Formalizing Practical Argumentation Lecture 3: Logics for Defeasible Argumentation II. Dialectical proof theory

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Bahia Blanca, June 1998

Introduction

- General idea:
  - A proof takes the form of a dialogue;
  - An argument is 'in' iff the proponent can make the opponent run out of moves against every possible attack.
- Relevant research:
  - Epistemology (Rescher)
  - Dialogue logic (Hintikka, Lorenzen, Lorenz, Barth & Krabbe)
  - Formal dialectics (Hamblin, Mackenzie, Walton & Krabbe)
  - AI (Simari & Loui, Loui, Vreeswijk, Dung, Prakken & Sartor)

P_1: Assuming the evidence concerning the glove
was not forged, it proves guilt of OJ.

O_1: I know that the evidence concerning the glove was forged,
since I was told so, so your assumption is not warranted.

P_2: The evidence concerning the glove was not forged,
since it was found by a police officer,
and as a general rule police officers don't forge evidence.

Proof theory for grounded semantics

Definition 0.1 *A* dialogue *is a sequence of moves of a proponent P and an opponent O such that*

1. *Each move is an argument;*
2. *P begins and then O en P take turns;*
3. *P does not repeat moves;*
4. *O's moves defeat P's preceding move;*
5. *P's moves strictly defeat O's preceding move.*

Definition 0.2 .

- *A player wins a dialogue iff the other player cannot move.*
- *An argument A is provably justified iff P has a winning strategy in a dialogue beginning with A.*

Results:

- Soundness in the general case
- Completeness in the finitary case, i.e. when each argument has at most a finite number of defeaters.

Proof theory for defeasible priorities

- Recall:
  - Language must contain a special predicate symbol $\prec$;
  - defeat is relative to the priority conclusions of sets of arguments (S-defeat).
- Problem: which priorities should be considered in determining defeat?
- Solution:
  - For P's moves: only those stated by P;
  - For O's moves: none.
- Restriction: $Args$-defeat must decrease if $Args$ increases

Two types of priority moves

P_1: r_1: $p \Rightarrow q$

O_1: r_2: $r \Rightarrow s$, r_3: $s \Rightarrow \neg q$

P_2: r_4: $t \Rightarrow \neg s$, $r_5 : r_2 \prec r_4$

P_1: r_1: $Monument(h) \Rightarrow \neg Modifiable(h)$

O_1: r_2: $Needs\_restructuring(h) \Rightarrow Modifiable(x)$

P_2: r_3: $Town\_planning\_rule(r_2) \wedge Protection\_rule(r_1) \Rightarrow r_2 \prec r_1$

O_2: T: $Later(r_2, r_1) \Rightarrow r_1 \prec r_2$

P_3: S: $More\_specific(r_3, T) \Rightarrow T \prec r_3$

Definition 0.3 *A* priority dialogue *is a sequence of moves of a proponent P and an opponent O such that*

1. *Each move is an argument;*
2. *P begins and then O en P take turns;*
3. *P does not repeat moves;*
4. *O's moves $\emptyset$-defeat P's preceding move;*
5. *P's moves (called P_i)*
   (a) *either strictly P_i-defeat O's preceding move;*
   (b) *or makes P_{i-1} strictly P_i-defeat O_{i-1}.*

The results still hold.

Research questions:

- How do changes in semantics and proof theory relate?
  - For *defensible* arguments: reverse burden of proof! And
  - For *preferred/stable* semantics: For each player its set of moves in a dialogue must be conflict-free (?)
- Extend to multi-agent decision-making and negotiation
- Relation with 'formal dialectics' (argumentation theory)