

Book Review: Reconstructing Behavior in the Primate Fossil Record. JM Plavcan, RF Kay, WL Jungers, & CP van Schaik, Eds. 2002. Kluwer Academic / Plenum Publishing.

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Abstract:

How can we best understand the adaptive significance of morphological features of fossil primates and, based on this understanding, reconstruct the behavior of these organisms? This edited volume, based on a Leakey Foundation-sponsored conference held at Duke University, reviews different approaches to these problems and makes an important contribution to the literature of primate paleontology. The authors and the editors are to be commended for their rigorous attempts to define important terminology (e.g., homology, adaptation), for their comprehensive coverage of a large and complex literature, and finally, for presenting a coherent viewpoint on how best to approach the difficult task of reconstructing the behavior of extinct primates. The book is organized into an introductory chapter that sets the theoretical foundation for all that follows, nine case studies dealing with different primate taxa and different anatomical/behavioral systems, and a final summary chapter by the editors.

Keywords: book reviews | anthropology | primate fossil record | morphological features | paleoanthropology

Article:

How can we best understand the adaptive significance of morphological features of fossil primates and, based on this understanding, reconstruct the behavior of these organisms? This edited volume, based on a Leakey Foundation-sponsored conference held at Duke University, reviews different approaches to these problems and makes an important contribution to the literature of primate paleontology. The authors and the editors are to be commended for their rigorous attempts to define important terminology (e.g., homology, adaptation), for their comprehensive coverage of a large and complex literature, and finally, for presenting a coherent viewpoint on how best to approach the difficult task of reconstructing the behavior of extinct primates. The book is organized into an introductory chapter that sets the theoretical foundation for all that follows, nine case studies dealing with different primate taxa and different anatomical/behavioral systems, and a final summary chapter by the editors.

At its heart, the problem of reconstructing the behavior of extinct organisms reduces to the use of the comparative method, a form of analogical reasoning in which form-function associations observed among extant taxa (for whom behavior and morphology can be observed) are compared with the morphological features of extinct organisms. This seemingly simple analogy is, however, strongly complicated by a variety of related issues, including phylogeny (and phylogenetic inertia) and allometry. By itself, the comparative method is unable to reconstruct behaviors associated with unique fossil morphologies (for whom no living analogues are available), and here the paleontologist must utilize the techniques of biomechanical analysis and notions such as optimization and efficient design in order to determine function.

In the first chapter, Ross et al. present a thorough analysis of the notion of adaptation and of how the comparative method can best be used to determine which morphological features of fossils can be said to be adaptations. This discussion is notable both for its appreciation of the importance of controlling for phylogeny in any comparative analysis (citing the work of biologists such as J. Felsenstein, M. Pagel, and P. Harvey), as well as its critical approach to some of the more dogmatic uses of phylogenetics in reconstructing fossilized behavior. The authors, rightfully in my opinion, cogently argue for the possibility of determining function for primitive as well as derived features of fossil taxa, and they are wary of the practical difficulties created by certain methods that require precise phylogenies. They advocate an eclectic approach to the use of the comparative method for reconstructing the behavior of fossils that includes biomechanical analysis, performance testing, allometric analysis, and the statistical analysis of form-function associations in extant taxa, all in the context of the established phylogeny of the taxa involved.

Hylander and Johnson's chapter on in vivo bone strain patterns in craniofacial morphology presents an excellent summary of their work that is dedicated to debunking the naive but common assumption that “the concentration, distribution, and geometry of bone mass within the craniofacial region is largely or exclusively determined by or associated with routine and habitual forces associated with mastication, incision, or isometric biting” (p. 43). Their work strongly suggests that using facial bone architecture among fossil primates to determine dietary behaviors or preferences remains problematic. Two chapters in this volume deal explicitly with ontogenetic topics and life history strategies. Ravosa and Vinyard provide a clear perspective on the sometimes contentious literature of ontogenetic allometry and heterochrony. They suggest that the study of relative growth among extant primates is essential for interpreting the form-function relationship among fossil taxa, and in particular, they explore the notion of “functional equivalence” in biomechanical function as size and shape changes. Godfrey et al. explore the life history strategies of some of the extinct giant lemurs of Madagascar (notably *Paleopropithecus* and *Archaeolemur*), based on the evidence from dental development. They apply a novel and

promising demographic method known as elasticity analysis to the exploration of life history strategies and their associated behavioral patterns based on skeletal materials of extinct taxa. In another contribution focusing on subfossil lemurs of Madagascar, Jungers et al. synthesize a large body of evidence to reconstruct body size and sexual dimorphism, activity cycles, diet, and positional behavior for many of the large-bodied extinct lemurs.

The other chapters in this volume explore topics such as the reconstruction of the diet of fossil primates (Ungar), the relationship between sexual dimorphism and social behavior in the fossil record (Plavcan), and the use of community paleoecology and taphonomy to better understand the dynamics of fossil assemblages (Reed). Each is a solid literature review written by individuals who have made significant contributions to our current knowledge of these areas.

The two most interesting and innovative chapters in this collection are, in this reviewer's opinion, those authored by Nunn and van Schaik and by Kay, Williams, and Anaya. Nunn and van Schaik utilize the comparative approach in an interesting way to reconstruct aspects of the socioecology of extinct primates. First distinguishing between knowable and unknowable ("K" and "U") variables relating to the socioecology of extinct primates, they proceed to use "K" variables (e.g., activity period, locomotor substrate, diet, habitat, and body size) as predictor variables for the "U" variables (e.g., population and foraging group size, and home range size), based on known associations between these variables among extant primates. Although the relationships between these socioecological variables among primates are complex, this approach holds great promise. The chapter by Kay et al. synthesizes paleoenvironmental and morphological (mostly molar shearing crest development and crown height) data concerning the life style and behavioral adaptations of *Branisella boliviana*, the earliest platyrrhine. The confounding effects of phylogeny are nicely explored through the use of Felsenstein's "independent contrasts" method, and the results suggest a somewhat atypical set of adaptations for a platyrrhine. The authors suggest that *Branisella*'s combination of high molar crowns with weakly developed molar crests suggests a similar adaptation to certain Old World monkeys that feed on or close to the ground.

In closing, I highly recommend this volume to all scholars and (graduate) students interested in primate paleontology. It will be a very useful resource on my bookshelf, and I suspect on many other bookshelves, for years to come.

In *Reconstructing Behavior in the Primate Fossil Record* (Plavcan JM, Kay RF, Jungers WL, van Schaik CP, eds.), pp 43–72. New York, Kluwer Academic/Plenum. Hylander WL, Johnson KR, Crompton AW (1987). In *Species, Species Concepts, and Primate Evolution* (Kimbel WH, Martin L, eds.), pp 539–553. New York, Plenum Press. Lanyon LE, Rubin CT (1985).