A Semantics for Argumentative Systems

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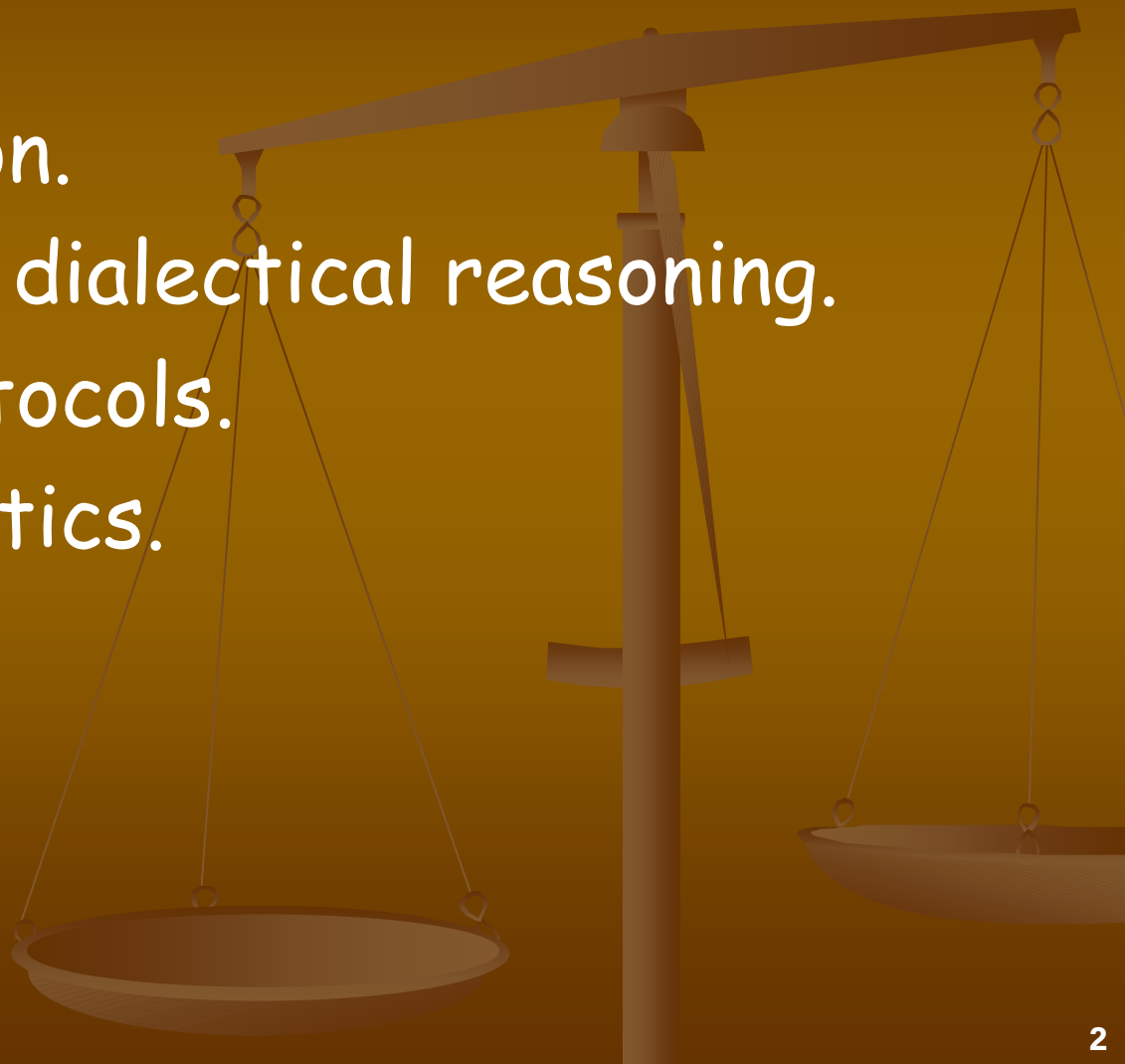
Outline

- Motivations.
- Course of action.
- Key aspects of dialectical reasoning.
- Dialectical Protocols.
- Induced semantics.
- Conclusions.
- Work ahead.

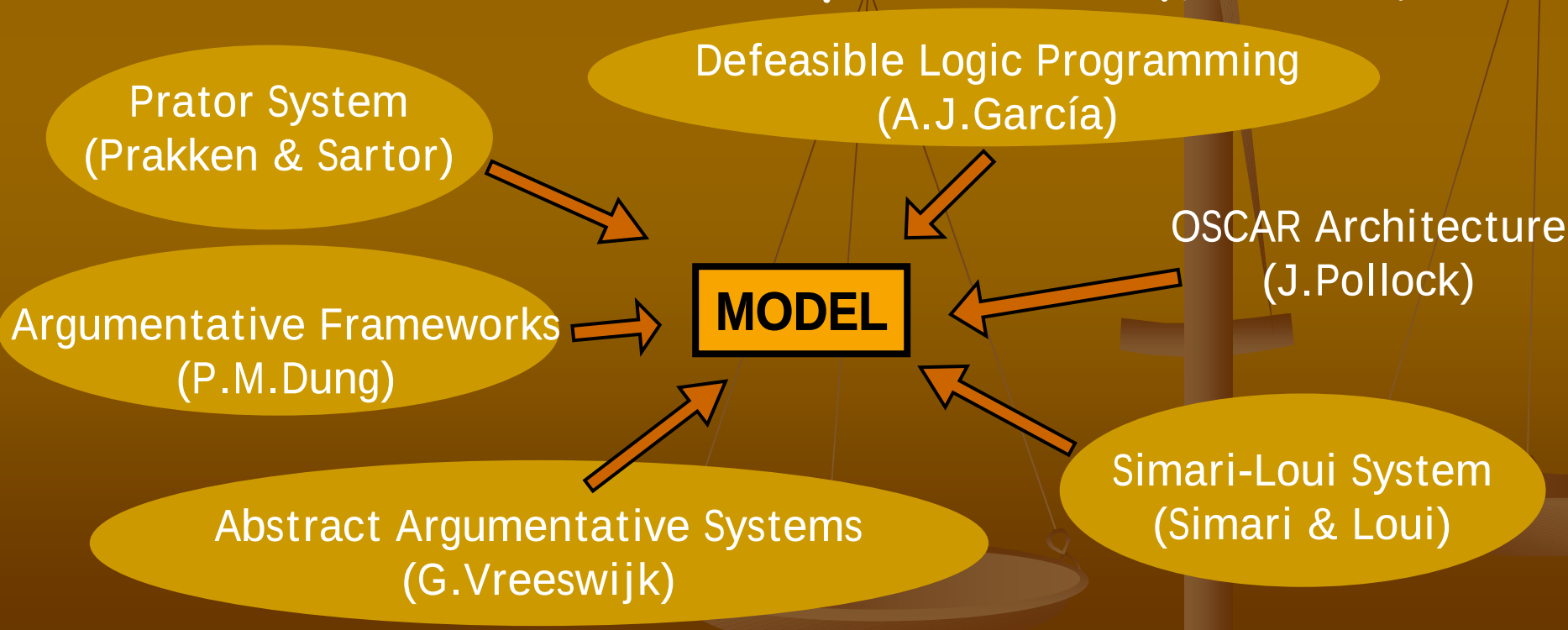


Motivations

- Most argumentative systems share a set of common aspects among them:
  - They provide an underlying logic.
  - They characterize the notion of argument.
  - They define when two arguments are in conflict.
  - They also define when an argument actually defeats another one.
  - They provide a mechanism for determining the ultimate state of arguments.

Motivations

- In this proposal we observed that most of the formalisms usually admit several theories: dialectical variant of their semantics.

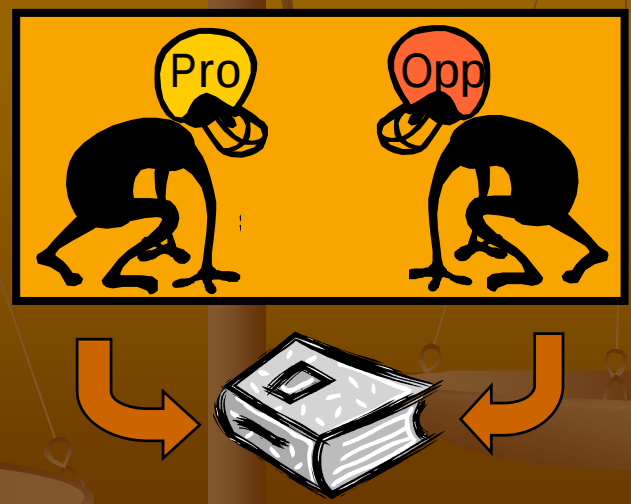


Course of Action

- Simply put, we want to characterize a generic model of dialectical reasoning.
- To do so, we first identify the key aspects involved in this process.
- Then, we introduce the notion of Dialectical Protocol:
  - a framework built upon these key aspects,
  - whose semantics is able to model what happens inside an argumentative system.

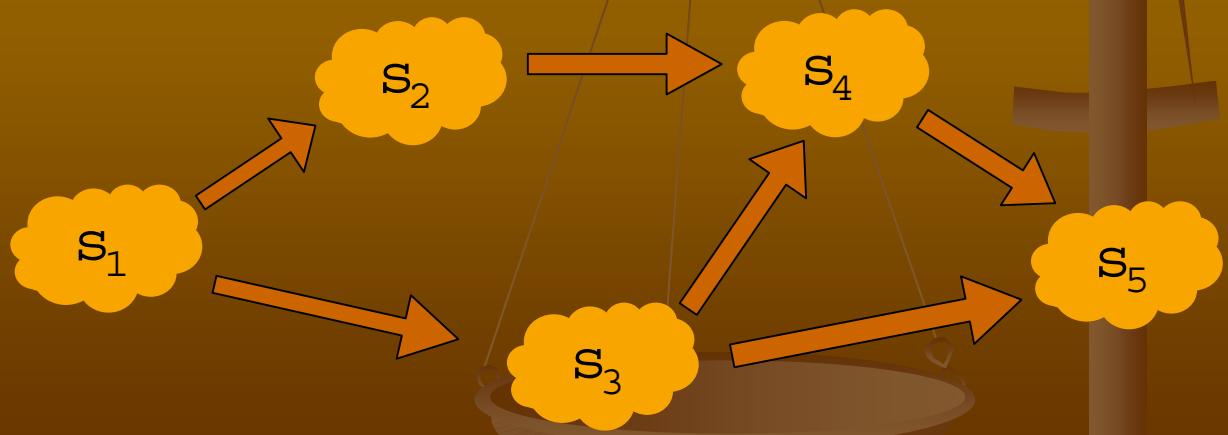
Key Aspects of Dialectical Reasoning

- One entity, yet two roles:
  - Proponent.
  - Opponent.
- A single knowledge base.
- Dialogical game:
  - Moves.
  - Argumentation lines.
  - State of a dispute.



Key Aspects of Dialectical Reasoning

- Issues to address in every state:
  - Who should move next?
  - What are the available, valid moves?
  - Is the dispute over? Who prevailed?
- Successor state.



Dialectical Protocols

- Context of a DP:

Definition 1: *Let us call context the tuple* $\gamma = (D, KB, args)$.

Knowledge representation language

Knowledge base

Mapping

Dialectical Protocols

- Move:

Definition 2: *Let us call move the tuple* (contender, argument).

contender ∈ {Pro, Opp}

argument ∈ *args*(KB)

Dialectical Protocols

- Argumentation line:

Definition 3: *We say that an argumentation line regarding* L *is a sequence of moves* $< m_0, m_1, \ldots, m_k >$, $k \geq 0$, *where* $m_0 = (Pro, argument)$.

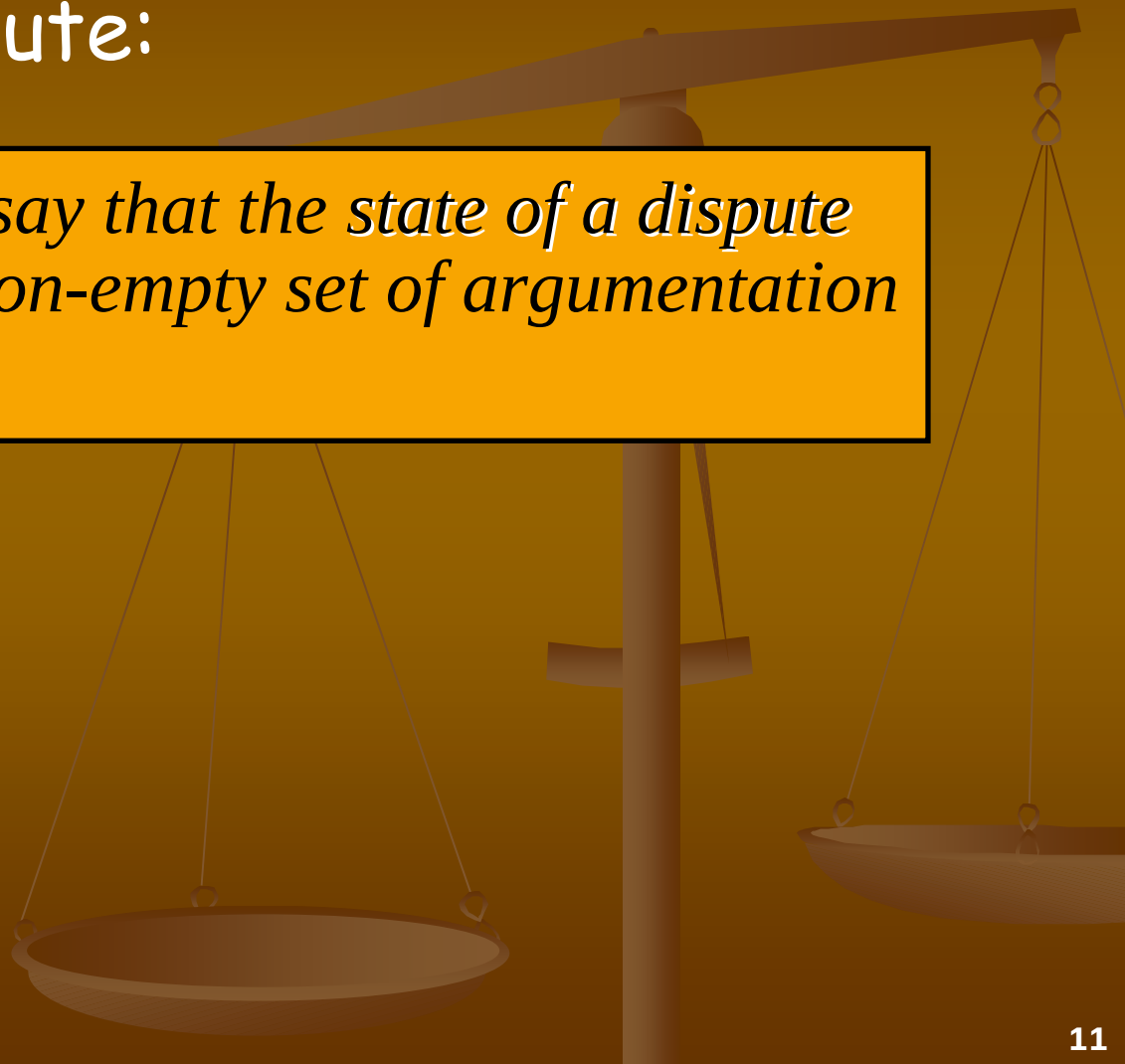
Claim under consideration

Argument supporting L

Dialectical Protocols

- State of a dispute:

Definition 5: *We say that the state of a dispute regarding* L *is a non-empty set of argumentation lines regarding* L.



Dialectical Protocols

- Successor state:

$$next : States \times Moves \times Lines \rightarrow States$$

Set of all the possible states of a dispute

Set of all the possible moves

Set of all the possible lines of argumentation

Dialectical Protocols

- Issues to address in every state:
  - Who should move next?

$$toMove : States \rightarrow \{Pro, Opp\}$$

  - What are the available, valid moves?

$$legal : Lines \rightarrow \mathcal{H}(Moves)$$

  - Is the dispute over? Who prevailed?

$$winner : States \rightarrow \{Pro, Opp\} \cup \{none\}$$

Dialectical Protocols

- Dialectical Protocol:

Definition 6: *We say that a dialectical protocol for* $\langle \mathcal{L}, \sim \rangle$, *noted* $\mathcal{H}_{\langle \mathcal{L}, \sim \rangle}$, *can be characterized through the tuple:*

$(Moves, Lines, States, legal, toMove, winner, next)$

Induced Semantics

- Having a concrete instance of a dialectical protocol allows us to capture an interesting set of claims.
- Namely, the one containing those claims able to remain undisputed even after sustaining a full dialectical debate.
- Simply put, those initially argued by the proponent, where the opponent fail to exploit its weaknesses.

Induced Semantics

- What characterizes such disputes?
  - The proponent start with an argument supporting the said claim.
  - Both contenders provide new moves conveying arguments and counter arguments, that extend the different argumentation lines being explored.
  - The states being traversed as a result of playing these moves are such that they finish in a state where the proponent wins.

Conclusions

- We introduced the notion of Dialectical Protocols, essentially a framework that can serve as an alternative semantics for argumentation systems.
- This framework stem from an analysis of the core features of the theories of defeasible argumentation present in the literature.
- Simply put, we observed that most of them defined their semantics in dialectical terms.

Work Ahead

- Formally define a particular instance of a dialectical protocol after a well known argumentative system.
- Test the semantics induced by this instance against the original semantics of the system.
- Prove (or disprove) whether the induced semantics behaves in a like manner.

Questions?

Thanks for your time!

Addendum

- Entailement:

Definition 7: *We say that* L *is entailed by* 1H; *if, and only if, there exists a finite sequence* $s_0, s_1, \ldots, s_n$ *of states of a dispute regarding* L, *where…*

$s_0 = \{\langle m_0 \rangle\}$, where $\langle m_0 \rangle$ is an argumentation line regarding L

winner $(s_n) =$ Pro
winner $(s_i) =$ *none*, $i < n$

$\langle m_0, \ldots, m_k \rangle \in s_i$, where $(\text{contender}, \text{argument}) \in \textit{legal}(\langle m_0, \ldots, m_j \rangle)$ is such that $\text{contender} = \textit{toMove}(s_i)$ and also $\textit{next}(s_i, (\text{contender}, \text{argument}), \langle m_0, \ldots, m_j \rangle) = s_{i+1}$