaker's desire is for the campaign to be over rather than for a particular candidate to win the race. Because her highest-ranked desire is for the campaign to be over, a desire which excites her, and any one candidate winning fulfills that desire, the existential requirement of an 'exciting' answer to the embedded question is (more than) met. This type of use is also visible with English emotive factives, which unlike their Estonian counterparts, are anti-rogative:

(57) I am excited that Cynthia won the election, (if) only because the campaign is finally over.

Thus, the second-pass denotation for *põnevil olema* appears sufficiently underspecified

to allow for both a specific answer to a question or the resolution to the question itself to be the source of the subject’s excitement.

However, there still remains one piece of the puzzle that is troublesome: embedded declaratives. While there is no compositional trouble if we assume the use of ID to turn embedded declaratives into questions, the second-pass attempt at defining *põnevil olema* generates some incorrect predictions about belief. In uttering ‘*x mõtlema p*’, a speaker asserts that ‘if *x* believed *p*, then *x* would be excited by *p*,’ while taking the truth of *p* for granted. And while this generates a belief entailment with first person subjects, it is perfectly possible for *p* to not be in the subject’s actual doxastic state; a naïve subject who would be excited by *p* would suffice to render the sentence true. Unlike *mõtlema*, emotive doxastics appear to entail commitment on behalf of their subjects with embedded declaratives.

To get around this problem, I propose that if the complement of a verb like *põnevil olema* is a singleton set containing only one proposition, that the subject believes that proposition. This solution is illustrated in the following denotation:

(58) Final denotation of *põnevil olema*

$$\llbracket \text{põnevil olema} \rrbracket^w = \lambda x. \lambda Q. \exists P_1, P_2 \in Q [P_1 \wedge \forall w' [DOX_x^{w'} \subseteq P_2 \rightarrow \text{excite}(P_2, x)^{w'}] \wedge ((\neg \exists P_3 \in Q. P_3 \neq P_1) \rightarrow DOX_x^w \subseteq P_1)]$$

While perhaps not maximally elegant, this denotation ensures that the subject believes the complement of *põnevil olema* if it is declarative.

4.4 Other ResPs

Let us now turn our attention to the more familiar ResPs like *teadma* and *üttelema*: those predicates for which *ResP Q* entails *ResP P* for some $P \in Q$. As I have discussed, there

is an intuitive appeal here to utilizing a propositional semantics for the complements of these predicates, since interrogative complements seem, in a sense, to covertly stand in for propositions with these verbs (Spector & Egré 2015). How, then, do we implement a question-embedding semantics for these predicates?

Let's begin with considering the alternative: a declarative-embedding denotation. A naive implementation of this approach for *teadma* with a declarative might be a straightforward indication of belief and presupposes the truth of its complement. Take DOX_x^w to be the set of worlds compatible with x 's beliefs in w :

(59) $\llbracket \text{teadma} \rrbracket^w = \lambda x. \lambda p. \text{DOX}_x^w \subseteq p$ if defined. A *teadma*-predicate is undefined iff p is false.

In other words, *teadma*, like *know* is simply a conjunction of the truth of the complement and that the subject believes the complement. Certain elements in this denotation can vary among different members of the class without loss of generality. DOX_x^w , for instance, could be replaced with the set of all worlds compatible with one's claims or speech acts in the denotation of a *teadma*-like speech act verb, and the factive presupposition could be omitted in the denotation of verbs like *üttelema*.

What becomes trickier, here, is picking the right way to yield a proposition from a question. To that end, I propose the use of a type-shifting operator that returns the true answer to a question argument, from Uegaki (2016):

(60) $\llbracket \text{ANSWER} \rrbracket^w = \lambda q. [\lambda p. p \wedge p \in q]$

Uegaki asserts that propositional semantics for embedded questions in ResP complements is not independently motivated (in the absence of the central argument here, that its *interpretation* is fundamentally proposition-like). However, I believe this to be an

uncharitable characterization of the approach. There are other instances in which questions and propositions appear in similar noncanonical argument positions. A proposition-to-question type-shifter is also independently motivated for at least English emotive expressions which can take superficially propositional CPs as subjects:

- (61) a. That Eustace saw Dorothy scared Mildred.
 b. Who Eustace saw scared Mildred. (=That Eustace saw some individual x scared Mildred)

The interpretation of (61b) is one in which the sentential subject *who Eustace saw* is interpreted similarly to the propositional sentential subject in (61a) is type-shifter, while conceptually necessary, needs to be refined in order to precisely capture all the facts. For instance, as alluded, Estonian ResPs need not presuppose the truth of their complements in *w*:

- (62) *Context: John is on a diet. He cheated by having donuts for breakfast today, but he lied and told Rein that he had fruit.*

John rääkis Reinule, mida ta hommikul sõi.
 John told Rein.ALL what.PART he morning.ADE ate
 ‘John told Rein what he ate for breakfast.’

If the interpretation of (62) is ‘John told Rein ANSWER what he ate for breakfast’, we incorrectly indicate that John told Rein the truth about what he ate, but (62) is nonetheless felicitous in the given context. Instead, the answer to the embedded question John was true with respect to the false proposition he was attempting to convey, rather than in the actual world.

This property of *teadma*-class ResPs, that they tend to indicate the truth of their complements, (the veridicality of Spector & Egré (2015)) is important to leverage here.

Non-ResP declarative embedders from taking interrogative complements, are, as far as I can tell, uniformly non-veridical (*arvama* ‘think’, *uskuma* ‘believe’).

The primary upshot is that there are certain ResPs which seem to lend themselves, quite naturally, to an analysis as propositional-embedding, which is at odds with the more parsimonious account of Estonian contemplatives as question-embedders.

One possibility for this asymmetry, which preserves this parsimony, is that ResPs are not a homogenous class with respect to their complement-embedding behavior. In this view, there are instead (at least) two classes of ResPs, those which embed propositions, and those which embed questions. This, however, may miss the generalizations to be made about the semantics of all ResPs more generally, and particularly that the same types of predicates seem to be ResPs in many languages. For instance, verbs with meanings like *know*—something like ‘to be certain of p and presuppose p ’ show a cross-linguistic tendency to be responsive, whereas nonfactive representational belief verbs tend to be anti-rogative (Lahiri 2002). While it seems a bit circular to say verbs with a particular type of meaning display particular semantic patterns, there is explanatory power to be derived from characterizing the precise nature of these connections.

For this reason, we might also take the totality of this evidence to indicate that *teadma*-like verbs are question-embedders after all, à la Uegaki (2016). We could then propose a denotation for *teadma* which is identical to Uegaki’s *know*:

(63) Denotation of *teadma*

$$\llbracket \text{teadma} \rrbracket^w = \lambda Q \in D_{\langle st, t \rangle} : \exists p \in Q [p(w) = 1] \lambda x. \exists p \in Q [p(w) = 1 \wedge \text{DOX}_x^w \subseteq p]$$

Note that just like the denotation given for emotive factives, Uegaki’s *know* (and subsequently, our *teadma*) existentially quantify over propositions within the set denoted

by the complement of the verb. The very idea of questions as sets of propositions provides us with a very neat way to capture the intuition of Spector & Egré, that embedded questions under *know* and *say* are interpreted in a very proposition-like way, while still permitting a unified class of 'responsive' predicates that universally select for question complements.

4.5 Semantic proposal: summary

The proposed analysis aims to capture the intuited meanings of ResPs with respect to their varying complement types. Contrary to many analyses of *teadma*-class verbs which treat their complements as semantic propositions, take propositions as arguments, I extend Uegaki's (2016) argument that all ResPs select question arguments. Nothing about this treatment is a slam-dunk refutation of propositional-reductive accounts, but such accounts would require extensive stipulation in order to account for the full range of behavior of contemplative predicates, in particular. With a question-embedding view of ResP complements in tow, we can now begin to understand the derivation of the interpretation of contemplatives with different types of complements.

5 The pragmatics of contemplatives

5.1 Interpretations of *mõtlemma* + interrogative

Recall one of the central puzzles presented in this paper: how do verbs like *mõtlemma* yield such different interpretations dependent solely upon the type of their complement? The semantics here involves an agent weighing a set of alternatives—different possible resolutions to a question—against one another. If a *mõtlemma*-sentence expresses a purely mental calculus about an agent's evaluation of alternatives: why should such a sentence

indicate anything about ‘wondering’ or ‘ignorance’?

Upon closer investigation, that *mõtlema* with an embedded interrogative canonically implicates ignorance is unsurprising given its semantics. If a person is weighing different alternative answers to a question against one another, the most natural reason for them to do so is that they are seeking the true answer to the question. While people can and do ‘muse’ about questions regularly, the precise reason for them doing so becomes much clearer in context. If a knock is heard at the door, a speaker who utters (62) can reasonably be understood to be ignorant of the true identity of the knocker. If they did in fact know who was at the door, it would be quite bizarre for them to indicate they were merely thinking about the possible alternatives, because it would not be a sufficiently informative reaction to the situation, a Quantity violation in the spirit of Grice (1975).

We can generalize this intuition: in any case where a *mõtlema P* alternative to a *mõtlema Q* utterance could have been cooperatively uttered by the speaker to further a conversational goal, the *mõtlema P* version will be more informative.

To illustrate this principle in action, let us revisit the now familiar case of (3), reprinted below as (64), with the addition of the attitude holder’s contemplation state:

(64) a. Liis mõtleb, et sajab vihma.

Liis thinks that falls rain

‘Liis thinks that it’s raining.’

$\text{CONTEM}_{\text{Liis}} = \langle \{\text{it is raining}\}, W_1 \rangle$

b. Liis mõtleb, kas sajab vihma.

Liis thinks Q falls rain

‘Liis wonders whether it’s raining.’

$\text{CONTEM}_{\text{Liis}} = \langle \{\text{it is raining, it is not raining}\}, W_2 \rangle$

In both cases, the *W*—the set of worlds under consideration—is taken by default to be the

set of worlds compatible with Liis's beliefs in the absence of evidence to the contrary. In the case of (64a), Liis is only considering worlds in which it is raining, whereas (64b) includes both rain-worlds and non-rain-worlds. Holding all of Liis's other beliefs constant, the set of worlds in Liis's contemplation state in (64b) is a superset of those in (64a).

Because (64b) allows for there to be both rain-worlds and non-rain-worlds in Liis's contemplation state—and again, these worlds are those compatible with Liis's beliefs. Because there is the additional possibility of non-rain-worlds in Liis's contemplation state with the embedded interrogative but not the embedded declarative, (64a) is a strictly more informative utterance. If only the proposition 'it is raining' is compatible with Liis's doxastic state, there is a pragmatic preference for uttering (64a) over (64b).

There are cases where *mõtlemata* *Q* does not license an ignorance inference, but these are precisely the sort of cases where the 'contemplative' nature of an agent is at-issue.

(65) *Context: Siim is reading a book about Estonian history. It got him thinking about all the reasons there were for Estonia to lose the war with Russia in the 1500s.*

Siim mõtleb, miks eesti kaotas sõja.
Siim thinks why Estonia lost war
'Siim is thinking about why Estonia lost the war.'

In the context, Siim knows full well why Estonia lost the war: for the reasons delineated in his book. Nonetheless, the topic sparked his imagination, and all of those reasons—as well as possible alternatives—are now a topic of active consideration for him. He is not ignorant as to why the war was lost, but merely a curious pontificator. While *mõtlemata*

can implicate ignorance towards an embedded question, this arises from the pragmatics of contemplation, rather than an entailment in the lexical entry for *mõtlemä*.

This is different than, for instance, Uegaki's (2016) analysis of *wonder* and anti-rogatives more generally. Uegaki takes anti-rogatives like *wonder* to presuppose ignorance. This is manifested as a requirement of these predicates that the cardinality of their complement is at least 2. Since *wonder* can only take questions as complements, this requires that the subject is 'wondering' about at least two possible alternatives. Even if the type-shifted version of an embedded interrogative is available to *wonder*, a question-version of a declarative sentence contains only one proposition. While I hesitate to make a direct comparison between *mõtlemä* and *wonder* per se, suffice to say that *mõtlemä* has no such presupposition—which may, in turn, connect to its freer range of permissible complements than *wonder*.

The existence of anti-rogatives in this account still requires explanation, however. An issue endemic to any reductive treatment of ResPs is the question of how to rule out the pure declarative- and interrogative-embedders of the lexicon from also taking clauses of the other type. If those clauses can be type-shifted, then what's to stop *think* from taking questions or *wonder* from taking propositions?

The presupposition of ignorance previously discussed for *wonder*-like anti-rogatives seems a promising route, though Uegaki's precise implementation requires some revision. As far as anti-rogative *think* and its Estonian analogues are concerned, we might consider whether such verbs necessitate a belief relationship in the same worlds of evaluation as *mõtlemä*. One possible route to pursue is that $[[think]]^w$ imposes a requirement that the belief of the attitude holder in the truth of the embedded proposition holds in w . In all cases, a careful examination of the lexical semantics of verbs with many different types of clausal-embedding behavior is in order, though I leave this as a question that will necessitate further study.

5.2 Interpretations of *mõtlemma* + declarative

A fundamental component of the analysis requires propositions and questions to be treated as complements of the same verb. Given the denotation of a contemplative verb as that of a question, it is necessary to invoke some sort of type-shifting operation for the complements that superficially appear to be declaratives. Following Uegaki (2016), I utilize the type-shifting operator ID, which takes a proposition as an argument and returns the singleton set containing that proposition. For further independent evidence motivating the existence of this sort of type-shifting operator, see Partee (1986). The denotation of ID is given in (66).

$$(66) \quad \llbracket \text{ID} \rrbracket^w = \lambda p. [\lambda q. q=p]$$

What ID allows us to do is pair *mõtlemma* with embedded declaratives without a type mismatch. If *mõtlemma* *Q* implicates ignorance, it may not be immediately obvious why *mõtlemma* *P* does not generate the same implicature. We have seen many uses of *mõtlemma* paired with a declarative complement which most naturally generates a belief interpretation. Consider the following:

- (67) Mu kass mõtleb, et pitsapoiss on mu omanik.
my cat thinks that pizza.boy is my owner
'My cat thinks that the pizza boy is my owner.'

In a typical situation, no ignorance of any sort is implicated by uttering (67): the speaker is intending to (anthropomorphically) ascribe a belief to his cat, namely the belief that the pizza boy is the speaker's owner (presumably because the pizza boy brings the speaker food, just as he does for the cat).

Why should this be the case? Note that a *mõtlemma* *P* sentence requires its complement to first be type-shifted into a set of propositions through application of ID. The

attitude holder is then taken to be contemplating a single-alternative question, which constitutes a trivial partition over the contextually relevant set of worlds.

For similar reasons to *mõtleva Q* implicating ignorance, *mõtleva P* implicates belief. If an agent only has one alternative under consideration, a natural inference is that that alternative is the most viable candidate for the actual world, as far as the agent is concerned. Were there to be multiple candidates for true resolutions to a particular question under discussion (with respect to some agent's epistemic state), it would be misleading to utter *mõtleva P*, because the $\neg P$ candidates are not mentioned. In normal circumstances, then, the speaker is taken to be asserting, indirectly, information about an agent's beliefs. In the case of (67), the speaker emphasizes that his cat is only considering the alternative where the pizza boy is the speaker's owner, rather than any other possible state of affairs.

This indirect method of belief ascription also naturally carries the implication that the purported belief in P is somehow 'weaker' than total commitment. While describing beliefs with *mõtleva* is fine, there are other belief verbs like *arvama*, *uskuma*, and *teadma* which lexically encode this belief. Because alternative ways of describing belief that *entail* that belief are available, the use of belief-implicating *mõtleva* is weaker by comparison.

The pragmatic competition among belief ascriptions may also help explain the apparent infelicity of taste predicates as complements of *mõtleva*:

- (68) Mu õde {arvab/#mõtleb}, et šokolaad on maitsev.
my sister thinks that chocolate is delicious
'My sister thinks that chocolate is delicious.'

A speaker's commitment to her belief in a taste predicate must be total, under the assumption that taste predicates require a 'judge' to be semantically evaluated (Stephen-

son 2007). Thus, if a commitment-entailing verb exists in the lexicon, ascribing a taste predicate belief to an individual should require the use of such a verb rather than a weaker, commitment-implicating verb like *mõtlema*.

6 Conclusion

This paper argued for an analysis of Estonian responsive predicates as question-taking, in large part based upon evidence from contemplative predicates that relates individuals to their contemplation states, the issues under active consideration by an individual. These predicates, alongside the Estonian emotive factives, are used to motivate an analysis of responsive predicates as question-embedding. This brought data from a lesser-studied language to bear on an age-old question. Estonian, like all but a handful of languages, has scarcely been investigated in depth with respect to the semantic properties of clausal embedding, though there are interesting patterns in Estonian that bear greater scrutiny in this domain.

Many outstanding questions remain to be answered, including how to treat non-ResP clausal embedders as mentioned in the previous section. A finer-toothed comb should be applied to examining question-embedding behavior more generally. For instance, one might ask how *mõtlema*, *teadma*, and *imestama* compare with respect to other complements which semantically or morphosyntactically resemble questions, including concealed questions, free relatives, and exclamatives, or even unrelated complements (like DPs) as well.

As in any project trying to classify predicates into categories based upon properties of their lexical semantics, detailed, attentive work on a large variety of predicates will be required. (Anand & Hacquard 2013) provide a detailed account of similarly chimerical ‘emotive doxastic’ predicates like *hope*, which encode both desire and the

requirement that their complement be epistemically available to the attitude holder (i.e., a doxastic component), and subsequently has both belief-like and desire-like subcategorization frames. This analysis, too, may prove fruitful for understanding the contemplatives, which have flavors of both belief (typically declarative-embedding) and ignorance (typically interrogative-embedding). If *mõtlema* lexically contains elements of both belief and ignorance, perhaps its responsive behavior is not so surprising after all.

A final productive conduit for future research in this domain is taken from Inquisitive Semantics (Ciardelli et al. 2013), in which declarative and interrogative clauses are identically typed; both clause types denote sets of propositions. This account is indistinguishable from a question-embedding approach to responsive predicates, but generates different predictions for the behavior of (anti-)rogatives. Future investigation of the lexical semantics of Estonian (anti-)rogatives may prove valuable in adjudicating between the two hypotheses, and better situate our understanding of the relevant lexical properties that correlate with embedding behavior.

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