

## Projective simulation for learning and agency

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I will first present the model of projective simulation (PS) [1] for a learning agent whose interaction with the environment is governed by a simulation-based projection. PS agents use a random walk in their episodic and compositional memory (ECM) to project themselves into future situations before they take real action. The PS model can solve basic tasks in reinforcement learning but it also allows for the implementation of advanced concepts such as generalization and meta-learning [2]. Notably, projective simulation can be quantized, allowing for a quantum mechanical speed-up in the agents deliberation process [3, 4]. I will also discuss recent applications of the PS model in robotics and in the philosophy of action, as well as the question to what extent learning agents can help in quantum experiments.

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[3] G. Paparo, V. Dunjko, A. Makmal, M. A. Martin-Delgado, and H. J. Briegel, Quantum speed-up for active learning agents, *Phys. Rev. X* **4**, 031002 (2014).

[4] V. Dunjko, J. M. Taylor, and H. J. Briegel, Quantum-enhanced machine learning, *Phys. Rev. Lett.* **117**, 130501 (2016).