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Statements associated with the Ph.D. thesis

Experimental analysis and modelling of the behavioural interactions underlying the coordination of collective motion and the propagation of information in fish schools

Valentin Lecheval

1. Because individuals from the *Hemigrammus rhodostomus* species swim in highly coordinated groups and are easy to maintain in laboratory facilities, *H. rhodostomus* can become a model species to investigate schooling behaviour in fish groups.
2. The method developed in this thesis to disentangle interactions among group members provides empirical evidences of the coexistence of attraction and alignment interactions.
3. Our computational model based on empirical data suggests that reacting to only one stimulus at a time may no be sufficient for fish to school.
4. Our model, supported by empirical data, shows that asymmetric local interactions relying on social conformity are responsible for the propagation of information and the degree of homogeneity of the behaviour of a group of a given size.
5. Our conditioning experiments using an aversive paradigm are promising to investigate the propagation of information of groups of fish under threat in a controlled way.
6. The combination of empirical analyses and modelling is helpful to investigate complex systems. The analyses of empirical data drive the formulation of hypotheses whose validity can be quantified by model simulations.
7. Modelling also facilitate the study of collective behaviours thanks to fruitful interactions between various life sciences, such as ethology and statistical physics.
8. Conducting experiments with various group sizes and using a bottom-up approach is a relevant workflow to disentangle the interactions among individuals and to investigate the collective behaviours of animals moving in groups.
9. « [...] et au lieu d'être celui dont vient le discours, je serais plutôt au hasard de son déroulement, une mince lacune, le point de sa disparition possible. » Michel Foucault, *L'ordre du discours*, 1970

"[...] instead, speech would proceed from me, while I stood in its path - a slender gap - the point of its possible disappearance." Michel Foucault, *The Discourse on Language*, translated by Rupert Swyer, 1971.