

## Publication

### A strategy to increase cooperation in the volunteer's dilemma: reducing vigilance improves alarm calls

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One of the most common examples of cooperation in animal societies is giving the alarm in the presence of a predator. A reduction in individual vigilance against predators when group size increases (the "group size effect") is one of the most frequently reported relationships in the study of animal behavior, and is thought to be due to relaxed selection, either because more individuals can detect the predator more easily (the "many eyes" effect) or because the risk of predator attack is diluted on more individuals (the "selfish herd" effect). I show that these hypotheses are not theoretically grounded: because everybody relies on someone else to raise the alarm, the probability that at least one raises the alarm declines with group size; therefore increasing group size does not lead to relaxed selection. Game theory shows, instead, that increasing the risk that the predator is not reported (by reducing vigilance) induces everybody to give the alarm more often. The group size effect, therefore, can be due to strategic behavior to improve the production of a public good. This shows how a selfish behavior can lead to a benefit for the group, and suggests a way to solve social dilemmas in the absence of relatedness and repeated interactions.

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