Unrestricted rebut in revisited ASPIC+: a first analysis

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Outline

- Rebut, restricted and unrestricted, in the family of ASPIC formalisms
- A brief introduction to the ASPIC^R (ASPIC+ revisited) formalism
- Preliminary results on unrestricted rebut in ASPIC^R

Ingredients of ASPIC formalisms

- A **language** provides the basic elements for the reasoning activity, in particular for defining premises and rules
- A **contrariness relation** identifies which elements are incompatible with which others in the language
- **Rules**, strict and defeasible, provide the building blocks to carry out inference activities and build arguments

Ingredients of ASPIC formalisms

- **Premises** (certain and uncertain) are the initial elements from which reasoning is developed
- **Arguments** are built from (certain and uncertain) **premises** by chaining (strict and defeasible) **rules** towards deriving a **conclusion**
- A **preference relation** between arguments can be identified

A simple example

- Language L = {ulg, hdl, uag, $\neg$ulg, $\neg$hdl, $\neg$uag}
  - » ulg = is under legal guardianship
  - » hdl = has driving licence
  - » uag = is under age
- Contrariness: each element *x* in L is contrary of $\neg x$ and vice versa
- Two strict rules:
  - » r_1: ulg $\rightarrow$ uag
  - » r_2: hdl $\rightarrow$ $\neg$uag

A simple conflict

- Two uncertain premises concerning an individual:
  - » P_1: ulg
  - » P_2: hdl
- Two arguments with conflicting conclusions
  - » A_1: $P_1 \rightarrow$ uag
  - » A_2: $P_2 \rightarrow \neg$uag
- A_1 and A_2 cannot stand together, the conflict has to be managed and their acceptability has to be assessed

Conflict management in ASPIC

- Attacks between arguments are identified taking into account their structure and possibly the preference relation
- Attacks at the structured level are used to build a corresponding Dung's abstract argumentation framework
- Argument acceptability is assessed using argumentation semantics at the abstract level
- The results are projected back on arguments and their conclusions at the structured level

Some essential requirements (rationality postulates)

- Direct consistency: the set of conclusions of accepted arguments does not include contrary elements

- Closure under strict rules: the set of conclusions of accepted arguments includes the conclusions derivable from the set itself through strict rules

A tricky interaction

- The need to satisfy the rationality postulates induces constraints on various aspects of the formalisms
- In particular a rather intuitive notion of attack turns out to be forbidden in some cases

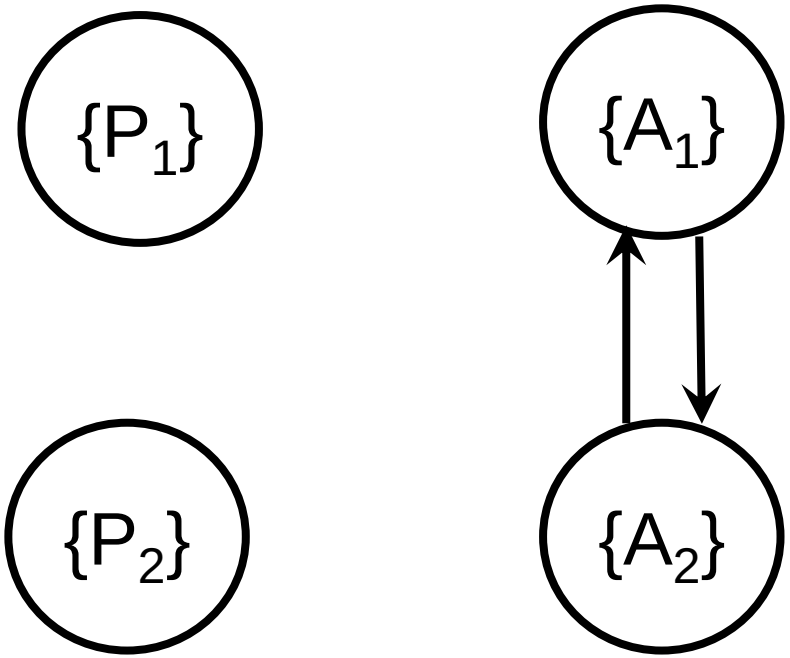
Rebut

- Attack based on clash of argument conclusions
- The conclusion of an argument is contrary to the conclusion of another argument
- Intuitively, in the example, A_1 and A_2 rebut each other
  - » A_1: $P_1 \rightarrow$ uag
  - » A_2: $P_2 \rightarrow \neg$uag

Restricted rebut

- Due to technical reasons related to the satisfaction of postulates, rebut is subject to a restriction
- Rebut can only be directed against arguments whose last rule is defeasible
- Technically A_1 and A_2 cannot rebut each other
  - » A_1: $P_1 \rightarrow$ uag
  - » A_2: $P_2 \rightarrow \neg$uag

Naive unrestricted rebut



One of the two conflicting conclusions is rejected but both premises are accepted, violating closure

A set of technical provisions

- To ensure the satisfaction of postulates ASPIC+ requires the closure of strict rules under transposition or under contraposition
- Moreover it should be recalled that an attack against a (sub)argument is "propagated" to its superarguments

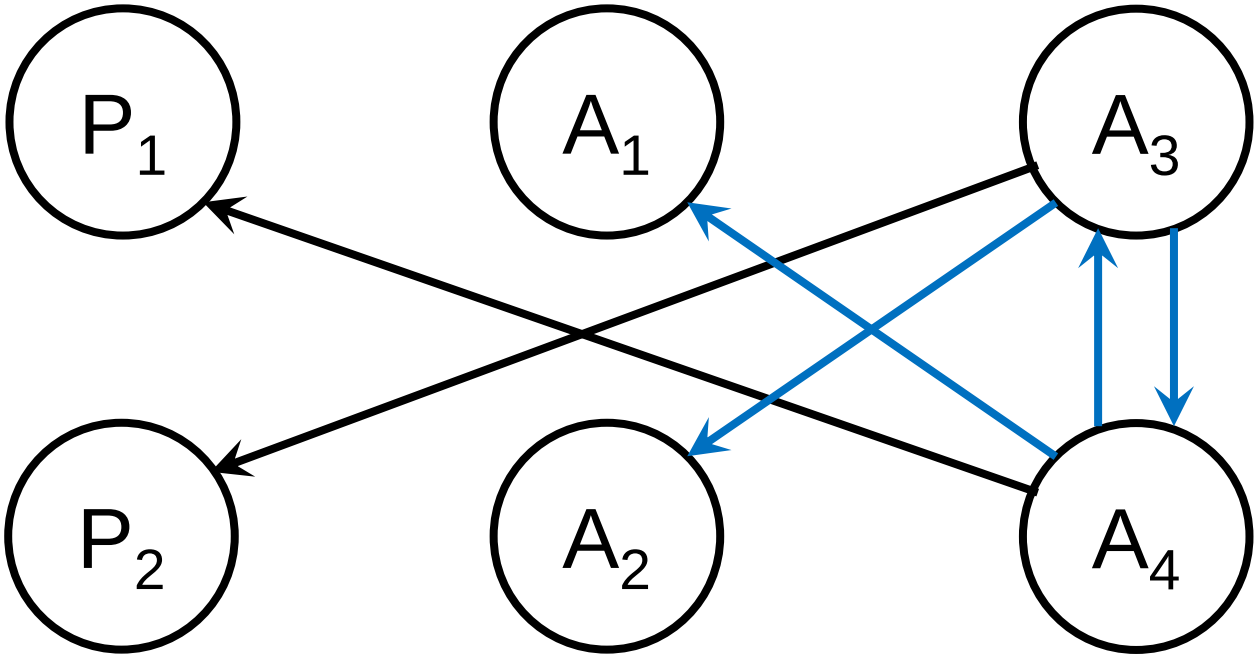
Technical provisions at work*

- The set of rules should include the transposed ones
  - » r_{1t}: $\neg uag \rightarrow \neg ulg$
  - » r_{2t}: $uag \rightarrow \neg hdl$
- Additional arguments are built
  - » A_3: $A_1 \rightarrow \neg hdl$ (with A_1: $P_1 \rightarrow uag$, P_1: ulg)
  - » A_4: $A_2 \rightarrow \neg ulg$ (with A_2: $P_2 \rightarrow \neg uag$, P_2: hdl)
- The additional arguments attack the uncertain premises and then their superarguments

*in the case of transposition and in absence of preferences

The resulting AF

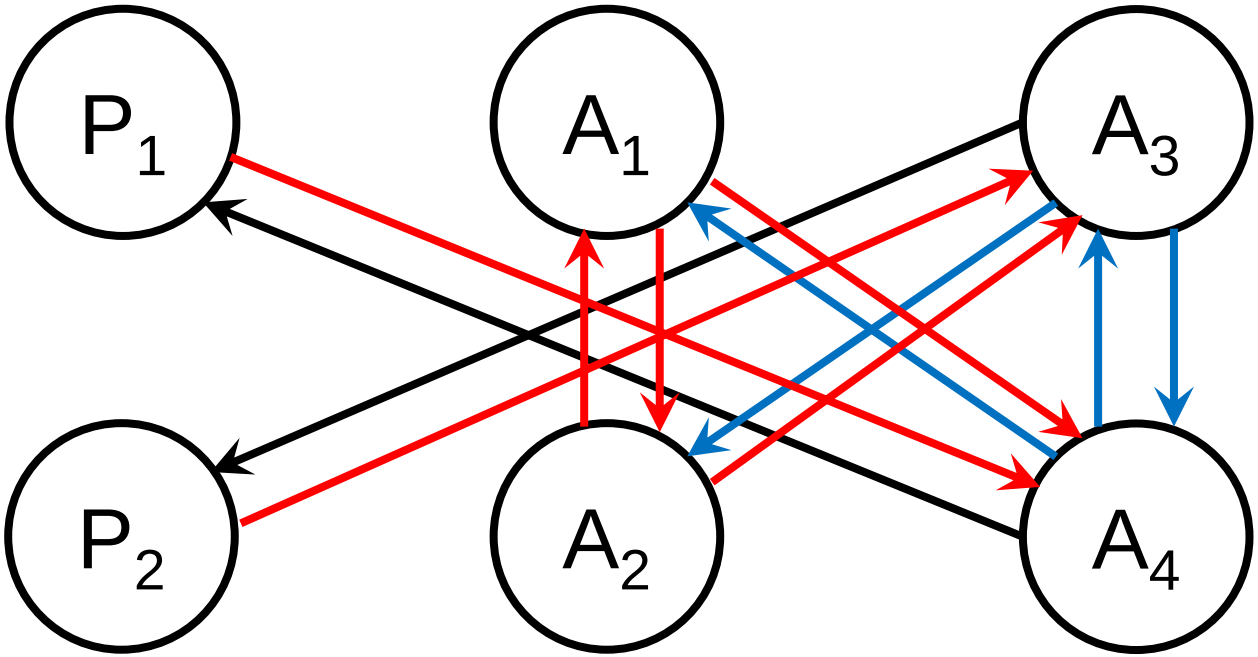
Mutually exclusive acceptance of the two premises with the relevant strict derivations



Attacks propagated via the subargument relation

The resulting AF with unrestricted rebut

P_1 and P_2 can defend themselves against A_3 and A_4 and be accepted together, closure is violated like in naive rebut



Additional unrestricted rebuts and relevant propagated attacks

Recovering unrestricted rebut

- Restricted rebut provides a working technical solution and can be given a conceptual interpretation
- But unrestricted rebut is immediately intuitive and there are claims that it is more appropriate in some contexts (e.g. representation of dialogues)
- Investigations on achieving postulate satisfaction with unrestricted rebut

Recovering unrestricted rebut

- Basic ASPIC (no preferences, closure of strict rules)
  - » Unrestricted rebut OK with grounded semantics only
- ASPIC+ (with preferences, closure of strict rules)
  - » No formal results on unrestricted rebut
- ASPIC- (with preferences but some expressiveness restrictions wrt ASPIC+)
  - » Unrestricted rebut OK with grounded semantics only

The ASPIC^{R} formalism

- Proposed in 2018 to improve some aspects of ASPIC+ which have nothing to do with restricted rebut (in particular the behavior in presence of multiple contradictories)
- Uses the same ingredients and approach for the construction of arguments
- Revises substantially the mechanism of evaluation of argument acceptability and the relevant technical provisions

ASPIC^R: closure of the contrariness relation

- In ASPIC^R the contrariness relation on language elements and the strict rules are used to derive an extended contrariness relation on sets of language elements, based on the notion of strict derivability
- Instead of transposing strict rules, we use them to produce "inferred" (set level) contrariness relations
- In particular:
  - » if a (language level) contrary of *x* is strictly derivable from a set S then S is a contrary of {*x*}
  - » if S is a contrary of {*x*}, then S is also contrary of T for any T from which *x* is strictly derivable

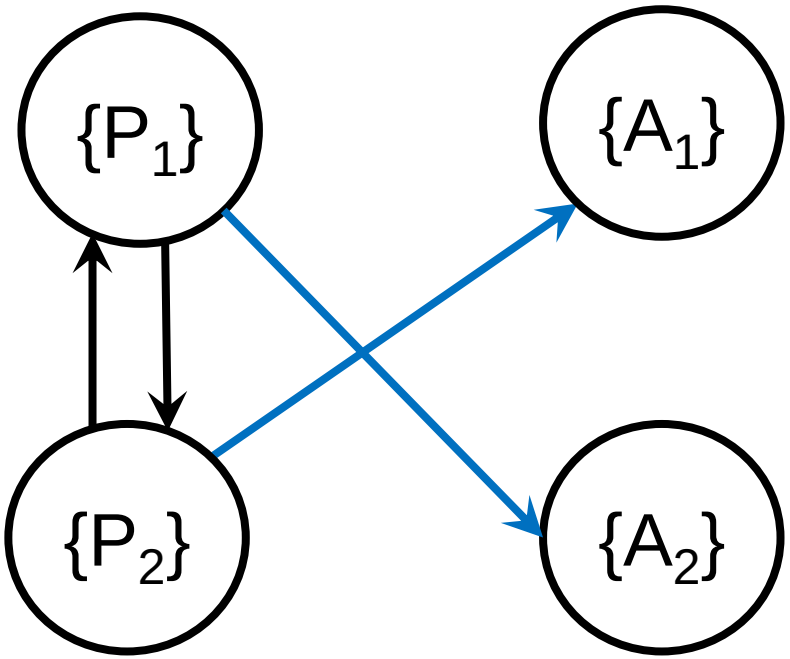
Extended set contrariness in the example

- Language L = {ulg, hdl, uag, $\neg$ulg, $\neg$hdl, $\neg$uag}
- Two strict rules: r_1: ulg $\rightarrow$ uag; r_2: hdl $\rightarrow$ $\neg$uag
- Set contrariness:
  - » obviously each set {*x*} is contrary of {$\neg$*x*} and vice versa
  - » {ulg} is contrary of {$\neg$uag}, {hdl} is contrary of {uag}
  - » {$\neg$uag} is contrary of {ulg}, {uag} is contrary of {hdl}, {ulg} is contrary of {hdl}, {hdl} is contrary of {ulg}

ASPIC^R: set based argumentation framework

- In ASPIC^R a Dung's argumentation framework whose nodes correspond to set of argument is built
- The set-level attacks are derived from the extended contrariness and take into account the subargument and the inclusion relation
- Three types of set-level attacks corresponding to the three types of attack in ASPIC+: undermine, undercut and (restricted) **rebut**
- Attacking sets can include ultimately fallible arguments only

The resulting set level AF



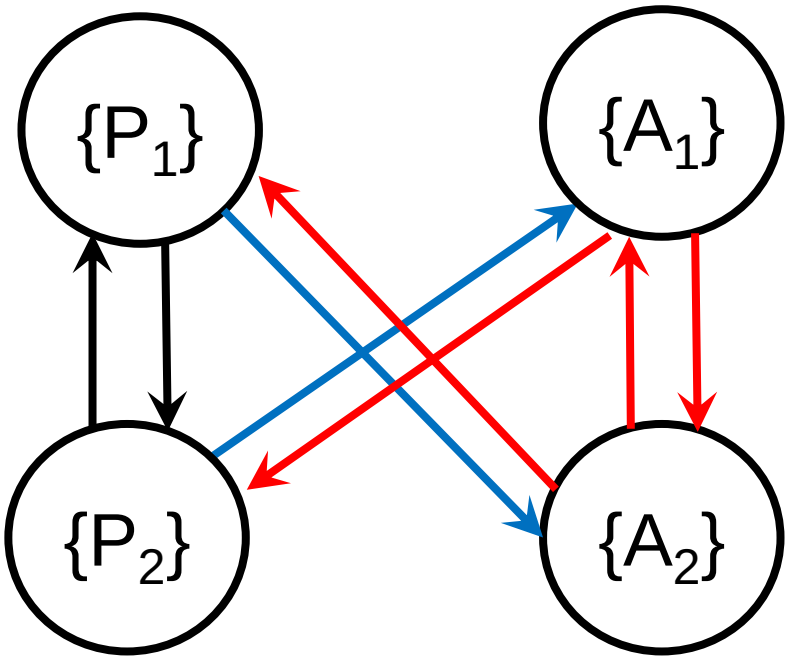
ASPIC^R and unrestricted rebut

- Research question: what happens (in terms of postulate satisfaction) if one changes the (set-based) definition of rebut in ASPIC^R allowing unrestricted rebut?
- In other words, can compatibility with unrestricted rebut turn out to be a further (not intended by design) interesting feature of ASPIC^R?

A preliminary and partially comforting result

- ASPIC^R with unrestricted rebut guarantees postulate satisfaction for **any complete based semantics in absence of preferences**
- Improvement with respect to basic ASPIC (more semantics, similar expressiveness)
- Alternative to ASPIC- (more semantics, lesser expressiveness)
- First example (to our knowledge) of successful use of unrestricted rebut with multiple status semantics "for free" (unintended byproduct of the approach)

The "unrestricted" set level AF



Unrestricted attacks

Next steps

- What happens in the case of ASPIC^R with preferences?
- Conjecture: counterexamples to postulate satisfaction can be found for ASPIC^R "as is"
- Perspective: "small adjustments" to ASPIC^R can achieve postulate satisfaction in presence of preferences for any complete based semantics
- The basic ideas of ASPIC^R are worth further investigation

Thank you for your attention!



… but sometimes restricting rebut can be wise