Female white-handed gibbons (*Hylobates lar*) lead group movements and have priority of access to food resources

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Summary

One of the disadvantages of group life is competition over food. How this conflict is solved is an interesting issue for sexually monomorphic species, with co-dominant sexes. Since female mammals, particularly primate females with long gestation and lactation periods, have higher reproductive costs, the question arises how this increased need translates into leadership among group members and, thus, priority of access to food resources. We investigated seven wild, pair-living and six multi-male groups of white-handed gibbons \((N = 13)\), in which females are expected to experience even increased rates of food competition. We examined leadership tendencies in the context of group movement, travel order, access to food resources and feeding priority (i.e., monopolizing/sharing a food patch). We found that females consistently led travel by maintaining their position at the front of groups and that traveling order amongst the entire group remained consistent between journeys. Lead females usually arrived first at food sources and tended to feed alone when food resources were limited. Female reproductive stage appeared to influence their motivation to lead, as cycling females led movements more frequently than pregnant and lactating females did. We conclude that, although appearing co-dominant, gibbon females assume a greater leadership role in coordinating group activities.

**Keywords:** feeding priority, gibbons, *Hylobates lar*, leadership, reproductive stages, travel progression.

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Introduction

For many animals, forming groups is an advantageous strategy that allows individual members to gain better protection against predators, to out-compete groups of conspecifics over food resources and to improve breeding opportunities or information exchange (Wrangham, 1980; van Schaik, 1983; Tella et al., 1998; Meunier et al., 2006). Despite benefits associated with increased gregariousness, close spatial proximity commonly comes with costs in the form of increasing competition between individuals over limited resources. Thus, conflicts among group members may erupt at any time, for example over deciding where to search for food or which individual(s) is allowed to first access a food source. The outcome of such competition can directly affect group coordination (Biro et al., 2006). Although underlying mechanisms by which groups reach decisions and achieve coordination are generally poorly understood, two opposing processes have been suggested to explain decision making in non-human primates: (1) personal leadership and (2) distributed leadership (Leca et al., 2003; Conradt & Ropert, 2005).

The personal leadership hypothesis proposes that a single individual leads while the rest follows (unshared decision). Mountain gorillas, Gorilla gorilla beringei, are an example where dominant adult males usually impose their decisions on other group members by ‘herding’ them (Schaller, 1963). The distributed leadership hypothesis posits instead that all group members (equally shared decision, e.g., hamadryas baboons: Kummer, 1968), or only a subgroup of individuals (partially shared decision), make trade-offs to reach a collective decision (Leca et al., 2003; Conradt & Ropert, 2005). Sharing decisions, instead of accepting the decisions of a single leader, seems a more profitable strategy for gregarious individuals to both maintain group cohesion and the advantages of group life (Conradt & Ropert, 2007).

Although individual(s) at the front position of moving groups are not always the decision-makers (Boinski, 1993; Byrne, 2000), the travel directions of the lead individual(s) are likely to influence feeding and foraging opportunities (Boinski, 1991), as well as being important in territorial defense and/or encounters with predators (Rhine & Westlund, 1981). The leadership role may not be static, and may instead depend on individual motivation. Primate groups are usually comprised of individuals of different age, sex, and reproductive condition, with distinct nutritional needs, foraging tactics and susceptibility to predation. The conflicting requirements of individuals may