Non-Vertical Cultural Transmission, Assortment, and the Evolution of Cooperation

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Supplementary material

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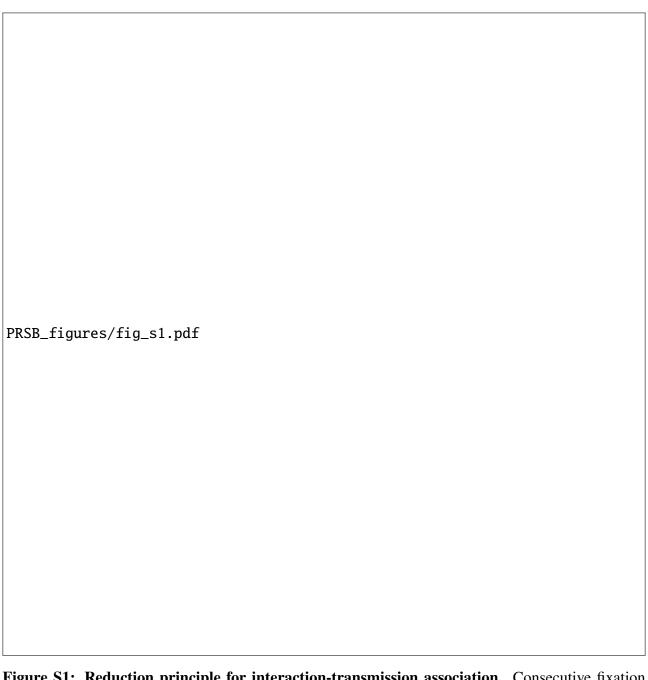


Figure S1: Reduction principle for interaction-transmission association. Consecutive fixation of modifier alleles that reduce interaction-transmission association α in numerical simulations of evolution with two modifier alleles (Eq. D1). When an invading modifier allele is established in the population (frequency > 99.95%), a new modifier allele that reduces interaction-transmission association by 5% is introduced (at initial frequency 0.5%). (a) The frequency of the cooperative phenotype A over time. (b) The frequency of the invading modifier allele m over time. (c) The population mean fitness (\bar{w}) over time. Here, c = 0.05, b = 1.3, $T_A = 0.4 < T_B = 0.7$, initial interaction-transmission association $\alpha_1 = 0.7$, lower interaction-transmission association threshold $a_2 = 0.605$.

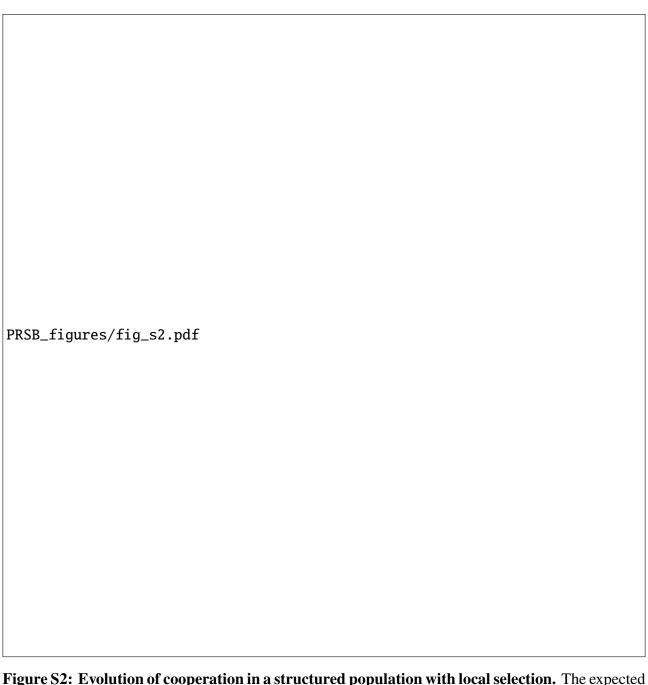


Figure S2: Evolution of cooperation in a structured population with local selection. The expected frequency of cooperators in a structured population after 10,000 generations is shown (red for 0%, green for 100%) as a function of both the cost of cooperation (c) on the y-axis, and the symmetric horizontal transmission rate ($T = T_A = T_B$) on the x-axis of panel (**a**), or the transmission bias $T_A - T_B$ on the x-axis of panel (**b**). Cooperation and horizontal transmission are both local between neighbouring sites, and each site had 8 neighbours. Selection operates locally (see Figure 4 for results from a model with global selection). The black curves represent the cost thresholds for the evolution of cooperation in a well-mixed population with interaction-transmission association, where $\alpha = 1/8$ in inequality 14 for panel (**a**) and in Eqs. 12 for panel (**b**). The population evolves on a 100-by-100 grid. Simulations were stopped at generation 10,000 or if one of the phenotypes fixed. 50 simulations were executed for each parameter set. Here, benefit of cooperation, b = 1.3; perfect vertical transmission v = 1. (**a**) Symmetric horizontal transmission, $v = T_A = T_B$. (**b**) Horizontal transmission rate v = 1. (**a**) Symmetric horizontal transmission, v = 1. (**b**) Horizontal transmission rate v = 1.