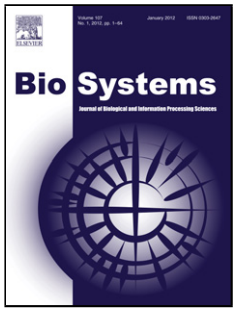

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A limit in the dynamic increase in the accuracy of group migration

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Abstract

Many migratory animals regularly travel thousands of kilometers, exactly finding their seasonal destinations. The nature of this ability is still not fully understood. The aggregation of animals in groups and their socially coordinated movement is considered a way to eliminate navigational errors. Orientation accuracy of a group may be significantly higher as the errors caused by a variety of casual factors are averaged due to social interactions. This idea, called the "many wrongs principle," has been confirmed both in behavioral experiments and numerical simulations. However, little is known about the dependence of this effect on the number N of individuals. Until now, there were no analytical models considering this effect and its limitations. In this article, a stochastic dynamic model of group navigation is presented in terms of the course deviation angle and its variance. The N-dependence of the variance of deviations is found. The variance first decreases with N, however the decrease then slows down thus showing disagreement with the "many wrongs principle." This can be interpreted as meaning that the growth in the accuracy of migration due to the aggregation of individuals into groups is limited. The limit depends on the individual sensitivity of the animal compass, the power of the herd instinct, and the level of random noise.

Keywords: migration, "many wrongs", orientation, flock, mathematical model, animal aggregation

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