

Chapter 9

Social Network, Information Flow and Decision-Making Efficiency: A Comparison of Humans and Animals

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ABSTRACT

Every day, millions of humans make decisions about issues of interest for the group they represent. Equivalent processes have already been well described for animal societies. Many animal species live in groups and have to take collective decisions to synchronize their activities. However, group members not only have to take decisions satisfying the majority of individuals (i.e. decision accuracy) but also have a relatively short period to do so (i.e. decision speed). In decision-making, speed and accuracy are often opposed. The decision efficiency will vary according to the way individuals are inter-connected, namely according to the social network. However, the traditional approach used in management and decision sciences has been revealed to be insufficient to fully explain decision-making efficiency. This chapter addresses the question of how social network may enhance collective decision-making by increasing both the accuracy and the speed of decisions. Studies within different animal species are discussed. These studies include human beings, and combine field experiments, social network analysis, and modelling to illustrate how the study of animals may contribute to our understanding of decision-making in humans.

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INTRODUCTION

Humans take decisions several times per day. The general public elects a President, workers decide on the best project for their firm, family members choose which film they will watch on TV, friends decide where to go for dinner... The decision made by an individual varies according to the relationships he or she has with the surrounding people (such as in a hierarchy, family, or friendship) as well as the number of individuals involved in the decision-making. For instance, the head of a firm or the parents of a family may have a great influence on the decision-making. For a presidential election, people do not generally know the opinions of other citizens and decide individually which candidate they will vote for (Acemoglu and Robinson, 2006; van Vugt *et al.*, 2008). In firms, the information flow, distribution of decisions and experience of individuals will have an impact on decision efficiency, that is to say not only on its productivity but also on the well-being of its workers. The efficiency of a decision is often defined as the ratio between two parameters: the time taken to make the decision and the accuracy of the decision. Accuracy means the quality of the decision, or whether almost all the individuals in the group or the community will be entirely satisfied by the decision. On the other hand, a shorter time taken to make the decision will also enhance productivity within the firm.

Equivalent processes in animal societies have already been well described by several authors (Conradt and Roper, 2003, 2005; Franks *et al.*, 2003; Langridge *et al.*, 2004; Marshall *et al.*, 2006; Pratt and Sumpter, 2006). Many animal species live in groups and have to take collective decisions. Group living decreases the risk of predation (Wrangham, 1980) and increases foraging efficiency (Alexander, 1974). However, this strategy requires group members to remain cohesive and to synchronize their activities in order to avoid group fission (Conradt and Roper, 2005; Krause and Ruxton, 2002). In many species, the different

activities cannot be carried out in the same area. Animals often have a specific resting area: for example, a cliff in the case of some primates or birds (Danchin *et al.*, 1998; Kummer, 1968), a burrow for many social carnivores or rodents (Fox, 1972; Rasa, 1986), or a collective building for social insects (Camazine *et al.*, 2001). However, individuals have to move collectively to another spot in order to forage or drink (Boinski and Garber, 2000; Fischhoff *et al.*, 2007; Kummer, 1968). Individuals have to decide when and where they will move collectively. However, animal groups are often composed of individuals with different needs. Males often have a higher body weight than females and therefore need more energy. Lactating females need more water than their conspecifics. This individual heterogeneity will have an impact on the decision-making process. Group members must take decisions that satisfy the majority of individuals (i.e. decision accuracy) but in a relatively short period (i.e. decision speed). In decision-making, speed and accuracy are often opposed. A substantial amount of time may be required to make an accurate decision between alternatives, because weighing up information may be a long process. This compromise between speed and accuracy is very common and has been termed “the speed–accuracy trade-off paradigm” (Busemeyer and Townsend, 1993; Osman *et al.*, 2000; Nikolic and Gronlund, 2002). Nevertheless, empirical studies demonstrating the conflict between speed and accuracy in decision-making are mostly investigations in the field of human performance and psychology. In many cases, people can actively choose their own compromise between accuracy and speed (Osman *et al.*, 2000; Vitevitch, 2002).

A speed–accuracy trade-off is not a desirable feature of a decision-making process in itself. Commonly, only one of these two factors can be controlled, but not both of them. It would, of course, be preferable to be able to make highly accurate decisions in the minimum time possible, but the individual or the group environment could

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