

Formal Models for the Semantic Analysis of D-BAS

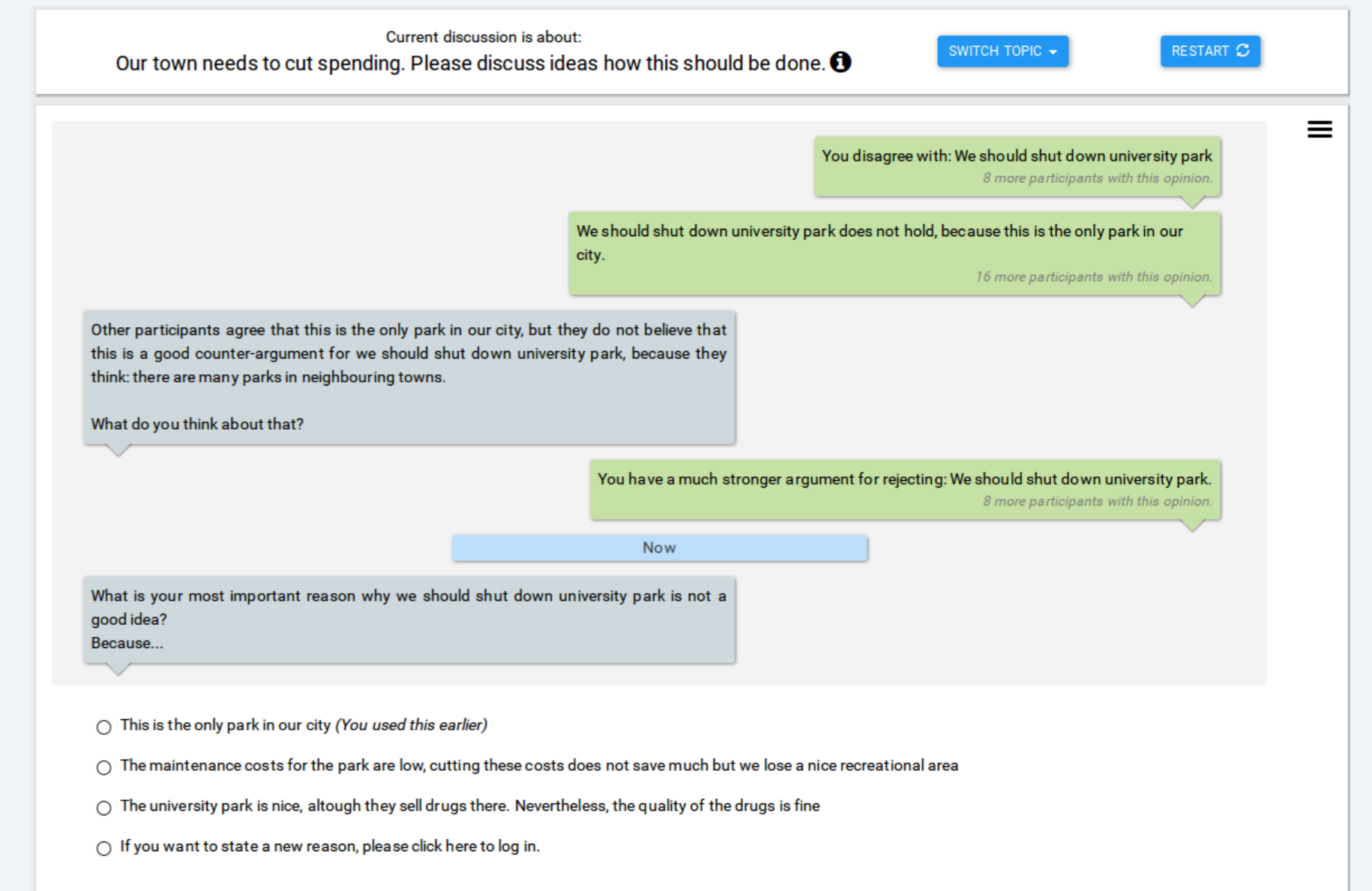
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The Dialog-Based Argumentation System (D-BAS)

D-BAS is a web tool for dialog-based argumentation currently under construction by members of the *NRW Fortschrittsskolleg Online-Partizipation* (<http://www.fortschrittsskolleg.de/>). An introductory paper [7] describing its features is accepted for presentation at COMMA 2016.

D-BAS guides users through a discussion using an artificial, mediated dialog: a user is confronted with an argument that was created by other users and is asked to react to it by selecting from predefined options (including rebutting, undermining and undercutting attacks), thus creating a new argument. To back up this argument, the user needs to select or enter one or several natural language statements as a premise. The system will then continue the artificial dialog by, in turn, attacking this new argument.



Our aim is to develop formal models that are suitable to describe the system's state at a given point in time and which allow semantic analysis of it. Challenges include the representation of all relevant aspects of such a D-BAS snapshot in the models used, and finally the development of, e.g., criteria for the consistency of user positions, measures of relevance for arguments or statements given a partial user position, enforcement criteria for statements, and possible notions of manipulation.

D-BAS Model

A *D-BAS snapshot* is a triple $(S, \mathcal{I}, \mathcal{A})$ where

- $S = \{s_1, \dots, s_n\}$ is a set of atomic *statements*,

- For $s \in S$, $\neg s$ denotes the negation of s ,
- for a set $S \subseteq S$, denote $\neg S = \{\neg s \mid s \in S\}$,
- for a set $S \subseteq S \cup \neg S$, denote $\hat{S} = \{s, \neg s \mid s \in S \text{ or } \neg s \in S\}$.

- $\mathcal{I} \subseteq S$ is a distinguished set of *issues*, and
- $\mathcal{A} \subseteq \text{Rul}(S)$ is a finite set of *arguments*.

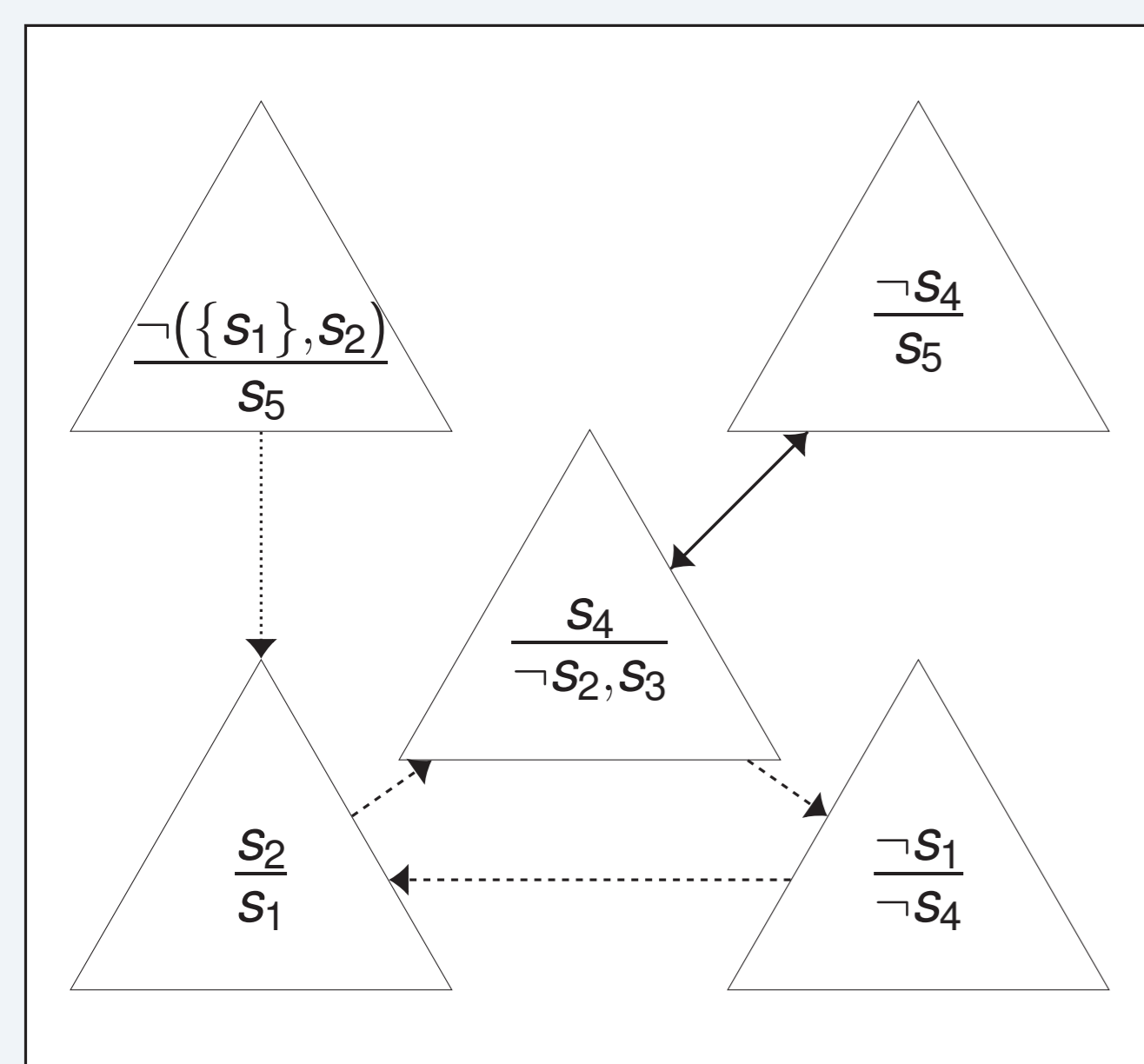
- $\text{Rul}(S) = \{(P, C), \neg(P, C) \mid P \in \text{Prem}(S) \text{ and } C \in (\hat{S} \setminus \hat{P})\}$ is the set of all possible *inference rules* on S , where $\neg r$ denotes the negation of a rule $r \in \text{Rul}(S)$, and
- $\text{Prem}(S) = \{\emptyset \subset P \subseteq \hat{S} \setminus \hat{I} \mid s \in P \Rightarrow \neg s \notin P\}$ is the set of all valid sets of *premises*.

D-BAS Model – Example

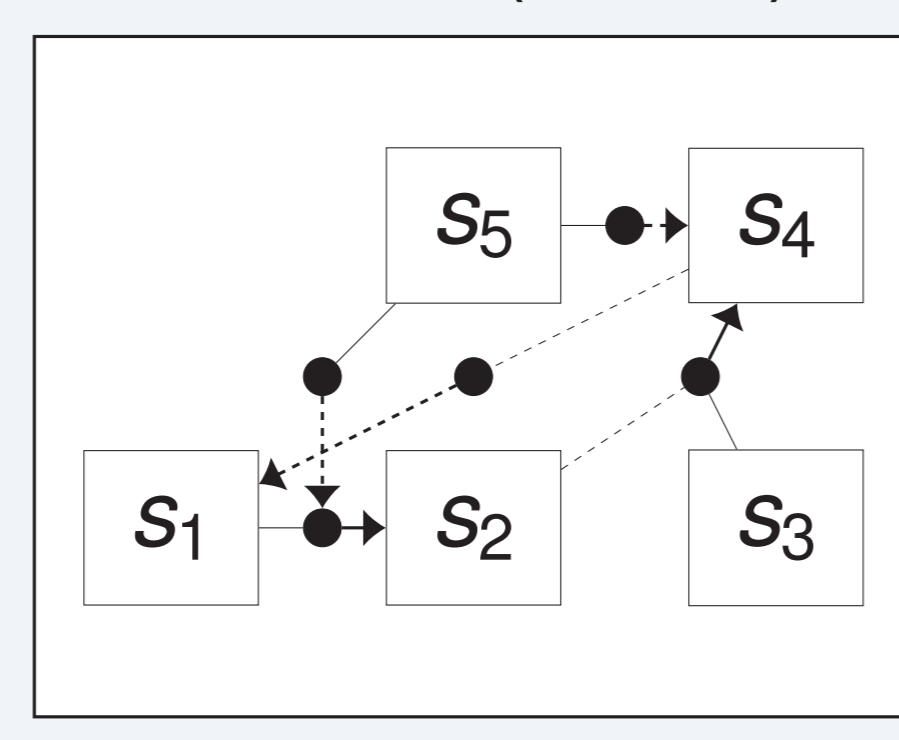
Consider the following D-BAS snapshot $(S, \mathcal{I}, \mathcal{A})$ with 5 statements, no issues, and 5 arguments:

$S = \{s_1, s_2, s_3, s_4, s_5\}$, $\mathcal{I} = \emptyset$, and

$\mathcal{A} = \{(\{s_1\}, s_2), (\{\neg s_2, s_3\}, s_4), (\{\neg s_4\}, \neg s_1), (\{s_5\}, \neg s_4), (\{s_5\}, \neg(\{s_1\}, s_2))\}$

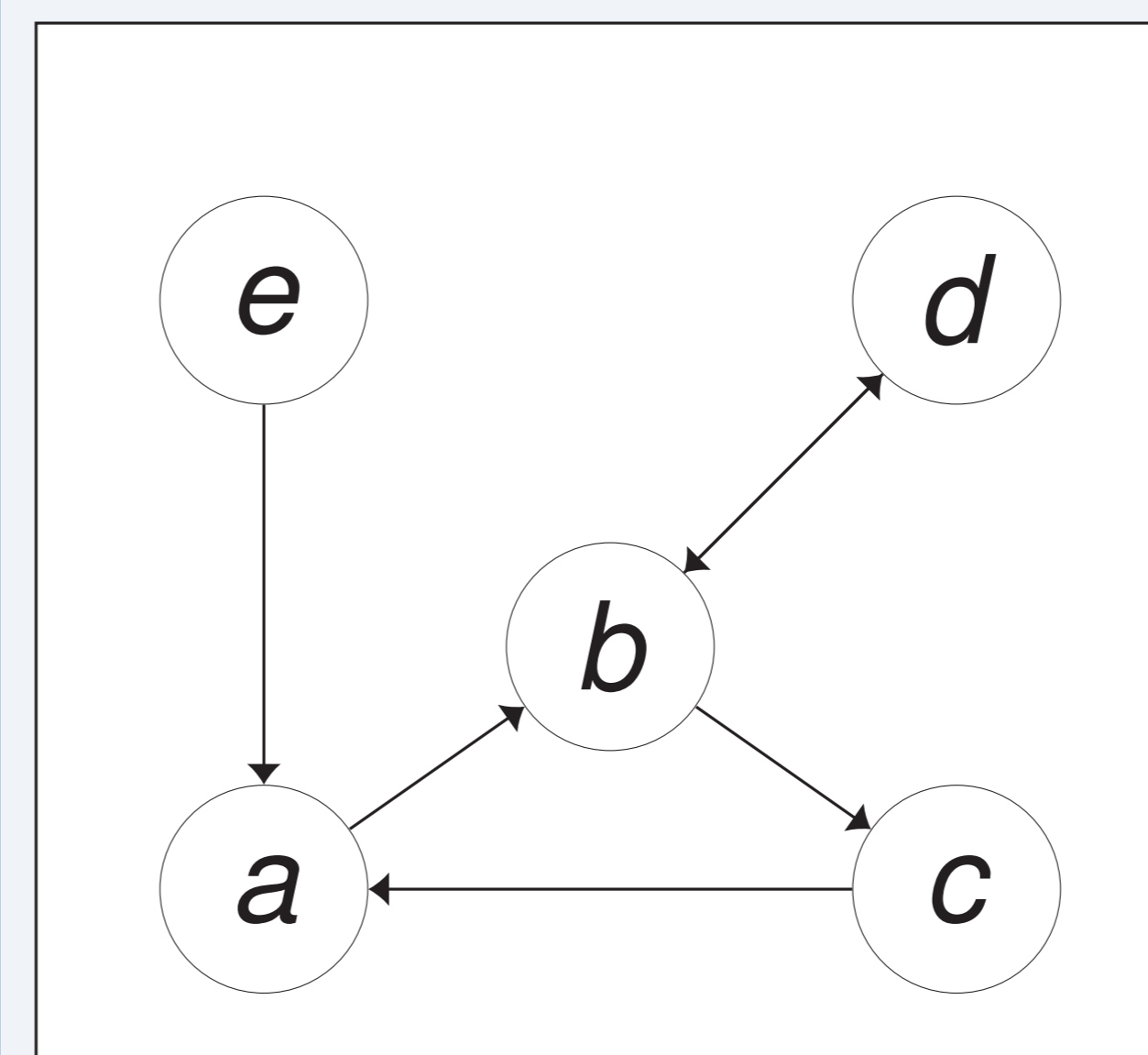


Argument-based visualisation (left) and statement-based visualisation (below).



Abstract Argumentation Frameworks (AF)

Abstract argumentation frameworks due to Dung [5] can be used to describe D-BAS snapshots at a very abstract level.



Therefore, one of our objectives is to contribute to the development of model extensions for Dung frameworks that increase their expressivity and applicability. We provided complexity results for the verification problem in argumentation frameworks with incomplete knowledge of the attack relation [1] and of the existing arguments [2], respectively.

ASPIC+ Instantiation

We currently develop a translation of D-BAS snapshots to instances of the well-established ASPIC+ framework proposed by Prakken [8]. The ASPIC+ instantiation shall serve as an intermediate representation between D-BAS and Dung's abstract model.

Outlook – Further Models

We want to employ more different frameworks to model D-BAS, next:

- Abstract Dialectical Frameworks (ADF) by Brewka and Woltran [3],
 - Carneades by Gordon, Prakken and Walton [6],
- ... and finally compare all models by testing the plausibility of their semantic analysis results (i.e., accepted statements/arguments) using real-world D-BAS snapshots.

References

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