

# The Epistemic and Practical Reasoner

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## General

- implementation of an argument-based practical reasoning system
- based on Dung's [4] abstract argumentation system
- arguments: trees of chained defeasible inferences
- aim: determine the status of a query given a belief base
- incorporation of recent theories of argument-based practical reasoning

## Combination of epistemic and practical reasoning: e-p-semantics [6]

- in certain contexts, reasoning about beliefs is sceptical while reasoning about action is credulous
- e-p-semantics / GP-game:
  - epistemic arguments: grounded sceptical semantics / G-game rules
  - practical arguments: preferred credulous semantics / P-game rules

## The practical syllogism [2]

- if action  $a$  realises  $p$ , and  $p$  is desired, then action  $a$  is also desired (positive practical syllogism)
- deal with possible negative side-effects of actions: if action  $a$  prevents  $q$ , and  $q$  is desired, then action  $a$  is not desired (negative practical syllogism)
- deal with alternative ways to reach a goal: if both action  $a$  and action  $b$  realise  $p$  and  $p$  is desired, the two arguments for desiring  $a$  and desiring  $b$  are conflicting (alternative defeat)

## Accrual of arguments [5, 2]

- accrual inference combines different arguments with the same conclusion into one argument
- accrual arguments may be stronger or weaker than their elements
- to ensure that the largest possible accrual is used, non-maximal accruals are undercut

## The program

- written in Java 6
- graphical user interface
- input:
  - a belief base of formulas, stated in a propositional language with a single modality D (desire)
  - a query formula
  - options: semantics (grounded, preferred credulous or e-p), practical syllogism on/off, accrual on/off, strength mechanism
- the program constructs arguments from the belief base and engages in an argument game to determine the status of arguments for the query formula
- output: network of arguments and moves, presented in two ways:
  - an XML file that conforms to an extended version of ASPIC's reification [1] of the Argument Interchange Format proposed by Chesñevar et al. [3]
  - a graph representation for human readability (made with Graphviz)

For more information and to download the program, go to <http://www.wietskevisser.nl/research/epr>.

## References

- [1] ASPIC AIFXML Schemas. <http://aspic.acl.icnet.uk/>.
- [2] Trevor J.M. Bench-Capon and Henry Prakken. Justifying actions by accruing arguments. In P.E. Dunne and T.J.M. Bench-Capon, editors, *Proceedings of the First International Conference on Computational Models of Argument (COMMA06)*, number 144 in Frontiers in Artificial Intelligence and Applications, pages 247–258. IOS Press, 2006.
- [3] Carlos Chesñevar, Jarred McGinnis, Sanjay Modgil, Iyad Rahwan, Chris Reed, Guillermo Simari, Matthew South, Gerard Vreeswijk, and Steven Willmott. Towards an argument interchange format. *The Knowledge Engineering Review*, 21(4):293–316, 2006.
- [4] Phan Minh Dung. On the acceptability of arguments and its fundamental role in nonmonotonic reasoning, logic programming and  $n$ -person games. *Artificial Intelligence*, 77:321–357, 1995.
- [5] Henry Prakken. A study of accrual of arguments, with applications to evidential reasoning. In *Proceedings of the Tenth International Conference on Artificial Intelligence and Law*, pages 85–94, New York, 2005. ACM Press.
- [6] Henry Prakken. Combining sceptical epistemic reasoning with credulous practical reasoning. In P.E. Dunne and T.J.M. Bench-Capon, editors, *Proceedings of the First International Conference on Computational Models of Argument (COMMA06)*, number 144 in Frontiers in Artificial Intelligence and Applications, pages 311–322. IOS Press, 2006. (Corrected version, May 14, 2007).

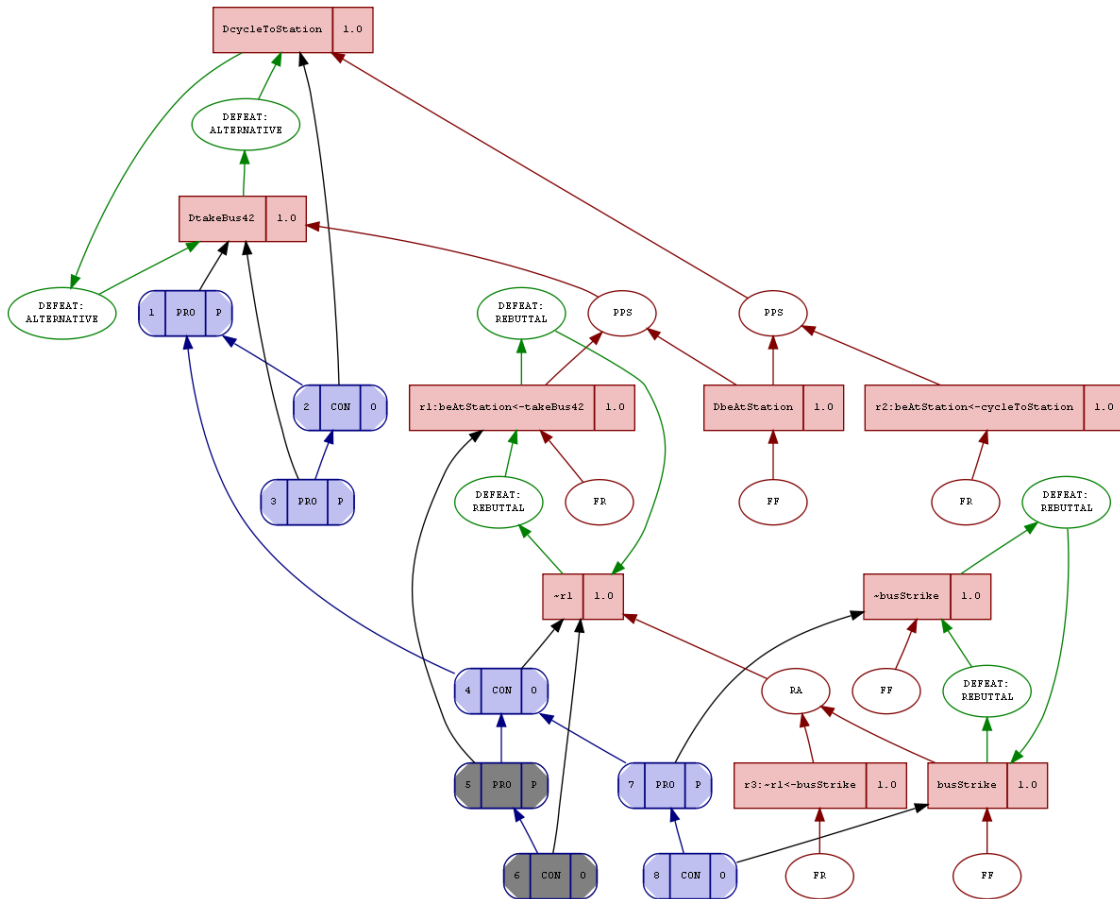
### Example with e-p-semantics and practical syllogism

**belief base:**  
 r1: beAtStation <- takeBus42.  
 r2: beAtStation <- cycleToStation.  
 DbeAtStation.  
 ~r1 <- busStrike.  
 busStrike.  
 ~busStrike.

**query:**  
 DtakeBus42.

**options:**  
 e-p-semantics  
 practical syllogism on  
 accrual off

**result:**



### Example with accrual

**belief base:**  
 fit <- jogging.  
 slim <- jogging.  
 wet <- jogging, rain.  
 Dfit.  
 Dslim.  
 D~wet.  
 rain.

**query:**  
 ~Djogging.

**options:**  
 e-p-semantics  
 practical syllogism on  
 accrual on  
 accrual strength mechanism: number promoted desires

**result:**

