

Semantic clause types and modality as features for argument analysis¹

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Abstract. This work investigates the role of semantic clause types and modality in argumentative texts. We annotate argumentative microtexts with situation entity (SE) classes and additionally label the segments that contain modal verbs with their modal senses. We analyse the correlation both of SE classes and of modal verbs and senses with components of argument structures (such as premises and conclusions) and their functions (such as support and rebuttal). We find interesting tendencies in the correlations between both argument components and argumentative functions with SE types.

We also see interesting differences in the distributions of modal verbs and senses within different argumentative components and functions, as well as evidence that modal senses can be helpful to distinguish conclusions and premises. We conclude that both semantic clause types and modal senses can be deployed for automatic recognition and fine-grained classification of argumentative text passages.

Keywords: Semantic clause types, modality, argumentation mining, modal verbs, modal senses, argumentative microtexts

1. Introduction

Argumentation mining has recently gained attention as a novel task in automatic discourse analysis which is of high relevance, for instance in the analysis of opinions in social media. Argumentation analysis aims at automatically identifying and structuring arguments in natural language texts. Informally, an argument can be understood as a discussion – or a monological debate – in which reasons (so-called premises) are advanced for or against some controversial issue, proposition or proposal (often called the conclusion) [18].

The aim of this study is to better understand linguistic features of argument components in argumentative texts. We take an analytical approach, investigating the roles of both modality and semantic clause types in an annotated corpus of argumentative microtexts [24].

¹This chapter is an extension of the original publication in [2]. Some of the material overlaps with [3]. The second author contributed to this work as a member of the Leibniz ScienceCampus project at Heidelberg University.

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In previous work [3], we have annotated the 112 microtexts in this corpus with semantic clause types in the form of situation entities [8].² In this prior work, we observed striking differences in the distribution of semantic clause types in argumentative texts, as compared to other textual genres. In the present work we extend these annotations by labeling the same texts with modal verbs and senses, which we also found to show characteristic properties in argumentative texts. We present the results of our investigation of the correlations between (1) clause types and various argument components and functions and (2) modal verbs and senses and various argument components and functions. Specifically, we are asking the following questions:

- Do particular **semantic clause types** correlate with specific argument components (i.e. conclusion, proponent premise, or opponent premise)?
- Do particular **semantic clause types** correlate with specific argumentative functions (i.e. support, rebuttal, and undercut)?

Similarly, we ask:

- Do particular **modal verbs or modal senses** correlate with particular argument components?
- Do particular **modal verbs or modal senses** correlate with particular functions of argument components?

In the following, we first, in Section 2, present the microtext corpus [24] on which we base our analysis. In Section 3 we introduce the annotation categories for situation entities and modal senses, which have both been established and annotated in prior work, for genres other than argumentative texts [8,10,16]. Section 4 analyzes the distributional properties of semantic clause types in the argumentative microtexts and their correlation with specific argument structure components. Section 5 performs a similar analysis for modal verbs and senses. In Section 6 we summarize our observations and draw conclusions on the contribution of semantic annotation categories for the linguistic characterization of arguments and argument components.

2. Data

The argumentative microtexts are a collection of short written texts (of usually 5 sentences) elicited in response to a trigger question, such as (1).³ The texts were written in German and translated to English; our analysis addresses the original German texts.

- (1) Sollten Videospiele in den Reigen der Olympischen Disziplinen aufgenommen werden?
Should video games be made olympic?

Figure 1 shows one complete microtext (b036), written in response to the trigger question above.

The microtexts are dense argumentative texts; each segment contributes to the argument. Each text contains one segment stating the **conclusion**, or the main claim of the **proponent**. In Fig. 1, this is the first sentence (*Video games ought to be included in the ranks of Olympic events*). The other segments in the text are **premises** either supporting the conclusion or presenting the view of a potential **opponent**. Premises are related to the conclusion or to other premises via the argumentative functions of

²See Section 4 for details on situation entities. The argumentative microtext corpus with pre-annotated argumentative functions comes from [24], while we added annotations of SE types and modality as new layers of annotation. For details of the dataset and the annotation process please refer to [3].

³23 of the 112 texts were written by one of the authors of the microtext corpus as teaching tools and were used mainly in teaching and testing the students' argumentative analysis, thus not associated with trigger questions.

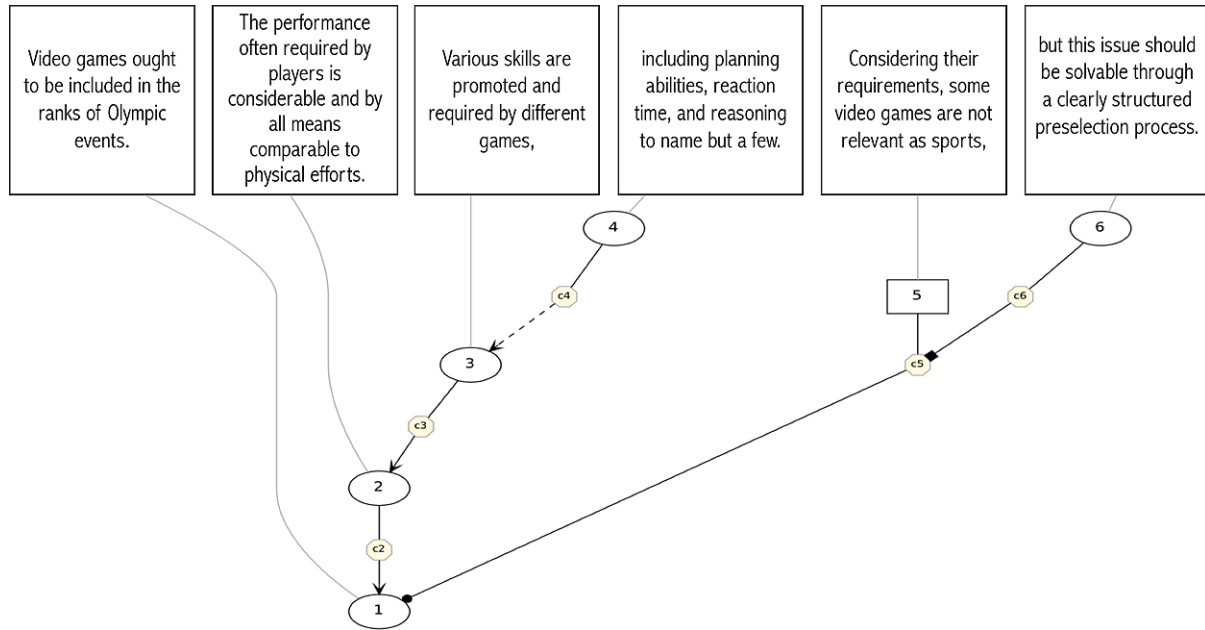


Fig. 1. Argumentation graph of a microtext.

(a) **support**; (b) **rebuttal**, in which a premise directly challenges a conclusion or premise; or (c) **undercut**, in which a premise challenges the acceptability of an inference between two other segments (two premises, or one premise and one conclusion). Again in Fig. 1, the second sentence (*The performance often required by players is considerable and by all means comparable to physical efforts*) supports the conclusion, while the fifth segment (*Considering their requirements, some video games are not relevant as sports*) attacks the conclusion and is therefore a opponent premise (represented as a square node). This fifth segment is in turn being undercut by the last segment (*but this issue should be solvable through a clearly structured preselection process*), which represents a proponent premise.

3. Annotations

3.1. Situation entity types

To investigate the semantic types of clauses found in **argumentative text passages**, we use the inventory developed by [30] and extended in later work [8,22]. **Situation entity (SE) types** describe the semantic types of situations (including *states, events, generics, habituals, questions, and imperatives*) evoked in discourse by individual clauses of text. As such, they concern the manner of presentation of content along with the conveyed information.

SE types are recognizable (and distinguishable) through a combination of linguistic features of the clause and its main verb, and it was found that the distribution of SE types in text passages correlates to some extent with whether the text passage is (e.g.) narrative, informative, or argumentative [3,17,21].

The use of linguistic features for distinguishing text passages is closely related to Argumentative Zoning [20,32], where linguistic features are used to distinguish genre-specific types of text passages in scientific texts. In this manner, those texts are segmented into types of text passages such as Methods or

Results. Notions related to SE type have been widely studied in theoretical linguistics [1,4,6,29,33,34] and have seen growing interest in computational linguistics [5,11,12,19,25,28,35].

Annotation categories. The inventory of SE types considered in our analysis starts with **states** and **events** (cf. Table 1 and Fig. 2 for examples from the microtexts).

- (2) STATE (S): *Armin has brown eyes.*
- (3) EVENT (EV): *Bonnie ate three tacos.*
- (4) REPORT (R): *The agency said applications had increased.*

Modality, negation, future tense, and conditionals, when coupled with an EVENT-type clause, cause a coercion to STATE. In these constructions, reference is made to actual or potential states of the world rather than to actual events that have occurred. Several examples appear below; note that no coercion happens for STATE clauses.

- (5) *Carlo got the job.* (EV) → *Carlo should get the job.* (S)
- (6) *Georg has blue eyes.* (S) → *Georg could have blue eyes.* (S)
- (7) *Darya answered.* (EV) → *Darya did not answer.* (S)
- (8) *Reza is short.* (S) → *Reza is not short.* (S)
- (9) *He won the race.* (EV) → *If he wins the race, . . .* (S)
- (10) *It is warm today.* (S) → *If it is warm tomorrow, . . .* (S)

The other two frequently-occurring SE categories in argumentative texts are **generic sentences** and **generalizing sentences**, the latter sometimes referred to as habituais. While the former predicate over classes or kinds, the latter describe regularly-occurring events, such as habits of individuals.

- (11) GENERIC SENTENCE (GEN):
Birds can fly.
Scientists make arguments.
- (12) GENERALIZING SENTENCE (GS):
Fei travels to India every year.

Three of these situation entity types can be used to express general knowledge about the world, to varying extents.

- GENERIC SENTENCES express the most general knowledge: attributes of classes,
- STATES often introduce facts held to be generally true, and
- GENERALIZING SENTENCES talk about “what usually happens”.

EVENTS, on the other hand, typically express episodic information.

The next category of SE types is broadly referred to as *Abstract Entities*. This type of clause presents semantic content in a manner that draws attention to its epistemic status. We focus primarily on a small subset of constructions – factive and propositional predicates with clausal complements. Of course a wide range of linguistic constructions can be used to convey such information, and to address them all would require a comprehensive treatment of subjective language. In the examples below, the matrix clause is in both cases a STATE, and the embedded clause (in italics) is both an EVENT and either a FACT, PROPOSITION, or RESEMBLANCE-type situation entity. Note that in the RESEMBLANCE case, it is unclear whether or not the embedded event took place.

- (13) FACT (F): Georg knows that *Reza won the competition.*
- (14) PROPOSITION (P): Georg thinks that *Reza won the competition.*
- (15) RESEMBLANCE (RES): Reza looks like *he won the competition.*

Finally, the labels QUESTION and IMPERATIVE are added to allow complete annotation of texts.

(16) QUESTION (Q): *Why do you torment me so?*

(17) IMPERATIVE (IMP): *Listen to this.*

Annotators had access to the full inventory of ten SE types described above, but only four of them occur often enough in the microtext corpus to allow for meaningful analysis (see Section 4 for details).

3.2. Modal verbs and modal senses

Modal verbs convey extra-propositional meaning of clauses, encoding information about possibility, necessity, obligation, permission, wishes, or requests [13]. Features of the verb such as modal auxiliaries, tense, and mood have been widely used in previous work for classifying argumentative vs. non-argumentative sentences [7,18]. For example, [18] include verb lemmas and modal auxiliaries as features, and [7] find that, for Greek web texts related to public policy issues, tense and mood features of the verbal constructions are helpful for determining the role of the sentences within argumentative structures. Classifiers that automatically distinguish modal senses in context have been developed by [26] and improved in subsequent work [15,16,36].

We annotate all modal verb occurrences in the microtexts with their modal sense, following the inventory of modal senses and annotation guidelines from [36]. They distinguish three senses: **epistemic (ep)**, indicating possibility/necessity, **deontic/bouletic (de)**, indicating permission/request/wish, and **dynamic (dy)**, indicating ability. Different types of modalities express different types of extrapositional meaning: dynamic modality captures knowledge about specific capacities of certain entities or types of entities, while epistemic modality expresses knowledge about how likely a certain proposition is. Deontic modality expresses wishes or requests that are desired or undesired, and that may be possible or counterfactual. We illustrate these modal senses below with sentences taken from the microtext corpus:

(18) DYNAMIC (DY):

Außerdem können sich nur große Unternehmen die zusätzlichen Personalkosten leisten.

In addition, only large companies can afford the additional personnel costs. (Ability)

(19) EPISTEMIC (EP):

Eine ungewollte Schwangerschaft kann sowohl für die Eltern als auch das Kind eine schwere Belastung für den Rest des Lebens darstellen.

An unwanted pregnancy can be a heavy burden for the rest of life for both the parents and the child. (Possibility)

(20) DEONTIC (DE):

Die Krankenkassen sollten Behandlungen beim Natur-oder Heilpraktiker nicht zahlen.

Health insurance companies should not cover treatment in complementary medicine. (Obligation)

(21) DEONTIC (DE):

Zwar wollen die Vermieter möglichst viel verdienen [...]

The landlords want to earn as much as possible [...] (Wish)

(22) DEONTIC (DE):

Der Staat darf ein medizinisches Produkt bzw. eine medizinische Behandlung nicht aus moralischen Gründen einschränken.

The state may not restrict a medical product or medical treatment for moral reasons. (Permission)

It is important to mention that the interpretation of modal verbs can vary with their context. [36] find that specific sense ambiguities such as dynamic vs. deontic readings of *can*, epistemic vs. dynamic readings of *could*, or epistemic vs. deontic readings of *should* are difficult to discriminate. Likewise, senses can be expressed through different modal verbs. In the following example, a possibility (epistemic sense) is expressed by two different German modal verbs (*mögen* and *können*):

(23) EPISTEMIC (EP):

Manche mögen das Konzept der Schul-Uniform anachronistisch finden.

Some may find the concept of school uniform anachronistic. (Possibility)

(24) EPISTEMIC (EP):

Obwohl die Geschäftszahlen von IBM in letzter Zeit nicht umwerfend waren **und die Stimmung an der Börse insgesamt besser sein könnte**, solltest du IBM Aktien kaufen.

*Although IBM's numbers haven't been staggering recently, **and the mood in the stock market could (können) be better on the whole**, you should (sollen) buy IBM shares. (Possibility)*

3.3. Extending argumentative annotations of microtexts to SE types and modal senses

We annotate all segments with their situation entity types, and those containing modal verbs, with their modal senses. Annotation examples are illustrated in Table 1 and Fig. 2 which also give examples of both SE types and modal verbs and their senses in argumentative texts. The premise *Sure, other people have to work in the shops on the weekend* (Table 1) is an example for a GENERIC SENTENCE, while the premise *This should be clear to everyone after the disclosures of Edward Snowden* in Fig. 2 is a STATE and the last segment in Fig. 2 (*Their tools, data and expertise have been used to keep us under surveillance for a long time*) a GENERALIZING SENTENCE.

Segmentation. Before annotating the microtexts, we first segment them into clauses (cf. [3]). As seen in Table 1, an argumentative component can in fact consist of several SE segments. The granularity of situation-evoking clauses is different from that of argument components, requiring that the texts be re-segmented prior to SE annotation. For segmentation we use DiscourseSegmenter [27], a Python package offering both rule-based and machine-learning based discourse segmenters.⁴ After preprocessing texts with the Mate Tools,⁵ we use DiscourseSegmenter's rule-based segmenter (edseg), which employs German-specific rules to determine the boundaries of elementary discourse units in texts. Because DiscourseSegmenter occasionally oversplit segments, we did a small amount of post-processing. On average, one argument component contains 1.16 clauses.⁶ These clauses are then annotated with SE types and modal verbs and senses.

Agreement statistics. We train two student annotators with backgrounds in linguistics for labeling texts with both SE types and modal senses. The two annotators then label the microtexts independently. We

⁴<https://github.com/WladimirSidorenko/DiscourseSegmenter>.

⁵<http://www.ims.uni-stuttgart.de/forschung/ressourcen/werkzeuge/matetools.html>.

⁶[31] annotated the microtext corpus additionally with two alternative approaches to discourse structure, Rhetorical Structure Theory (RST, [14]) and Segmented Discourse Representation Theory (SDRT, [1]). The authors make similar observations to ours regarding the granularity of SE segments and argument components, finding that argument components may consist of several elementary discourse units (EDUs) as used in RST and SDRT.

Table 1

Sample microtext (micro_b015), German and English versions, with SE labels, proponent/opponent status, and argumentative functions (support, undercut, rebuttal, addition)

Arg	German/English + (SE-Labels) & [Modal Senses]
Concl.	Also, ich als Arbeitnehmer fände es sehr praktisch, (STATE) <i>Well, I as an employee find it very practical \\</i> zumindest an Wochenenden einkaufen zu können [dynamic] . (GENERIC SENTENCE) <i>to be able to shop at least on weekends.</i>
Prem. Opp:Reb	Klar müssen [deontic] dann auch Leute am Wochenende in den Läden arbeiten, (GENERIC SENTENCE) <i>Sure, other people have to work in the shops on the weekend,</i>
Prem. Pro:Und	aber die haben dann eben innerhalb der Woche frei (GENERIC SENTENCE) <i>but they can have days off during the week \\</i> und können [dynamic] in Ruhe Termine wahrnehmen, (GENERIC SENTENCE) <i>and run errands at their leisure \\</i> während ich im Büro sitze. (GENERALIZING SENTENCE) <i>while I'm stuck in the office.</i>
Prem. Pro:Supp	Ausserdem will [deontic] doch der Staat, (STATE) <i>Plus, the state wants me \\</i> dass ich mein Geld ausbebe, (EVENT) <i>to spend my money,</i>
Prem. Pro:Add	und wie soll [deontic] ich dass machen, (QUESTION) <i>and how am I supposed to do that \\</i> wenn die Geschäfte nicht offen sind, (GENERIC SENTENCE) <i>when the shops aren't open \\</i> wenn ich frei habe? (GENERALIZING SENTENCE) <i>when I'm off work?</i>

Modal verbs and their senses are marked in boldface; \\ indicates clause segment boundaries.

compute agreement both for SE types and for modal senses and gain an inter-annotator agreement of 0.40 for the former and 0.75 for the latter, both reported as Cohen's Kappa. As reported by several studies [23], the annotation of argumentative texts is a difficult task for humans. The agreement statistics reported above suggest that this is also the case for the task of labeling argumentative texts with SE types. The SE-labels that caused most disagreement among the annotators are STATE vs. GENERIC SENTENCE (39% of all disagreements), followed by STATE vs. GENERALIZING SENTENCE (22%). For modal verbs, most disagreements are caused by the labels dynamic vs. epistemic (60% of all disagreements), followed by epistemic vs. deontic (24%). We then produce a gold standard annotation by re-annotating all segments for which the two student annotators disagreed about the SE type and/or the modal sense. This third annotation is done by an expert annotator (one of the authors), and we use the adjudicated annotations for our analysis.

4. Analysis of semantic clause types

4.1. Distributions of SE types within different genres

We find that the most important SE types within the microtexts are STATE, EVENT, GENERIC SENTENCE, and GENERALIZING SENTENCE, while the remaining six types occurred not at all or infre-

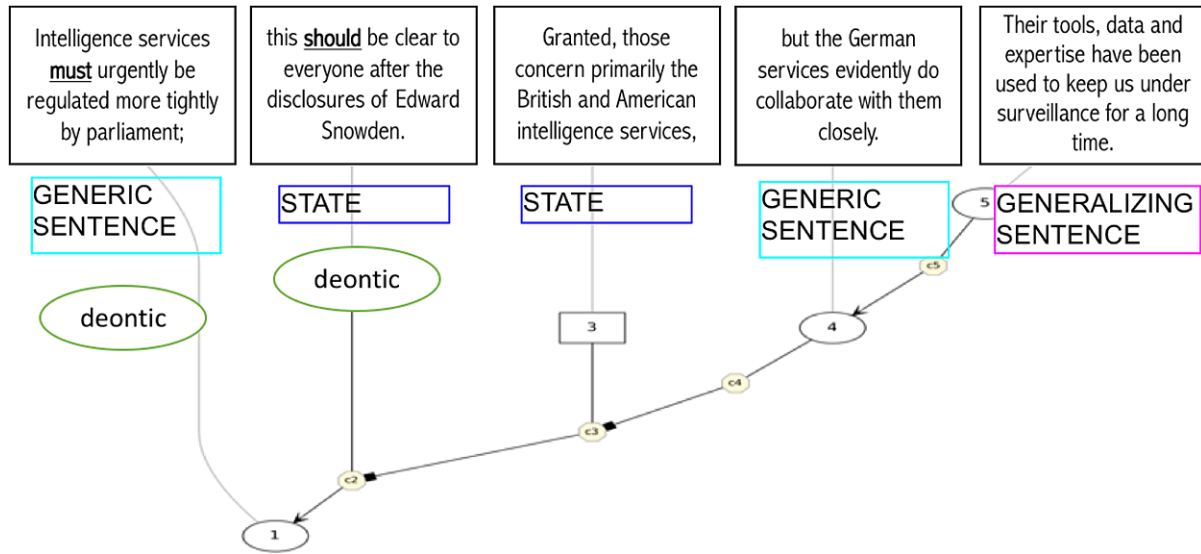


Fig. 2. Argumentation graph with clause type and modal sense annotations.

quently: QUESTION (10 segments), PROPOSITION (2 segments), RESEMBLANCE (2 segments), FACT (0 segments), REPORT (0 segments), and IMPERATIVE (0 segments). Thus, our further analysis will focus only on the four most frequent SE types STATE, EVENT, GENERIC SENTENCE, and GENERALIZING SENTENCE.

In order to investigate whether argumentative texts can be distinguished from non-argumentative texts with respect to the distribution of SE types (cf. [30]), we compare the distribution of STATES, EVENTS, GENERIC SENTENCES, and GENERALIZING SENTENCES in the microtext subcorpus to those of other text genres. Therefore, we first segment and then annotate a small corpus with texts of different genres with SE types. This corpus includes the following genres: fiction (47 segments), reports (42 segments), TED talks (50 segments) and commentary (127 segments).

The microtexts, which can be described as “purely” argumentative texts, are characterized by a high proportion of GENERIC SENTENCES and GENERALIZING SENTENCES and very few EVENTS, while reports and talks, for example, contain a high proportion of STATES. This is displayed in Fig. 3. Fiction is characterized by a high number of EVENTS. The commentary genre, which contains many argumentative passages but is not as purely argumentative as the microtexts, is most likely to be comparable to the microtexts. This finding suggests that SE types could be helpful for modeling argumentative regions of text.

4.2. Correlations between SE types and argument components

GENERIC SENTENCES are the most frequent type overall, distinguishing argumentative texts from other genres, in which GENERIC SENTENCES occur quite infrequently [8]. In the microtexts, conclusions are almost exclusively GENERIC SENTENCE or STATE, while premises, next to a majority of GENERIC SENTENCE, include a higher proportion of GENERALIZING SENTENCES and EVENTS (cf. Table 2 and Fig. 4(a)). This is in line with the role of the conclusion in the argument – it should concisely state the supported position, which is more likely to be a statement about a class of things (e.g.

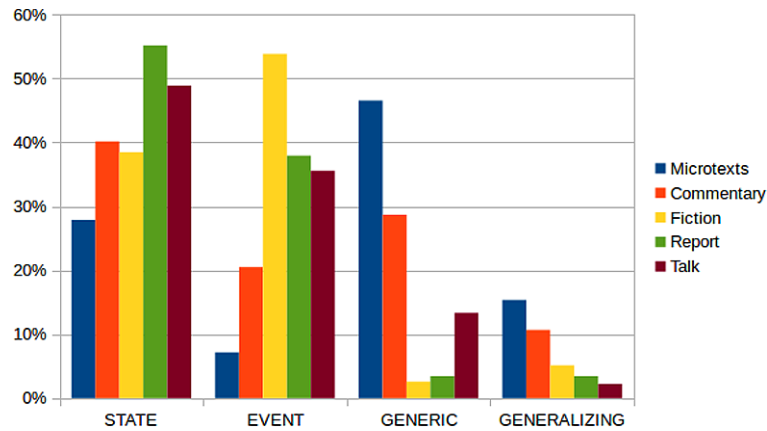


Fig. 3. Distribution of SE types within different genres.

Table 2

Distributions of SE types for argument components and functions, along with absolute number of each type of segment in the microtext corpus (in brackets: subset without coerced cases)

	All segments		Premises only		Functions		
	Conclusions	Prem-All	Prem-Pro	Prem-Opp	Supp	Rebut	Undercut
#	112	464	339	125	263	108	63
GEN	0.48 (0.48)	0.49 (0.49)	0.52 (0.52)	0.42 (0.42)	0.51 (0.51)	0.42 (0.42)	0.56 (0.56)
GS	0.05 (0.05)	0.12 (0.12)	0.08 (0.08)	0.13 (0.13)	0.12 (0.12)	0.13 (0.13)	0.11 (0.11)
S	0.44 (0.17)	0.29 (0.17)	0.29 (0.18)	0.31 (0.18)	0.29 (0.19)	0.32 (0.17)	0.24 (0.08)
EV	0.03 (0.30)	0.10 (0.22)	0.11 (0.22)	0.14 (0.27)	0.08 (0.18)	0.13 (0.28)	0.09 (0.25)

GEN: GENERIC SENTENCE; GS: GENERALIZING SENTENCE; S: STATE; E: EVENT.

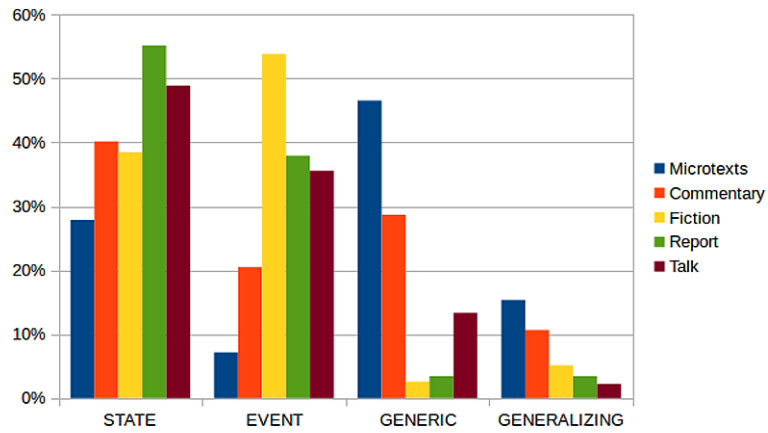
Not everyone should be obliged to pay TV license) or a condition or attribute of the world (e.g. *Raising the retirement age on the basis of physical fitness of the average citizen is fair*) rather than reference to an episodic event.

Looking at premises only, GENERIC SENTENCES are extremely frequent for proponent premises (52%) and less so for opponent premises (42%) (cf. Fig. 4(b)).

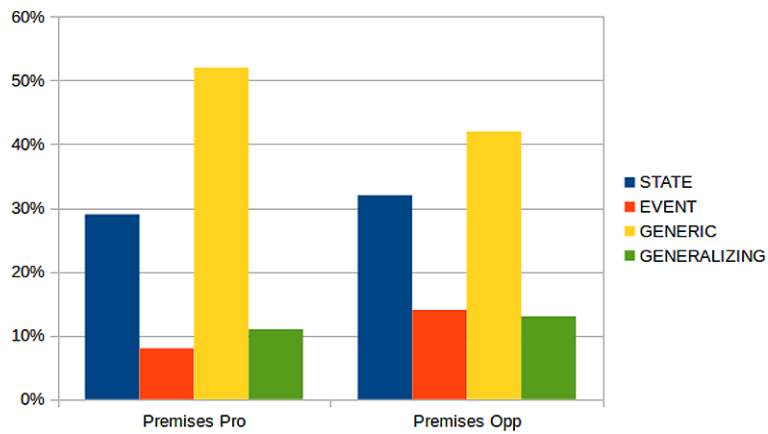
Table 2 shows the distributions over the four major SE types for the various types of argument components in the microtext corpus.

4.3. Correlations between SE types and argumentative functions

Turning to correlations between SE types and argumentative functions of premises, we focus on the three most frequent functions: *support*, *rebuttal*, and *undercut* (Table 2, rightmost section, and Fig. 5). Supporting premises have a SE type distribution very similar to that of proponent premises overall. This is not surprising given that most microtexts contain only a single opponent premise. Undercutting premises show an even higher frequency of GENERIC SENTENCES (56%), with the caveat that undercuts occur less frequently than the other types. Finally, rebutting premises show a lower frequency of GENERIC SENTENCES (only 42%) and a fairly high occurrence of STATES (32%). This tendency can be illustrated with the following example, where a STATE (bold face) rebuts the conclusion (in italics).



Correlations between SE types and conclusions/premises



Correlations between SE types and propositions

Fig. 4. SE types and argument components and propositions.

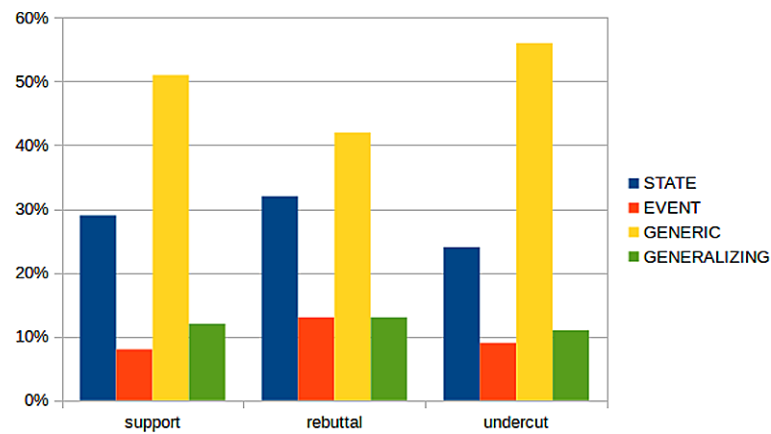


Fig. 5. Correlations between SE types and argumentative functions.

- (25) Die Krankenkassen sollten Behandlungen beim Natur-oder Heilpraktiker nicht zahlen, (GENERIC SENTENCE) **es sei denn der versprochene Effekt und dessen medizinischer Nutzen sind handfest nachgewiesen.** (STATE)

Health insurance companies should not cover treatment in complementary medicine unless the promised effect and its medical benefit have been concretely proven.

What is additionally notable about rebutting premises is that they show the highest proportion of (overall low-frequency) EVENTS (13%) among all argumentative functions. This indicates that authors tend to rebut or argue against premises or conclusions by referring to episodic events.

These results suggest that situation entity types could be helpful even for a finer-grained analysis of argumentative functions.

Of course, our annotated corpus is very small, and the phenomena we observe can be interpreted solely as tendencies. Nevertheless, we hypothesize that the prevalence of the GENERIC SENTENCE and GENERALIZING SENTENCE labels, as well as the absence (or rareness) of the EVENT label are indicators not only of argumentative text passages, but in particular of conclusions and proponent argument components.

4.4. Analysis on the dataset without considering coercions

As mentioned above, linguistic features such as modality, negation, future tense or conditionals cause a coercion from EVENT-type to STATE. We find 84 such coercions in our dataset, 30 within conclusions and 54 within premises.

To better understand the effect of these coercions on our analyses, we reiterated our analyses on the same dataset, but undoing these coercions. This means that we use a version of the dataset in which what ordinarily would be treated as cases of coercion are instead labeled with the SE type that holds prior to coercion. Example (26) e.g. would be labeled as EVENT instead of as STATE:

- (26) Deshalb sollte Deutschland die Todesstrafe nicht einführen!

That's why Germany should not introduce capital punishment!

The distributions of SE types within the dataset with and without coercions can be found in Table 2 (version without coercions in brackets) and are visualized in Fig. 6.⁷ Since coercion affects the proportion of STATE- and EVENT-types, we of course find a smaller number of STATES and a higher number of EVENTS in this analysis. As Fig. 6 shows, the relation between STATES and EVENTS changes the most for conclusions. Instead of only 3% EVENTS (when applying coercion), we find 30% EVENTS (without coercion), i.e., a difference of 27 percentage points (for premises, the difference is only 12 percentage points). Moreover, while in the analysis considering coercions we find a higher percentage of STATES compared to EVENTS, in the analysis ignoring coercion the reverse is true. Here we find more EVENTS than STATES for all categories (argument components as well as argumentative functions) – except in supporting premises, where we find 19% STATES and only 18% EVENTS.

This supports the assumption that episodic events are dispreferred for supporting a conclusion or a premise, but preferred for attacking a conclusion or another premise. This second claim is supported by the high proportion of EVENTS within rebutting and undercutting premises (28% and 25%). In other words, anecdotal reference to events occurs more often for attacking than for supporting. This can be illustrated with the following example, where a generic premise (in italics) is rebutted by a negated and modalized premise which is accordingly coerced from EVENT to STATE:

⁷Please note that all other figures in this paper report results on the original dataset, with coercions.

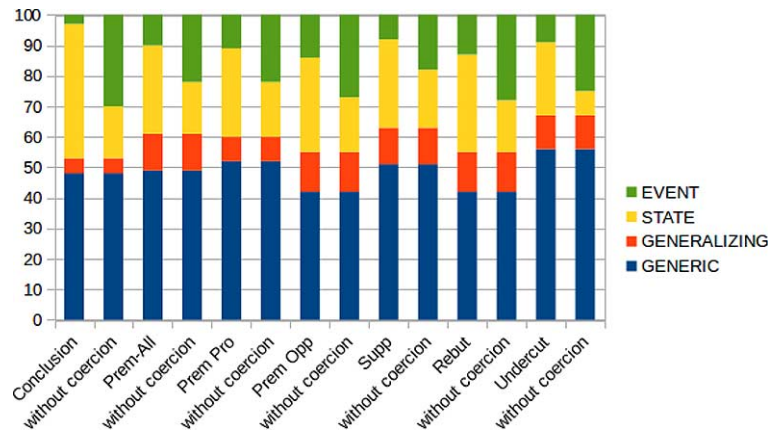


Fig. 6. Distributions of SE types within argument components and argumentative functions, with and without coercions.

- (27) Befürworter der Todesstrafe setzen auf die abschreckende Wirkung sowie die endgültige Eliminierung einer potentiellen Gefahr. (GENERIC SENTENCE) **Offensichtlich kann aber auch die drohende Todesstrafe in entsprechenden Ländern nicht verhindern, dass es Mord und Gewaltverbrechen gibt.** (EVENT → STATE)

*Proponents of the death penalty count on its deterring effect as well as the ultimate elimination of any potential threat. **However also the threat of the death penalty in the respective countries apparently cannot prevent murder and violent crime.***

Our motivation of comparing the datasets with and without coercions was to learn more about the effect that modals and other linguistic features which cause coercions may have on the distribution of SE types within argumentative texts. We find that indeed there is a considerable effect: as reported above, we naturally find fewer EVENTS within the dataset without coercions – a distributional effect that one can possibly exploit in an automatic system. What we also find is that 59 of the 84 coercions (70%) in our data are due to modal verbs. We thus complement our study of SE types with an investigation of the role of modal verbs and their senses within argumentative texts.

5. Analysis of modal verbs and senses

5.1. Modal verbs within argumentative and non-argumentative texts

In our annotation we found that modal verbs constitute a high-frequency linguistic phenomenon in the microtexts. The overall 188 modal verbs included in the microtexts occur in 31% of all argumentative segments (57% of conclusions and 26% of premises) and are thus at least partly responsible for the high number of STATES, due to the coercion of EVENTS to STATES when embedded under a modal verb. In comparison, only 5% of the segments of the mixed-genre subcorpus introduced in Section 4, including genres such as fiction, report, commentary and TED talks (see [3]), contain modal verbs. Due to this coercion, the contribution of modality indicators is orthogonal to SE types. We thus complement the analysis of SE types with a deeper investigation of modality-indicating expressions, here modal verbs.

Table 3 shows the German modal verbs and their available senses. Note that *wollen* is not a modal verb, but was included because *mögen* (may/want to) is ambiguous, and thus we included the synonymous *wollen* and tagged this sense as *deontic* (wish).

Table 3

German modal verbs with English translations and available modal senses (ep = epistemic; de = deontic; dy = dynamic), as well as number of occurrences in the data

Verb	Occ.	Translation	Senses
sollen	81	shall/should	ep, de
können	45	can/could	ep, de, dy
müssen	36	must/have to	ep, de
dürfen	9	may/might	ep, de
mögen	7	may/want to	ep, de
wollen	10	want to	de

Table 4

Distributions of modal verbs and modal senses for various argument components and functions, plus absolute number of modal-verb-containing segments in the microtext corpus

	All segments		Premises only		Functions		
	Conclusions	Prem-All	Prem-Pro	Prem-Opp	Support	Rebut	Undercut
#	68	120	85	35	60	30	17
Deontic	0.97	0.61	0.64	0.53	0.62	0.50	0.76
Dynamic	0.015	0.15	16	0.15	0.18	0.11	0.12
Epistemic	0.015	0.24	0.20	0.32	0.20	0.39	0.12
sollen	0.86	0.19	0.21	0.14	0.18	0.10	0.40
können	0.03	0.36	0.38	0.31	0.42	0.30	0.24
müssen	0.07	0.25	0.22	0.31	0.25	0.33	0.24
dürfen	0.02	0.07	0.08	0.04	0.06	0.03	0.06
mögen	–	0.06	0.03	0.14	0.02	0.17	0.06
wollen	0.02	0.07	0.08	0.06	0.07	0.07	–

Our analysis looks closely at distributions of both modal verbs and modal senses and is performed on a subset of the segments from the SE type analysis, as we are concerned only with segments containing modal verbs (cf. first row in Table 4).

5.2. Correlations between modal verbs/senses and argument components

Overall, the most frequent modal verb in the microtexts is *sollen* (121 occurrences, 41% of modal verbs), and the most frequent sense across all modal verbs is deontic (133 occurrences, 75%).

Of the **conclusions** that contain a modal verb, an overwhelming 97% (62/64) are deontic; compare this to **premises** that contain modal verbs, for which only 61% (71/117) are deontic (Fig. 7(a)).

The prevalence of *sollen* within conclusions (86%) warrants a caveat: most of the trigger questions contain some form of *sollen*, and so it is possible that the predominance of *sollen*, particularly in conclusions (86%), is a result of the form of the trigger questions.⁸ However, the distribu-

⁸The frequency of certain modal verbs could also be a feature of a specific type or subclass of argumentative texts: While most of the microtexts can be characterized as persuasive/suggestive towards certain future actions, argumentative texts may also be of an epistemic nature (e.g. arguments in scientific discourse). Therefore, our observations of features of argumentative texts first of all hold for the subclass of argumentative texts as represented in the microtext corpus, while we leave the analysis of features of other subclasses as future work.

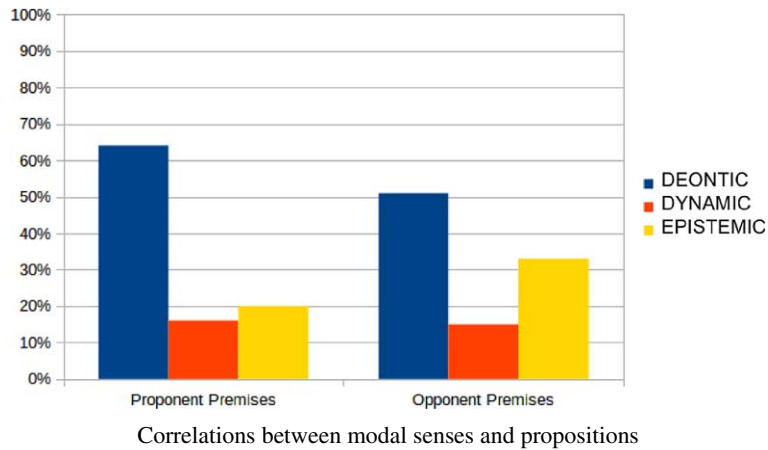
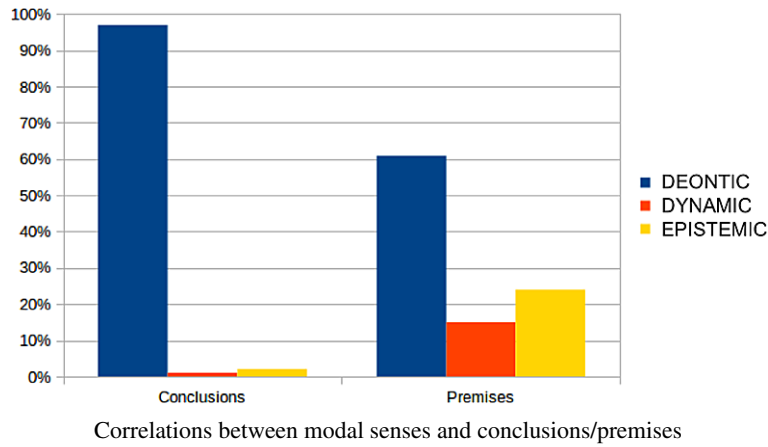


Fig. 7. Modal senses and argument components and propositions.

tions of modal verbs within the subset of microtexts not associated with a trigger question are very similar to the overall distributions (among conclusions: *sollen* = 77%, *können* = 8%, *müssen* = 15%). This suggests that the observed distributions are not overly influenced by the trigger questions.

The other nearly 40% of premises are *epistemic* and *dynamic* senses of MVs, which occur in conclusions with a combined frequency of only 3%. The prevalence of these two senses is reflected in the high frequency of *können*, which frequently occurs as dynamic or epistemic. As is generally the case, *müssen* in epistemic sense is rather rare. The tendencies can be seen clearly in the upper part of Table 4, which displays the modal sense distributions.

In **premises**, the most frequent modal verb is *können*, at 36%, followed by *müssen* with 25%. These again stand in stark contrast to conclusions, where these two verbs occur with frequencies of 3% and 7%, respectively. A similar observation concerns **proponent and opponent** premises (Fig. 7(b)). Here, 64% of proponent components with a modal verb are *deontic*, while this is true only for 53% of opponent components with modal verbs. Instead, we find a relatively high proportion of *epistemic* senses (32%) for opponent premises, and a similarly high proportion for *epistemic* sense is found with **rebutting premises**.

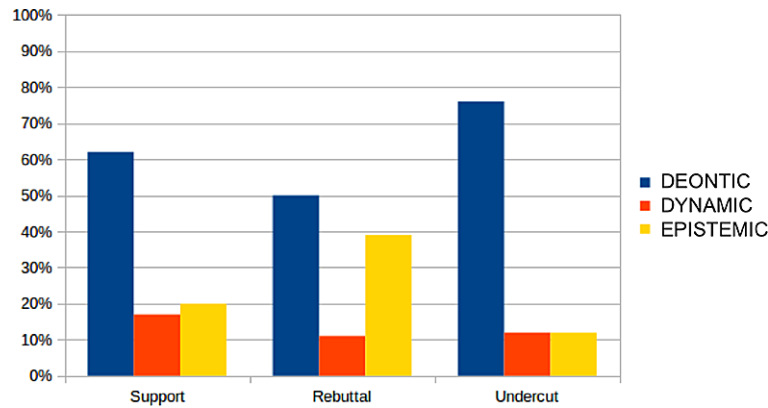


Fig. 8. Correlations between modal senses and argumentative functions.

5.3. Correlations between modal verbs/senses and argumentative functions

Epistemic modals refer to alternative, often counterfactual worlds, and as such they are well suited for rebutting preceding or hypothesized arguments or premises (Fig. 8). An example of this from our data is given in example (28), where bold face marks a rebutting premise:

- (28) Obwohl die Geschäftszahlen von IBM in letzter Zeit nicht umwerfend waren **und die Stimmung an der Börse insgesamt besser sein könnte**, solltest du IBM Aktien kaufen.
*Although IBM's numbers haven't been staggering recently, **and the mood in the stock market could (können) be better on the whole**, you should (sollen) buy IBM shares.*

Turning to *dynamic sense*, we find it more strongly associated with **supporting** function. We typically find this sense realized with *können*, bringing forth abilities or capabilities of entities, presented as options and chances, in support of a premise (29).

- (29) Bereits heute dominieren Supermärkte und grosse Einkaufszentren den Markt. **So können auch kleinere Geschäfte von der zusätzlichen Freiheit profitieren**, da die Kunden am Sonntag im Durchschnitt entspannter einkaufen.
*Supermarkets and large shopping centres dominate the market today already. **Thus smaller shops could (können) benefit from the additional freedom**, as customers are on average more laid-back on Sunday.*

Finally, even though *deontic* is the most frequent modal sense within all of the microtexts, it is especially frequent within **undercuts**: 76% of the undercuts that contain modal verbs have the modal sense deontic (obligation).

As an example, we find (30):⁹

- (30) Man sollte einem langjährigen Eigentümer nicht die Chance auf Angleichung seiner Rendite auf Marktniveau verwehren.
One should not deny a longtime owner the opportunity to approximate his return to market level.

In **rebuttals** with modal verbs (30 occurrences) we count only 50% deontic and 39% epistemic modal senses, see (31) for a deontic rebuttal.

⁹Note that the English translation does not render the deontic sense of *müssen* in the German original.

(31) Dennoch sollten Frauen vor der Einnahme über die Risiken aufgeklärt werden und gynäkologisch untersucht werden.

However, women should be educated about the risks and gynecological studies before taking them.

This echoes the finding in the situation entity analysis that rebuttals pattern somewhat differently from the other argumentative functions.

6. Conclusion

This study extends our understanding of linguistic features of argumentative texts by investigating the utility of SE types and modal verb senses for modeling regions of argumentative texts. Although the microtext corpus is small and the observed phenomena can be interpreted only as tendencies, our analyses show that both semantic clause types and modal senses can be useful features for automated argumentation analysis – not as stand-alone features, but as part of a larger system. Table 5¹⁰ summarizes our findings and gives an overview of the features we believe can be deployed to improve systems for automated argumentation analysis.

Our analyses revealed some clear-cut distinctions as well as weaker tendencies. First, SE types, especially GENERIC SENTENCES, allow for a clear distinction between argumentative and non-argumentative text passages. Similar to SE types, a high proportion of modal verbs was found to be a characteristic feature of argumentative texts as opposed to other text genres.

The high frequency of GENERIC SENTENCES and the rareness of EVENTS within conclusions compared to premises can be helpful to identify conclusions and premises within argumentative texts.

Proponent premises were found to be characterized by a high proportion of GENERIC SENTENCES and very few EVENTS, whereas a higher amount of EVENTS are found within rebutting premises and opposing premises when controlling for coercions. This finding supports the assumption that references to episodic events are suitable to rebut against conclusions or other premises.

Modal verbs and senses can be used to distinguish conclusions from premises since conclusions show a strong tendency to be deontic. Modal senses can also be helpful for classifying proponent and opponent premises, since the former show a higher proportion of deontic sense.

Table 5
Clause types and modality as features for argumentation mining: Summary

Linguistic phenomena	Useful as features for...
<i>Clause types</i>	
High frequency of GENERIC + GENERALIZING SENTENCES	Identifying argumentative text passages
High proportion of GENERIC SENTENCES + rareness of EVENTS	Distinguishing conclusions from premises
High proportion of GENERIC SENTENCES	Distinguishing proponent from opponent premises
High proportion of EVENTS + STATES	Identifying rebuttals
<i>Modality</i>	
High frequency of modal verbs	Identifying argumentative text passages
High frequency of <i>sollen</i>	Distinguishing conclusions from premises
High proportion of deontic modal sense	Identifying conclusions and proponent premises
High proportion of epistemic modal sense	Identifying rebuttals and opponent premises

¹⁰Note that the results for SE types are based on the original dataset, cf. Section 4.4.

Finally, we found rebutting premises to contain more epistemic modal verbs than supporting or undercutting premises.

Moving forward, we will extend our analysis to longer texts with both argumentative and non-argumentative passages. With more data, we will be able to consider finer distinctions in the usage of modal senses, for example investigating the sense distributions for particular modal verbs in particular components of argumentative structures. We also consider broadening the scope of modality-indicating expressions to modal adjectives (*possible*) and adverbials (*probably*) or attitudinal expressions (*to be expected*).

Using automatic classifiers to assign situation entity [9] and modal sense labels [15,16], the contribution of these phenomena to argument structure parsing can be examined on a broader scale.

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