beneficial effect more specific than "social bonds" must be identified.

The remainder of the book is taken up with mathematical models and theoretical discussion of play. Models for the optimal placement of play in ontogeny, for play as a cooperative social behavior, and for play as a mechanism by which novel adaptive behavior is discovered are presented. There is extensive discussion, from an individual-strategy point of view, of how social play should be structured. Fagen points out that two individuals engaging in social play may have opposing optimal goals and that the structure of social play is therefore open to interpretation in a game-theoretical framework. Much of the material in these chapters probably will promote interesting debate.

This book is carefully and thoughtfully produced and will be a valuable reference document for many years. There are useful appendixes, an extensive bibliography, and well-done author and subject indexes. The quality of most of the photographs is only fair, but, as Fagen notes, good photographs of play are rare. On p. 201, a photograph of a Dall sheep lamb is mislabeled as representing a Siberian ibex.

In addition to its reference value, the book should serve as a stimulus to more and better research on play. Most of the current ideas about play are fairly summarized, and functional hypotheses are thoughtfully critiqued. The extensive theorizing in the latter part of the book will introduce readers to the complexity of issues in behavioral development. Those who have not followed the play literature can catch up with those who have by reading this book.

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A bout of locomotor play by a hippopotamus (*Hippopotamus amphibius*) calf, Kazinga Channel, Uganda. *Top*, "Calf play-nibbles conspecific's lips." *Bottom*, "After rearing, vigorously waving its front legs, and leaping over its playmate, the . . . calf does a back flip with all four feet waving." [Maitland A. Edey; reproduced in *Animal Play Behavior*]

Data from a Satellite

X-Ray Astronomy. Proceedings of an institute, Erice, Sicily, July 1979. RICCARDO GIACCONI and GIANCARLO SETTI, Eds. Reidel, Boston, 1980 (distributor, Kluwer Boston, Hingham, Mass.). viii, 406 pp., illus. $47.50. NATO Advanced Study Institutes Series C, vol. 60.

An instrument of vastly increased sensitivity often leads not primarily to a resolution of long-standing observational questions but rather to a deeper appreciation of the difficulty of their solution. The second High Energy Astronomy Observatory, "Einstein," an orbiting satellite capable of detecting celestial x-ray sources 1000 times fainter than previous instruments have been able to detect, is an excellent example of such a situation. Results from Einstein dominate in this book of proceedings. The proceedings differ from those of many previous x-ray astronomy gatherings in that they appear promptly enough to be useful and stimulating both as a reference for researchers in the field and as the basis for a graduate course in extrasolar x-ray astronomy. A sprinkling of theoretical papers supplies a means for placing many of these new data in proper perspective.

A review of the topics covered in the book is simultaneously a recital of the questions in x-ray astronomy that have been intriguing but unsettled for a period of 10 to 20 years. It is perhaps instructive to restate some of these and to ask how data from Einstein have changed our viewpoint on them. What is the origin of the diffuse, isotropic x-ray background radiation? This question has been with us for 20 years; two competing models have been proposed, one invoking a superposition of distant point sources and the other invoking truly diffuse radiation from a hot intergalactic gas, whose inferred mass density would have great cosmological significance. Results from Einstein provide support and difficulties for both models, with no resolution of the argument. Giacconi and Tananbaum describe in detail how large numbers of

quasi-stellar objects (QSO's) are detected by Einstein as luminous x-ray emitters and postulate that an extrapolation of the properties of those objects observed individually might well explain the entire diffuse background. Unfortunately the Einstein observations have involved preselected, radio-luminous QSO's, whose x-ray properties have been established to differ from those of the more common, radio-quiet QSO's. Thus supporters of this model must extrapolate considerably to obtain the x-ray luminosity of the "typical" QSO—a radio-quiet, high-redshift, optically luminous but not superluminous object. Einstein has not detected x-ray emission from even one such object directly, so such extrapolations are understandably complex. The x-ray spectra of the few QSO's and related active galactic nuclei (Seyfert galaxies, BL Lacertae objects) that are well observed are nicely described by Holt and do not agree well with the observed spectrum of the diffuse background, thus seemingly favoring the thermal interpretation of the radiation. On the other hand, these observations are available for only a small number of very-low-redshift objects, though the bulk of any isotropic radiation must come from high redshift. Again an uncertain extrapolation is necessary.

Are interesting constraints on neutron star structure available from limits or detections of thermal x-radiation? This is another question of 20 years' standing that has yet to be answered, although Fabbiano and Tsuruta provide updates in this volume. Are the compact, degenerate companions of Scorpius X-1 and Cygnus X-2, the two oldest and best-studied stellar x-ray sources, neutron stars or white dwarfs? Yet another two-decade-old question still unanswered; van den Heuvel describes how we at least have a consistent picture of how such objects fit the canonical concepts of binary star evolution. Is Cygnus X-1 a black hole? What is the origin of the hot, diffuse gas in rich clusters of galaxies? What is the nature of the bright x-ray sources clustered near the galactic center? These three questions are merely ten years old. Einstein has supplied many new details on the last two, but no obvious solutions.

Finally, the x-ray astronomer finds that data from Einstein are of sufficiently high quality to squarely confront him or her with questions already struggled with by non–x-ray astronomers. What energizes the coronae of normal stars? What is the "engine" in the center of active galactic nuclei? Discussions by Rossner and Vaiana on the former and by Bergeron and by Rees on the latter show that we have many clues but no firm answers.

It is surely demanding too much of one experiment to settle 20 years' worth of questions in x-ray astronomy. In this case, the Einstein observatory has been a spectacular success, and even if we are perplexed by this flood of data we should have no cause for complaint. This volume nicely portrays at least a sample of the contributions of Einstein on each of these questions and should be on the bookshelf of every serious worker in the field.

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Native Peoples of Florida

Florida Archaeology. JERALD T. MILANICH and CHARLES H. FAIRBANKS. Academic Press, New York, 1980. xviii, 290 pp., illus. $19.50. New World Archaeological Record.

A more accurate title for this book would be "Archaeology of the Florida Indians," for it is entirely devoted to the prehistory and history of the native Americans. The Europeans are introduced when their presence helps explain the archeological record of the Indians, but nowhere is their archeology considered—archeology that is perhaps foremost in the public mind with such great projects as colonial St. Augustine or the spectacular underwater archeology of sunken treasure ships. This omission, I hasten to emphasize, is by no means a fault. It is time that Indian archeology be given equal recognition.

Florida Archaeology attempts to review the total 12,000 years of aboriginal Indian occupation within the boundaries of the modern state of Florida. In accomplishing this ambitious goal the authors are generally very successful. They have done a fine job of pulling together and creating a coherent whole from the diversity found in the archeological record. Their tracing of economic and social developments through time and space, and very different environmental situations, offers a series of important human ecological reconstructions. In the process, they present a considerable quantity of new data and reveal the latest archeological thinking.

The most enduring impression of the cultures examined is one of isolation. Despite the strategic position of the peninsula, there is little indication of contact with the Caribbean islands or mainland shores of the Gulf of Mexico. Florida seems to have been culturally, as it is geographically, an appendage of southeastern North America and a cul-de-sac. Cultural influences were frequently received from other parts of the Southeast, but they became greatly attenuated toward the south and rarely reached the tip of the peninsula. Thus the greatest cultural complexities and changes are observable in the northern part of the state, contiguous to the Southeast proper, and the least are found in the south.

One of the few exceptions to the apparent passivity of Florida peoples on the North American scene seems to have been the Weeden Island culture. In the middle of the first millennium A.D. its influences were widely spread throughout the Southeast. Not surprisingly, because of this importance and the fact that it has been a focus of research by the principal author, Weeden Island receives the most lengthy treatment. Apparently the publication was perceived as an opportunity for summarizing the Weeden Island research, and in part it reads like a series of minireports. This emphasis does result in a slightly unbalanced and complicated account, but it is compensated for by the wealth of detail and the thoughtful restructuring of older archeological concepts. Overall, we have a definite advance in resurrecting the past.

The principal criticisms I have of the book pertain to matters of presentation. Some of the chapters are oriented temporally and others geographically or culturally. There is some overlap and redundancy and more than a little suggestion of cut and paste. Redundancy especially arises when, once the few diagnostics of a particular archeological unit have been displayed, an attempt is made to flesh out the broader cultural content with discussions of social organization, subsistence base, mortuary customs, "black drink" ceremonialism, and other putative details. These discussions really do not add content to the archeological structures, and only detract from their distinctiveness (which is not to deny that the speculations presented are probably valid). Tighter organization might have relieved this problem.

Also a problem in presentation is that there are too few tables: more could have substituted for some of the redundancy in the text. The illustrations are generally adequate, but unexciting, and the halftones are not of high quality. The lack of a listing of tables and illustrations is an inconvenience. But these are minor problems.

Florida Archaeology is the best gener-