BUILDING SMART GROUPS

BY THOMAS D. SEELEY

Many animals, including humans, live in sophisticated societies. As a result, many important decisions are made not by individuals acting alone, but by groups acting collectively. In humans, these group decisions range from some friends choosing a restaurant to a nation electing a government. Likewise, in a school of fish, troop of baboons, or swarm of bees, the group's members have to make decisions about where to go or what to do. The fundamental puzzle is this: How can a group use its members' knowledge to choose an optimal course of action for the group as a whole?

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Women show their completed voting cards during the 2009 general election in India, the largest democratic election in the world, with some 743 million voters.

The problem of collective decision-making has challenged philosophers and political scientists from Plato onwards. Many have been skeptical about group decision-making. Henry David Thoreau, for example, penned in his *Journal* in 1838: "The mass never comes up to the standard of its best member, but on the contrary degrades itself to a level with the lowest." Likewise, Friedrich Wilhelm Nietzsche wrote in *Beyond Good and Evil* in 1886: "Madness is the exception in individuals but the rule in groups."

The natural world, however, presents us with many examples of clever animal groups—consider a flock of migrating geese deciding when to take flight or a swarm of honeybees choosing a new home. And as James Surowiecki noted in 2004 in his book *The Wisdom of Crowds*, in a human group with the right organization, "the many are smarter than the few." For example, in guessing the number of jelly beans in a jar, the average of a group of independent guesses is often more accurate than the best individual guess.

Recently, John H. Miller, an economist at Carnegie Mellon University and part-time research professor at the SFI, and Nigel Franks and I, biologists specializing in social insects, from the University of Bristol in England and Cornell University respectively, organized a workshop at the Santa Fe Institute on how to optimize group decision-making. The workshop, titled "Collective Decision-Making: From Neurons to Societies," brought together some 20 experts in animal behavior, neuroscience, political science, and engineering to explore common features of natural systems—such as monkey brains, ant colonies, and Vermont towns—that show good collective decision-making. Part of the attraction of this topic is to offer strategies to improve how human organizations make decisions.

The discussion focused on the scenario in which a group makes a single collective choice that is binding for all its members. Examples include human legislative decisions regarding passage of a new law, choices of travel direction in cohesive groups, and visual neurons deciding about the direction of an approaching object. The fundamental question is how to make a decision based on a pool of information that is dispersed across the group's members. The talks at the workshop revealed some astonishing consistencies among the mechanisms of decision-making in primate brains, insect societies, and New England town meetings. In each type of system, every member of the group has limited information and limited intelligence, and yet the group as a whole makes first-rate collective decisions. Furthermore, in each system, the decision-

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These rock ants wear radio frequency identification tags, which allow researchers to determine each individual's role in the collective decision on a new nest site.

making process is a popularity contest—a race between competing accumulations of evidence in support of the various alternatives. The winner is the first to gather enough evidence (support) to cross a critical threshold (quorum). The better the choice, the more rapidly it gains supporters (neurons, insects, or persons), and the more likely it is to be the first alternative to gain enough support to become the community's choice.

It appears that an important feature of all these systems is having the right mix of independence and interdependence between the group members. Individuals generally assess the quality of different alternatives independently. But they are also more likely to support an alternative that is more strongly supported by others. For example, in a "debate" among ants over which rock crevice should be their new home, the individuals that have found a first-class site will advertise it most powerfully and create the strongest positive feedback loop of supporters recruiting additional supporters—those who "shout" loudest, in other words, are most convincing.

Without sufficient independence in evaluating the alternatives, an informational cascade (groupthink) can lead to a bad decision. This happened with the Space Shuttle Columbia disaster in 2003, in which Linda Ham, the leader of the Mission Management Team, did not encourage independent views on the consequences of the foam that struck the shuttle's wing during launch. Similarly, without sufficient interdependence, the decision-making can also be suboptimal, as the group cannot amplify its information about good alternatives. This situation arose in the AIG debacle. Individuals within the corporation knew that selling credit default swaps was risky but could not influence those that chose (foolishly, we now know) to do so. There was not a broad discussion of the wisdom of this decision, hence no opportunity for interdependence.

The workshop revealed important avenues for future investigation. Researchers of individual decision-making have shown that people exhibit many unintentional biases when making quick, intuitive judgments. For example, when asked to estimate the gestation period of animal X (elephants, for instance), people tend to say nine months. This is a case of unintentional "anchoring"—tending toward a value that is familiar, even if irrelevant. The problem can be overcome with certain habits of thought, such as being one's own "devil's advocate" to trigger mental deliberations. Are group decisions prone to such analogous biases, and if so, what are the strategies for avoiding them? When a group's debate seems inadequate, could it foster deliberations by weakening positive feedback interactions among its members, or by increasing the critical level of support needed to identify a chosen alternative? Along with such questions, the workshop's participants left with a new appreciation for the commonalities of collective decision-making across a wide range of systems. ◀

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