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Ising model for collective decision making during group motion
ITAI PINKOVIEZKY, Departments of Physics and Biology, Emory University, NIR GOV, Department of Chemical Physics, Weizmann Institute of Science, IAIN COUZIN, Department of Collective Behaviour, Max Planck Institute for Ornithology — Collective decision making is a key feature during natural motion of animal groups and is also crucial for human groups. This phenomenon can be exemplified by the scenario of two subgroups that hold conflicting preferred directions of motion. The constraint of group cohesion drives the motion either towards a compromise or towards one of the preferred targets. The transition between compromise and decision has been found in simulations of flock models, but the nature of this transition is not well understood. We present a minimal spin model for this system where we interpret the spin-spin interaction as a social force. This model exhibits both first and second order transitions. The group motion changes from size-dependent diffusion at high temperatures to run-and-tumble motion below the critical temperature. In the presence of minority and majority subgroups, we find that there is a trade-off between the speed of reaching a target and the accuracy. We then compare the results of the spin model to detailed simulations of a flock model, and find overall very similar dynamics, with the role of the temperature taken by the inverse of the number of uninformed individuals.

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