▸ LOES OLDE LOOHUIS, *Games for multi-player Logic, and Logic for multi-player Games.*

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Following previous work by Abramsky(2007), Tulenheimo and Venema(2007) (for full references, see [1]) and ourselves [1], we develop a multi-player logic MPL_R for *rational* players. The syntax of MPL_R is as follows:

$$\phi ::= p \mid (\phi \vee_i \psi) \mid \neg_{ij}\phi,$$

where $i, j \in A$, the set of players. Formulas of MPL_R describe games, where $\vee_i$ is a choice operator for player i and negations, of the form $\neg_{ij}$, permute the roles of players i and j. A valuation assigns to each proposition letter a set of winners.

MPL_R can be seen as a generalization of two-player game semantics of propositional logic. We show that the complexity of MPL_R is linear in the general case, but if we impose some (reasonable) restrictions to the valuation function, it becomes NP-complete. Also, a completeness result for a functionally complete extension, MPL_R^+, of MPL_R will be shown. The logic MPL_R^+ contains two families of negations that are the same in the classical two-player setting.

The fact that we assume rationality of the players allows us to study the logics from a game theoretical perspective. Each extensive form game can be described by a formula of MPL_R and we compare our semantics to various solution concepts from game theory. In particular, we will show that if a backward induction solution to the game exists, this will be the semantic value of its formula. We illustrate this point by analyzing some well-known games like the Centipede game within our framework.

[1] Loes Olde Loohuis, *Multi-Player Logics* ***ILLC publication series***, (2008), no. MoL-2008-07. url: http://www.illc.uva.nl/Publications/ResearchReports/MoL-2008-07.text.pdf