

## – Erratum –

# On the Expressiveness and Complexity of ATL

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The claim that  $\text{ATL}^+$  model checking is  $\Delta_3^P$ -complete is wrong (Theorem 19 in the conference version [LMO07], and Proposition 3.14 and Theorem 3.17 in the journal version [LMO08]). The error actually already appears in [Sch04]: the fact that  $\text{ATL}^+$  can be translated into ATL does not imply that  $\text{ATL}^+$  admits memoryless winning strategies. As an easy example, consider the formula  $\langle\langle A \rangle\rangle (\mathbf{F} a \wedge \mathbf{F} b)$  in the one-player game depicted on Figure 1: memoryless strategies would only visit one side of the structure.

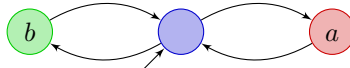


Figure 1: A one-player game

The correct result is proven in [WSH15]:

**Theorem 1** ([WSH15]). *Model checking  $\text{ATL}^+$  is PSPACE-complete over explicit CGSs.*

It is not difficult to extend this result to implicit CGSs. This can be proven e.g. by using a labelling algorithm relying on the translation of  $\text{ATL}^+$  into ATL: proceeding bottom-up, we consider each strategy quantifier in the formula. It has the form  $\langle\langle A \rangle\rangle \varphi$  where  $\varphi$  is a boolean combination of basic path formulas. Such a formula can be translated into a disjunction of several ATL formulas. It then suffices to enumerate these disjuncts and check for each state whether one of them holds true.

Hence:

**Theorem 2.** *Model checking  $\text{ATL}^+$  is PSPACE-complete over implicit CGSs and ATs.*

## References

- [LMO07] François Laroussinie, Nicolas Markey, and Ghassan Oreiby. On the expressiveness and complexity of ATL. In Helmut Seidl, editor, *Proceedings of the 10th International Conference on Foundations of Software*

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- [LMO08] François Laroussinie, Nicolas Markey, and Ghassan Oreiby. On the expressiveness and complexity of ATL. *Logical Methods in Computer Science*, 4(2:7), May 2008.
- [Sch04] Pierre-Yves Schobbens. Alternating-time logic with imperfect recall. In *Proceedings of the 1st Workshop on Logic and Communication in Multi-Agent Systems (LCMAS'03)*, volume 85(2) of *ENTCS*. Elsevier, 2004.
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