Supplementary Information

Title: Indirect reciprocity is sensitive to costs of information transfer

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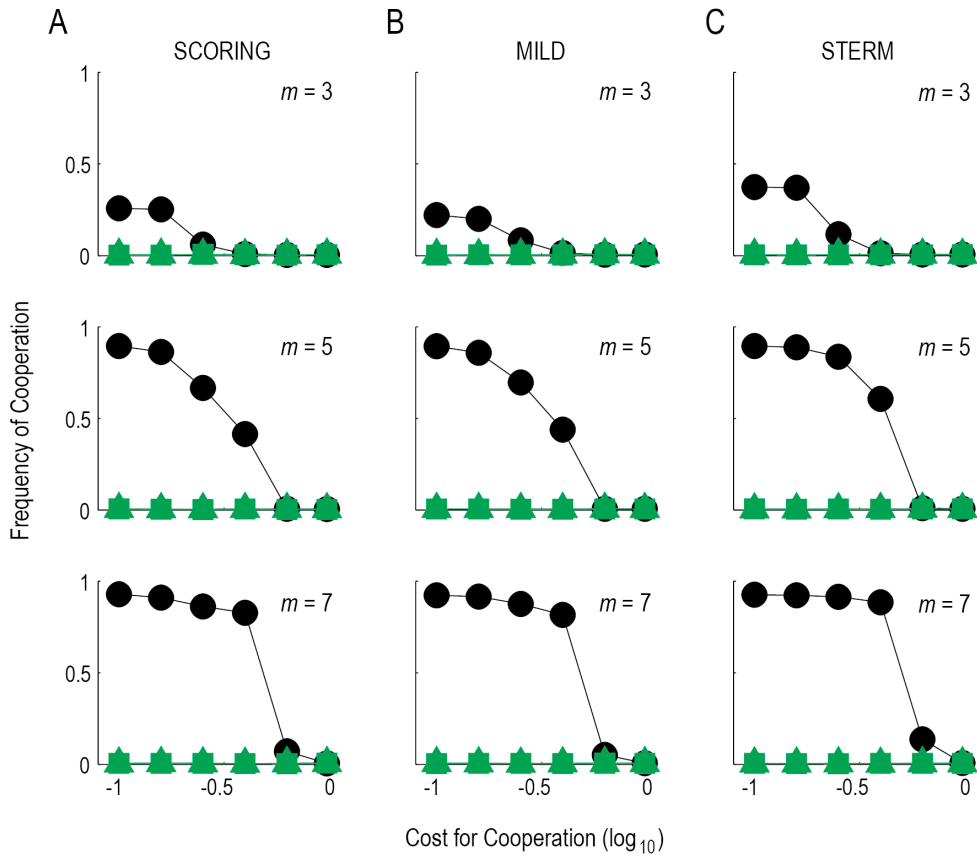

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Fig. S1. Effect of the cost of reputation building, c_R, on the evolution of cooperation in a situation where the reputation of a donor is built by the recipient instead of a third person/observer. The figure format and simulation parameters are the same as those used for Fig. 1. *Black* points indicate a case without the cost of reputation building, and *green* points represent a case with the cost, c_R (*triangles*: $c_R = 0.1$; *squares*: $c_R = 0.01$; these symbols overlap). (A) Individuals use the moral assessment rule, *SCORING*. Top row: the average number of rounds for each individual in a generation, m, is 3; Middle row: $m = 5$; Bottom row: $m = 7$. (B) *MILD*. (C) *STERM*.
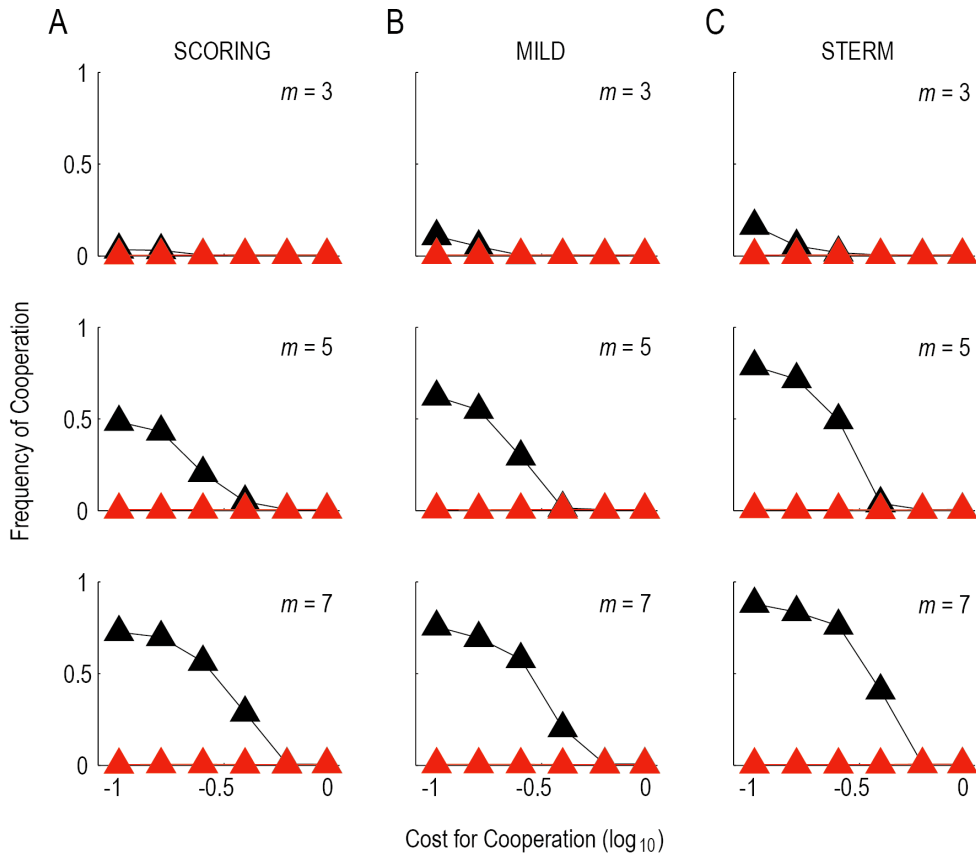
Fig. S2. Effect of the cost of reputation building for second-order observers, $c_{R'}$, on the

evolution of cooperation. The figure format and simulation parameters are the same as those

used for Fig. 1, but the cost for (first-order) observers, c_R, is fixed at 0.1. *Black* points indicate a

case without the cost for second-order observers (i.e., $c_{R'} = 0$), and *red* points represent a case

with the cost, $c_{R'} = 0.1$. (A) Individuals use the moral assessment rule, *SCORING*. Top row: the

average number of rounds for each individual in a generation, m, is 3; Middle row: $m = 5$;

Bottom row: $m = 7$. (B) *MILD*. (C) *STERM*.
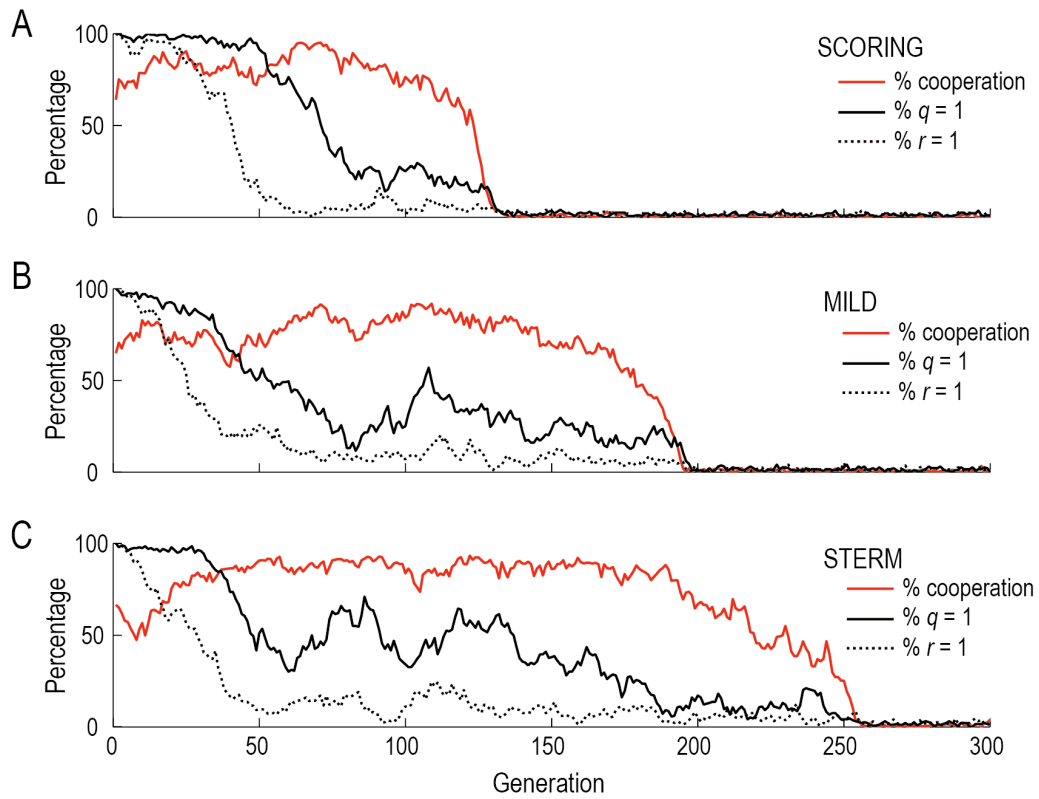
Fig. S3. Evolutionary dynamics in a situation where an observer who does not build the donor's reputation can lose his/her own good reputation. The percentages of cooperation (*red solid* lines), the individuals who build the donor's reputation when in the role of an observer (i.e., $q = 1$; *black solid* lines) and the individuals who build the observer's reputation in the role of a second-order observer (i.e., $r = 1$; *black dotted* lines) in a typical simulation run are plotted as a function of generation (benefit of cooperation $b = 1$; cost of cooperation $c = 0.25$; population size $n = 200$; the average number of rounds for each individual in a generation $m = 5$; probability of implementation error $\varepsilon = 0.05$; mutation rate $\mu = 0.01$; cost of reputation building, $c_R = c_{R'} = 0.1$; at the first generation an individual's strategy k is determined randomly and $q = r = 1$). Regardless of the moral assessment rules, an individual building reputation in the role of a

second-order observer ($r = 1$) is exploited by individuals with $r = 0$ because of the cost c_R; then, no individual builds the donor's reputation in the role of a (first-order) observer since the reputation-building no longer results in the observer's good reputation; thus, indirect reciprocity never works. (A) Individuals use the moral assessment rule, *SCORING*. (B) *MILD*. (C) *STERM*.