UNIVERSITY OF TARTU
FACULTY OF ARTS AND HUMANITIES
INSTITUTE OF ESTONIAN AND GENERAL LINGUISTICS

Maria Matthis

Double Modals in Estonian

Master's Thesis

Petar Kehayov

TARTU
2026

Author's Affirmation

I confirm that I have written this thesis independently and have correctly cited all sources. The thesis complies with the requirements of the Institute of Estonian and General Linguistics and with good academic practice.

Maria Matthis

Abstract

This thesis investigates constructions with two modal verbs in Estonian, focusing on which combinations of modal verbs occur, their semantic interpretations, and the structural constraints governing their use.

The study is based on the Estonian National Corpus 2023. Twelve modal verbs were chosen, to examine their full combinatorial space, up to 30 examples per modal pair were collected where available. Corpus-wide frequency estimates were then approximated using a reweighting approach.

The results show a skewed distribution concentrated in a small centre and fading out to less frequent combinations. *Pidama* 'must' functions as the dominant outer modal, while *võima* 'may, can' and *tulema* 'must' are secondary. Modal verbs mainly fall into two classes of preferring the inner or outer position. Word order is flexible with all six logically possible orders attested, and greater flexibility in more frequent combinations. Semantically, the data supports a hierarchy of modal scope (dynamic < circumstantial < deontic < epistemic), with one counterexample. The semantic classification further reveals verb-specific specialization and the central role of *pidama* as a default outer modal.

Keywords: Estonian modality, double modals, corpus linguistics, semantic hierarchy, word order

Table of Contents

1 Introduction

Modality, here understood as the linguistic expression of possibility and necessity, is a central domain in linguistics. Cross-linguistically and in Estonian, modality can be expressed through a range of means, including grammatical mood, verbs, adverbs, and particles. This thesis focuses specifically on modal verbs in Estonian. The term double modal is used here to refer to constructions in which a modal verb has as its verbal complement another modal verb (whose verbal complement is a lexical verb), so a single clause with two modal verbs.

Together with the lexical verb, these elements form a structural and semantic unit. While individual modal verbs have been extensively studied, the semantic properties of such combinations have received little attention and have not been studied at all for Estonian.

The semantics of single modal verbs are relatively well understood and can be described in terms of modal force and flavour, with their interpretation shaped by context. In contrast, double modal constructions are rare, and it should not be assumed without study that their meanings arise from a simple combination of the meanings of the individual modals. Their semantic interaction therefore requires independent investigation.

The study of double modals provides insight into how modal meanings interact within a single construction and whether systematic constraints govern their combination. For example, it was assumed that certain scope relations are dispreferred or excluded, such as deontic modality scoping over epistemic modality, e.g. (Nauze 2009: 327), for which this study found one example. In addition, the distribution of combinations may shed light on the degree of grammaticalization of individual modal verbs, as more grammaticalized forms may more readily take scope over others (Lehmann 2015: 152). The analysis also considers the relative ordering of modal verbs and the lexical verb, showing that all six logically possible orders are attested in the data.

The main questions addressed in this thesis are:

- Which combinations of modal verbs occur, and how frequently?
- What semantic types of double modal constructions can be identified?
- What constraints on modal combinations are observable in the data?

Methodologically, this study is based on a corpus-derived, annotated dataset of double modal constructions in Estonian. The data are analysed quantitatively to determine the frequency and distribution of combinations, and qualitatively to develop a semantic typology of the constructions.

This thesis provides the first systematic overview of double modal constructions in Estonian and proposes a framework for their semantic classification. It contributes both an empirical account of their distribution and a qualitative analysis of their meanings, offering new insights into the interaction of modal verbs.

The structure of this thesis is as follows. Section 2 presents the relevant background and literature. Section 4 describes the data and methods. Section 5 outlines the theoretical framework. The analysis is presented in two parts: Section 7 examines the effect of the outer modal, and Section 9 the effect of the inner modal. Section 11 discusses the results, and Section 12adds the conclusion.

2 Literature Review

This work is to my knowledge the first investigating double modals (two modal verbs, not adverbs or other modal constructions) in Estonian and its focus is on the semantic structure of combinations of two or three modal verbs. The literature review is thus fourfold: The first subsection sets the terminology and discusses the semantic map of modality. The following and longest subsection examines research on Estonian modal verbs. The third subsection discusses research on double modals in English, as I am currently not aware of such research in any other language. The final subsection presents the core concepts of Kratzer's formal semantics, the distinction between modal base and ordering source. I will later apply this framework to Estonian double modal constructions.

2.1 Theory and Terminology

Following van der Auwera and Plungian (1998), we use 'modality' to denote the semantic domains involving possibility and necessity (two terms that have to be treated as primitives here).

Table 1 is adapted from (van der Auwera & Plungian 1998: 82) and shows the main modality types. There are two axes, modal force and modal flavour. The modal force is possibility or necessity and the modal flavour is the domain, that is participant-internal, participant-external, or epistemic. The boldface expressions are the ones I mainly use.

Table 1. Modality types

<table>
<tr><td colspan="4">Possibility</td></tr>
<tr><td colspan="3">Non-epistemic possibility</td><td rowspan="3">Epistemic possibility (Uncertainty)</td></tr>
<tr><td rowspan="2">Participant-internal possibility (Dynamic possibility, Capacity)</td><td colspan="2">Participant-external possibility</td></tr>
<tr><td>circumstantial, non-deontic possibility</td><td>Deontic possibility (Permission)</td></tr>
<tr><td rowspan="3">Participant-internal necessity (Need)</td><td>(Non-deontic necessity)</td><td>Deontic necessity (Obligation)</td><td rowspan="3">Epistemic necessity (Probability)</td></tr>
<tr><td colspan="2">Participant-external necessity</td></tr>
<tr><td colspan="3">Non-epistemic necessity</td></tr>
<tr><td colspan="4">Necessity</td></tr>
</table>

Let us now make a few more general remarks about modality. Modal expressions are frequently polyfunctional in a variety of ways. First, a single modal may express both possibility and necessity, that is, polyfunctionality related to modal force. Since the distinction between necessity and possibility is not always discrete, but may instead form a spectrum or cline (van

der Auwera, Ammann, & Kindt 2005: 6), some modal expressions are indeterminate between the two. An example is Danish *må*.

(1) Nu må du fortælle. 'Now you must/may tell a story.'

In sentence (1), *må* allows both a necessity and a possibility reading, and without further context neither interpretation can be excluded.

Second, modal expressions may also be polyfunctional with respect to modal flavour. A single modal can express different types of modality, for example epistemic and deontic modality. Thus, polyfunctionality is not restricted to modal force, but also concerns the semantic domain in which a modal operates. van der Auwera, Ammann, and Kindt (2005) note that such polyfunctionality between epistemic and non-epistemic (situational) modality is particularly characteristic of European languages.

Third, polyfunctionality itself may be restricted in systematic ways. In particular, restrictions may apply to positive and negative forms of a modal. For example, English *must* can express epistemic necessity, whereas epistemic uses of *must not* are at best marginal. Conversely, *cannot* can express epistemic modality, while affirmative *can* generally cannot (van der Auwera, Ammann, & Kindt 2005: 14).

A phenomenon arising from such polyfunctionality is underspecification or indeterminacy. Importantly, polyfunctionality at the level of a modal expression does not necessarily imply ambiguity in any individual utterance. In many cases, a particular modal token receives a single interpretation from its context. For example, in *Her boss told her that she must submit the report by Monday*, *must* receives a deontic interpretation, whereas in *She must be at home by now*, it is interpreted epistemically. In such cases, despite the modal's broader polyfunctionality, contextual information is sufficient to determine the intended meaning.

Indeterminacy arises when context does not resolve the interpretation and multiple readings remain available simultaneously, as in sentence (1). Polyfunctionality in itself therefore does not necessarily pose a problem for the semantic classification of modal expressions in context. Indeterminacy, however, introduces difficulty because it becomes impossible to assign a single interpretation to a given example, and even contextual information might not be enough to decide the exact meaning.

Polyfunctionality follows clear described paths as was shown in (van der Auwera & Plungian 1998). These paths show how over time the meaning of a modal can change, for example is it typical that a modal with participant-internal flavour expands its meaning to participant-external flavour and potentially later to an epistemic meaning. These meanings can co-exist within a single modal expression. However, the semantic map shown in Figure 1 — an updated version of the original map from van der Auwera and Plungian (1998) that was proposed in (van der Auwera, Kehayov, & Vittrant 2009) — predicts that co-occurring meanings should be adjacent. Thus,

we do not expect to find modals that express epistemic and participant-internal modality while lacking participant-external modality.

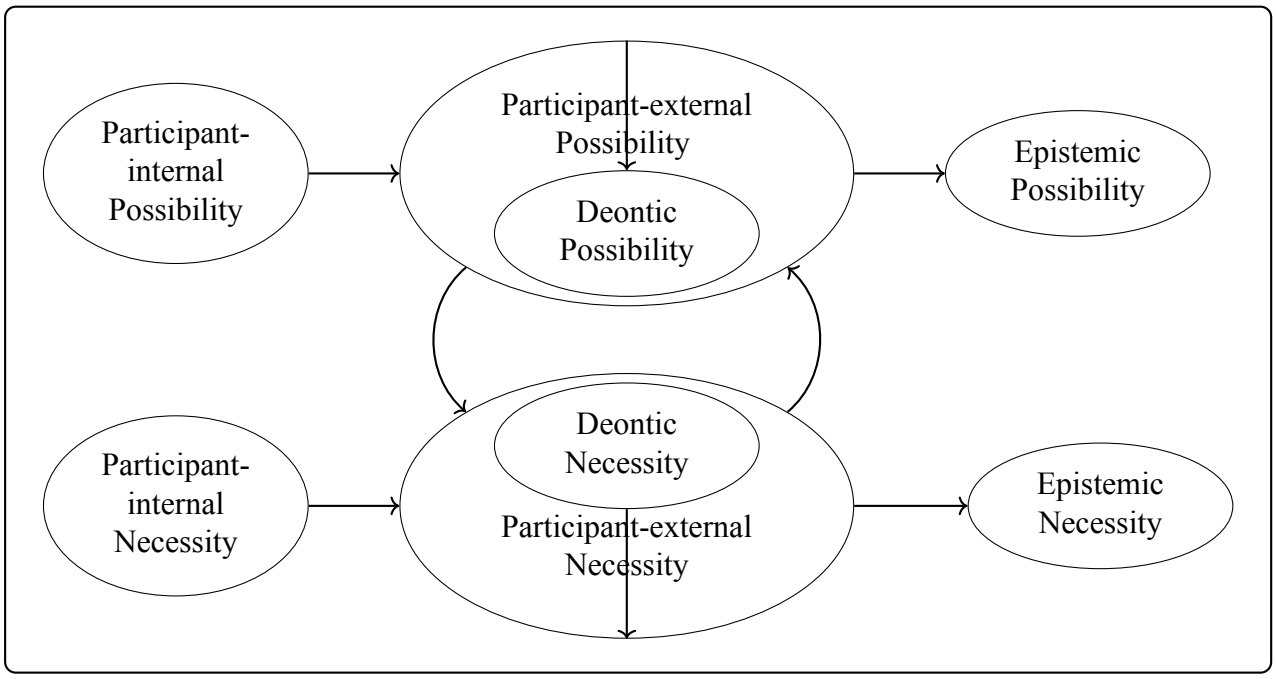


Figure 1. Modal Space

2.2 Double Modals

Double modals constitute a relatively recent topic of investigation, and the number of dedicated studies remains limited.

Kehayov (2017: 42) proposes on example-based evidence that there should be a scope hierarchy of modal and semantically adjacent categories (attitudinal and discurse-structural expressions) that has the following shape:

illocutionary > evidential > epistemic > deontic > dynamic

Or, to say it differently, we would expect epistemic operators to take scope over deontic and dynamic operator, but we would not expect to find a deontic operator scoping over an epistemic. These hierarchies predict that in combinations of two modal verbs the outer modal verb should express a meaning which is to the left (i.e., in the scope of) of the meaning of the inner modal verb.

In a similar vain, Nauze (2009: 327) proposes a hierachy including circumstantial modality:

epistemic > deontic > circumstantial

thereby placing circumstantial modality underneath deontic modality.

2.2.1 Double Modals in English

In their 2024 article, Coats and Morin examine the geographical distribution of the rare double modal construction in English, drawing on data from Twitter/X (Coats & Morin 2024). In English, modal verbs (e.g. *may/might, can/could, will/would, must, shall/should*) lack infinitival forms and are therefore "disfavored by the rules of Standard English grammar, which typically restrict clauses to a single tensed verb" (Huddleston and Pullum 2002: 107, referred through (Coats & Morin 2024: 1)). Meaning, that because English modal verbs lack an infinitive, they are disfavoured for the inner modal position with the result that the double modal construction is generally rare in English. In contrast, Estonian does not have any formal reasons for disfavouring double modals, so we can expect to see different results.

For the purposes of the present study, the following findings of Coats and Morin (2024) are particularly relevant:

- Previous survey-based and corpus-based research indicates that the most frequent double modal constructions tend to receive epistemic interpretations, although dynamic and deontic readings are also attested. At the same time, the precise meanings associated with specific combinations remain insufficiently understood, especially in the case of less frequent types. (Coats & Morin 2024: 1)

- The authors further suggest that, in Australian and New Zealand English, double modals following the schematic pattern dynamic modal (*will, would*) + epistemic modal (*can, could, might*) may represent a default configuration, meaning that almost all double modals in English follow the form *will/would* preceding *can/could/might*. (Coats & Morin 2024: 3)

The classification of *will/would* as dynamic is not unproblematic, as these forms are frequently associated with volitional or future-oriented meanings rather than participant-internal modality. Similarly, the classification of *can/could* as epistemic is questionable, they could also represent participant-internal or circumstantial modality.

2.3 Estonian Modals

In many European languages modal verbs form a closed class based on formal criteria. For example, we have seen that English modal verbs have no infinitive. German modal verbs have an infinitive form which coincides with their past participle. Now, Estonian modal verbs cannot be distinguished as a class based on formal criteria. In addition, quite a few of them (e.g. *pidama* 'keep, consider', *saama* 'get', *tulema* 'come' and *pruukima* 'be used to') have also very common non-modal meanings. The following should provide a short overview on what is known on specific modal verbs.

From (Kehayov & Torn-Leesik 2009), we know that *võima, pidama* and *saama* (with their cognates) provide the core modal stock in the Finnic languages. They are attested in all languages

and are highly polyfunctional. *Tulema* is also a central Finnic modal. *Tarvitsema* is more peripheral and has also only two functions.

Concerning dynamic possibility, Metslang et al. (2024) only list *suutma* and more marginally *võima* and *saama* for dynamic possibility. Verbs such as *oskama*, *jõudma* or *jaksama* are not included.

2.3.1 *Pidama*

Pidama encompasses both the agent-oriented (dynamic and deontic) and the epistemic domain. It also has three postmodal meanings: intentional (volitive), avertive and reportative. If *pidama* is in the conditional mood and deontic, than the obligation expressed is less strong (Erelt 2001: 10). If *pidama* is epistemic and in the conditional form, than the event is probable but not certain.

Important to the corpus search in this study is also the fact that the da-infinitive of *pidama*, may also express reportive evidentiality, as insentence (2).

(2) *Ta pidada oskama kõiki pillisid mängida.* (Jõh, vt Kask 1984:270 referred through Erelt (2001: 17))
'He is said to be able to play any musical instrument.'

As such, the combination of a modal verb and reportive pidada is for our purposes not a double modal construction.

2.3.2 *Saama*

Saama is the least grammaticalized of the three core modals *pidama, saama* and *võima* (Erelt 2003: 106f). Today *saama* expresses mostly participant-external non-deontic possibility and to a lesser degree participant-internal possibility. It is not used much (but can still be) for deontic or epistemic modality (Habicht & Tragel 2017: 23). Due to German influence was *saama* also used to express epistemic modality and future in Old Written Estonian. *Saama* can take both *-ma* and *-da* infinitive, but the *-ma* infinitive is associated with future and resultative meaning whereas the *-da* infinitive goes with the modal meanings (Habicht & Tragel 2017: 24f). We can also note that *saama* is often used in its negative form, Penjam (2008: 136) shows that *saama* is negated in 49% of its modal occurences, while other verbs with similar frequency are only negated around 20% of the time. Also, *suutma* and *tohtima* are negated 80-90%.

2.3.3 *Tulema*

Tulema expresses any non-epistemic necessity, it is often synonymous with *pidama*, but not always, because for lifeless agents it is not always possible to use *tulema*: * *Mütsil tuleb peas olema.* (Tragel 2003: 34) *Tulema* can also appear motion-cum-purpose construction by taking another infinitive.

2.3.4 *Tarvitsema*

Penjam (2011) researches the modal verb *tarvitsema* and finds that it can express all kinds of necessity (participant-internal, participant-external non-deontic, deontic, epistemic). However, for the non-epistemic uses, non-deontic participant-external modality overweighs the other uses that only occur rarely. Proportionally, 44,4% of uses were epistemic, 49,8% non-epistemic and 5,8% could not be distinguished. It is also worth pointing out that the subject was marked in 40% of the non-epistemic uses with the adessive case, but never for epistemic modality.

The study of Lindström and Vihman (2017) deals with the related modal constructions *vaja olema* and *tarvis olema*.

2.3.5 *Tahtma*

The article (Habicht, Penjam, & Tragel 2010) considers among other, also modal uses of *tahtma*. It seems that *tahtma* is in the early stage of grammaticalization into participant-internal possibility, participant-external necessity and epistemic necessity. However, I do not regard this verbs as modal, and have not included it into my study.

2.4 Formal Semantics

This is a short introduction to the standard analysis of modal verbs, based on the exposition in (Nauze 2009). I deliberately excluded all usual symbolism to make it more accessible to the reader. To engage with this topic more thoroughly, the main sources are (Kratzer 1977) and (Kratzer 1991). The analysis was originally developed on the basis of English and German modal verbs, but there is no reason to suppose it would not apply to Estonian as well.

Given a proposition, e.g.

It has to be raining.

We can define the following notions:

- the **intentional context**: These are facts relevant to the conversation, i.e. the conversational background that helps determine what counts as relevant information for interpreting the utterance. In Kratzer's framework, this can be understood as part of the *circumstances of evaluation*, together with any other salient contextual assumptions. In the case of this particular example, this might include facts such as: people come into the shop where the conversation is taking place with wet umbrellas, their coats are dripping, the pavement outside is visibly wet, and they are discussing the weather.

- the **nuclear scope** of the modal verb: in the example sentence, this is the proposition expressed by the clause embedded in the scope of the modal verb, i.e. *it is raining*.

In order to analyse the example sentence now, we

1. fix the **modal base**: this encompasses the intentional context of the utterance and any other (relevant) circumstances. The modal base is a set of propositions describing the context of the utterance, i.e. those facts that are taken to be settled for the purposes of the conversation.

The modal base lets us consider a set of possible worlds[1], namely all possible worlds in which the relevant circumstances of the utterance are the same.

In the example, this would be all possible worlds where people with wet umbrellas are entering the room, where the pavement outside is wet, and where the other contextually given facts about the situation hold.

Earlier approaches would have stopped here and evaluated the modal claim "It has to be raining" by checking whether it is raining in all of these worlds. The idea is to understand necessity and possibility as *quantifiers*: a necessity claim is true if the proposition is true in all relevant possible worlds, and a possibility claim is true if there is at least one such world in which it is true.

However, this is too strong. The modal base, as defined above, may include worlds that fit the observable evidence but differ in their underlying explanations. For instance, there are worlds in which people come in with wet umbrellas even though it is not raining outside. In such a world, the wet umbrellas are explained by alternative circumstances, for example by the presence of an umbrella-washing workshop nearby or by artificial water sprinklers outdoors.

Such worlds still satisfy the relevant contextual facts (people enter with wet umbrellas), but they differ in whether it is actually raining. As a result, if all logically possible explanations are taken into account, there will typically be at least some worlds in which it is not raining. On a purely quantificational analysis, the necessity claim "it has to be raining" would therefore come out as false, even though the inference from the available evidence to rain seems perfectly reasonable in the context.

This selection of "good" possible worlds is called the ordering.

2. the **ordering**: depending on the modal flavour (see Table 2), we will only allow the best possible worlds according to the relevant contextual ranking of worlds. This ranking reflects additional circumstantial information, such as what counts as normal, expected, or stereotypical given the situation.

Thus, base and ordering together define a context dependent set of possible worlds. In each one, the nuclear scope proposition is evaluated, and a necessity modal is true, if the proposition is true everywhere and false otherwise. The possibility modal is true if it true somewhere and false if it is true nowhere.

[1]There is no philosophical consent on what a possible world is, but intuitively we can imagine worlds like our own, inhabited by people like us that differ in details.

[3]Goal oriented modality

[3]Modality expressing desirability

Table 2. Stereotypical modal base and ordering

modal flavour	modal base	ordering
epistemic	what is known	what is normal
deontic	circumstances	rules are obeyed
circumstantial	circumstances	what is normal
dynamic	participant's inner state	what is normal
teleological[2]	circumstances	goal is achieved
bouletic[3]	circumstances	wish is fulfilled

The rain example was epistemic, but let us also consider at least one non-epistemic example because they work slightly differently:

John can swim.

The context is that the class teacher asks the parents before an excursion, and the example is the answer of John's father.

To apply the analysis, we need to fix John's inner state (what he is like mentally and developmentally etc) and look at normal possible worlds. If we can find at least one, in which 'John swims' is true, the dynamic modal claim is true.

As a last example, let us take a deontic modal.

Anna has to return the Tartu city bicycle within 1 hour[4].

The modal base encompasses facts relating to how Anna borrowed the bicycle and how she has used it so far. Thus, we evaluate "Anna returns the Tartu city bicycle within 1 hour" in possible worlds where Anna borrowed the bicycle just as she actually did. The ordering tells us that we should only consider those possible worlds where people obey the rules of use for the bicycles. So we have to imagine that everyone in Tartu follows them without exception, so nobody returns bicycles late, damages them or does anything else that is forbidden. Now surely, under these assumptions Anna returns the bicycle on time, so the sentence comes out true.

What we can see from the last example is that in the end we do not evaluate "Anna returns the bicycle on time" in our own world (because it is not so that all the rules are actually obeyed). A second observation from this example is that the circumstances under which we evaluate the proposition in the nuclear scope thus differ from actuality, so in particular if we have a double modal, the modal base of the inner modal can contain further facts that where introduced through the ordering of the outer modal.

[4]... or pay an extra euro, but for illustration, let us stick to the simpler rule.

3 On the choice of modal verbs

The selection of modal verbs in this study was guided by both theoretical relevance and empirical attestation. The verbs *pidama, võima, saama,* and *tulema* were included as core modals of Estonian, given their high degree of polyfunctionality and their established status in the literature, including their attestation across other Finnic languages. In addition, *tarvitsema* and *pruukima* were included, as they are consistently classified as modal verbs in Estonian grammars.

By contrast, *tahtma* was excluded despite its occasional modal uses: although it has been argued to be undergoing early stages of grammaticalization toward modality, it remains predominantly a verb of volition. Moreover, its modal and non-modal uses are structurally indistinguishable, as both occur with a *-da* infinitive complement, which would require extensive work of disambiguation.

A more inclusive approach was adopted with respect to verbs expressing dynamic modality. Verbs such as *oskama, jõudma, kannatama, jaksama,* and *suutma* are not uniformly classified as modal verbs in Estonian grammars, with the exception of *suutma*, which is sometimes recognized as such. Nevertheless, these verbs were included on the grounds that they systematically express dynamic modality in Estonian. Excluding them would not only substantially reduce the available dataset, but also hinder cross-linguistic comparability, as these verbs constitute the primary means of expressing dynamic modality in Estonian. Furthermore, the data show that several of these verbs, in particular *jõudma, oskama,* and *suutma*, are capable of taking scope over other modal verbs.

Finally, *vajama* was excluded, as it expresses need/necessity but does not take verbal complements, while constructions like *vaja olema* and *tarvis olema*, although valid expressions of modality, fall outside the scope of the study as they do not involve modal verbs proper.

3.1 Notes and Comments

In the following discussion, all examples are translated but not glossed. The span containing the two modal verbs and the lexical verb they govern is not in italic, and can thus be easily identified.

The three verbs are shown in bold. In addition, the outer modal verb is marked with a superscript 1, and the inner modal verb with a superscript 2. In cases with three modal verbs, the innermost modal carries a superscript 3. The source (subcorpus and website or similar) is provided above each sentence.

In Section 11, some tables refer to the order of the two modal and lexical verbs. There, the order 123 means that first comes the outer modal (1) verb, then the inner modal verb (2) and lastly the lexical verb (3). Order 312 would mean that we have the lexical verb first (3), followed by the outer modal (1) and the inner modal (2). The order is not only determined by the meaning, but is also unambiguous in formal terms: only the outer modal is in a conjugated form, and

the lexical verb is not a modal verb. The only case in which ambiguity might arise is when the lexical verb would have the same lemma as the inner modal verb, but this is rare.

4 Methodology

For investigating double modality, I needed a large enough corpus of examples, which is representative, and which would not skew the analysis in certain direction.

4.1 Data and Corpus

I conducted the search in the Estonian National Corpus 2023 (Estonian NC 2023)[5], which is currently the largest and most recent available Estonian corpus. It is tagged for grammatical features (word classes and morphological form) and also for sentence boundaries.

It consists of the Estonian Reference Corpus (90s–2008), Contemporary (2000–2023) and Old (1864–1945) literature, Estonian Web (2013, 2017, 2019, 2021, 2023), Timestamped Estonian corpora (2014–2021, 2020–2023), Estonian Wikipedia (articles: 2023, talkpages: 2017) and Estonian academic writing (2020–2023). Table 3 gives an overview of the relative composition of the Estonian NC. As can be seen in Table 3, the vast majority of the material (slightly less than 80%) comes from the Estonian web corpora.

Table 3. Estonian National Corpus 2023 Composition

Subcorpus	Tokens	%
Estonian Reference Corpus	224,055,836	5.92
Contemporary literature	148,559,737	3.925
Old literature	7,421,569	0.196
Web 2013	302,950,928	8.004
Web 2017	638,470,425	16.869
Web 2019	613,775,513	16.217
Web 2021	884,524,889	23.371
Web 2023	571,221,646	15.093
Timestamped Estonian corpora	344,463,562	9.101
Estonian Wikipedia articles 2023	30,747,204	0.812
Estonian Wikipedia talkpages 2017	7,571,584	0.20
Estonian Academic writing	11,026,315	0.291
Total	3,784,789,208	100

Given the lack of prior research on genre effects in double modal constructions, no genre-based adjustments were applied.

The corpus was accessed via the API[6].

[5]It is accessible under `https://app.sketchengine.eu/#dashboard?corpname=preloaded%2Festonian_nc23`

[6]This is the Application programming interface.

4.2 Initial Corpus Query

Data extraction and preprocessing were carried out using a set of Python scripts. The workflow consisted of three main stages:

(i) retrieval of concordance data via API requests using CQL[7] queries,

(ii) restructuring of the returned JSON[8] data, including initial filtering, and

(iii) application of rule-based filters to remove false positives based on verb-specific collocational patterns.

In a double modal construction, we need to find an outer modal verb (in any grammatical form) that takes as its argument the inner modal verb (in the appropriate *-ma* or *-da* infinitive, depending on the outer modal) which has also a verbal complement, the lexical verb (again in the appropriate infinitive).[9]

With the exception of *pidama*, all Estonian modal verbs included in this study take verbal complements with *da*-infinitive.

The search interface lets us specify grammatical feature (like *ma*- or *da*-infinitive), lemmas and distances between objects. Additionally, one can later filter the results, e.g. excluding certain lemmas/tags in or around the kwic. The kwic is the hit of the search engine. Unfortunately, there is no syntactic tagging available. Thus one cannot search for e.g. *pidama* with verbal complement *võima*, or even *pidama* and *võima* in the same clause. Instead, I search for occurrences in the same sentence.

Thus, the basic CQL was

```
[lemma="{v1}"] []{{0,}}
[lemma="{v2}" & features= "{verb2inf}"] []{{0,}}
[tag="V.*" & features= "{verb3inf}"]
within <s/>
```

This CQL describes the following structure:

1. first modal verb (v1), followed by any number of other tokens
2. second modal verb (v2), tagged with the appropriate infinitive and followed by any number of other tokens
3. any verb, tagged with the appropriate infinitive

[7] Corpus Query Language

[8] JSON (JavaScript Object Notation) is an open standard file format often used for data exchange.

[9] There are examples of proper double modals where the lexical verb is ellipsed. Those were excluded from the search to minimize the unusable results, e.g. *Tööle kandideerija **peab oskama** eesti keelt.* is not a double modal, but for example *esimene reaktsioon oli muidugi wtf, kuidas saab inimene osata mitte jalgrattaga sõita – aga siis jõudsin järeldusele, et jalgrattaga sõitmine ei ole evolutsiooniliselt küll nii oluline tegevus, et seda ilmtingimata igaüks **oskama peaks**.* could count as a proper double modal, because the lexical verb was mentioned before.

4. restrict search to sentence boundaries

To not presuppose that the three elements would occur in this exact order, I also looked for the other five possible orders of the two modal verbs and the lexical verb. The full python API request is included in Section A in the appendix.

After the basic CQL, I applied a number of filters. In its basic form, the CQL returns many false positives.

The first filter has the purpose of removing results with additional other finite verbs inside the kwic. If there is another finite verb, chances are very high that the three verbs of the hit result were not part of the same clause. This also removes all good results with a centre-embedded clause between the modal verbs and the lexical verb.

There is no direct way to remove all results with a finite verb that is not the first modal v1. Thus, the filter removes all results that contain some verb, whose lemma is not the first modal verb and that is not tagged by a non-finite suffix.

```
[lemma!="{v1}" & tag="V.*" & longtag!=".*{NONFINITE_SUFFIXES}$"]
```

As nonfinite suffixes I defined the set of $\{tud, tav, v, da, ma\}$ [10]. *da* and *ma* infinitives had to remain because the second modal and the lexical verb would have these endings.

The second filter was

```
[lemma="{CONJUNCTIONS}"]
```

with the set of conjunctions being { *kuidas, et, mis, kui, ehk, kuhu, kus, kust, kuid, ja, ning, ega, või, kes, kas, sest, kuna, miks, mil, millal, milele*[11], *kuivõrd, kuigi*}. This set was chosen based on conjunctions that frequently appeared in the results and usually indicate that the kwic was spread over multiple clauses. Of course, for example *ja* does not necessarily mean that there are multiple clauses, as it could as well between coordinate noun phrases, but that would be much rarer.

Thus,

- *Seda asjaolu* ***tuleb silmas pidada ka üleiõpilastel, kes prognoosivaid uuringuid just selles valdkonnas tegema*** *asuvad.* is removed because of *kes* (and *silmas pidama* is not a modal)
- *Kontojäägi kontrollimiseks* ***võib tulevikus tarvitseda vaid pangakaardil nuppu vajutada*** *, ning andmed kuvataks väikesel ekraanil otse kaardi pinnal.* is retained because *vaid* is not on the list.

The third filter was

[10] ideally, this set should have included $-des$, as in *b) mida nad* ***peavad oskama õppides teha****, et neid asju õppida, ning kuidas õpetaja saab aidata osata*, but it did not

[11] The intended form was *millele* but I mispelled it.

```
[tag="Y" & word="^[^A-Za-z0-9….,;:!?-]+$"]
```

According to the explanation of the tag set, the tag 'Y' is used for abbreviations, such as 'USA'. There is no reason to exclude abbreviations from the search. However, 'Y' is also used for emojis, and emojis are used to end sentences without any other punctuation, so that this is not annotated in Sketch Engine.

The filter excludes all objects that are tagged 'Y' but do not contain any letters, numbers or punctuation, these should include all emojis and not much else[12]. I do not assume that many emojis are used inside a clause, so if one appears between the verbs of interest, it probably means that there is at least a clause boundary.

- *Ja kolmandaks:* ***tuleb üle saada refleksist 7♥ panna*** *– küsimus on ju ladvatihides.* is also removed, but ideally would have been kept, because 7♥ is an object and not a clause boundary here.
- *Aga see elurütm* ***tuleb lihtsalt sisse saada*** 🙂 ***Soovitan kasvõi iga õhtu võtta*** *endale 1 tegevus, et täna teen suuretoa täiesti korda tolmu võtan ära jne .. teine päev magamistuba ja riidekapid , et nädalavahetusel saaks mõnusalt puhtas kodus perekeskel puhata* 🙂 is removed. One would think that the *Soovitan* would have been enough to remove this sentence earlier, but it is tagged as a proper noun (probably because it is capitalized). Actually, *kasvõi* also removes it.

The last filter was

```
[tag = "Z"]
```

The tag 'Z' is used for all punctuation, e.g. -, /, …. These also usually indicate a clause boundary, so

- *Päriselt ka – no* ***ei jaksa jõuda igale poole, olla*** *kõikjale kaasatud, arvata kõigest midagi* ... is removed because of the comma in the kwic.

The decision of how to search and which filters to use came from looking at the results each time, and for the final data, I used the script in Section A, to have a reproducible result.

In Figure 7 in the appendix, the absolute concordance size with the basic CQL (above) and after applying all four filters (below) are visible. Displayed is the data for the typical word order of modal1 followed by modal2 followed by the lexical verb.

There are certainly double modal constructions in the corpus that escaped my search. I indicated for each filter, how also good examples could be filtered out. Given that I made the mistake of spelling *oskata* instead of *osata* in my first search, I know that there are double modals

[12]It did include § and € as well, unfortunately.

with *osata* spelled as *oskata* in the corpus, and those are as well as any other wrongly spelled or tagged double modals not included in the final data.

One could say that it would have been possible to do all filtering with python under better control, however, I decided to use the filter options in Sketchengine to get a better return. It is not possible to download all results and work with them, but only pages of 1000 results. Doing earlier filtering increases the number of downloadable good results.

Since getting the results, I have come to realize that one might be able to download up to 10 pages of 1000 results each, but at that time it was too late.

4.3 Automated Filtering and Processing (Python)

The next step was removing more false positives and bringing the data in a more workable format.

Initially, only the kwic was marked separately in the .json file from Sketchengine. The following steps were applied

1. split the tags into its parts
2. identify modal 1, modal 2 and the lexical verb, and annotate them in the file
3. filter out any sentences with any verbs not tagged by $\{tud, tav, v\}$ (which can indicate adjectival use of the verb) other then the three verbs of interest within the kwic
4. remove as many non-modal uses of the verbs as possible, to be precise, exclude

```
        FORBIDDEN_BEFORE = {
    "saama": ["aru", "kätte", "ära", "lahti", "valmis", "lõpuks", "
                                        pihta", "läbi"],
    "tulema": ["vastu", "meelde", "toime", "järgi", "välja", "ära" ],
    "pidama": ["vastu", "ülal", "pidu", "meeles"],
    "kannatama": ["ära"]
}
```

   occuring directly before the respective verb.

Figure 7 in Section B (Appendix) compares the number of concordance lines left before and after applying the filtering for the default word order.

4.4 Manual Filtering

The next step was manual filtering. The goal was to obtain approximately 30 valid examples for each attested modal pair, with a target of 20 examples from the default word order and up to 10 from the remaining orders (where available).

To facilitate this process, a Python script was used to iteratively present concordance lines and classify them as either valid or invalid instances. For each modal pair and word order, the procedure was terminated once either the target number of valid examples had been reached or 50 invalid examples had been encountered. The latter threshold was introduced to limit the time spent on combinations with a low proportion of relevant results.

In practice, most modal combinations showed a strong skew, yielding either predominantly valid examples or predominantly false positives.

For those combinations where the filtering process terminated after reaching the threshold of 50 invalid examples, an additional round of targeted filtering was carried out. This involved implementing combination-specific exclusion patterns in Python to remove recurrent sources of noise, such as non-modal uses or instances involving clause boundaries.

This process resulted in a dataset of 813 sentences, which were subsequently annotated and thereby cleaned of any remaining false positives.

4.5 Annotation / Tagging

The next step was to annotate the double modal constructions semantically, which is a challenging task, as it has not been done before.

A central design consideration concerned the representation of the two modal verbs. In order to avoid presupposing that the meaning of double modal constructions is fully compositional, the annotation scheme was initially conceived to treat the modal complex as a single unit.

However, iterative refinement of the scheme showed that this approach did not adequately capture recurring patterns in the data. The final annotation framework therefore represents each modal verb individually, alongside an additional layer encoding its interaction with the other modal verbs. This allows study systematically both the contribution of each modal and the compositional meaning of the combinations of modals .The final framework is described in Section 5.

The semantic annotation includes:

- the semantics of the inner modal (dynamic, deontic, circumstantial, epistemic),
- the interaction between the two modals,
- the semantics of the outer modal (dynamic, deontic, circumstantial, epistemic, bouletic, teleological).

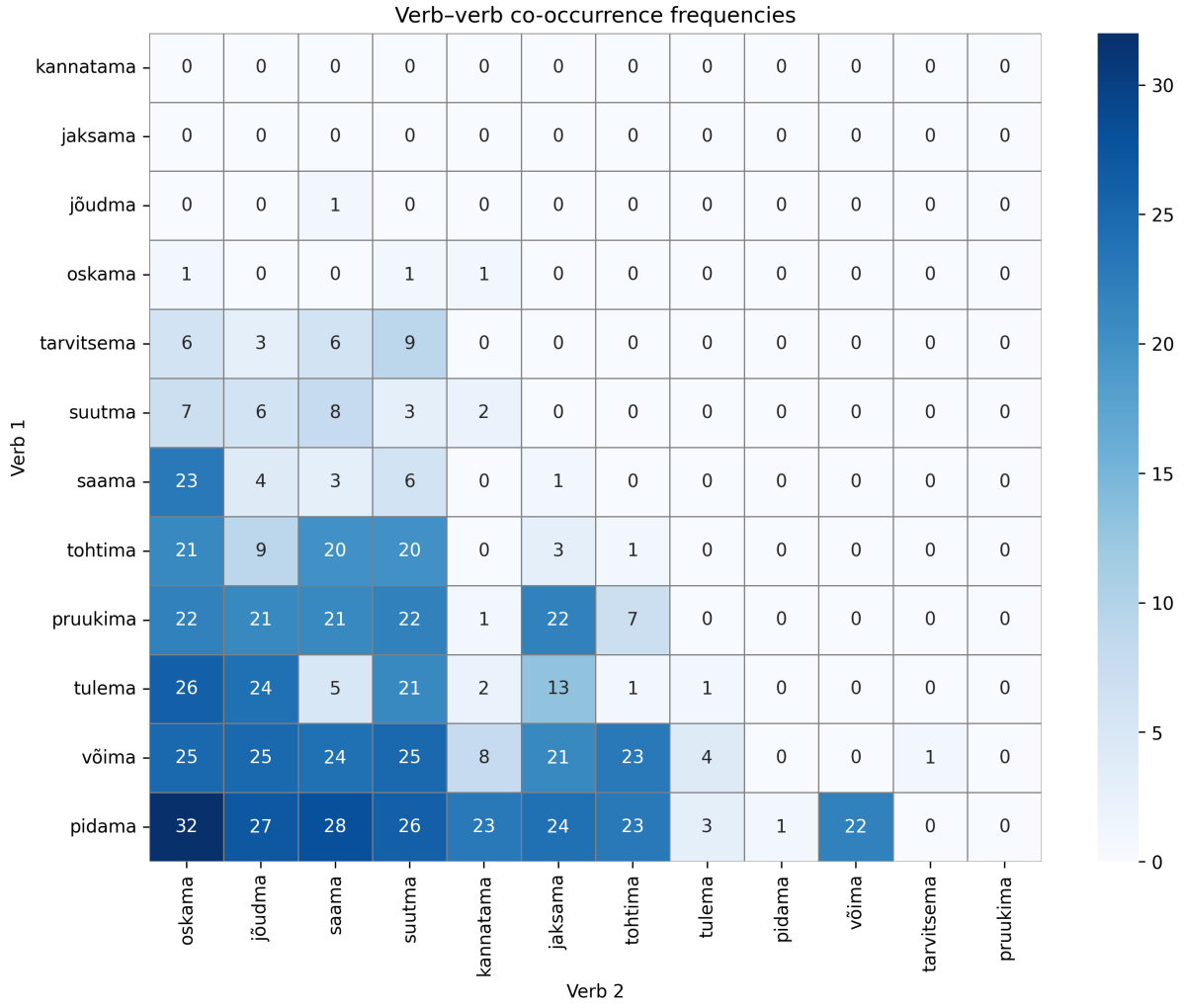
These three components are encoded as a three-letter label.

In addition, each sentence was annotated for negation (negated vs. non-negated). Any clause containing negation—whether on the outer modal, the inner modal, the lexical verb, or through double negation—was classified as negated.

4.6 Final Dataset

The final annotated data set contained 739 sentences. The distribution for verb combinations can be seen in Figure 2. A full report of counts of each verb combination including order is available in Table 41 in the appendix.

Figure 2. Overview over final data



In Figure 2, the modal verbs are ordered such that the data clusters in the lower left corner of the table. The attested combinations are concentrated below the diagonal of the matrix.

For each modal-modal combination, up to 30 examples[13] were collected. Counts reaching 20 or more, which was the upper limit for the basic word order, suggest that additional occurrences likely exist in the corpus beyond the sampled set, whereas lower counts indicate that most or all attested examples for that combination were likely captured in the final dataset.

[13] *Pidama-oskama* contains 32 examples due to a minor implementation artifact during data sampling. The intended design was to collect up to 30 examples per combination across six prompt orders (20 from the default order and up to 10 distributed across alternative orders, with backfilling when necessary). During early development of the sampling script, interim limits were set (initially 20 for the default order and 5 for each alternative, later revised to 20, 2, 2, 2, 2, 2). This transition led to slight over-sampling for *pidama-oskama*. As downstream analyses use reweighting and normalized ratios, this deviation does not materially affect the results.

4.7 Analytical Methods

The analysis followed an iterative qualitative procedure combining pre-annotation with subsequent refinement. After initial semantic annotation of each construction, grouping by label allowed for systematic comparison of semantically similar instances. This process facilitated the identification of recurrent functional clusters, which were used to refine the original annotation scheme. Where contextual analysis of comparable examples revealed inconsistencies or borderline cases, annotations were revised to ensure internal coherence across categories.

4.8 Reliability and Limitations

- The CQL query retrieved a non-random subset of corpus hits, returning the first 1000 occurrences rather than a randomized sample. While this was not consequential for low-frequency verb–verb combinations (which contained fewer than 1000 hits in total), it introduces a potential sampling bias for more frequent combinations. In these cases, the dataset may overrepresent earlier portions of the corpus and underrepresent later genres.
- The retrieval of rare constructions required supplementary, pattern-based search strategies tailored to observed contexts in the data. While effective in identifying additional instances, this approach is not fully systematic and may limit the reproducibility of the extraction procedure.
- As a non-native speaker of Estonian, the interpretation of modal semantics was supported by consultation with native speakers and the use of machine translation tools. However, despite these measures, some degree of interpretative uncertainty in individual cases cannot be excluded.
- The analysis of double modality is inherently complex, as meaning emerges from the interaction of two modal elements within context. In borderline cases, this may lead to ambiguity in categorisation despite careful contextual analysis.
- Due to the exploratory nature of the study and time constraints, no formal statistical testing or error estimation procedures were conducted.

These limitations should be taken into account when interpreting the frequency distributions and semantic categorisations presented in the analysis.

5 A Theoretical Framework for Classifying Double Modality

An easy approach to classifying double modal constructions would be to classify flavour and force for both inner and outer modal verb. Yet, it appeared that this is not enough to capture the semantics of the combination properly because there are examples of e.g. deontic over dynamic that are functionally very different. For example:

- A two month old baby should be able to lie on its stomach for 10-20 seconds.
- The participating child must not be able to walk yet.

Thus, I used a three-letter classification system instead, where two of the letters represent the flavour of the inner and outer modal (the force is not encoded), and the last letter should give insight into their interaction. The following gives theoretical motivation of this decision.

The standard analysis of modal semantics follows Kratzer's possible world semantics, where a modal is understood as a quantifier over possible worlds.

As discussed in Section 2.4, a modal expression is interpreted relative to:

1. a *modal base*, which determines which worlds are relevant, and
2. an *ordering source*, which ranks those worlds according to contextual criteria.

The modal is then evaluated with respect to the best-ranked worlds compatible with the modal base, that is to say, a set of possible worlds is associated to a modal expression.

In a double modal construction, the two modals are not interpreted independently. The outer modal is interpreted first. It establishes a set of worlds relative to its own modal base and ordering source. The inner modal is then interpreted relative to those worlds.

This means that the outer modal can indirectly influence the interpretation of the inner modal. The inner modal still contributes its own modal base and ordering source, but these are evaluated within the worlds already selected by the outer modal. As a result, the circumstances fixed by the outer modal may substantially change the set of worlds associated with the inner modal.

This effect is particularly easily visible with deontic outer modals.

Consider the sentence:

> *In the ideal business model, every worker should only be able to do one kind of work.*

The inner modal expression is:

> *Every worker is able to do only one kind of work.*

Taken on its own, this sentence would normally be false in the actual world. Workers are usually capable of performing several different tasks, changing positions, or acquiring new skills. Evaluated independently, the dynamic modal *be able to* therefore selects worlds compatible with workers' actual abilities, and these worlds generally include workers who can perform multiple kinds of work.

In the double modal construction, however, the outer modal *should* first introduces a deontic perspective. The sentence no longer concerns the actual organization of labour, but ideal worlds in which a particular business norm is perfectly realized. In such worlds, workers may be trained in only one task, prevented from changing positions, or organized in a way that strictly limits the range of work they can perform.

The inner dynamic modal is then evaluated relative to these already idealized worlds. Consequently, the worlds associated with *be able to* inside the double modal construction differ fundamentally from the worlds associated with the same modal expression in isolation.

This interaction is theoretically important because the two sets of worlds can thus even be disjoint. The worlds compatible with workers' actual abilities may contain workers capable of many kinds of work, whereas the idealized deontic worlds may systematically exclude such workers altogether. Thus, the outer modal does not merely add an additional layer of modality, but can alter the circumstances under which the inner modal itself is interpreted.

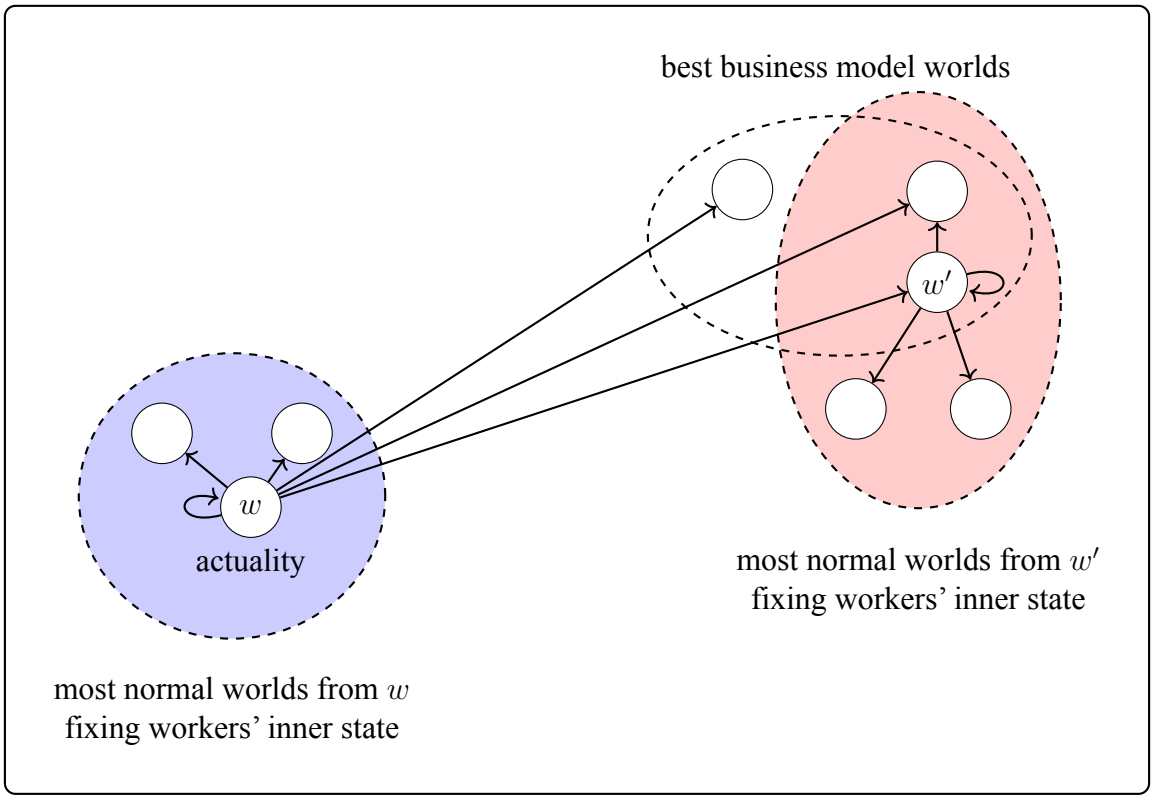


Figure 3. Graphical illustration of "ideal business world" example

Figure 3 is an illustration of this: It shows how evaluating the expression "Every worker is able to do only one kind of work" structurally differs from evaluation that inside the deontic

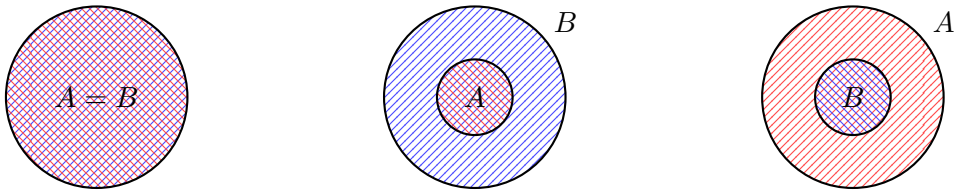
operator. w denotes our world, w' is an ideal business world and evaluation the inner modal expressing gives a distinct set of worlds.

5.1 Set theory

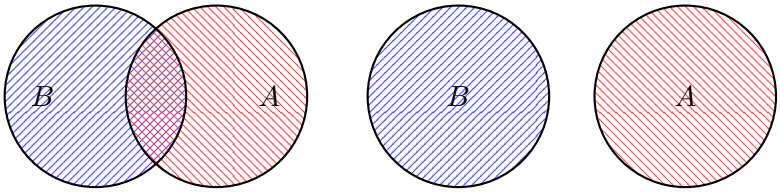
To describe these interactions, I compare two sets of worlds:

- Set A: the worlds associated with the inner modal when interpreted inside the double modal construction;
- Set B: the worlds associated with the same inner modal when interpreted independently.

The relation between these sets can vary systematically.



(1) Identical (2) Subset (3) Superset



(4) Overlap (5) Disjoint

These are

(1) identical (or, for our purposes similar sets), abbreviated S (for similar)

(2) smaller set, not confirmed in the data

(3) larger set, abbreviated E (for extension)

(4) overlaping sets, abbreviated O (for orthogonal or overlap)

(5) completely different set, abbreviated D (for disjoint)

In assigning, this means that possible worlds (scenarios) assossiated to the double modal construction are compared to those tied only to the inner modal.

5.2 Final labels

The final labels have the following structure:

Pos. 1: Inner modal		×	Pos. 2: Interaction		×	Pos. 3: Outer modal	
dynamic	A		similar	S		dynamic	A
circumstantial	C		superset	E		circumstantial	C
teleological	T		overlap	O		teleological	T
deontic	S		disjoint	D		volitional	V
epistemic	E					deontic	N
						epistemic	E

The first letter of the label represents the flavour of the inner modal, the second letter the relation between the modal domains, and the third letter the flavour of the outer modal.

For example, the sentence:

> The student must be able to answer all questions.

is classified as AON. The first letter, A, indicates that the inner modal *be able to* expresses dynamic possibility. The final letter, N, indicates that the outer modal *must* is deontic.

The interaction is classified as O ('overlap'). Interpreted independently, the inner modal refers to worlds compatible with the student's actual abilities and knowledge. Under the scope of *must*, however, the inner modal is evaluated relative to normatively ideal worlds in which the relevant requirements are satisfied. The two sets of worlds therefore partially overlap, but do not coincide completely.

In assigning labels, constructions were considered in their positive form. The labels describe the interaction between modal domains rather than the contribution of sentential negation. Thus, expressions such as *ei pruugi osata* were typically classified as AEN or AEE. Although the negation may superficially appear restrictive, *pruukima* weakens the claim relative to plain *oskama*, since *ei pruugi osata* remains compatible with *oskab*. In this sense, the set of possible worlds introduced by *pruukima osata* is a superset of that associated with *oskama* alone. In essence, this compares skills that can be expected to be there (should be there) with actually existing skills.

The labels primarily served as a heuristic tool for identifying recurring semantic and pragmatic patterns in the data. For example, constructions classified as ON (overlap + deontic outer modal) frequently shared the function of expressing rules.

Moreover, it is an theoretical insight that the subset relation was not needed.

To account for recurring internal variation within the interaction class ON, I introduced a refined sublabel ON′. This refinement was motivated by the observation that a substantial subset

of constructions classified as ON formed a semantically coherent cluster that was not adequately distinguished by the existing three-letter system.

Importantly, this distinction is not reflected in the three-letter system, since the final position encodes only the outer modal flavour (here deontic N), and the interaction label O collapses structurally similar but functionally divergent cases. As a result, ON conflates (i) rule-like, context-bound deontic interpretations with (ii) more general, aphoristic or maxim-like statements that behave differently in discourse, despite sharing label.

ON' was therefore introduced as a post hoc refinement within ON to mark this semantically and pragmatically coherent subset. Crucially, ON′ does not introduce a new theoretical category of modal interaction; rather, it functions as an empirical sub-classification that preserves the integrity of the main typology while capturing systematic variation that would otherwise be lost in the coarse-grained encoding.

As will become clear in the following sections, the outer modal is much more interesting than the inner modal, and it appears that the central letter, meant to encode the interaction, has much more bearing on the interpretation of the outer modal, than on the inner modal. Thus, semantic types of the outer modal derive from the last two letters.

6 On normative and epistemic modals

Let us consider the following example:

(3) Timestamped 2014–2023 – pmo.ee

Kahekuune beebi **peaks**[1] kõhuli **jaksama**[2] **olla** *umbes 10- 20 sekundit.* Type: ASN

'A two month old baby should be able to lie on its stomach for 10-20 seconds.'

Is *peaks* "should" epistemic or not?

6.1 Comparison to prototypical example

The prototypical example of epistemic modality is something like:

1. Anton finishes work usually around 4pm.
2. He *should* be at home by now (because it is already 5).

Should in 2. is an epistemic modal.
The example sentence seems to be structurally more similar to 1. So if then we had,

1. A two month old baby should be able to lie on its stomach for 10-20 seconds.
2. Anton's daughter should be able to lie on her stomach for 10-20 seconds (because she is already two months old and of normal development).

The *should* in 2. is epistemic, but for the *should* in 1., it is not so clear.

6.2 Substitute Tests

Epistemic modals can be replaced by adverbs like *probably, certainly, maybe, possibly, potentially etc*.

We can paraphrase *Anton should be at home by now (because it is already 5)* with

Anton is probably at home by now

without changing the meaning.

Let us test the following options as paraphrases of *A two month old baby should be able to lie on its stomach for 10-20 seconds*:

1. A two month old baby can *probably* lie on its stomach for 10-20 seconds.
2. A two month old baby can *potentially* lie on its stomach for 10-20 seconds.
3. A two month old baby can *certainly* lie on its stomach for 10-20 seconds.

I find 2. the best, but none of them is a satisfactory paraphrasis of the sentence with should. The undertone is not quite the same and in 1. and 2., I read some uncertainty into it and for 3. too much certainty. The modal *should* does not so much seem to be connected to certainty or probability but more to emphasize that normal child development is assumed.

Better paraphrases are given by *normally* and *usually*. Compare:

1. A two month old baby can *usually* lie on its stomach for 10-20 seconds.

2. A two month old baby can *normally* lie on its stomach for 10-20 seconds.

These sound much better.

6.3 Possible world semantics - the view from the philosophy of language

In possible world semantics, an epistemic modal is analysed as having a base of someone's knowledge that is kept fixed and then all worlds that conform to this are ordered under normalcy. This means that all worlds that have strange developments, even if conforming to one's knowledge, are sorted out. This includes things like an alien invasion or being a brain in a vat.

Then the claim without the epistemic modal is evaluated in all remaining possible worlds, i.e. in our case: all babies that are two months old are able to lie on their stomachs for 10-20 seconds. This should be false: It conforms to one's knowledge that their are children of anormal development (due to being born too early for example) that are not able to. So formally the modal evaluates to false (both as necessity which would require truth in all possible worlds and in possibility which would require truth in at least one possible world).

We can get the correct predictions by using facts concerning biological development for babies as a base (so only possible worlds where babies grow up as they actually do) and normalcy as the ordering (so we select the set of those possible worlds for evaluation where babies grow up normally, so no illnesses or early birth or similar occurs).

With this ordering and source, the sentence comes out true.

7 The effect of the outer modal

The following modals we can find attested as outer modals, ordered below by roughly how many inner modals they can scope over. The verb *pidama*, for example, occurs with ten of the twelve verbs considered in this study; it is not attested in the data only with *tarvitsema*, and *pruukima* in its scope. The second in the list, *võima*, displays occurrences with nine modal verbs (all but *pidama*, *võima*, and *pruukima*). Section 11 contains tables indicating attestation and frequency of combinations.

1. pidama
2. võima
3. tulema
4. pruukima
5. tohtima
6. saama
7. suutma
8. tarvitsema
9. oskama
10. jõudma

Of the twelve verbs I investigated, only *kannatama* and *jaksama* do not appear as an outer modal.

In the next section, we will go over these modal verbs one by one and see what effect they have semantically.

7.1 *Pidama*

7.1.1 Formal Overview

Frequency, etc, gaps

I have 213 occurences of *pidama* in my data.

Table 4. Counts of combinations with *pidama* as first modal in the data set

oskama	jõudma	saama	suutma	kannatama	jaksama	tohtima	tulema	pidama	võima
32	27	28	26	23	24	23	3	1	22

7.1.2 Semantic baseline

Pidama expresses any (participant-internal, participant external, deontic, epistemic) kind of necessity. It can also express epistemic possibility (Metslang et al. 2024). But the epistemic reading is mostly restricted to the third person in conditional mood and imperfect tense of *pidama*, see (Erelt 2001)

7.1.3 Semantic effect of *pidama*

Overall, *pidama* tends to receive a normative or deontic reading as an outer modal in double modal constructions.

This normative reading can take multiple forms, the most common is what could be called *stating rules or rule-like expectations*, and is exemplified in sentence (4).

(4) Web 2021 – geenius.ee

”Jalg- või tõukerattur liigub suhteliselt kiiresti ja **peab**[1] ise ka alati **jõudma**[2] **veenduda**, *et tee ületamine ohutu on.* Type: AON

‘A cyclist or scooter rider moves relatively quickly and must always make sure for themselves that it is safe to cross the road.’

That the use is *stating rules* can be confirmed by replacing the outer modal with an expression such as *has the duty to* or *is responsible to*. We can rephrase sentence (4) into

> A cyclist or scooter rider moves relatively quickly and is responsible to always make sure for themselves that it is safe to cross the road.

Superficially very similar is a use of *pidama* which we can call a *normative expectation*, here based on experiences and knowledge about certain groups a statement is made, as exemplified in sentence (5).

(5) Timestamped 2014–2023 – pmo.ee

Kahekuune beebi **peaks**[1] kõhuli **jaksama**[2] **olla** *umbes 10- 20 sekundit.* Type: ASN

‘A two-month-old baby should be able to lie on their stomach for about 10 to 20 seconds.’

In this use, *pidama* can be replaced by ”generally” or ”normally”.

I consider this use to be normative, rather than epistemic, for an extended discussion, see Section 6 above.

The key difference to the case above is the relation to truth: From a normative expectation we are more or less licensed to infer that the capacity is there.

There is one more normative reading, that is a *wish for the existence of a rule or social convention*. Here we often find the conditional mood, as in sentence (6).

(6) Web 2013 – maaleht.ee

Kahjustuse pealt **peaks**[1] **tohtima**[2] **lasta** *igaüks ,kel relvaluba.* Type: SEN

‘Anyone with a firearm permit should be allowed to shoot at the scene of an incident.’

A second example of this is given in sentence (7).

(7) Web 2017 – blogspot.com

Hilineda peaks[1] mingil määral **tohtima**[2]. Type: SEN

‘It should be acceptable to be a little late.’

A paraphrase test for this use can be either *ideally* or *it ought to be the case that*. We can paraphrase sentence (7) as

> Ideally, it is acceptable to be a little late.

Pidama can also receive an epistemic reading. This reading is much less frequent than the normative one but occurs most frequently with the modals *kannatama, saama* and maybe *võima*.

As suggested by Erelt (2001), the epistemic use of *pidama* seems to be only available for the conditional mood.

Usually, if we have an epistemic reading for the outer modal in a double modal construction, the effect of it is weakening the claim by being explicitly cautious. This amounts to some uncertainty by the speaker and possibly making sure that s/he is not accountable if the possibility is not there. We shall call this use *epistemic caution*.

(8) Web 2017 – estonianchopper.com

Homme õhtuks **peaks**[1] **saama**[2] ratta uuesti lahti **võtta** *ning reedel äkki liivapritsi suunata.*
Type: CSE

'I/You/etc. should be able to take the bike apart again by tomorrow evening, and maybe give it a quick sandblasting on Friday.'

In sentence (8) *peaks* adds caution: tomorrow evening we can take the bicycle apart again *if nothing prevents us*. The speaker does not want to commit fully to the action or to the availability of favourable circumstances. Note that since the conditional mood in Estonian has no personal endings, the subject of sentence (8) is only given contextually.

A replacement test for this use works with *probably*.

A second category of epistemic uses is not related to probability but to potentiality. By this I mean that *peaks* is not about whether an event is likely as in sentence (8). Paraphrases with *probably* or *certainly* work only if likelyhood is expressed. In case of potentiality, a paraphrase works with *potentially*.

Definition 7.1 (Epistemic Potentiality) *Asserting that a proposition could be true, without asserting how likely it is. It expresses that something is possible in principle, given what is known or conceivable.*

Definition 7.2 (Epistemic Probability) *The degree to which a proposition is likely to be true, often based on evidence or reasoning. It expresses a quantifiable confidence in the truth of a statement.*

While sentence (8) expresses probability, sentence (9) expresses potentiality. The speaker expresses no attitude as to how likely or unlikely s/he finds the proposition.

(9) Reference Corpus 1990–2008 – ===NONE===

Bush : Saddam tuleb kukutada George W. Bush on varem kinnitanud, et Ameerika Ühendriigid on valmis Iraaki ründama ka üksi, kui ÜRO ei **peaks**[1] **suutma**[2] Iraagi suhtes midagi otsustavat ette **võtta**. Type: AEE

'Bush: Saddam must be overthrown. George W. Bush has previously stated that the United States are prepared to attack Iraq even on their own if the UN should be unable to take decisive action against Iraq.'

7.1.4 Overview

The common semantic effects of *pidama* can be found in Table 5. Not all of the semantic types listed there have been introduced yet; these will be defined and illustrated in the following sections. As specified in Section 5.2, the capitals in brackets stand for the interaction type and the modal flavour of the inner modal, respectively.

Table 5. Semantic effects of *Pidama* including frequencies

Type	Count
stating a rule (ON)	84
normative expectation (SN)	35
wish for existence or rule (EN)	17
idealized constraint (DN)	5
gnomic (ON')	1
epistemic expectation (SE)	33
potentiality (EE)	5
counterfactual (DE)	1
inference (OE)	1
teleological (OT)	12
intention (OV)	14
circumstantial (SC)	1

7.2 *Võima*

7.2.1 Semantic baseline

Võima can express any kind of possibility (participant-internal/external and epistemic).

It can also express weak necessity, a recommendation for example, see (Metslang et al. 2024).

7.2.2 Formal overview

Table 6. Counts of combinations with *võima* as first modal in the data set

oskama	jõudma	saama	suutma	kannatama	jaksama	tohtima	tulema	tarvitsema
25	25	24	25	8	21	23	4	1

7.2.3 Semantic effect of *võima*

The main use of *võima* is deontic/epistemic borderline, so an epistemic possibility is introduced and simultaneously endorsed. This can sound like a wish or recommendation with a hedged, tentative or just polite undertone, see sentence (10) and sentence (11). Let us call this use *polite suggestion*.

Definition 7.3 (A polite suggestion) *is a softly expressed desire or suggestion that is framed as a possibility rather than a direct statement of intent or obligation. It combines two layers at once:*

- *an epistemic possibility ("this could be the case"), and*
- *a weakly endorsed preference ("it would be good if this were the case").*

The speaker avoids sounding forceful or categorical. Instead, the utterance leaves room for uncertainty, negotiation, or politeness.

(10) Web 2023 – ituudised.ee

Nende baasil **võiks**[1] me **suuta**[2] paremini **prognoosida** *inimeste vajadusi ning neile seda ka öelda.* Type: AEE

'Based on this, we might be able to better predict people's needs and communicate them to them.'

(11) Web 2013 – ulme.ee

Kes **võiks**[1] veel paremini **osata**[2] eesti keeles **teha** *ülevaadet sellest, mida soome keeles ulmest kirjutatakse?* Type: AEE

'Who could do a better job of providing an overview in Estonian of what's being written about science fiction in Finnish?'

One can also express the preference without an epistemic layer, as in sentence (12), where a normative expectation is expressed:

(12) Web 2021 – ohtuleht.ee

Teist lingvistikas õpetaja **võiks**[1] kõigepealt ise vigadeta **kirjutada osata**[2]. Type: ASN

'A linguistics teacher should first of all be able to write without mistakes.'

We can contrast these uses with those that do not carry endorsement and are purely epistemic that is to say that no opinion is expressed on whether the sentence's propositional content is preferred or desirable. Examples are sentences (13) and (14).

(13) Web 2021 – eestikirik.ee

Vanadekodust saab erilisi kogemusi: täiesti dementsed vanurid **võivad**[1] **osata**[2] **laulda** *vaimulikke laule.* Type: ASE

'Nursing homes offer unique experiences: elderly people with severe dementia may be able to sing spiritual songs.'

(14) Web 2019 – delfi.ee

Sa **võid**[1] **jõuda**[2] vägagi palju ära **teha**, *aga paraku võib kiirustava rahmeldamise tõttu kannatada su tööde kvaliteet.* Type: ASE

'You can get a lot done, but unfortunately, the quality of your work may suffer if you rush through it.'

We can name this use *potentiality*.

Definition 7.4 (Potentiality) *refers to a use of an epistemic modal verb where the speaker presents a possibility as being open or available, without evaluating whether it is good, desirable, or likely. It frames a situation as permitting or affording an outcome, rather than endorsing it.*

The modality is thus epistemically neutral in terms of value judgment, yet pragmatically it still grants access to a potential outcome.

In sentence (15), *võima* introduces a hypothetical situation: it was not that the mother of the narrator could not see the fulfillment of her hopes, because the time or location were difficult, but because it happened after her death.

(15) Web 2021 – kirmus.ee

Aga võib olla, et mina kuidagi ikka ka oma ema lootuseid kaugemale viskamise poolest oleksin rahuldanud, kui tema seda oleks **näha saada**[2] **võinud**[1] Type: CDE

'But perhaps I would have managed to exceed my mother's expectations in some way, had she been able to see it.'

Definition 7.5 (Counterfactual) *The speaker presents an event as something that could have happened in an imagined (past) situation, but in fact did not. It expresses a missed or unrealized possibility, often dependent on conditions that were not met (e.g., someone being alive, present, or in a different situation).*

Rather than granting real potential in the actual world, it reconstructs an alternative scenario in which that potential would have been available. It is therefore not about current possibility, but about retrospective hypothetical possibility.

To my surprise, I could not find any cases, where *võima* is used to express epistemic caution.

7.2.4 Overview

The common semantic effects of *võima* can be found in Table 7.

Table 7. Semantic effects of *võima* including frequencies

Type	Count
normative expectation (SN)	6
polite suggestion (EE/EN)	132
potentiality (SE)	15
counterfactual (DE)	3

7.3 *Tulema*

7.3.1 Semantic baseline

Tulema expresses non-epistemic necessity. Unlike all other Estonian modals, it takes impersonal (3SG) forms and its nominal argument is in the adessive case, e.g. *Mul tuleb midagi teha*.

7.3.2 Formal overview

Tulema can scope over *oskama, jõudma, saama, suutma, kannatama, jaksama, tohtima*. (Maybe also over itself, but it is hard to tell if the potential examples are genuine or typos.)

Table 8. Counts of combinations with *tulema* as first modal in the data set

oskama	jõudma	saama	suutma	kannatama	jaksama	tohtima	tulema
26	24	5	21	2	13	1	1

7.3.3 Semantic effect

In the great majority of my examples, *tulema* expresses what is needed to achieve some goal, what is or pre-described by the circumstances, but unlike *pidama* in an impersonal way. The necessity is not imposed by an authority or a legal context. An example is sentence (16), in which the force behind the need to be able to defend the democracy derives from general norms.

(16) Timestamped 2014–2023 – err.ee

* *Meie parlamentaarset demokraatiat* **tuleb**[1] **suuta**[2] **kaitsta** *ja seda peab tegema ka president.* Type: AON'

'We must be able to defend our parliamentary democracy, and the president must do so as well.'

For surprisingly many examples, this use feels like a fortune cookie wisdom, as in sentences (17) and (18).

(17) Timestamped 2014–2023 – postimees.ee

Siiski **tuleb**[1] **osata**[2] enda uhkus alla **neelata** *ja oma vigu tunnistada.* Type: AON'

'However, you have to be able to swallow your pride and admit your mistakes.'

(18) Web 2017 – barprof.ee

Moraal - ka ootamatult sülle langenud õnne **tuleb**[1] **osata**[2] **hoida***!* Type: AON'

'One must know how to cherish even happiness that has unexpectedly fallen into one's lap!'

Let us name this use *gnomic necessity*, for it reminds of aphorisms.

Definition 7.6 (Gnomic necessity) *refers to a use of a modal verb where the speaker presents an action as required by the circumstances, general norms, or practical reasoning, rather than by an explicitly identified authority or agent.*

The modality is thus deontic in force but impersonal in source: it frames the necessity as arising from how situations are structured or how one is expected to act in general, often conveying advisory or gnomic overtones rather than directive with a specific deontic source.

Similarly to *pidama*, we also find the uses of *stating a rule*, see sentence (19), and *wish for existence of a rule*, see sentence (20).

(19) Web 2019 – ulmeajakiri.ee

Ohutusreeglid näevad ette, et lifti **tuleb**[1] **saada**[2] **siseneda** *ka kogu tarkvara täieliku riknemise korral."* Type: SON

'Safety regulations stipulate that it must be possible to enter the elevator even in the event of a complete software failure.'

(20) Web 2019 – delfi.ee

Veekvaliteedi analüüsi tõendit **tuleks**[1] **saada**[2] **uuendada** *mitte igal aastal, vaid, kui kõik korras, iga 3 aasta järel.* Type: SEN

'The water quality analysis certificate could possibly be renewed not every year, but – if everything is in order – every three years.'

I found two more uses I would like to distinguish. The first of those is *teleological*, that is goal-oriented modality; an example of this is sentence (21).

(21) Web 2017 – honda-club.ee

Sharniiride puhul **tuleb**[1] **saada**[2] see määre **lasta** *sinna porikummi alla vot siis on sellest tolku mitte see kui porikummid ära määrida!* Type: COT

'When it comes to ball joints, you need to get the grease in there under the dust boot – that's what makes a difference, not just greasing the dust boots themselves!'

Definition 7.7 (Teleological necessity) *refers to a use of a modal expression where the necessity of an action is derived from a goal or intended outcome. The speaker presents the action as required in order to achieve a particular result or to avoid an undesirable consequence.*

The second one is *tulema* expressing intent, that is the necessity comes from the aspirations of the speaker, and it is to some degree possible to substitute it with ‘want’ or ‘intent to’. Examples are sentence (22) and sentence (23).

(22) Web 2021 – blogspot.com

”Karm” siiski selles mõttes, et kujuta ette - kogu selle 12 päeva kestva suvise festivali kava näidati ära 5 päevaga ja selle aja jooksul **tuli**[1] **jõuda**[2] **vaadata** *nii palju kui vähegi võimalik!* Type: COV

‘”Intense,” though, in the sense that – just imagine – the entire lineup of this 12 – day summer festival was crammed into 5 days, and during that time we had to see as much as we possibly could!’

(23) Timestamped 2014–2023 – err.ee

Vaktsineerimise kavadest **tuleb**[1] **suuta**[2] kinni **pidada** *ja tempo peab tõusma.* Type: AOV

‘We must be able to stick to the vaccination schedules, and the pace must pick up.’

Goal and intent can be very similar at times, because they often co-occur. If a goal requires an action, one also might also intent on carrying it out. The source of the necessity is different though: in the teleological case, it is grounded in the state of the actual world whereas in the case of volitional modality, it is grounded in the internal state of the speaker.

7.3.4 Overview

The common semantic effects of *tulema* can be found in Table 9.

Table 9. Semantic effects of *tulema* including frequencies

Type	Count
gnomic (ON’)	53
stating a rule (ON)	5
wish for existence of rule (EN)	1
teleological (OT)	22
intention (OV)	12

7.4 *Pruukima*

7.4.1 Formal overview

Pruukima can scope over *oskama*, *jõudma*, *saama*, *suutma*, *kannatama* and *tohtima*, in other words, to modals that mainly express possibility.

Pruukima is always negated.

Table 10. Counts of combinations with *pruukima* as first modal in the data set

oskama	jõudma	saama	suutma	kannatama	jaksama	tohtima
22	21	21	22	1	22	7

7.4.2 Semantic baseline

participant-external and epistemic necessity

7.4.3 Semantic effect

Pruukima has its main use on the border between *epistemic caution* and *normative expectation*. For the former, we can replace *pruukima* by certainly (albeit negated, so "it is not certainly the case that") and for the later "it is not normally the case that". While this is more of a spectrum than a clear-cut distinction, sentence (24) is clearly epistemic, whereas sentence (26) is more normative; most examples, as sentence (25), fall somewhere in between.

(24) Web 2019 – delfi.ee

"Need rünnakud vangla pihta, kus hoitakse Daeshi terroriste, viivad katastroofini, mille tagajärgedega ei **pruugi**[1] maailm **suuta**[2] toime **tulla***," öeldakse kurdide avalduses.*
Type: CSE

'"These attacks on the prison where Daesh terrorists are being held will lead to a catastrophe whose consequences the world may not be able to handle," the Kurds' statement says.'

(25) Web 2021 – festool.ee

Aga võtke seejuures arvesse, et kui te seda teete, ei **pruugi**[1] te **saada**[2] **kasutada** *selle veebisaidi kõiki funktsioone.* Type: SSE

'However, please note that if you do so, you may not be able to use all the features of this website.'

(26) Web 2019 – delfi.ee

Lapsed ei **pruugi**[1] **suuta**[2] kõdistamise ajal naermist **lõpetada** *ka siis, kui see neile üldse ei meeldi.* Type: ASN

'Children are usually unable to stop laughing when they are being tickled, even if they don't like it at all.'

In individual cases, it can be hard to decide in what direction (epistemic or normative) a construction is leaning.

7.4.4 Overview

The common semantic effects of *pruukima* can be found in Table 11.

Table 11. Semantic effects of *pruukima* including frequencies

Type	Count
normative expectation (SN)	49
epistemic expectation (SE)	67

7.5 *Tohtima*

7.5.1 Formal Overview

Tohtima can scope over *oskama*, *jõudma*, *saama*, *suutma*, *jaksama* and *tohtima*.

Table 12. Counts of combinations with *tohtima* as first modal in the data set

oskama	jõudma	saama	suutma	jaksama	tohtima
21	9	20	20	3	1

It is always negated, with few exceptions in questions.

7.5.2 Semantic Baseline

Tohtima expresses deontic possibility.

7.5.3 Semantic effect

In my examples, *tohtima* expresses deontic and epistemic necessity, so it is used similarly to *pidama*.

It can be used to state rules, as in sentence (27) that soecifies the conditions for the participation in a study.

(27) Web 2017 – delfi.ee

· *Osaleva lapse vanus peab olema vähem kui 1,5 aastat ning ta* ei **tohi**[1] **osata**[2] **kõndida**.
Type: AON

'The participating child must be under 1.5 years old and must not be able to walk.'

When used to state a rule, *tohtima* appears often in indicative mood.

A subcategory of rule stating are idealized constraints, that is *tohtima* is often used even when the speaker knows that the rule can be broken. So *tohtima* highlights a tension between norm and reality: the rule says "this must not be possible" but reality may contradict it (and that contrast is often the point).

Sentence (28) is a good example of this. The speaker states a rule or *idealization* that is true in the ideal business model, namely that no worker can have multiple skills. This constraint exists only, I suppose, to simplify the model and is not based on reality in a meaningful way.

(28) Web 2017 – automoto.ee

Üldiselt töötab ju ideaalne ärimudel selliselt, et keegi ei **tohi**[1] **osata**[2] kaht asja **teha**. Type: ADN

'Generally speaking, the ideal business model works in such a way that no one should be able to do two things at once.'

Another example is sentence (29). The imposed constraint that Bulgarian politics should not be influenced by other countries is utopic, clearly other countries can influence the politics of Bulgaria.

(29) Timestamped 2014–2023 – err.ee

"Mitte ükski riik, ei idas ega läänes, ei **tohiks**[1] **saada**[2] **mõjutada** *Bulgaaria poliitikat," ütles ta.* Type: SDN

'"No country, neither in the East nor in the West, should be allowed to influence Bulgarian politics," he said.'

Definition 7.8 (An idealized constraint) *is a rule formulated as if it were universally valid, but understood to function as a guiding principle rather than a strict or inviolable law; in fact, it is presupposed that it can and will be violated.*

Paraphrases work with "ideally", i.e. "Ideally, no country, neither in the East nor in the West is allowed to influence Bulgarian politics".

Next to rule stating, we can also find examples of normative expectations or epistemic uses, again more on a spectrum than as discrete categories: Sentence (30) is a normative expectation (it is based on developmental norms for children), and in sentence (31) and sentence (32) the epistemic scent is stronger.. I assigned sentence (31) to be a normative expectation (it seems to be an observation based on previous experience), but sentence (32) is more of an inference from knowledge of how computers work. I am not trying to argue that my assignments are undeniably correct, but that they move along a gradient from the deontic to the epistemic flavour.

(30) Web 2023 – wordpress.com

Alla poole aastased ei **tohiks**[1] **osata**[2] **jonnida** *jonni pärast (öeldud, et isegi aastane ei nuta jonni pärast, aga see juba küsitav).* Type: ASN

'Children under six months old shouldn't be able to throw tantrums just for the sake of it (it's said that even a one-year-old doesn't cry just to be stubborn, but that's debatable)'

(31) Web 2023 – co.ee

Nüüd istmevahelt väike kang sisse ja jällegi ei **tohiks**[1] ratast **jõuda**[2] **pöörata**. Type: CSN

'Now insert a small lever between the seats, and again, you shouldn't be able to turn the wheel. '

(32) Web 2019 – hinnavaatlus.ee

samas vigane video ei **tohiks**[1] ju **suuta**[2] poweroffi esile **kutsuda***?* Type: SOE

'At the same time, a faulty video shouldn't be able to trigger a power-off?'

Another undecided case of an *epistemic inference* or *normative expectation* is sentence (33). We can see that it would easily be possible to replace *tohiks* here by "probably" or "normally", i.e., the patients are *probably* unable or *normally* unable.

(33) Literature Contemporary 2000–2023 – ===NONE===

Püramidaalsüsteemi kahjustusega patsiendid, kes ei suuda tahtlikult näoilmeid teha, ei **tohiks**[1] **suuta**[2] näo abil **petta***, sest nad pole võimelised võltsilmeid esile kutsuma või tegelikke alla suruma.* Type: AOE

'Patients with damage to the pyramidal system who are unable to make voluntary facial expressions should not be able to deceive others with their faces, as they are unable to produce false expressions or suppress genuine ones.'

A clear epistemic inference is the following, very interesting example, sentence (34). It comes from a scientific article on cryptography or computability.

(34) Balanced Corpus 1990–2008 – ===NONE===

Kõigepealt on selge, et Bob ei **tohi**[1] **osata**[2] **arvutada** *y väärtusest Jacobi sümboli väärtust.* Type: AOE

'First of all, it is clear that Bob cannot possibly calculate the value of the Jacobi symbol from the value of y.'

The text continues as follows and explains why Bob is unable:

(35) *Selgub, et võrrandil x = a (mod n) on täpselt neli lahendit, millest kahe puhul on Jacobi sümboli (x/n) väärtus 1 ja kahe puhul -1. Nii et isegi kui Bobil õnnestuks leida kõik neli lahendit, ei ole tal teada, millisega nendest Alice alustas oma arvutusi.* 'It turns out that the equation x = a (mod n) has exactly four solutions, two of which have a Jacobi symbol (x/n) of 1 and two of which have a Jacobi symbol of -1. So even if Bob manages to find all four solutions, he won't know which one Alice started her calculations with. '

Here *tohtima* must denote logical or alethic[14] modality, because the situation is such that given Bob's information state, the value of the Jacobi symbol is underspecified. He has no logical or mathematical method to determine which of the two values Alice has started with.

In order not to complicate the classification system further, I would classify this as epistemic modality with the maximal degree of certainty.

For the epistemic cases, I decided to use the term

Definition 7.9 (An (epistemic) inference) *is a judgment in which a speaker uses available evidence – such as general knowledge, contextual cues, or beliefs about causal or structural relations – to project a conclusion about a state of affairs. The inferred conclusion is defeasible, meaning it may later turn out to be incorrect if the underlying assumptions are incomplete or mistaken.*

7.5.4 Overview

The common semantic effects of *tohtima* can be found in Table 13.

Table 13. Semantic effects of *tohtima* including frequencies

Type	Count
rule stating (ON)	14
idealized constraint (DN)	22
normative expectation (SN)	13
inference (OE)	25

7.6 *Saama*

7.6.1 Formal overview

Saama can scope over modal verbs of dynamic ability: *oskama*, *suutma*, *jõudma*, *jaksama* and *saama*.

Table 14. Counts of combinations with *saama* as first modal in the data set

oskama	jõudma	saama	suutma	jaksama
23	4	3	6	1

7.6.2 Semantic baseline

Saama can express any kind of possibility and also (rarely) participant-external necessity.(Metslang et al. 2024)

[14] Alethic modality is concerned with metaphysical or logical necessity and possibility. The canonical example is 'All bachelors are unmarried men'.

7.6.3 Semantic effect

Saama as an outer modal is not very common.

In my examples, it is used to express that some capacity does not exist due to external circumstances and the flavour is circumstantial or epistemic.

Sentences (36) and (37) illustrate nicely why it can be difficult to decide between circumstantial and epistemic flavour in a particular example.

(36) Reference Corpus 1990–2008 – ===NONE===

Nathan Road 36/44 koosneb nii paljudest osadest ja korrustest, et silm ei **saagi**[1] **jaksata**[2] sadu eri firmasid kokku **lugeda**. Type: ASC

'36/44 Nathan Road consists of so many sections and floors that it's impossible to keep track of all the different businesses there.'

(37) Web 2021 – sirp.ee

Unustati, et lõpptarbija on harjunud traditsiooniliste toimingutega, ta ei oska ega **saagi**[1] **osata**[2] **näha** *tõeliselt edasiviivaid lahendusi.* Type: ASE

'It was overlooked that the end user is accustomed to traditional procedures; they are unable to – and cannot be expected to – recognize truly innovative solutions.'

In sentence (36), we have a situation in which the sheer number of sections makes it difficult to keep track of them all. Now, we can read *ei saagi* as a circumstantial modal '36/44 Nathan Road consists of so many sections and floors that *under such circumstances* it's impossible to keep track of all the different businesses there.' or as epistemic, emphasizing that the second part of the sentence is a conclusion of the first half: '36/44 Nathan Road consists of so many sections and floors that it is *therefore* impossible to keep track of all the different businesses there.' The circumstantial interpretation is more adequate here because it locates the actual source of the modality, which lies in the real world.

In contrast, for sentence (37) the epistemic reading appears to be better: it is less intuitive to read *saagi* as 'under such circumstances' in the sentence. This backs the epistemic interpretation, especially because the link between being acquainted with traditional procedures and being unable to recognize innovative solutions is less immediate and requires more argumentative support.

All but two of the collected corpus sentences fall onto this line of circumstantial/epistemic modality. The exceptions are sentence (38) and sentence (39).

(38) Web 2017 – blogspot.com

Näiteks mina kuulsin seda lauset oma lapsepõlves iga päev ning loomulikult eeldasin selle põhjal, et naine ongi roolis mingi imelik erand, naine ei **saagi**[1] autoga **sõita osata**[2] *ja kõik kaasliiklejad suhtuvadki temasse ette põlgusega.* Type: ASN

‘For example, I heard that phrase every day during my childhood, and naturally, based on that, I assumed that a woman behind the wheel was some kind of strange exception, that a woman simply couldn’t know how to drive, and that all other drivers looked down on her.’

In sentence (38), it is not an inference from prohibitive circumstances that women might be unable to drive a car, the speaker expresses their former opinion that *intrinsically, women are unable to drive a car*, which is according to my earlier classification a case of a ’normative expectation’.

Sentence (39) is not only of interest because of the modal interpretation, but also because it is a nice case of *saama* taking scope over itself. Given that the two forms of *saama* have different grammatical form, it is very unlikely that the co-occurence is unintended.

(39) Web 2017 – blogspot.com

Kas **saab**[1] **saada**[2] juba **lugeda***/kuulda sellest speshul kutist või ei saa?! :PKõik õhtud Sul ka nagunii selle tüübiga kinni ja blogitsikkide jaoks üldse aega ei jää ega midagi.... :/* Type: CON

‘Can we already read/hear about this special guy, or not?! :P You’re tied up with him every night anyway, so there’s no time left for blogging or anything else.’

Concerning the intended meaning, I would interpret the outer *saama* as deontic and the inner *saama* as circumstantial. The speaker asks whether the addressee is willing (allowing) to give others the circumstantial opportunity to read about the ’special guy’. Or, formulated differently, if they are in principle against posting it on their blog, so that the blog readers can read about it. Thus, the classification should be ‘rule stating’, which in a question is of course not stating a rule, but asking if a rule exists.

The data also shows that *saama* is a negative polarity item which appears (with one exception) only negated or in questions. This connects back to Penjam (2008) finding that *saama* is negated in 49% of its modal occurrences, meaning that this effect is even stronger if a modal *saama* has another modal in its scope. My data contains 35 occurrences of *saama*, of those 27 are negated, 7 are positive but are found in questions (which are also non-veridical environments) and only one positive occurrence is found in a non-interrogative context, which means that significantly more than half of the occurrences are negated.

7.6.4 Overview

The common semantic effects of *saama* can be found in Table 15.

Table 15. Semantic effects of *saama* including frequencies

Type	Count
stating a rule (ON)	1
normative expectation (SN)	1
epistemic expectation (SE)	16
circumstantial (SC)	19

7.7 *Suutma*

7.7.1 Formal Overview

With 26 examples in total, *suutma* scopes over *oskama*, *jõudma*, *saama*, *kannatama* and *suutma*.

Table 16. Counts of combinations with *suutma* as first modal in the data set

oskama	jõudma	saama	suutma	kannatama
7	6	8	3	2

7.7.2 Semantic Baseline

Dynamic ability, especially grounded in the physical state.

7.7.3 Semantic effect

In double modal constructions, *suutma* tends to shift attention away from mere physical ability and toward the broader conditions that make the embedded capacity possible, such as mental state, situational factors, or circumstantial constraints. In addition, it contributes an aspect of successful realization or achievement to the embedded capacity.

Notably, the data contain almost no clear cases where *suutma* expresses purely physical ability in the sense of bodily strength or endurance. This is somewhat surprising given that physical ability is central to the semantic baseline of *suutma* outside double modal constructions.

It is often negated (12/26 occurrences).

In sentence (40), *suutma* implies that the mental state enables ability to choose, thus it denotes dynamic ability.

(40) Literature Contemporary 2000–2023 – ===NONE===

Täiskasvanutena peaksime me olema piisavalt nutikad, et **suuta**[1] **osata**[2] **valida**. Type: ASA

'As adults, we should be smart enough to know how to choose.'

In sentence (41), *suutma* is used to express that the state of the economy blocks developing the capacity to fulfill certain requirements, hence it denotes circumstantial possibility. Also, *suutma* takes here scope over itself.

(41) Web 2013 – envir.ee

”Ka Ühendkuningriik kuulub nende viie riigi hulka, mis ei **suuda**[1] **suuta**[2] **täita** *2020. aastaks euroliidu poolt kehtestatud taastuvenergeetika 20% kasutamise kriteeriumi,” tõdes Harrison.* Type: CSC

‘”The United Kingdom is also among the five countries that will not be able to meet the European Union’s target of 20% renewable energy use by 2020,” Harrison noted.’

We can see in both (40) and (41) (and this is confirmed by the other examples) that *suutma* makes the inner modal redundant.

7.7.4 Overview

The common semantic effects of *suutma* can be found in Table 17.

Table 17. Semantic effects of *suutma* including frequencies

Type	Count
circumstantial (SC)	10
dynamic (SA)	16

7.8 *Tarvitsema*

7.8.1 Formal Overview

With 24 examples in total, *tarvitsema* scopes over *oskama*, *saama*, *suutma* and *jõudma*.

Table 18. Counts of combinations with *tarvitsema* as first modal in the data set

oskama	jõudma	saama	suutma
6	3	6	9

7.8.2 Semantic Baseline

Tarvitsema expresses necessity, participant-external and epistemic.It occurs negated, and thus its negative forms expresses possibility.

7.8.3 Semantic effect

It is most commonly used for expectation management, that is to say that a capacity might not be there. For this use, we can substitute it with ‘potentially’ or ‘maybe’. It also occurs only negated in this meaning. An example is sentence (42).

(42) Web 2013 – politsei.ee

Kui te hilinete ootealale, siis ei **tarvitse**[1] te **saada**[2] soovitud ajal piiri **ületada**. Type: CEE

‘If you arrive late at the waiting area, you may not be able to cross the border at the desired time.’

Sentence (43) is from a novel, where the protagonist has two opponents, and considers, if he would manage to shoot both of them. In this sentence, despite not being in the conditional mood *ei tarvitsenud* introduces a counterfactual possibility.

(43) Literature Contemporary 2000–2023 – ===NONE===

Pärast esimest lasku pidanuks ma suunama püstolitoru kohe teisele poole ja ma ei **tarvitsenud**[1] enam **jõuda**[2] seda **teha**. Type: CDE

‘After the first shot, I would have had to swing the pistol to the other side at once, and I might not have managed to do it in time.’

Lastly, there are two non-negated occurrences of *tarvitsema* in sentences (44) and (45), that are both referring to the same quote.

(44) Web 2021 – saartehaal.ee

Väga ilmekalt-tabavalt on seesuguse tegevuse kohta lausunud endisaegne prantsuse kirjanik ja poliitik Chateaubriand: ”Vallutajaist tülgastumiseks **tarvitseb**[1] vaid **tunda saada**[2] *kõiki neid hädasid, mida nad põhjustavad.”* Type: COT

‘The French writer and politician Chateaubriand once made a very vivid and apt observation about such actions: ”To grow weary of conquerors, one need only experience all the hardships they cause.”’

(45) Web 2021 – wordpress.com

Mitte ilmaaegu pole öeldud, et vallutajaist tülgastumiseks **tarvitseb**[1] vaid **tunda saada**[2] *kõiki neid hädasid, mida nad põhjustavad.* Type: COT

‘It is no exaggeration to say that to grow weary of conquerors, one need only experience all the hardships they cause.’

This use of *tarvitsema* differs from the epistemic ones we saw before. Here, *tarvitsema* expresses what is sufficient to reach a certain state (being weary of conquerors), thus it must express teleological modality.

7.8.4 Overview

The common semantic effects of *tarvitsema* can be found in Table 19.

Table 19. Semantic effects of *tarvitsema* including frequencies

Type	Count
potential (EE)	21
counterfactual (DE)	1
teleological (OT)	2

7.9 *Oskama*

7.9.1 Formal Overview

I found three examples; in those *oskama* scoped over itself, over *suutma*, and over *kannatama*. In the last one, *oskama* is itself an inner modal and we have a construction including three modal verbs.

Table 20. Counts of combinations with *oskama* as first modal in the data set

oskama	suutma	kannatama
1	1	1

7.9.2 Semantic Baseline

Oskama expresses dynamic ability, in particular, ability achieved through learning.

7.9.3 Semantic effect

Due to there being only three examples, we can look at them individually:

(46) Web 2023 – volvoclub.ee

Sain aru, et kontrollivad käitumist roolis (et **oskaksid**[1] **osata**[2] **arvestada** *raskema haakega sõitmisel tekkivaid lisaraskusi) käitumist.* Type: ASA

'I understood that they were assessing driving behavior (specifically, the ability to account for the additional challenges that arise when driving with a heavier trailer).'

This double use of *oskama* in sentence (46) seems strange to me, but potentially *oskama arvestada* is becoming a fixed expression[15] – a subject to semantic bleaching – and therefore, a second 'oskama' is applied to reinforce the modal meaning.

(47) Web 2021 – wordpress.com

Siis oleks ma ehk **osanud**[1] **suuta**[2] oma valuga toime **tulla** *ja mu pere oleks terveks jäänud.* Type: ADA

[15] Arvestama occurs 1102689 times in the Estonian National Corpus, of these 9076, so a bit less than 1%, are with *oskama* in the direct vicinity (±5 words).

‘Then maybe I would have been able to cope with my pain, and my family would have stayed together.’

In sentence (47), I would interpret *oskama* as ‘having learned’. The context before includes reference to having missed certain teachings in life, so ”then I maybe would have learned to be able to cope...”

The third sentence including *oskama* contains three modals:

(48) Web 2023 – horisont.ee

Pead[1] **oskama**[2] **kannatada**[3] lõpmatuseni mikroskoobi taga **istuda**, *see on seotud teatud temperamendiga.* Type: 3

‘You have to be able to sit endlessly at a microscope; it has to do with a certain temperament.’

In sentence (48), it also makes sense to read *oskama* as ‘having learned’, i.e. ”you have to have learned to be able to sit endlessly...”

Based on these observations, I would propose that if *oskama* scopes over other dynamic modals, it has the non-modal meaning of ‘having learned’.

7.10 *Jõudma*

7.10.1 Formal Overview

This verb occurred only once as an outer modal, taking I found a single example in which *jõudma* scopes over *saama* in its scope.

Table 21. Counts of combinations with *jõudma* as first modal in the data set

saama
1

7.10.2 Semantic Baseline

Jõudma has the non-modal meaning ‘to reach’. As a modal it expresses dynamic ability, but with a connotation of managing or achievement.

7.10.3 Semantic effect

In the only example, sentence (49) *jõudma* adds achievement.

(49) Web 2019 – palverand.ee

Siis tohime põhjusega loota, et kord jälle lahedamaid aegu ja vabamaid päevi **jõuame**[1] **näha saada**[2]*!* Type: CSC

‘Then we have good reason to hope that we will once again get to see better times and freer days!’

8 Semantic effects of the outer modal

The aim of this section is to examine how a certain semantic effect can be achieved.

8.1 Recapitulation of semantic types

To recapitulate, we have identified the following 15 semantic types for the effect of the outer modal:

Deontic types:

Stating a rule (ON) the speaker states a duty or responsibility that someone has. Possible paraphrases: 'has the duty to', 'is responsible to', or, (if the force is possibility), 'is allowed to'. An example is sentence (4) in Section 7.1.3.

Gnomic (ON') is a subtype of *stating a rule*, and used for cases that are aphorism-like in presenting an action as necessary without a clear source for that necessity. An example is sentence (17) in Section 7.3.3. This type has been mainly assigned for *tulema*.

Idealized constraint (DN) is used to state rules or constraints that follow from some prior conception of an ideal state of affairs, which are not obeyed to in reality, and this tension is highlighted by the modal verb. Paraphrases are possible with 'ideally'. An example is sentence (28) in Section 7.5.3.

Normative expectation (SN) is a generalization what members of a certain group are like. It can be paraphrased by *normally* or *generally*. An example is sentence (5) in Section 7.1.3.

Wish for existence of a rule (EN) is stating a rule that does not exist in that form yet, but that the speaker considers good and reasonable. It is a suggestion for a possible rule. In a *wish for a rule*, the norm itself is hypothetical or proposed; in an *idealized constraint*, the norm is presupposed, but compliance with it is incomplete or absent. An example is sentence (6) in Section 7.1.3.

Between deontic and epistemic use is the *polite suggestion*

Polite suggestion (EE/EN) combines an epistemic possibility with a weakly endorsed preference for it. It thus sits between epistemic and deontic uses. An example is sentence (10) in Section 7.2.3.

Espistemic uses

Inference (OE) based on knowledge of how something works (e.g. a technical system), the speaker predicts a possible result or development. The inference may ultimately prove incorrect. An example is sentence (33) in Section 7.5.3.

Counterfactual (DE) Statements possible and neccessary states of affairs in a counterfactual situation (mostly in the past). An example is sentence (43) in Section 7.8.3.

Potentiality (EE) (or (SE) if the outer modal expresses possibility, e.g. for *võima*) Acknowledging or simply considering a potential state of affairs. The speaker is not expressing that the mentioned state of affairs is likely or desirable. An example is sentence (42) in Section 7.8.3.

Epistemic expectation (SE) a statement about what is likely or probable (to happen in the future or under certain circumstances), not based on a specific argument as the *inference*, but on general knowledge of the circumstances. Unlike *potentiality* the speaker judges the mentioned state of affairs as likely. An example is sentence (8) in Section 7.1.3.

The remaining types, where the outer modal is neither deontic nor epistemic in flavour, are:

Teleological (OT) what must/may happen for a goal to be achieved. An example is sentence (21) in Section 7.3.3.

Intention (OV) what someone plans or wants to happen. An example is sentence (23) in Section 7.3.3.

Circumstantial (SC) This category concerns what is possible or necessary given the relevant circumstances. When the relevant circumstances include rules, obligations, or normative principles that determine the outcome, the modality is instead classified as deontic. An example is sentence (36) in Section 7.6.3.

Dynamic (SA) what is necessary/possible according to someone's capacities. An example is sentence (40) in Section 7.7.3.

Counterfactual Ability (DA) The only example is sentence (47) in Section 7.9.3.

8.2 Which outer modals can be used for which semantic type?

Table 22 gives an overview of which outer modal the final data set confirms to go with which semantic types.

Table 22. Outer modal verbs to types

	DA	DE	DN	EE	EE/EN	EN	OE	ON	ON’	OT	OV	SA	SC	SE	SN
jõudma													✓		
oskama	✓											✓			
pidama		✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓
pruukima														✓	✓
saama								✓					✓	✓	✓
suutma												✓	✓		
tarvitsema		✓		✓						✓					
tohtima			✓				✓	✓							✓
tulema						✓		✓	✓	✓	✓				
võima		✓		✓	✓										✓

9 Inner modal

In this section, we will examine for each inner modal its semantic contribution.

9.1 *Pidama*

There is one example of *pidama* as an inner modal in the data and there, *pidama* takes scope over itself.

(50) Timestamped 2014–2023 – err.ee

”Aktuaalne kaamera” küsis Jüri Rataselt, kuivõrd ta **pidi**[1] neljapäeval **pidama**[2] oma kolleegidele **selgitama** *Eesti valitsuse ministritelt rahvusvahelisse meediasse jõudnud sõnumeid.* Type: CON

‘”Aktuaalne kaamera” asked Jüri Ratas to what extent it was his duty to have to explain to his colleagues on Thursday the statements made by Estonian government ministers that had reached the international media.’

Why are there two forms of *pidama* in sentence (50)? One explanation, hinted at in the translation, is that there is a (circumstantial) need to give an explanation, and this is expressed by the inner *pidama*. The outer *pidama* denotes deontic necessity, in the sense of who is responsible for providing the explanation. If this is analysis is correct, *kuivõrd* ‘to what extend’ does not scope over how lengthy the explanation had to be, but rather the degree to which he, Jüri Ratas[16], was responsible.

So, *pidama* as an inner modal denotes circumstantial necessity in sentence (50).

9.2 *Võima*

I have 22 examples of *võima* in the scope of *pidama*. No other modal in my data can scope over *võima*.

Most commonly, *võima* denotes circumstantial possibility in my examples, as in sentence (51).

(51) Web 2021 – eki.ee

Näidendi **peaks**[1] **võima**[2] **esitada** *kolme tunni piires.* Type: CSE

‘The play should be possible to perform within three hours.’

I have also examples where *võima* expresses dynamic modality and modality according to social conventions, that is deontic modality.

Sentence (52) demonstrates a case of dynamic ability.

[16] Jüri Ratas is an Estonian politician who served as the prime minister of Estonia from 2016 to 2021

(52) Web 2013 – folklore.ee

Ühel korral, siis kui laada aeg olnud, juhtunud siis nad kokku ja kohe tülisse selleperast, et nõid ei **pea**[1] **võima**[2] tuld ära **keelata***, kui põleb, aga nõid ütelnud, et tuli temale midagi ei tee.* Type: ASC

'Once, during a fair, they happened to meet and immediately got into an argument for the reason that the witch might not be able to put out the fire once it was burning, but the witch said the fire wouldn't harm her.'

Sentence (53) shows a case of possibility according to social norms.

(53) Web 2021 – kodutud.com

Vastama eeldatakse naissugu, **kommenteerida peaksid**[1] aga mehed ju küll **võima**[2]*??? (Kus krt mul nüüd see soolise võrdõiguslikkuse voliniku kõnetoru nummer on jäänud..)* Type: SEN

'I guess women are supposed to answer, but surely men should be able to comment too, right??? (Where the hell did I put the phone number for the Gender Equality Commissioner...)'

A very interesting example is sentence (54). Here *võima* arguably expresses epistemic modality. This rare configuration is significant because it suggests that the assumed fixed hierarchy between epistemic and deontic modality may not be absolute. While epistemic modality is generally understood to take propositional scope (i.e. evaluate the truth of a proposition), this example shows a structure in which a deontic modal appears to have wider scope.

(54) Web 2017 – delfi.ee

Häda on nüüd selles et miks me **peaksime**[1] sellist õudu **võima**[2] **näha***: kas Hansson ei oleks siiski pidanud teadusloogiliselt lisama – praeguse majanduspoliitika püsimise tingimusel (nagu seda sageli teeb ka EL Komisjon) – ehk lisama et tingimusel kui istuv valitsus ja keskpank piisavaid olulisi arvukaid reforme selle makroökonoomilise kriisi lõpetamiseks viivitamatult ette ei võta.* Type: ESN

'The problem now is the reason why we should be in a position to see such horror: should Hansson not, from a scientific standpoint, have added — assuming the current economic policy remains in place (as the EU Commission often does) — or perhaps add that, provided the current government and central bank do not immediately undertake sufficient, significant, and numerous reforms to end this macroeconomic crisis.'

For context, Ardo Hansson is an Estonian economist. He was the Governor of Bank of Estonia from 2012 to 2019 and worked as a senior economist at the World Bank. Sentence (54) comes

from a comment section on delfi.ee.[17] The comment reuses material from a memorandum, see (55), cited in the article, itself containing a reported utterance by Ardo Hansson, and embeds it in a new propositional structure with additional modal marking and speaker evaluation.

(55) *Märgukiri 18.VI. 13 «Järgnevatel aastatel võime näha esmakordselt hõive kahanemist vaatamata tööpuuduse vähenemisele,»tõdes Eesti Panga president Ardo Hansson keskpanga värsket majandusprognoosi tutvustades.*

'Memorandum 18.VI. 13: "In the coming years, we may see a decline in employment for the first time despite a decrease in unemployment", noted Bank of Estonia governor Ardo Hansson while presenting the central bank's latest economic forecast.'

Now, concerning the use of the modal *võima* in sentence (54), we can see it is in direct reference to (55). There too, the construction *võime näha* is used, and this use is clearly epistemological, for we can paraphrase "may" there by "will possibly".

Is the use in sentence (54) still epistemological? Given that it comes in the discourse after (55), it is conceivable that *võima näha* in sentence (54) is an echoic use of *võime näha*" in sentence (55), so the author repeats the utterance and qualifies it with an outer modal. Specifically, in sentence (54), the writer criticises that this prognosis was brought forward without a clear exposition of the assumptions underlying it, as it is common in economics to formulate such a prognosis as an implication.

So speaking in terms of modal flavours, *peaksime* denotes deontic necessity (is it morally good?), and *võima* in its scope concerns the epistemic position of any person who read or heard about sentence (55). This epistemic position enables them to see the horror of an unemployment crisis.

Hence, the possibility *võima* denotes is grounded in (our) information state, which is typical for epistemic possibility. The only other option I see to understand *võima* in sentence (54) would be dynamic possibility, which generally applies in cases of willingness or ability.

Both classifications seem appropriate, but epistemic modality might be the better interpretation because predictions based on knowledge are epistemic modality.

Table 23. Distribution of modal flavour where *võima* is inner modal

circumstantial	deontic	dynamic	epistemic
14	4	3	1

9.3 *Tulema*

The corpus contains eight examples of *tulema* in the scope of another modal verb, four in the scope of *võima* and four in the scope of *pidama*.

[17] `https://arileht.delfi.ee/artikkel/66273866/hille-hinsberg-mis-meie-riik-maksab/kommentaarid?reg=1&no=0&s=1`

Table 24. Modal verbs scoping over *tulema*

pidama	võima	tulema
3	4	1

Tulema seems to express mainly circumstantial necessity, especially if it arises in the future, as in sentence (56) or (57).

(56) Web 2013 – reform.ee

Ja kuulakem meie ametiühingutegelasi, kes raiuvad kui rauda, et mitte keegi ei mõtle kedagi tööle võttes sellele, et tal **võib**[1] **tulla**[2] ühel päeval **teha** *ka teistsugune otsus.* Type: CEE

'And let's listen to our union leaders, who insist with unwavering conviction that no one, when hiring someone, ever considers the possibility that they might one day have to make a different decision.'

(57) Web 2017 – blogspot.com

Kui edaspidi **peaks**[1] **tulema**[2] Teile **kirjutada***, siis olen poole viisakam.* Type: CEE

'If I ever should have to write to you again, I will be more polite.'

Especially sentence (57) sounds formal and old fashioned and interestingly the adessive argument *mul* is ommitted.

We can see German influence in constructions, as in sentence (58), which comes from a legal document from 1903. Probably, *täita tulema* was translated from *zu erfüllen kommen* or a similar construction. This is still visible in the word order which is typical for German but not for Estonian.

(58) Web 2023 – ra.ee

Walla p...wad ja koha peal olewad tööd, mis walla ehk kroonu poolt selle koha täita on ehk ka edaspidi **peaks**[1] **täita tulema**[2] *peab rentnik ilma wastu hakkamata ära täitma niisama ka kõik posti kui ka seaduslikud küla tööd peawad kohalise ülewaatamise järele ära tehtud saama.* Type: X

'All work on the estate and on the premises – which the estate or the Crown may be required to perform in the future – must be carried out by the tenant without objection; likewise, all postal duties and lawful village work must be performed following local inspection.'[18]

However, sentence (58) does probably not exemplify a double modal verb. Instead, we can consider *tulema* in (58) to be a light verb, that is a verb with little semantic content that forms

[18] `https://www.ra.ee/vallakohtud/index.php/record/view?id=3710&ru=5uepwp`

a predicate together with some additional expression, as its German equivalent *kommen* is in similar expressions.

An inner *tulema* does in two instances also express deontic necessity; an example is sentence (59), which is about the possibility that an association might have to pay for their losses.

(59) Web 2013 – eca.ee

Kui maksame osamaksuks 10 krooni, siis sellega ka vastutame, kui ühingul **peaks**[1] **tulema**[2] **kanda** *kahjusid.* Type: SEE

'If we pay a membership fee of 10 kroons, we are also liable if the association should incur any losses.'

9.4 *Pruukima*

there are no cases of *pruukima* in the scope of another modal in the corpus

9.5 *Tohtima*

Table 25. Modal verbs scoping over *tohtima*

pidama	võima	tulema	pruukima	tohtima
23	23	1	7	1

Tohtima expresses almost exclusively deontic possibility, as in sentence (60) that is about legally regulated work allowances while receiving unemployment benefits.

(60) Web 2021 – rup.ee

Töötushüvitise saamise ajal **võiks**[1] **tohtida**[2] **töötada** *väikeses mahus.* Type: SEE

'While receiving unemployment benefits, it should be permitted to work on a small scale.'

In a couple of cases (currently three) *tohtima* does not express deontic possibility.

In sentence (61), *tohtima* is more dynamic ('be capable of') and in sentence (62) the flavour is more circumstantial, though that can be debated.

(61) Web 2019 – joogafestival.ee

Kui sa teed joogat targalt – see tähendab, et pigem pingutad vähem kui üle, lõpetad keha esimese märguande peale (valu, iiveldus, pearinglus, hingeldus, südamepekslemine) ja lõdvestud nii nagu juhendatud, siis **peaksid**[1] joogat **tohtima**[2] **teha** *igas eas.* Type: CSN

'If you practice yoga wisely – that is, if you tend to hold poses gently rather than straining, stop at the first sign your body gives you (pain, nausea, dizziness, shortness of breath, or a racing heart), and relax as instructed – then you should be able to practice yoga at any age.'

(62) Timestamped 2014–2023 – err.ee

Kui tohib uurida aatomite lõhkumise ja DNA häkkimise võimalusi, miks ei **peaks**[1] **tohtima**[2] **uurida** *taimetee joomist?* Type: CSN

'If it's permissible to study the possibilities of splitting atoms and hacking DNA, why shouldn't it be possible to study the consumption of herbal tea?'

Sentence (62) could be interpreted as deontic possibility, but it is not actually forbidden to study herbal tea consumption, rather, it is more likely to be dismissed by the scientific community and not taken seriously. In that sense, *tohtima* in the sentence is about what is socially desirable.

9.6 *Saama*

Table 26. Modal verbs scoping over *saama*

pidama	võima	tulema	pruukima	saama	tohtima	suutma	tarvitsema	jõudma
28	24	5	21	3	20	8	6	1

Saama as an inner modal denotes usually participant-external, that is circumstantial or deontic possibility.

In sentence (63), *saama* relates to the circumstantial possibility of watching a film. In sentence (64), *saama* expresses the deontic possibility of filing a claim.

(63) Timestamped 2014–2023 – postimees.ee

Kahjuks ei ole hetkel veel teada, kas ja kuidas seda süngelt lahedat jõulufilmi Eestis **näha saama**[2] **peaks**[1]*, kuid siin-seal (USA, UK, Canada, Venemaa) esilinastub film detsembri alguses.* Type: CSE

'Unfortunately, it's not yet clear whether and how this darkly charming Christmas movie will be available to watch in Estonia, but it's set to premiere in various places (the U.S., the U.K., Canada, Russia) in early December.'

(64) Web 2017 – aripaev.ee

"Selleks **peavad**[1] kannatanud **saama**[2] **esitada** *seaduserikkuja vastu kahju hüvitamise nõudeid," märkis ta.* Type: SSN

'"To that end, victims must be able to file claims for damages against the offender," he noted.'

Even for possibilities that are on the surface level more dynamic, *saama* usually gives a more circumstantial interpretation, as in sentence (65):

(65) Web 2019 – delfi.ee

”Õhus on Kaire ju sellises asendis, et põhimõtteliselt **peaks**[1] **saama**[2] jalgu ette **viia** *küll,” lisab ta.* Type: CSE

‘”In the air, Kaire is in such a position that, in principle, she should be able to bring her legs forward,” he adds.’

Moving the legs somewhere is a dynamic ability, but in sentence (65) the focus is on the anatomic side, which brings forward a more participant-external reading.

A few cases where *saama* expresses true dynamic ability nonetheless exist, as in sentence (66).

(66) Web 2023 – wordpress.com

Miks ei **või**[1] laps **saada**[2] prügi prügikasti **panna***?* Type: AEE

‘Why can’t the child put the trash into the rubbish?’

9.7 *Suutma*

Table 27. Modal verbs scoping over *suutma*

pidama	võima	tulema	pruukima	saama	tohtima	suutma	tarvitsema	oskama
26	25	21	22	6	20	3	9	1

It should come to no surprise that *suutma* mainly expresses dynamic ability, or circumstantial ability that is tied to the capacities of an actor. Also it often carries a connotation of *successfully* completing, so an English translation would use ‘manage’, and *suutma* is not restricted to physical abilities.

Sentence (67) displays how *suutma* carries a connotation of success and also how the capacity in question (to find answers) is not strictly dynamic, but still strongly tied to what a person can or cannot do.

Sentence (68) shows a use of *suutma* where it expresses dynamic ability, although the ability in question is mental. At first sight, one might therefore expect *oskama* instead. Probably, the explanation is that *suutma* here does not mean “having proficiency in three languages” — which would indeed require *oskama* — but rather “having the capability to communicate constantly in three languages without becoming exhausted.” The emphasis is thus on mental endurance and sustained capacity, not on knowledge of the languages themselves.

(67) Web 2017 – toidutare.ee

Te **peate**[1] **suutma**[2] need vastused **leida***, lihtsalt peate.* Type: AON

‘You have to manage find those answers, you just have to.’

(68) Web 2023 – picuki.com

Töö on ühtpidi nõudlik - **suhelda peab**[1] **suutma**[2] *kolmes keeles, teisalt aga mõnusalt*

paindlik - te ei tea kunagi Luxi klienditeenindusse helistades või kirjutades, kas teile vastav abivalmis tütarlaps toimetab sel hetkel bussijaama kontoris või istub parasjagu rätsepistes joogamatil oma mõnusas kodus. Type: AON

'On the one hand, the job is demanding – you need to be able to communicate in three languages – but on the other hand, it's pleasantly flexible – when you call or write to Lux's customer service, you never know whether the helpful young woman assisting you is currently at the bus station office or sitting on a yoga mat in her cozy home.'

Suutma does not strictly speaking express deontic possibility in my data. There are a couple of cases where it refers to possibility inside a framework of rules to some degree, such as in sentence (69). There, the rules for calling witnesses depend on a majority vote which the Republicans potentially do not have.

(69) Timestamped 2014–2023 – err.ee

Senati vabariiklased ei **pruugi**[1] **suuta**[2] **takistada** *tunnistajate kutsumist* Type: SSE

'Senate Republicans may not be able to prevent witnesses from being called.'

This verb is compatible with inanimate actors. In sentence (70), *suutma* denotes a technical capacity that is (or should be) restricted by the laws of physics.

(70) Web 2021 – veskimees.eu

Hendekaforkaator ei **tohiks**[1] **suuta**[2] ruumi **pöörata** *ja väga mitmetel kaalutlustel tundub tõenäoline, et see avab mingi järgmise dimensiooni, millest ka minu rahvas teab vaid legendide tasemel."* Type: SDN

'The hendekaforkator should manage to rotate space, and for a great many reasons it seems likely that it opens some further dimension, about which even my people know only at the level of legend.'

9.8 *Tarvitsema*

Table 28. Modal verbs scoping over *tarvitsema*

võima
1

The only example of *tarvitsema* as the inner modal I have found is sentence (71).

(71) Web 2013 – fyysika.ee

Kontojääägi kontrollimiseks **võib**[1] tulevikus **tarvitseda**[2] vaid pangakaardil nuppu **vajutada**, *ning andmed kuvataks väikesel ekraanil otse kaardi pinnal.* Type: TEE

‘In the future, all it may take to check your account balance is to press a button on your bank card, and the information will be displayed on a small screen right on the card itself.’

In sentence (71), *tarvitsema* is about what one will have to do in order to see the bank account information given a possible technical development, thus it denotes teleological necessity (what is needed to achieve a goal).

It is interesting to compare *tarvitsema* with *pruukima*, which according to Sõnaveeb are synonyms. Both are usually negated, but we can see that they behave differently in my data.

Overall, *pruukima* is much more widely used as an outer modal, expressing both epistemic and normative necessity whereas *tarvitsema* is very limited in use and only expresses epistemic modality as an outer modal verb.

There are no occurences at all of *pruukima* as an inner modal. For *tarvitsema* there is sentence (71) where it is both negated and teleological.

9.9 *Oskama*

Table 29. Modal verbs scoping over *oskama*

pidama	võima	tulema	pruukima	saama	tohtima	suutma	tarvitsema	oskama
32	25	26	22	23	21	7	6	1

Oskama is overwhelmingly used for dynamic ability, as in sentence (72), where it is used for the ability of driving a car. This is an ability that can be learned.

(72) Web 2013 – riigikogu.ee

Lisaks sellele tahan ma öelda, et üks normaalne sotsiaaldemokraat **võiks**[1] **osata**[2] autoga **sõita**. Type: CEE

‘In addition, I want to say that any normal social democrat should know how to drive a car.’

There are a couple of more interesting cases, where *oskama* does not denote a learned ability.

(73) Web 2019 – hinnavaatlus.ee

High Memory Area (HMA) on minuteada see ala mis on kohe peale 1 MB, kuid nii kaugele 8086 ei **tohiks**[1] **osata**[2] **adresseerida**. Type: SOE

‘High Memory Area (HMA) is to my knowledge the area just above 1 MB, but the 8086 shouldn’t be able to address that far.’

Sentence (73) is interesting because here *oskama* means capability in a technical or logical sense.

To give some context, the sentence is about early PC architecture and memory limits in the Intel 8086 processor. The 8086 CPU has a 20-bit address bus, which means it can directly address up to 1 MB of memory (2^{20} bytes). So in theory, anything above 1 MB should be unreachable. However, the High Memory Area (HMA) refers to a small region above 1 MB which becomes accessible due to a technical quirk in the 8086 architecture.

(74) Web 2021 – co.ee

Muuseas kas ma **tohin**[1] **osata**[2] libahunte **ravida** *tavalisteks inimesteks või see on võimatu)* Type: SON

'By the way, can I turn werewolves back into ordinary humans, or is that impossible?'

In sentence (74), the rules of a game are discussed, and a player asks if they can use their healing abilities to turn werewolves back into humans. Thus *oskama* in (74) in an ability according to the game rules.

(75) Web 2013 – amor.ee

Kui naine kellega vahekorras plaanid olla sinu murest ei tea ei **tohiks**[1] ta ju **osata**[2] midagi **arvatagi**/*teada.* Type: COE

'If the woman you plan to have sex with doesn't know about your concerns, she shouldn't be able to guess or know anything.'

Sentence (75) shows a case where *oskama* is circumstantial ability, because the ability cannot exist due to circumstances.

9.10 *Jõudma*

Table 30. Modal verbs scoping over *jõudma*

pidama	võima	tulema	pruukima	saama	tohtima	suutma	tarvitsema
27	25	24	21	4	9	6	3

As an inner modal *jõudma* adds dynamic or circumstantial possibility to the meaning of the construction.

Sentence (76) shows a case where *jõudma* expresses circumstantial possibility, in this case the possibility to spread diseases.

(76) Web 2021 – sirp.ee

Enamasti need loomad looduses kauaks ellu ei jää, kuid enne kui nad hukkuvad, **võivad**[1] nad **jõuda**[2] **levitada** *teistele looduses leiduvatele liikidele ohtlikke haigusi.* Type: CEE

'In most cases, these animals do not survive long in the wild, but before they die, they may be able to spread diseases that are dangerous to other species found in the wild.'

Sentence (77) displays a very typical use of *jõudma*: the ability to fulfil a task. A good number of the sentences I collected are concerned about whether the required amount of work is manageable within the given time.

(77) Web 2019 – rate.ee

Magad ja uneski näed vaid seda,mida kõike **tuleb**[1] **jõuda**[2] veel **teha**. Type: AON'

'You sleep, and even in your dreams you see only all the things you still have to do.'

In sentence (78), we observe figura etymologica *jõudma* features once as an expression of dynamic possibility ('we cannot even manage/be able to') 1, and then as an aspectual marker ('get to the point of') [19] within the phrasal verb *kokkuleppele jõudma*. I am fairly certain that the double use of *jõudma* in the sentence is intentional, because it adds emphasis in a sensible position and the quote comes from an edited article on ERR.

(78) Web 2019 – err.ee

Kui me ei **suuda**[1] **jõuda**[2] kokkuleppele **jõuda** *isegi selles, et tehisintellekt ei tohiks kunagi inimest tappa, ei suuda me kunagi kokkuleppele jõuda ka tehisintellekti õigluse, kallutatuse, läbipaistvuse või millegi muu osas," sõnas Helfand.* Type: ASA

'"If we are unable to reach agreement even on the point that artificial intelligence should never kill a human, we will never be able to reach agreement on AI fairness, bias, transparency, or anything else either," said Helfand.'

9.11 *Kannatama*

Table 31. Modal verbs scoping over *kannatama*

pidama	võima	tulema	pruukima	suutma
23	8	2	1	2

Like *jõudma*, *kannatama* is used for circumstantial and dynamic possibility. Sentence (79) shows a case of dynamic possibility, and sentence (80) circumstantial possibility. It is worth noting here that at least nine of the sentences in the corpus are concerned with vehicles driving under different conditions, which is about a quarter of all sentences in which *kannatama* features as an inner modal.

(79) Web 2021 – wordpress.com

Täna sain töökaaslaselt informatsioonitüki, et tatrapadjaga üle kuu aja ei **pruugi**[1] **magada kannatada**[2]. Type: ASE

[19] English seems to have a strong preference for "manage" instead of another more overtly modal construction in this position

‘Today, a coworker told me that you might not be able to sleep on a buckwheat mattress for more than a month.’

(80) Web 2021 – hange.ee

Teed kasutavad sõiduautod, aga aastas korra **võiks**[1] **kannatada**[2] ka C-kat peale **lasta**. Type: CEE

‘The road is used by passenger cars, but once a year it could also accommodate C-class vehicles.’

9.12 *Jaksama*

Table 32. Modal verbs scoping over *jaksama*

pidama	võima	tulema	pruukima	saama	tohtima
24	21	13	22	1	3

Jaksama is also used for (mainly) dynamic and (much less) circumstantial possibility.

In its dynamic possibility sense, it relates to activities that are tedious or strenuous, such as waiting, physical endurance or throwing away rubbish; an example is sentence (81).

(81) Web 2017 – royal-canin.ee

Otse diivanilt tulnud sohvalõvi ei **pruugi**[1] kogu distantsi läbi **joostagi jaksata**[2]. Type: ASN

‘A couch potato who’s just gotten up from the couch might not even have the stamina to run the whole distance.’

When it comes to circumstantial possibility, *jaksama* is also used in cases that relate to endurance of technical devices, with almost no exception.

(82) Web 2017 – kalale.ee

V põhjaga **peab**[1] mootor paati võibolla 15 cm veest välja **tõsta jaksama**[2]*, mida rohkem kiilus põhi seda rohkem jõudu vaja on.* Type: CSN

‘With a V-shaped hull, the engine may need to lift the boat about 15 cm out of the water; the more V-shaped the hull, the more power is required.’

10 Triple modals

Although the study focused on double modal constructions, two instances of triple modal constructions were also identified in the corpus. Since triple modals were not systematically searched for, these examples should be treated as incidental observations rather than exhaustive evidence.

(83) Web 2019 – keskkonnaagentuur.ee

Kui soovime olla ka tulevikus rikkaliku loodusega rahvas, **peame**[1] **suutma**[2] **osata**[3] loodust paremini **lugeda***," võttis teema kokku Uudo Timm.*

'"If we want to remain a nation blessed with a rich natural environment in the future, we must learn to better understand nature," Uudo Timm summarized.'

(84) Web 2023 – horisont.ee

Pead[1] **oskama**[2] **kannatada**[3] lõpmatuseni mikroskoobi taga **istuda***, see on seotud teatud temperamendiga.*

'You have to be able to sit at a microscope for hours on end; it takes a certain temperament.'

Semantically, they reveal nothing new, but their presence suggests that triple modal stacking, while marginal, is structurally possible.

11 Discussion

In Section 1 I stated three research questions, concerning possible combinations and frequency of double modals, a semantic classification and constraints on modal combinations. We will now discuss the findings.

11.1 Modal combinations and their frequency in the corpus

Based on the data and methodology, it is possible to estimate how many combinations of each modal pair the corpus should roughly contain. The data was initially extracted from a corpus and processed using Python-based filtering, followed by a manual verification step. At each stage of filtering, the number of retained and discarded examples was recorded. This made it possible to reconstruct the proportion of valid cases and, in turn, extrapolate back to the estimated total number of occurrences in the original corpus before filtering. These estimates are plotted in Figure 4.

Figure 4. estimated corpus size total

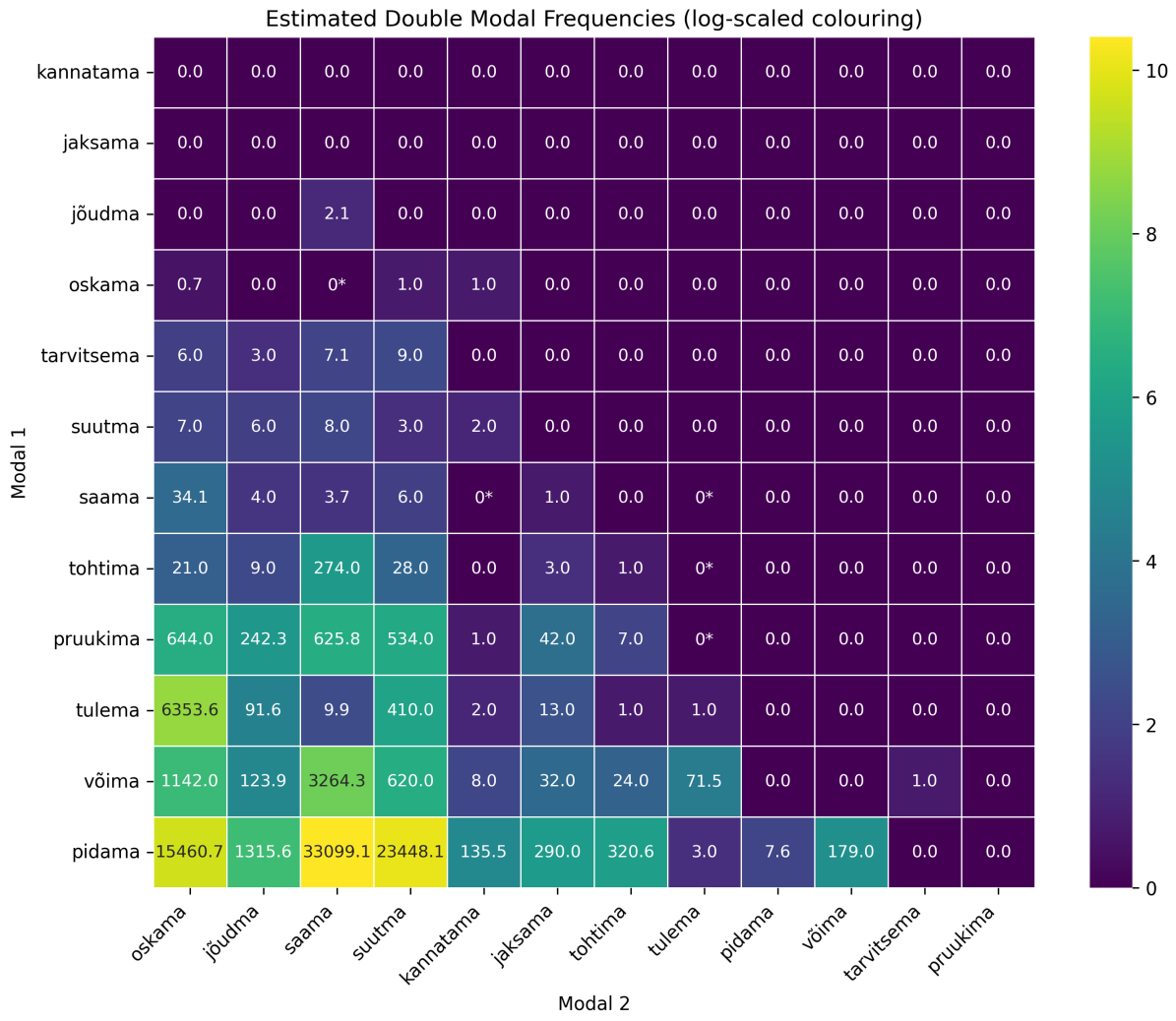


Figure 5. estimated corpus size total, different ordering modals

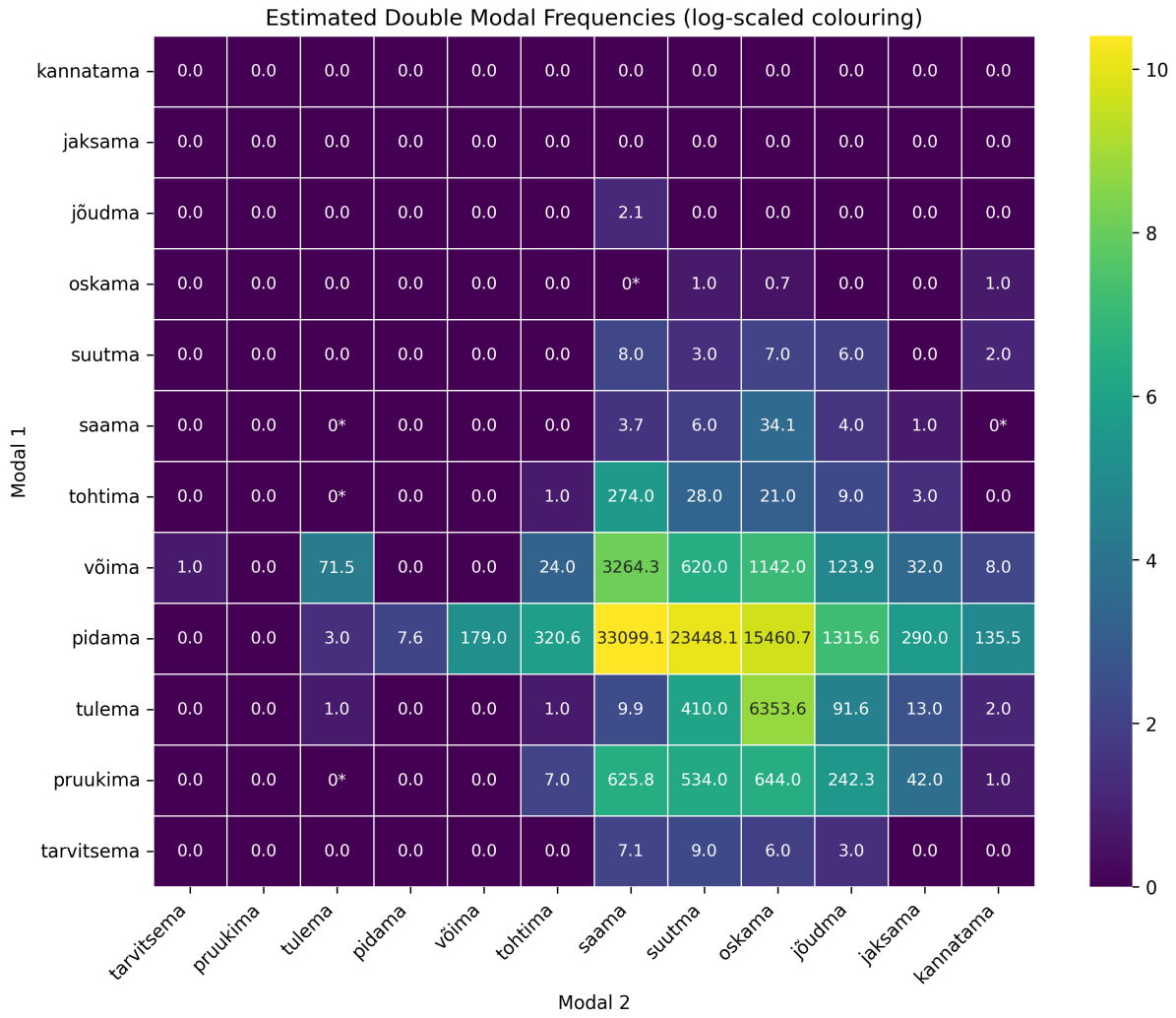


Figure 4 presents estimated frequencies of double modal combinations in the corpus (the colouring is log-scaled) and the verbs are ordered along the axes by approximate number of modals they combine with.

Figure 5 presents the same data but with a different ordering on the axes. For Figure 5, both axes have the same ordering, so that the diagonal has the values for modal verbs taking scope over themselves. In addition, the first four modals express necessity and the later eight express possibility, so that the lower left quadrant corresponds to necessity over necessity, to the right of it, we have necessity over possibility and so on. Inside these blocks, the modals are again ordered by how many other modals they combine with approximately.

The values are not raw counts but extrapolations based on the filtering procedure described in Section 4. For each modal pair and each ordering, the proportion of valid to discarded cases throughout the filtering process was used to estimate the total number of genuine occurrences for each combination in the entire corpus, adding up the numbers for each ordering.

Cells marked 0* indicate that at least 50 automatically pre-filtered concordance lines were manually examined without yielding any positive examples. While this strongly suggests that such combinations are extremely rare, it does not entirely exclude the possibility of their occurrence elsewhere in the corpus.

One methodological limitation concerns the API restriction to the first 1,000 concordance lines, which may introduce genre bias into some estimates if the retrieved subset is not fully representative. However, this effect is likely limited: many modal combinations did not approach this retrieval ceiling, and the initial portion of the corpus includes a balanced subcorpus. Moreover, there is no strong a priori reason to expect double modal usage to vary systematically by genre. Overall, the estimates should therefore be interpreted as approximate but informative indicators of relative frequency across modal combinations.

11.1.1 Few modals dominate double modality

Pidama is overwhelmingly as the outer modal across combinations, *võima* also combines broadly, but to a lesser extend than *pidama*. *Tulema* shows a similar pattern to *võima*. Together, these form the high-frequency core for the outer modal position. It follows that not all modals are equally ”stackable”, but very few function as multi-purpose outer modals, suggesting that stacking is partly ‘lexicalized’. By this, I mean that one basically chooses *pidama* for the outer modal if necessity is required and *võima* if possibility, rather than trying to choose a modal that fits very closely semantically. Surpringly, the highly-polyfunctional core modal *saama* does not play an important role as an outer modal. A possible reason is that *saama* is a negative polarity item.

It is also noteworthy that of the semantically very similar *tarvitsema* and *pruukima*, *pruukima* is much more common.

11.1.2 Possibility and Necessity

The data also shows that the preferred relation is that the inner modal denotes possibility and the outer modal necessity.

Table 33. Estimated counts for possibility and necessity in inner and outer modal

outer\inner	possibility	necessity
possibility	5629.84 (6.3%)	72.48 (0.1%)
necessity	83250.90 (93.6%)	11.61 (0.0%)

11.1.3 Inner vs Outer modal

Most modals tend to strongly prefer outer over inner position or vice versa. Table 34 shows, based on the estimated frequencies in the corpus (Figure 4), how often each modal verb approximately appears as the inner modal and how often as the outer modal in the entire corpus.

Table 34. Estimated inner vs outer modal occurrences

Modal verb	Inner	Outer
jaksama	381.0	0.0
jõudma	1795.4	2.1
kannatama	149.5	0.0
oskama	23669.1	2.7
pidama	7.6	74259.2
pruukima	0.0	2096.1
saama	37293.9	48.8
suutma	25059.1	26.0
tarvitsema	1.0	25.1
tohtima	353.6	336.0
tulema	75.5	6882.2
võima	179.0	5286.7

Of all modal verbs considered, only *tohtima* appears in equal measures as inner and outer modal. *Pidama, pruukima, tarvitsema, tulema* and *võima* prefer the outer position, while *jaksama, jõudma, kannatama, oskama, saama* and *suutma* prefer the inner position.

The distinction does not seem to depend on how grammaticalized and multifunctional the modal verbs are, otherwise *saama* (which is highly multifunctional) should appear more often as an outer modal, nor is it dependable on the factor necessity vs. possibility, because then *võima* should prefer the inner position (like the other possibility modals), nor on frequency in any obvious way, as we have both high- and low-frequency inner and outer modals. Indeed, the question of the preferred position seems to be tied to the type of modality (the flavour) the modal expresses predominantly: modals expressing deontic and epistemic modality tend to take the outer scope, circumstantial and dynamic modality usually take the inner position. There seems to be a functional layering, where the inner modal is mostly tied to properties of a participant or objective circumstances of the event, while the outer modal is related to illocutionary force (orders, permissions, moral norms in the case of deontic modality) or propositional truth (in the case of epistemic modality). Moreover, even modals that are polyfunctional and express all flavours of modality (e.g. *võima*) have a preferrable role in double modality.

11.1.4 Clusterings

By far the most frequent combinations are *pidama* together with any of *saama, suutma* or *oskama*, as well as *võima-saama* and *tulema-oskama*. These combinations are clearly the preferred pairings, and they are not random, but reflect common discourse functions such as stating rules and normative expectations. This suggest that these combinations are partially conventionalized constructions to express these meanings, and not just freely generated.

11.1.5 Empty zones

Only about half of the possible cells in the table corresponds to attested combinations, and even of those, many combinations are attested <10 times. In Figure 4, everything above the diagonal is empty (in this figure, the modal verbs are ordered on both axes approximately by how many modals they can combine with). In Figure 5, the verbs are ordered such that modals expressing necessity are to the left/below and modals expressing mainly possibility are to the right/above with the ordering identical on both axes. In Figure 5 we can thus see that double modality concentrates on the two quadrants where the inner modal expresses necessity.

One might assume that stacking the same modal twice is a rare phenomenon, but the diagonal of Figure 5 is not significantly less populated compared to neighbouring cells. Thus, stacking the same modal twice is not unpreferred specifically, it is just occurring in a region of the table where modals stack rarely in general.

The empty zones largely correspond to combinations where at least one modal verb is in its unpreferred position (e.g. inner modal *tarvitsema* or outer modal *kannatama*) or combination that are more conventionally expressed differently; e.g. *võima* + *tulema* is preferred to *võima* + *pidama* even if both should be capable of expressing epistemic possibility over circumstantial/deontic necessity).

11.1.6 Gradience

There is no abrupt border between very frequently used combinations and unattested ones, instead there are single borderline cases everywhere. This suggests that restrictions on modal combinations are not absolute, indicating that any constraints of combinations are generally soft and not categorical.

11.1.7 Frequency and possibility

Many combinations are attested in the corpus but extremely rare in practice. This suggests that the grammar allows more combinations than actual usage exploits. In addition, the distribution of the rarest combinations suggests that these are not mistakes, because they occur only following the visible gradient, but just extremely rare.

11.2 Ordering of modals

Every logical order of the two modal verbs and the lexical verb is attested in the corpus. Consider the following examples with *pidama oskama* displaying all six possible orders. The order is encoded by a permutation of 1, 2 and 3, with 1 representing the position of the outer modal, 2 of the inner modal and 3 of the lexical verb.

(85) *"Sa* **pead**[1] **oskama**[2] kõigile küsimustele **vastata**. Order: 123

(86) *Et arvustada omletti,* ei **pea**[1] tingimata **muneda oskama**[2]. Order: 132

(87) **Oskama**[2] **peab**[1] hobuse küljepeal **rippuda** *jne - tegu on eluohtlike trikkide baasiga, mida on võimelised ellu viima ainult eriväelased.* Order: 213

(88) Ja veel viimaseks : Üks tuntud inimene rääkis, et ”Ei pea kaklema, aga ***oskama***[2] ***kakelda peab***[1] kindlasti”. Order: 231

(89) *Kas ta* **laulda peab**[1] **oskama**[2]*?* Order: 312

(90) *Ma ei saa aru, miks kuradi pärast me peame näpuga järge ajama, mida lapsed mingis vanuses* **teha oskama**[2] **peaksid**[1]*, mitu hammast neil suus on või kelle laps siis tublim on.* Order: 321

This in itself is a striking result, because it shows how flexible Estonian word order is. The rich morphology allows the language user to identify the scope of the modal verbs, and therefore that the scope relation does not have to be linearly mapped onto the word order.

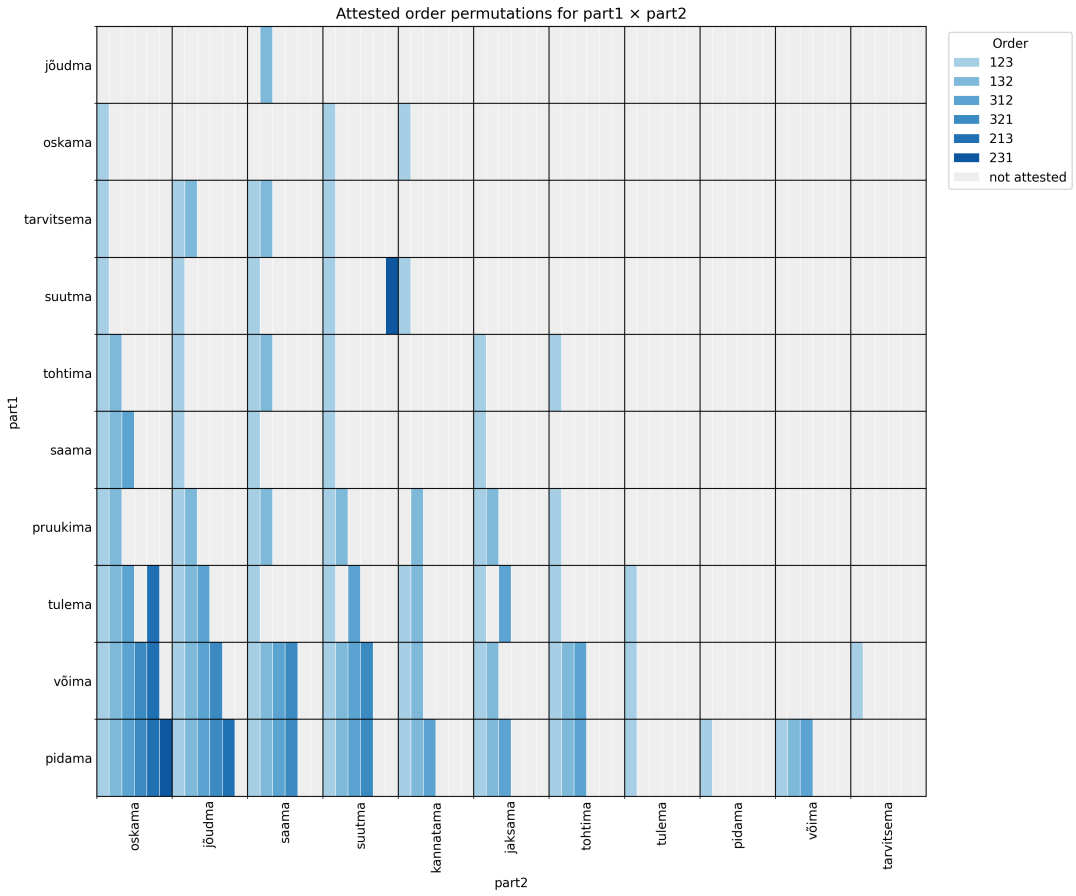


Figure 6. Attested orders and modal combinations

Figure 6 shows which orders are attested at all (no frequencies) for each pair of modals. The distribution in the table suggests an implicational hierarchy indicating that with few exceptions we have

$$123 > 132 > 312 > 321 > 213 > 231$$

that is to say one would only expect to find the order 321 if orders 123 and 132 are also attested.

Subordinate vs main clause appears to have an influence on the chosen word order, but since the data set is not annotated for clause type, this is difficult to test. Upon annotation I had the impression that word order 132 is preferred for negated clauses, but Table 35 does not support this.

However, we can see that negation only occurs in the default word order 123 and in 132, suggesting that rarer word orders are generally not chosen for negated sentences.

Also note that the number of negated clauses is comparatively high because some modal verbs have negative polarity (those are *saama, pruukima* and *tarvitsema* in the outer modal position).

Table 35. Negation and word order in the final data set

Order	Positive	Negated
123	378	253
132	36	16
213	6	0
231	2	0
312	30	0
321	18	0

Non-default word order is probably also chosen for emphasis and style, as in sentence (88).

A comparison of Figure 6 (attested word orders) and Figure 4 (estimated frequency) suggests strongly that flexibility in word order is linked to frequency; higher frequency combinations manifest higher flexibility in word order.

11.3 Semantic types

We will turn now to questions regarding the semantics of double modals.

11.3.1 Hierarchy of inner and outer modal flavour

The final data set had the following distribution of inner modal flavour to outer modal flavour:

Table 36. Pivot table of inner and outer modal flavour in final data set

	A	C	T	V	N	E
A	19	23	23	13	186	136
C	0	8	11	12	60	126
T	0	0	0	0	0	1
S	0	0	2	1	60	57
E	0	0	0	0	1	0

Table 36 uses the same abbreviations as in Section 5.2, that is A (dynamic), C (circumstantial), T (teleological), S/N (deontic), E (epistemic) and V (volitional).

Table 36 shows on the left the inner modal flavours, on the top the outer modal flavours. The abbreviations are the same as in Section 5.2, and the counts refer to the total counts in the

final data set. As a methodological flaw, V (volitional) and T (teleological) might not have been assigned consistently, but sometimes deontic flavour might have been assigned instead. Additionally, all occurrences of *polite suggestion (EE/EN)* are for the sake of simplicity subsumed under epistemic.

In any case, Table 36 strongly supports the idea of a hierarchy in ordering of modal flavour, which was previously theoretically postulated but not shown in a corpus study. In particular, we have the scope hierarchy of which modal flavour may take scope over which other flavours

dynamic < circumstantial < deontic (+ teleological + volitional) < epistemic

confirmed across the data with one exception: in sentence (54) there is a deontic modal taking scope over an epistemic modal. Sentence (54) seems to be a case of an echoic use, and therefore does not seem to constitute a valid exception to the hierarchy.

A second observation is that while otherwise all combinations of (dynamic, circumstantial, deontic, epistemic) in the correct order are attested, the epistemic + epistemic combination is not attested. This combination might be preferably expressed with adverbs.

Based on these annotations, the estimated frequencies of flavour stacking between inner and outer modals were calculated (see Table 37). For each modal pair, the proportion of each flavour combination in the annotated subset was first determined across all orders. These proportions were then multiplied by the total estimated frequency of the corresponding modal pair in the corpus. This calculation assumes that order does not affect the semantic interpretation of the modal combination. The resulting estimates were subsequently summed across all modal pairs to obtain the overall estimated frequencies for each flavour-stacking combination. For this table the teleological and volitional flavour were combined under the deontic flavour (these flavours are similar, they are all about fulfilling an ideal, be that that rules are adhered to or that goal and wishes are achieved).

Table 37. Estimated occurences of inner < outer flavour stacking in the corpus

	A	C	N	E
A (dynamic)	18.7	34.9	38,783.8	4,865.3
C (circumstantial)	0.0	9.1	11,612.3	12,629.5
S (deontic)	0.0	0.0	14,470.3	6,532.8
E (epistemic)	0.0	0.0	8.1	0.0

In Table 37 we can see that deontic and epistemic scoping over dynamic, circumstantial and deontic are all fairly common, the remaining four combinations (dynamic>dynamic, circumstantial>dynamic, circumstantial>circumstantial and deontic>epistemic) are all very limited.

One possible reason for this is that, I, as the annotator, tried to mentally separate out the meanings of the inner and the outer modal while annotating, and thus unconsciously avoiding dynamic/dynamic and circumstantial/circumstantial in cases of ambiguity. This is less true for deontic modality, as different deontic layers tend to be better separable (i.e. the inner one is a

concrete rule set applicable to some situation and the outer layer is grounded in what is moral and good[20]). Against this counts that for the final data set, these combinations are far more common.

The rarity of deontic>epistemic is unsurprising, as it goes against the established scope hierarchy. In contrast, circumstantial > dynamic combinations are compatible with a hierarchical interpretation. However, it is possible that such cases are pragmatically more often interpreted in terms of rules rather than pure circumstantial constraints. In other words, speakers may preferentially conceptualise circumstances that restrict an action as rule-like prohibitions, which could influence how these cases were classified in the annotation.

11.3.2 Typology of double modal constructions

In Section 7 and Section 8 a typology for the semantics of the outer modal of a double modal construction was established. This typology was built atop the three letter labels coming from formal possible world semantics, such that the last two letters tie closely to the interpretation of the outer modal.

The classification identifies certain recurring semantic-pragmatic functions of Estonian double modal construction, and as such is a cross-linguistically applicable basis of comparison. It showed that certain modal verbs are preferred for certain semantic types, such as *tulema* for the gnomic type (for which it is, as an impersonal modal verb, particularly well suited) or *tohtima* for making defeasible claims.

11.3.3 Gradience and overlap between categories

Throughout the classification, boundaries between categories proved to be fuzzy. This is particularly visible in the continuous spectrum between *wish for existence of a rule* (deontic), *polite suggestion* (intermediate), and *potentiality* (epistemic), where the interpretation depends on subtle contextual and pragmatic cues concerning speaker stance and communicative intent. In many cases, it remains deliberately underspecified whether the speaker merely presents a possible state of affairs, weakly endorses it as desirable, or indirectly proposes it as a norm. This indeterminacy appears not simply as a limitation of the classification system, but as a pragmatically useful feature of the constructions themselves, allowing speakers to express preferences and suggestions indirectly without committing themselves to an explicit directive or evaluative stance.

Other cases of overlap appear to be semantic rather than interactional in nature. In examples such as sentence (36) and sentence (37) (which were about the absence of a capacity which was tied to some general characteristics of the situation), both circumstantial and epistemic interpretations are plausible because the relation between the two clauses can be conceptualized either as a direct consequence of the circumstances themselves or as an inference drawn from them. The distinction is therefore not always categorical, but depends on how the source of the modality is construed in context.

[20] this is also the reason they now have different letters...

The overlap between normative expectation and epistemic expectation reflects the broader connection between regularity and probability: what is perceived as normal or proper within a social or functional framework also tends to be treated as statistically or pragmatically expected in individual instances.

Thus, all types are best understood as prototypical tendencies and not discrete classes.

Nevertheless, the classification remains useful because it identifies recurring interpretive tendencies and allows systematic comparison between different modal combinations. Even where individual cases remain ambiguous, broader distributional patterns emerge clearly, such as preferences of specific modal verbs for certain readings and the asymmetrical distribution of modal flavour stacking. The typology therefore functions primarily as a descriptive and comparative framework rather than as a strict inventory of mutually exclusive semantic classes.

The existence of borderline cases also raises methodological questions regarding annotation. Since many examples permit multiple plausible construals simultaneously, assigning a single label may artificially sharpen distinctions that remain fluid in actual language use.

Table 38 shows estimated frequencies for all types (i.e. how many sentences probably have this type if projected to the whole corpus). Frequencies were estimated by reweighting observed conditional distributions of types given (inner modal, outer modal) pairs with independently estimated pair frequencies. As a main contributor was identified any outer modal verb contributing to more than 30% of the estimated total count. These estimates are fragile in that they depend on correctly assigned types and are subject to all methodological biases earlier introduced.

Table 38. Estimated distribution of types and main outer modals expressing them

Type	adjusted estimated count of type	Main contributor (outer modal)
DA	1.00	oskama (100.0%)
DE	151.63	võima (94.0%)
DN	1,332.25	pidama (92.5%)
EE	2,412.13	pidama (77.5%)
EE/EN	4,435.27	võima (100.0%)
EN	706.11	pidama (99.7%)
OE	86.09	tohtima (93.2%)
ON	36,305.25	pidama (99.1%)
ON’	5,429.17	tulema (91.1%)
OT	6,354.29	pidama (75.1%)
OV	6,526.63	pidama (98.6%)
SA	17.67	suutma (90.6%)
SC	44.07	saama (54.0%)
SE	16,942.48	pidama (92.6%)
SN	8,220.77	pidama (86.0%)

The adjusted frequency estimates suggest that, although several outer modals may in principle express a given semantic outer type, actual usage is highly asymmetrical. Most outer types are overwhelmingly associated with a single dominant outer modal, frequently accounting for more

than 90% of the estimated distribution. In the majority of cases, this dominant contributor is *pidama*.

Double modal constructions appear to constitute a highly restricted and lexically uneven domain. Although the semantic space available to outer modality is in principle broader, the adjusted estimates suggest that much of this space is conventionally realized through *pidama*, which functions as the dominant outer modal across a wide range of contexts. Other modal verbs appear to occupy comparatively narrow and semantically specialized niches — for example, *tulema* in gnomic or aphoristic contexts, likely facilitated by its impersonal usage patterns; *tohtima* in defeasible inferential or constraint-related readings; and *võima* in polite possibility/-suggestion constructions. Outside such specialized functions, *pidama* is generally the preferred realization of outer modality in double modal constructions.

12 Conclusion

The three research questions were:

- Which combinations of modal verbs occur, and how frequently?
- What semantic types of double modal constructions can be identified?
- What constraints on modal combinations are observable in the data?

Of the 144 possible pair combinations of the 12 modal verbs in the study[21], 58 combinations were attested in the corpus. Their distribution showed a strong skew towards a small subset of combinations, and rarer combinations were as rare as one example in the corpus. *Pidama* is the dominant outer modal verb, *võima* and *tulema* are secondary and most of the other are marginal. Table 39 shows the estimated corpus frequency of the top 10 outer/inner modal combinations and the top three (*pidama saama*, *pidama suutma* and *pidama oskama*) contribute to over 80% of the total.

Table 39. Top 10 pair contributions by estimated frequency

Outer modal verb	Inner modal verb	est. frequency	share (%)
pidama	saama	33,099.1	37.20
pidama	suutma	23,448.1	26.36
pidama	oskama	15,460.7	17.38
tulema	oskama	6,353.6	7.14
võima	saama	3,264.3	3.67
pidama	jõudma	1,315.6	1.48
võima	oskama	1,142.0	1.28
pruukima	oskama	644.0	0.72
pruukima	saama	625.8	0.70
võima	suutma	620.0	0.70

Except for *tohtima*, which occurs with similar frequency in both positions, all other modal verbs strongly prefer either position.

The distribution shows a central cluster and gradual fading towards the rarest combinations.

Concerning word order it was found that all six logically possible orders of outer modal verb (1), inner modal verb (2) and lexical verb (3) are attested and that flexibility in word order is higher among more frequent combinations. Table 40 shows the estimated respective shares of the possible word orders. The default word order is attested in about 88% of attestations.

Semantically, a systematic hierarchy of scope

dynamic < circumstantial < deontic (+ teleological + volitional) < epistemic

[21] These are *tarvitsema, pruukima, tulema, pidama, võima, tohtima, saama, suutma, oskama, jõudma, jaksama* and *kannatama*.

Table 40. Contributions by order value.

order	est. frequency	share (%)
123	78,498.8	88.24
132	8,131.8	9.14
312	2,291.7	2.58
321	25.9	0.03
213	14.7	0.02
231	2.0	0.00

could be confirmed, with one dubious counterexample (epistemic < deontic).

In addition, a semantic classification system for double modality was developed.

The data suggests that while almost all attested outer modals were polyfunctional between different types, semantic types (i.e. specific modal flavour and pragmatic function) are in the estimated corpus distribution strongly dominated by certain modal verbs (often $> 90\%$).

Methodologically, this was a corpus-based study utilizing the Estonian National Corpus 2023. Since the primary aim was to investigate the range and behaviour of possible modal combinations, the dataset was constructed to maximize combinatorial coverage rather than to mirror the natural corpus distribution directly. Up to 30 examples were collected for each modal pair where available, and corpus-wide frequency estimates were subsequently approximated through reweighting.

References

van der Auwera, Johan, Andreas Ammann, and Saskia Kindt 2005. Modal polyfunctionality and Standard Average European. *Modality*. University of Toronto Press, pp. 247–272. ISBN: 978-1-84553-910-8. (Visited on 04/20/2026).

van der Auwera, Johan, Petar Kehayov, and Alice Vittrant 2009. Acquisitive modals, pp. 271–302.

van der Auwera, Johan and Vladimir A. Plungian 1998. Modality's semantic map. *Linguistic Typology* 2.1. ISSN: 1430-0532, 1613-415X. (Visited on 06/02/2025).

Coats, Steven and Cameron Morin 2024. Double modals beyond the Atlantic: New evidence from computational sociolinguistics. *English Today* 40.4, pp. 294–299. ISSN: 0266-0784, 1474-0567. (Visited on 04/17/2026).

Erelt, Mati 2001. Some notes on the grammaticalization of the verb *pidama* in Estonian. *Estonian: typological studies V*. University of Tartu, pp. 7–25.

– 2003. Estonian Language Linguistica Uralica Supplementary Series /Volume 1. Ed. by Mati Erelt. (Visited on 04/21/2026).

Habicht, Külli, Pille Penjam, and Ilona Tragel 2010. Kas tahtma tahab abiverbiks? *Eesti ja soome-ugri keeleteaduse ajakiri. Journal of Estonian and Finno-Ugric Linguistics* 1.2, pp. 115–146. ISSN: 2228-1339. (Visited on 04/21/2026).

Habicht, Külli and Ilona Tragel 2017. saama-verb grammatilistes konstruktsioonides. *Keel ja Kirjandus* 60, pp. 22–40.

Kehayov, Petar 2017. *The Fate of Mood and Modality in Language Death: Evidence from Minor Finnic*. De Gruyter. ISBN: 978-3-11-052408-6. (Visited on 06/02/2025).

Kehayov, Petar and Reeli Torn-Leesik 2009. Modal verbs in Balto-Finnic. Ed. by Ferdinand de Haan Björn Hansen. Empirical Approaches to Language Typology 44. Mouton de Gruyter, pp. 363–401. ISBN: 978-3-11-021920-3.

Kratzer, Angelika 1977. What 'must' and 'can' must and can mean. *Linguistics and Philosophy* 1.3, pp. 337–355. ISSN: 1573-0549. (Visited on 04/17/2026).

– 1991. Modality. *Handbuch Semantik*. Ed. by Arnim von Stechow and Dieter Wunderlich. De Gruyter, pp. 639–50.

Lehmann, Christian 2015. *Thoughts on grammaticalization*. Classics in Linguistics 1. Berlin: Language Science Press.

Lindström, Liina and Virve-Anneli Vihman 2017. Who needs it? Variation in experiencer marking in Estonian 'need'-constructions. *Journal of Linguistics* 53.4, pp. 789–822. ISSN: 0022-2267, 1469-7742. (Visited on 04/17/2026).

Metslang, Helle, Andriela Rääbis, Ann Veismann, Annika Viht, Eva Liina Asu, Helen Plado, Külli Habicht, Liina Lindström, Mati Erelt, Pärtel Lippus, Pire Teras, Reet Kasik, Renate Pajusalu, and Tiit Hennoste 2024. *Eesti grammatika*. Ed. by Andriela Rääbis, Ellen Niit, Helle Metslang, Külli Habicht, and Reet Kasik. Tartu: Tartu Ülikooli Kirjastus. ISBN: 978-9916-27-449-1.

Nauze, Fabrice 2009. Modality and context dependence. *Cross-linguistic Semantics of Tense, Aspect, and Modality*. Ed. by Lotte Hogeweg, Helen de Hoop, and Andrej L. Malchukov. Linguistik Aktuell/Linguistics Today. John Benjamins Publishing Company, pp. 317–340. ISBN: 978-90-272-5531-0 978-90-272-8893-6. (Visited on 04/20/2026).

Penjam, Pille 2008. "Eesti kirjakeele da- ja ma-infinitiiviga konstruktsioonid." PhD thesis. dissertationes philologiae estonicae universitatis tartuensi.

– 2011. eesti kirjakeele subjektilised ja adessiivadverbiaaliga tarvitsema-konstruktsioonid.

Tragel, Ilona 2003. "eesti keele tuumverbid." PhD thesis. dissertationes linguisticae universitatis tartuensis.

Topeltmodaalid eesti keeles. Kokkuvõte

Magistritöö uurib eesti keele topeltmodaalkonstruktsioone, s.t konstruktsioone, milles ühe ja sama verbikompleksi sees esineb kaks modaalverbi. Uuring püüab vastata kolmele küsimusele: (i) millised modaalverbide kombinatsioonid esinevad korpuses ja kui sagedasti; (ii) millised on nende kombinatsioonide semantilised tõlgendused; (iii) millised struktuursed ja sõnajärjepiirangud reguleerivad modaalverbide kombinatsioonide esinemust.

Uurimus põhineb Eesti Rahvuskorpuse 2023. aasta andmetel. Analüüsi kaasati kaksteist eesti modaalverbi, mis moodustasid kokku 144 teoreetiliselt võimalikku paariskombinatsiooni. Andmestik koostati rõhuasetusega kombinatoorsele katvusele, mitte korpuse otsesele representatiivsusele: võimaluse korral koguti kuni 30 näidet iga modaalverbipaari kohta. Korpuse üldiste tendentside ligikaudseks hindamiseks tuletati sagedushinnangud hiljem ümberkaalumise (*reweighting*) meetodi abil.

Tulemused näitavad, et 144 loogiliselt võimalikust modaalverbikombinatsioonist esineb korpuses vaid 58. Sagedusjaotus on väga ebaühtlane ning tugevalt koondunud väikese hulga väga sagedaste kombinatsioonide ümber. Kui kombinatsioonid järjestada sageduse järgi ümber väga sagedase keskme, hääbub sagedus järk-järgult kogu korpuse ulatuses ühekohaliste arvudeni. Modaalverb *pidama* osutub domineerivaks väliseks modaalverbiks (ehk siis modaalverbiks, mille laiendina esineb teine modaalverb), sellele järgnevad sageduselt *võima* ja *tulema*. Ülejäänud modaalverbid on välise verbi positsioonis suuresti piiratud ning kalduvad esinema ainult mõnes kombinatsioonimustris. Üldiselt näitavad enamik modaalverbe selget eelistust kas välise või sisemise positsiooni suhtes; erandiks on tohtima, mis esineb suhteliselt tasakaalustatult mõlemas positsioonis.

Sõnajärje analüüs näitab, et andmestikus esinevad kõik kuus loogiliselt võimalikku välise modaalverbi, sisemise modaalverbi ja leksikaalse verbi järjestust. Siiski eelistatakse tugevalt vaikimisi ühte sõnajärge, mis moodustab ligikaudu 88% kõigist esinemusest. Sõnajärje paindlikkus näib olevat tugevas korrelatsioonis sagedusega: kõige sagedasemad modaalverbide paarid võimaldavad suurimat sõnajärjelist varieeruvust.

Semantilisest vaatenurgast kinnitab uurimus modaalsete tähenduste süstemaatilist mõjualahierarhiat:

dünaamiline < situatsiooniline < deontiline < episteemiline

See tähendab, et situatsioonilist modaalsust väljendavate modaalverbide mõjualas võib olla dünaamilist ja teine situatsioonilist modaalsust väljendav verb, kuid mitte näiteks episteemilist modaalsust väljendav verb. Täheldati vaid üht võimalikku vastunäidet, kus episteemilise tähendusega verb näis olevat deontilise tähendusega verbi mõjualas.

Lisaks töötati välja topeltmodaalsuse semantiliste tüüpide klassifikatsioonisüsteem, mis võimaldas modaalsete interaktsioonimustrite detailsemat analüüsi. Tulemused viitavad sellele, et kuigi enamik modaalverbe on polüfunktsionaalsed ja esinevad mitmes semantilises tüübis,

on iga konkreetse tüübi puhul olemas üks eelistatud modaalverb. See verb moodustab sageli üle 90% vastava semantilise tüübi esinemustest. Näiteks esineb *pidama* üldotstarbelise välise modaalverbina, samal ajal kui teised sagedased modaalverbid kalduvad täitma semantiliselt ja struktuurselt spetsialiseerunumaid rolle.

A Python scripts

Python API request for corpus data:

```
import time
import json
import requests
import socket
import os
import copy
from requests.exceptions import Timeout, ConnectionError

USERNAME = 'username' # username on Sketchengine
API_KEY = 'apikey'    # api key on sketchengine, can be found in the profil
BASE_URL = 'https://api.sketchengine.eu/bonito/run.cgi'
SLEEP_SECONDS = 45.0 # Sketchengine fair use policy recommends wait time of
                                    4s when doing 900 requests within a
                                    day, or 45s for more than 900, I have
                                    12*12*6=864 requests, but retries
                                    may add to this (or maybe they don't)
MAX_RETRIES = 5
BACKOFF = 2

verbs = [ "võima", "pruukima", "tarvitsema", "oskama", "suutma", "pidama",
                                    "tulema", "jaksama", "kannatama", "
                                    tohtima","saama", "jõudma"]
word_orders = [123, 132, 213, 231, 312, 321] # all possible orders of the 3
                                    elements


NONFINITE_SUFFIXES = "(tud|tav|v|da|ma)"
CONJUNCTIONS = "(kuidas|et|mis|kui|ehk|kuhu|kus|kust|kuid|ja|ning|ega|või|
                                    kes|kas|sest|kuna|miks|mil|millal|
                                    milele|kuivõrd|kuigi)"


url = f"{BASE_URL}/concordance"

json_payload_template = {
    "concordance_query": [
        {
            "queryselector": "cqlrow",
            "cql": None,                    # will fill in loop
            "default_attr": "word"
        },
        {
            "queryselector": "cqlrow",
```

```
            "pnfilter": "n",
            "inclkwic": True,
            "cql": None,                    # will fill in loop
            "filfpos": 0,
            "filtpos": 0,
            "default_attr": "word"
        },
        {
            "queryselector": "cqlrow",
            "pnfilter": "n",
            "inclkwic": True,
            "cql": f'[lemma="{CONJUNCTIONS}"]',
            "filfpos": 0,
            "filtpos": 0,
            "default_attr": "word"
        },
        {
            "queryselector": "cqlrow",
            "pnfilter": "n",
            "inclkwic": True,
            "cql": f'[tag="Y" & word="^[^A-Za-z0-9….,;:!?-]+$"]',
            "filfpos": 0,
            "filtpos": 0,
            "default_attr": "word"
        },
        {
            "queryselector": "cqlrow",
            "pnfilter": "n",
            "inclkwic": True,
            "cql": f'[tag = "Z"]',
            "filfpos": 0,
            "filtpos": 0,
            "default_attr": "word"
        }
    ],
    "structures": "<s/>"
}

params_template = {
    "corpname": "preloaded/estonian_nc23",
    "json": None,           # filled inside loop
    "format": "json",
    "viewmode": "sen",
    "pagesize": 1000,
    "fullref": 1,
    "attrs": "word,lemma,tag,longtag",
    "attr_allpos": "all"
```

```
}

for word_order in word_orders:
    for v1 in verbs:
        for v2 in verbs:
            if os.path.exists(f"word_order_{word_order}/raw_data/{v1}_{v2}.
                                                    json"):  #if a timeout
                                                    happened, the programme
                                                    will continue where it
                                                    left off
                continue
            else:

                # Determine inflections for v1, v2
                verb2inf = "ma" if v1 == "pidama" else "da"
                verb3inf = "ma" if v2 == "pidama" else "da"


                print(f"  Processing: {v1} + {v2} in {word_order}")

                # Build **CQL queries** fresh each iteration
                if word_order == 123:
                    cql_query_main = (
                        f'[lemma="{v1}"] []{{0,}} '
                        f'[lemma="{v2}" & features= "{verb2inf}"] []{{0,}}
                                                                '
                        f'[tag="V.*" & features= "{verb3inf}"]'
                        f'within <s/>'
                    )
                if word_order == 132:
                        cql_query_main = (
                        f'[lemma="{v1}"] []{{0,}} '
                        f'[tag="V.*" & features= "{verb3inf}"][]{{0,}} '
                        f'[lemma="{v2}" & features= "{verb2inf}"] '
                        f'within <s/>'
                    )
                if word_order == 213:
                    cql_query_main = (
                        f'[lemma="{v2}" & features= "{verb2inf}"] []{{0,}}
                                                                '
                        f'[lemma="{v1}"] []{{0,}} '
                        f'[tag="V.*" & features= "{verb3inf}"]'
                        f'within <s/>'
                    )
                if word_order == 231:
                    cql_query_main = (
```

```
            f'[lemma="{v2}" & features= "{verb2inf}"] []{{0,}}
                                                    '
            f'[tag="V.*" & features= "{verb3inf}"][]{{0,}} '
            f'[lemma="{v1}"] '
            f'within <s/>'
        )
    if word_order == 312:
        cql_query_main = (
            f'[tag="V.*" & features= "{verb3inf}"][]{{0,}} '
            f'[lemma="{v1}"] []{{0,}} '
            f'[lemma="{v2}" & features= "{verb2inf}"] '
            f'within <s/>'
        )
    if word_order == 321:
        cql_query_main = (
            f'[tag="V.*" & features= "{verb3inf}"] []{{0,}} '
            f'[lemma="{v2}" & features= "{verb2inf}"] []{{0,}}
                                                    '
            f'[lemma="{v1}"]'
            f'within <s/>'
        )

    cql_query_filter = (
        f'[lemma!="{v1}" & tag="V.*" '
        f'& longtag!=".*{NONFINITE_SUFFIXES}$"]'
    )

    # Build json payload
    json_payload = copy.deepcopy(json_payload_template)
    json_payload["concordance_query"][0]["cql"] =
                                            cql_query_main
    json_payload["concordance_query"][1]["cql"] =
                                            cql_query_filter

    # Build params
    params = params_template.copy()
    params["json"] = json.dumps(json_payload)

    # --- API REQUEST WITH RETRIES ---
    for attempt in range(MAX_RETRIES + 1): #retry multiple
                                            times, but at some
                                            times of day, even 6
                                            retries is not enough
        try:
            response = requests.get(
                url,
                params=params,
```

```
                auth=(USERNAME, API_KEY),
                timeout=120
            )
            break
        except (Timeout, ConnectionError, socket.gaierror) as e
                                                :
            if attempt < MAX_RETRIES:
                wait = BACKOFF * (attempt + 1)
                print(f"Attempt {attempt+1} failed: {e}.
                                                    Retrying
                                                    in {wait}
                                                    s...")
                time.sleep(wait)
            else:
                print("All retries failed.")
                raise

    if response.status_code != 200:
        print(f"  Error {response.status_code} for {v1}-{v2}: {
                                                response.text}")
        continue

    data = response.json()

    # Save output
    os.makedirs(f"word_order_{word_order}", exist_ok=True)
    os.makedirs(f"word_order_{word_order}/raw_data", exist_ok=
                                            True)

    with open(f"word_order_{word_order}/raw_data/{v1}_{v2}.json
                                            ", "w", encoding='utf
                                            -8') as f: #save
                                            response file in
                                            folder
        json.dump(data, f, indent=4, ensure_ascii=False)

    print(f"  Saved {data.get('concsize')} sentences for {v1} +
                                            {v2} in {word_order}"
                                            )
    time.sleep(SLEEP_SECONDS)
```

B Concordance size before and after automatic filtering

Table 41. Final data set

part1	part2	123	132	213	231	312	321	total
jõudma	saama	0	1	0	0	0	0	1
oskama	kannatama	1	0	0	0	0	0	1
oskama	oskama	1	0	0	0	0	0	1
oskama	suutma	1	0	0	0	0	0	1
pidama	jaksama	20	2	0	0	2	0	24
pidama	jõudma	19	2	1	0	2	3	27
pidama	kannatama	19	2	0	0	2	0	23
pidama	oskama	20	2	2	1	2	5	32
pidama	pidama	1	0	0	0	0	0	1
pidama	saama	20	2	0	0	2	4	28
pidama	suutma	20	2	0	0	2	2	26
pidama	tohtima	19	2	0	0	2	0	23
pidama	tulema	3	0	0	0	0	0	3
pidama	võima	20	1	0	0	1	0	22
pruukima	jaksama	20	2	0	0	0	0	22
pruukima	jõudma	19	2	0	0	0	0	21
pruukima	kannatama	0	1	0	0	0	0	1
pruukima	oskama	20	2	0	0	0	0	22
pruukima	saama	20	1	0	0	0	0	21
pruukima	suutma	20	2	0	0	0	0	22
pruukima	tohtima	7	0	0	0	0	0	7
saama	jaksama	1	0	0	0	0	0	1
saama	jõudma	4	0	0	0	0	0	4
saama	oskama	20	2	0	0	1	0	23
saama	saama	3	0	0	0	0	0	3
saama	suutma	6	0	0	0	0	0	6
suutma	jõudma	6	0	0	0	0	0	6
suutma	kannatama	2	0	0	0	0	0	2
suutma	oskama	7	0	0	0	0	0	7
suutma	saama	8	0	0	0	0	0	8

Continued on next page

part1	part2	123	132	213	231	312	321	total
suutma	suutma	2	0	0	1	0	0	3
tarvitsema	jõudma	2	1	0	0	0	0	3
tarvitsema	oskama	6	0	0	0	0	0	6
tarvitsema	saama	4	2	0	0	0	0	6
tarvitsema	suutma	9	0	0	0	0	0	9
tohtima	jaksama	3	0	0	0	0	0	3
tohtima	jõudma	9	0	0	0	0	0	9
tohtima	oskama	20	1	0	0	0	0	21
tohtima	saama	19	1	0	0	0	0	20
tohtima	suutma	20	0	0	0	0	0	20
tohtima	tohtima	1	0	0	0	0	0	1
tulema	jaksama	12	0	0	0	1	0	13
tulema	jõudma	20	3	0	0	1	0	24
tulema	kannatama	1	1	0	0	0	0	2
tulema	oskama	20	2	2	0	2	0	26
tulema	saama	5	0	0	0	0	0	5
tulema	suutma	20	0	0	0	1	0	21
tulema	tohtima	1	0	0	0	0	0	1
tulema	tulema	1	0	0	0	0	0	1
võima	jaksama	20	1	0	0	0	0	21
võima	jõudma	19	3	0	0	2	1	25
võima	kannatama	7	1	0	0	0	0	8
võima	oskama	19	2	1	0	2	1	25
võima	saama	19	2	0	0	2	1	24
võima	suutma	20	2	0	0	2	1	25
võima	tarvitsema	1	0	0	0	0	0	1
võima	tohtima	20	2	0	0	1	0	23
võima	tulema	4	0	0	0	0	0	4

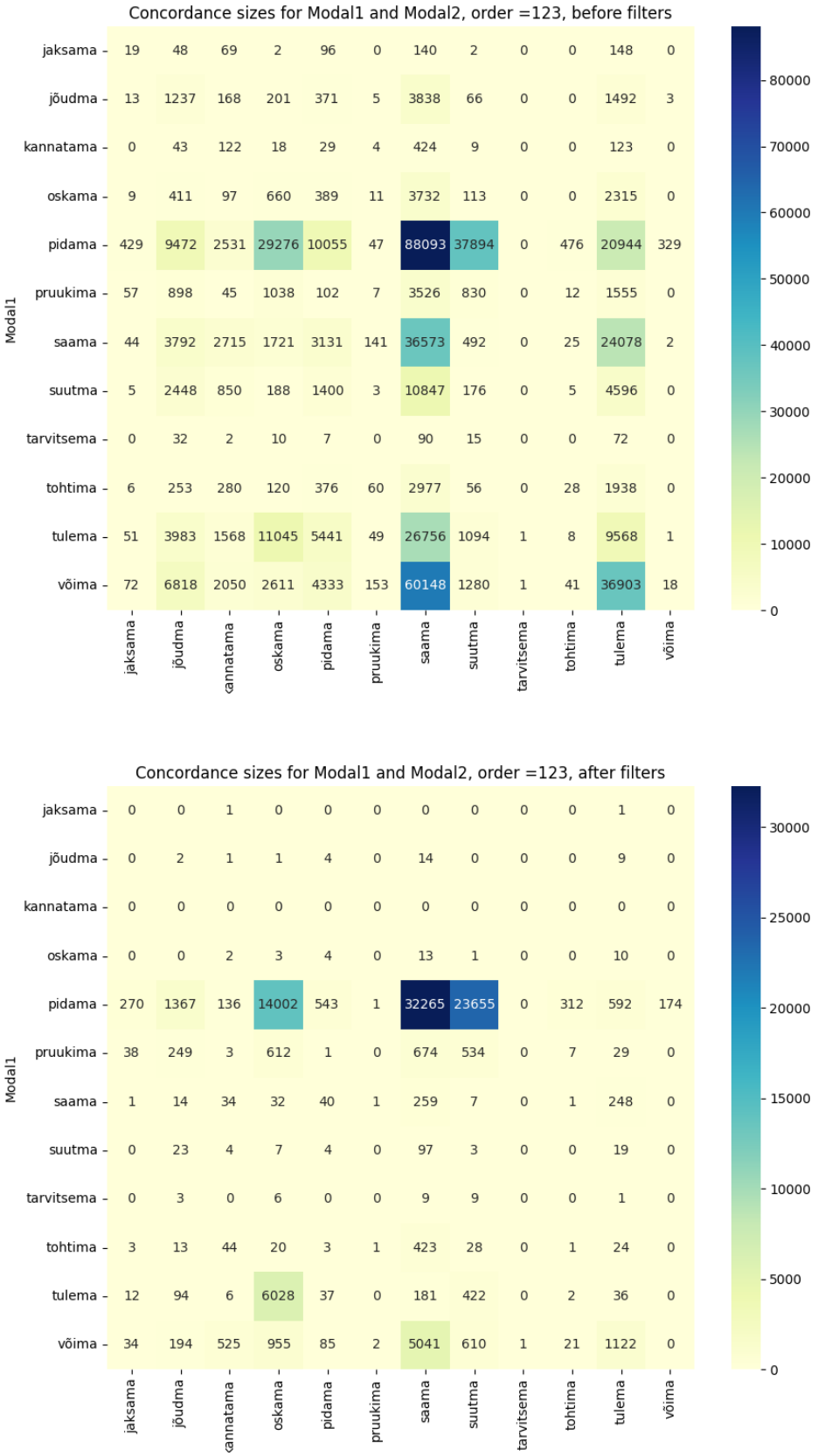


Figure 7. Concordance sizes for default word order (123) before and after applying Sketchengine filters

C Statement on the Use of AI Tools

During the preparation of this thesis, AI-based tools (ChatGPT) were used as assistive technologies in a limited and supervised manner. Specifically, AI was employed to support (1) the translation of corpus examples and clarification of their contextual meaning, (2) writing code ("vibecoding"), and (3) language refinement, including improvements in style, coherence, and text flow.

All analytical decisions, interpretations, and final formulations remain the sole responsibility of the author. The use of AI did not replace critical analysis, nor was it used to generate original research findings or arguments without author review and verification.

Non-exclusive Licence for Reproduction and Public Communication of the Thesis

I, **Maria Matthis**,

1) grant the University of Tartu a free, non-exclusive licence to reproduce my thesis ”**Double Modals in Estonian**” for preservation, including adding it to the digital archive for the duration of copyright;

2) authorise the University of Tartu to make the thesis publicly available under the Creative Commons licence CC BY-NC-ND 4.0;

3) am aware that the rights mentioned in points 1 and 2 remain with the author;

4) confirm that granting the licence does not infringe third-party rights.