

Personalities in fish without genetic differences: a model

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Differences in personality between individuals are usually attributed to genetic differences, and seldom to differences in experience. In this study, we investigated to what degree personalities may result from differences in experience, that are caused by self-organisation of behaviour and chance. We use an individual-based model to generate such an explanation for the experimental findings on personalities in perch (Magnhagen & Staffan., 2005, *Behav Ecol Sociobiol*, 57, p.295). In this study, small groups of individuals could either hide in vegetation, or visit an open area that contained food, but was near a predator. Individuals were attributed a personality, based on the time that they spend in the open area, and on how fast they fed there.

In our model, we mirror this experiment, with artificial individuals that are genetically identical. We test whether personalities arise as a consequence of three mechanisms: habituation, social facilitation, and competition. To this end, we study three models: a model of only habituation, a second one of habituation and social facilitation, and a third that includes all three mechanisms.

The first model focuses on habituation. Artificial individuals habituate by increasing their (initially low) tendency to enter the open area after each successful foraging event. Although this self-reinforcing effect led to personality differences, these differences disappeared as soon as all individuals were habituated.

In the second model, we added social facilitation. This implied that individuals tended to visit the open area more, if it was already occupied by group members. Social facilitation led to a positive correlation between personality of an individual and that of its group members. Because of this, groups more often arose, that consisted of a single personality type. Both observations resemble the empirical data. However, in this model, personality differences also disappeared because all individuals habituated.

In the last model, we added competition. This was represented by a 'residence effect': upon arrival in the open area individuals captured less prey, if group members had arrived before them. Here, personality differences appeared to be stable over long periods of time.

In sum, our models show that differences in speed of habituation may give rise to personality differences, and that these differences are reduced by social facilitation, and maintained by competition. We conclude that it is valuable to consider learning and social interactions as an explanation for the origination of personality in animals.

that can reside in either a protected area or an open area with food. However, all individuals are genetically identical, and start with a low tendency to reside in the open area. Similar to the empirical experiment, they can reside in either a protected area, or an open area with food.