Seventh Workshop Dynamical Systems Applied
to Biology and Natural Sciences DSABNS 2016
Évora, Portugal, February 2-5, 2016

WHEN MORE OF THE SAME IS BETTER

José Fernando Fontanari[1]*

[1]Instituto de Física de São Carlos, Universidade de São Paulo, São Carlos, SP, Brazil

fontanari@ifsc.usp.br (*corresponding author)

ABSTRACT

Understanding the factors that influence the capability of a task force to solve problems is of great economic importance, since problem solving (e.g., drug design, traffic engineering, software development) represents a substantial portion of the economy of developed countries today. Common sense says that a group of cooperating individuals can solve a problem faster than the same group of individuals working in isolation, and that the higher the diversity of the group members the better the performance. But the fact is that we know little about the quantitative improvements, if any, that result from cooperation. Here we discuss an agent-based model of distributed cooperative problem solving systems, in which agents cooperate by broadcasting messages informing on their partial success towards completion of the goal and use this information to imitate the more successful agents in their influence networks. For a fixed imitation rate, we find that there is an optimal value of the group size at which the computational cost (i.e., the product between the group size and the time the group needs to solve the task) is minimized: too much imitation or too large a group yield a performance poorer than that of independent agents. Given the ubiquity of imitative learning in nature, we conjecture that its efficacy could be a factor determinant of the group size of social animals. In addition, we find that endowing the group members with different search strategies or different imitation rates impairs the group performance for small group sizes and that the best performance is achieved by a group of homogeneous agents. The performance gain due to diversity, which is observed for large groups only, is not enough to outdo the work of the independent agents.

 ISBN: 978-989-98750-2-9