

# The evolutionary viability of individual and group commitments in social dilemmas

Tom Lenaerts

Machine Learning Group

Département d'Informatique, Université Libre de Bruxelles

Boulevard du Triomphe - CP 212

When starting a new collaborative endeavor, it pays to establish upfront how strongly your partner or partners plan to commit to the common goal and what compensation can be expected in case the collaboration is violated. Diverse examples in biological and social contexts have demonstrated the pervasiveness of making prior agreements on posterior compensations, suggesting that this behavior could have been shaped by natural selection. We have analyzed the viability of such a strategy both within the context of the pairwise prisoners dilemma, both one-shot [1] and iterated [2] games, and the n-player public goods game [3]. We showed that when the cost of arranging a commitment deal lies within certain limits, this strategy easily evolves and substantial levels of cooperation are attained. Moreover, in the iterated case, revenge, apology and forgiveness are naturally evolving behaviors to deal with mistakes during the commitment and after it fails.

Yet, as with other approaches, one cannot fully exclude the presence of defectors, raising the question of how they can be dealt with to avoid the demise of cooperation. In the context of the public goods game [3] we showed that both avoiding creation of the common good, whenever full agreement is not reached, and limiting the benefit that disagreeing defectors can acquire, using costly restriction mechanisms, are relevant choices. Nonetheless, restriction mechanisms are found the more favorable, especially in larger group interactions.

[1] The Anh Han, Luis Moniz Pereira, Francisco C Santos and Tom Lenaerts (2013) Good agreements make good friends. *Scientific Reports* 3:2695.

[2] Luis A. Martinez-Vaquero, The Anh Han, Luís Moniz Pereira and Tom Lenaerts (2015) To err is human, to forgive evolutionary viable when the apology is sincere. (under review)

3] The Anh Han, Luis M Pereira and Tom Lenaerts (2015) Avoiding or restricting defectors in public goods games? *Journal of the Royal Society Interface* 12: 20141203