

REPLY TO MYRSETH AND WOLLBRANT:

Our model is consistent with altruism, and helps to explain its evolution

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Myrseth and Wollbrandt's critique (1) of our paper "Intuition, deliberation and the evolution of cooperation" (2) is incorrect. They claim that our model "precludes the survival of altruistic individuals" and thus "precludes altruism in equilibrium" (where they define "altruism" as cooperating even in one-shot games).

This statement is false. On the contrary, a major focus of our paper is precisely to demonstrate how our model can support one-shot game cooperation ("altruism") in equilibrium. We show the conditions necessary for the dual-process cooperator (DC) strategy profile to be an equilibrium, and a key feature of DC is that it cooperates in one-shot games [with probability $c(1 - p)/d$, where c is the cost of cooperation, p is the probability of interactions with future consequences, and d is the maximum cost of deliberation]. See, for example, figure 2D of our paper (2), which demonstrates the high level of one-shot cooperation that can be achieved in equilibrium in our model. Furthermore, the model's predictions are supported by human behavioral experiments showing that altruism in one-shot games is affected by exposure to social environments that promote or inhibit cooperation (3, 4), and is undermined by deliberation (5–7).

We also note that our model includes assortment, the fundamental evolutionary force that promotes

unconditional ("altruistic") cooperation in one-shot games. Assortment has been presented as an explanation for, among other things, the evolution of "strong reciprocity" (8), which Myrseth and Wollbrandt use as an example of the kind of altruism they (incorrectly) believe our model precludes. Even when assortment is sufficiently high for purely altruistic individuals who always cooperate (even in one-shot interactions) to dominate the population, our calculations show that it continues to be true that "evolution never favors strategies for which deliberation increases cooperation." Conceptually, this is because forces that directly make one-shot cooperation successful also necessarily make repeated cooperation successful, and, because the same behavior is optimal in both one-shot and repeated settings, there is no benefit to deliberating to differentiate between them—instead, unconditional intuitive cooperation is favored.

In sum, one of our paper's main contributions (2) is to show how evolution could favor such "altruistic" cooperation, providing an ultimate explanation for the proximate psychological mechanisms that Myrseth and Wollbrandt mention (many of which are based on intuitive processes, such as prosocial emotions). Our model thus explains the very features of human behavior that Myrseth and Wollbrandt claim it ignores.

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