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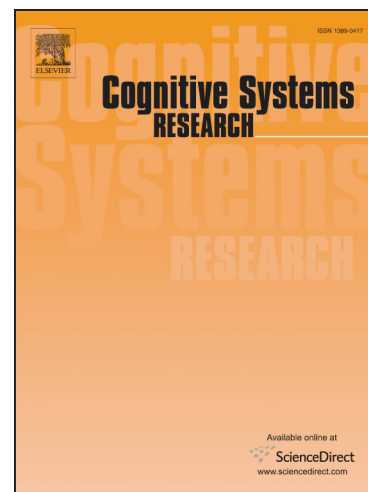
Social Learning in Repeated Cooperation Games in Uncertain Environments

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## COVER PAGE

**Title:** Social Learning in Repeated Cooperation Games in Uncertain Environments

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**Abstract**

Cooperation and social learning are fundamental mechanisms that maintain social organisation among animals and humans. Social institutions can be conceptualised abstractly as cooperation games with social learning. In some cases potential cooperation partners may be easily identifiable, while in other cases this is difficult. Real world institutions always operate in uncertain environments. Here we use agent-based simulation to explore the interaction between social learning, cooperation and environmental uncertainty with and without easy to identify cooperation partners. Our agents use a communication language to indicate their cooperation intentions. We discuss the measurement of communication or language complexity metrics, which may be used as correlates of the level of cooperation. The results show that more uncertainty induces more cooperation and that social learning increases the level of cooperation. We show that the positive impact of social learning is bigger in low uncertainty environments than in high uncertainty environments and also in cases where identification of potential cooperation partners is harder. The results suggest that environmental uncertainty, social learning and easy identification of cooperation partners may play alternating roles in the promotion of cooperation in social institutions and the expansion and development of these institutions.

**Keywords:**

agent-based modelling, cooperation, evolutionary simulation, institution modelling, social learning, uncertainty

**Competing interest statement:** The author declares that he has no competing interests.

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