But if these two processes are required for structural and functional plasticity, how are they balanced? That is, how are the distinct molecular cascades underlying exocytosis and actin cytoskeletal reorganization coordinated? Perhaps evolution has perfectly balanced their rates, or maybe there is a physical link between the two systems. For instance, receptors delivered to the synapse from the recycling endosomes could stabilize the actin cytoskeleton and thereby provide a simple accounting process to balance changes in synaptic strength and spine size. Maybe when we fully understand how spine size and synapse strength are coordinated will we be poised to comprehend why spine size matters.

References

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Human cooperation may have evolved as a consequence of genetic relatedness, culture, or language within groups.
prosocial behavior. The absence of these kinds of leveling mechanisms in primate groups may explain why human societies differ from those of other primates.

Make no mistake. This is not a “group selection” hypothesis that competes with “kin selection” hypotheses [see the Review by Nowak (5) on page 1560 of this issue for a discussion of conditions that favor the evolution of cooperative behavior]. Both concepts are equivalent frameworks for describing the same evolutionary process. The group (also known as multilevel) selection approach describes all natural selection as going on in a series of nested levels: among genes within an individual, among individuals within a group, and among groups. The kin selection approach accounts all fitness effects back to the individual gene. Bowles adopts the multilevel selection framework, but you can pose exactly the same argument in a kin selection framework and if you do your sums properly, you will get exactly the same answer. The real questions are: Are amounts of genetic variation observed among contemporary human foraging groups representative of the Pleistocene hominin populations in which distinctively human behavior probably evolved? Were the benefits of success (survival) from intergroup competition in ancestral human populations large enough to compensate for the individual costs of participating in such contests? And, did the kinds of leveling mechanisms observed among contemporary foragers exist and work in the same way in ancestral populations?

The role of leveling mechanisms is especially tricky. In other primate species, access to resources is usually regulated by social dominance. Dominant males monopolize mating and dominant females get better access to food, sleeping sites, and so on. There is little dominance among human foragers, and access to resources is more egalitarian. Thus, it seems likely that the variance in reproductive success in human foraging groups is lower than in other primates. However, at least some of the leveling mechanisms that we see in human groups seem to require a degree of prosociality not seen in other primates. Food sharing and dispute resolution, for example, could rest on exactly the same prosocial impulses that Bowles seeks to explain. It is certainly fair to invoke reproductive leveling to explain the stability of extended altruism among humans, but whether it is sufficient to explain its origin is not yet clear.

The main competing explanations for the distinctive level of human cooperation do not suffer from this potential liability. Some authors have argued that theory of mind, spoken language, and other cognitive innovations have allowed humans to build larger coalitions among nonkin than other primates (6). Others have proposed that rapid cultural adaptation generated cultural variation among groups, and intergroup competition subsequently favored the spread of culturally transmitted group-beneficial beliefs and practices (7). In both cases, the triggering factor (such as language or social learning) is supposed to have evolved for some other reason; cooperation and prosocial preferences arose as a side effect. Of course, there is no reason why these hypotheses need be mutually exclusive. Language or culture may have led to the evolution of leveling mechanisms, which then potentiated the spread of prosocial genes because these mechanisms reduced the costs of cooperation.

Research into evolutionary processes that spawned our uniquely cooperative societies may help us understand the nature of our social preferences. Bowles’s hypothesis is consistent with suggestions that people have innate, prosocial motivations, and that these feelings are elicited by cues of common group membership. Other hypotheses seem to fit more easily with alternative views of human nature. These are old questions, but still important ones. The kind of quantitative empirical work that Bowles has done will help answer them.