

## A STRATEGY TO ARTIFICIALLY SELECT FOR SOCIAL BEHAVIOUR

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When a group performs a task well, it is often unclear whether this is due to shared efforts, or due to a few exceptional individuals. This is especially true in flocks of birds or shoals of fish, where the group dynamics are generally inferred from global measures such as polarisation or group cohesion[1]. We present analysis of a general algorithm to select a minority of socially well-performing individuals from a population with high accuracy and without individual labelling. This is done by dividing the entire population into groups, which are then subject to several rounds of evaluating, sorting and permuting. The group ordering is monitored over time, and a rank correlation is used to judge whether the sorting has stabilised. This procedure will be used to perform an artificial selection experiment on guppy fish based on sociality.

The sorting procedure is simulated by assuming for each individual a hidden sociality measure, which has a defined mean and variance. The performance of a group is then given by either the minimum score, the mean score, or the maximum score in the group, representing a wide range of experimental possibilities[2]. We show that in all three cases, the algorithm maximally sorts the population within only a small number of rounds - around 20 for experimentally realistic parameters. A score of group sociality based on the mean of the scores of its members is found to be the most ideal, and we present a theoretical analysis of this case.

[1] I.D. Couzin and J. Krause. *Adv. in Study of Behavior* **32** (2003).

[2] C. Brown and E. Irving. *Behavioural Ecology* **25**, 95-101 (2014).