papers concern the full quantum theory of gravity. In fact a satisfactory theory of this kind does not yet exist, partly because when gravity is coupled to matter the usual quantization procedures lead to a nonrenormalizable theory. B. S. DeWitt reviews the present status of these problems, and Hawking and S. Weinberg offer accounts of their own proposals for solving them (Hawking using path integrals in a space-time with positive-definite metric, which he believes may be dominated by gravitational instantons, and Weinberg using renormalization group arguments in terms of which he proposes that the requirement of renormalizability may be adequately replaced by a weaker one of asymptotic safety).

The book is remarkably varied and the papers are of a consistently high quality and interest. Indeed, in their power and comprehensiveness they constitute a unique monument to the genius of Einstein, and, may I add, to the brilliant and profound work of the contemporary generation of relativists, many of whom are at once the creators of the present state of the subject and, in the pages of this marvelous book, its masterly expositors.

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Zooarcheology

Reindeer and Caribou Hunters. An Archaeological Study. ARTHUR E. SPIESS. Academic Press, New York, 1979. xiv, 314 pp., illus. $25. Studies in Archaeology.

No species evokes clearer images of windswept northern wastes than *Rangifer tarandus*, known popularly as the reindeer in Eurasia and as the caribou in North America. Over most of its arctic and subarctic range, this species is by far the most common large mammal and therefore a prime source of meat and skins for indigenous peoples. Anthropological interest in the relationship between these animals and people dependent on them is especially great because during Pleistocene glacial intervals the species extended its range far southward and was widely preyed upon by Paleolithic hunters in mid-latitude Eurasia.

Spiess has brought together a great deal of information on the distribution and ecology of recently observed reindeer/caribou and on the social organization and technology of the people who hunted and, in some cases in Eurasia, also herded them. He emphasizes that people exploiting these animals must be responsive to marked seasonal changes in the composition and distribution of the animals' social groupings. For archeologists, the seasonally changing age-sex composition of these groupings, combined with the fact that the great majority of the calves are born at more or less the same time (usually within a two-week period between mid-May and mid-June, depending on the place), means that the age-sex profile of the animals represented in a site can be used to establish the season when people were at the site, as well perhaps as the purpose for which (for meat or skins) and the methods by which people obtained the animals. These methods could range from selective stalking of individual animals to driving of whole groups into corrals or other traps.

Spiess shows that some previous attempts to determine the age and sex of archeological reindeer used methods of questionable accuracy or reliability, whereas the methods he employs have a high probability of providing meaningful results. To demonstrate the interpretative potential of caribou age-sex profiles from archeological bone assemblages, he uses his analyses of bones from various protohistoric North American sites to show that there is a reasonable fit between the human behavior inferred from the bones and behavior that could have been predicted from historic observations. He then undertakes the more ambitious task of drawing similar inferences from a Paleolithic reindeer sample, where of course no ethnohistoric check is possible. The Paleolithic sample was derived from layers dated between roughly 35,000 and 18,000 years ago ("early Upper Paleolithic") at the Abri Pataud in southwestern France, meticulously excavated over many years by Hallam L. Movius.

The most interesting and important inference that Spiess draws from his study of the Pataud materials is that people occupied the site between late fall and early spring. This appears to be true for the entire 17,000 years of occupation, although changes in artifacts indicate that the people who brought reindeer bones to the site at different times belonged to very different cultures.

Spiess's writing is very loose, and the presentation could have been substantially improved by greatly reducing the amount of detail about the recently observed hunters and replacing it with relevant background material on Paleolithic archeology and the place of the Abri Pataud in prehistory. Still, Spiess's work is a valuable contribution to archeology because it illustrates as clearly as any study to date the information about human behavior that can be obtained from careful determination of the ages and sexes of animals represented in ancient archeological sites. All that is necessary for this kind of study to burgeon now is the kind of thoughtful selection of sexing and aging methods exemplified in Spiess's work and the careful excavation of large bone samples, comparable in size and quality to the samples obtained by Movius at the Abri Pataud.

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Primate Behavior

The Great Apes. DAVID A. HAMBURG and ELIZABETH R. MCCOWN, Eds. Benjamin/Cummings, Menlo Park, Calif., 1979. xiv, 554 pp., illus. $18.95. Perspectives on Human Evolution, vol. 5; a publication of the Society for the Study of Human Evolution, Inc.

Long awaited and already widely cited, this volume consists of papers presented at a 1974 Burg Wartenstein conference, plus a few papers added later. The majority of the papers describe long-term, systematic field observations of gorillas, orangutans, and chimpanzees carried out under difficult conditions. Care was also taken to provide some representation of laboratory and theoretical perspectives, and there are several fine essays on communication and a detailed theoretical paper on aggressive competition in animals generally. No comparable body of reliable information about the natural history of great apes exists. Thus, the book suffers relatively little from its late publication, although an updated summary chapter would have been valuable.

The extraordinary biochemical similarities between humans and the terrestrial African apes (gorillas and chimpanzees) that have been investigated through DNA hybridization, protein sequencing, and immunological analysis will be well known to readers of *Science*. Less well known may be some of the recent findings that challenge old ideas about the behavioral differences that separate humans from other primates. This volume documents for other hominoids intercommunity killings, avoidance of inbreeding through female emigration (in two of the three great apes), face-to-face copulation and elaborate sexual foreplay (among wild orangutans;