Friendships (Cambridge University Press, 1981), this book is one of the most important in the study of peer relationships and social skills. All of the topics in this burgeoning—if not sprawling—area are dealt with, and at least some of the contributors suggest by the sophistication of their discussions that this area is about to come of age. An initial descriptive phase often provides the basis for hypothesis generation and evaluation, but all too frequently psychologists stop short of theory construction and assessment, either because fashions change or because the work becomes too difficult. Fortunately, it is clear that some prominent scholars are already grappling, in estimable fashion, with these challenging but crucial tasks in the study of peer relationships and social skills.

Dunn and Kendrick's book also represents a heartening advance in the study of children's relationships with other children. Theirs is a monograph, rather than a collection, and whereas Rubin and Ross's volume will be of greatest value to advanced researchers (graduate students and professors), Dunn and Kendrick's will be accessible and of value to teachers, clinicians, advanced undergraduates, and even concerned parents. (It is, however, more demanding, and more valuable, than all but a handful of the books in the series The Developing Child, also published by Harvard University Press.)

Dunn and Kendrick describe their research on 40 English families—or more accurately, mother-child-child triads, for the fathers in these families receive little more than an occasional mention. Mother and first-born were observed and interviewed before the second child was born as well as on several occasions post partum. Using data derived from their observations and interviews, Dunn and Kendrick explore the effects of the second-born on the relationship between mother and first-born, the development of sibling relationships, the factors associated with individual differences in the quality of child-mother and sibling relationships, and the emergence of social (empathic) understanding as manifest in the utterances and behavior of the older children. Dunn and Kendrick's was a remarkably rich study—by far the best yet undertaken on the development of sibling relationships. The study is also praiseworthy for its recognition that the sibling relationship must be viewed in the context of other relationships within the family—even though the authors fail to address the father's role in the social systems studied.

Unfortunately, the findings are so interesting and so provocative that the authors sometimes appear to forget that this was an exploratory, hypothesis-generating study. All the findings must consequently be viewed cautiously until replicated in other studies. Some of the more straightforward findings are likely to be robust, but the more unexpected and complex relationships (for example, those concerning the sex composition of the sibling dyads) are unlikely to be replicable in their entirety, given the small number of subjects in each of the relevant cells. An attempt to look for consistency and replication across studies is especially important in the case of exploratory studies like this one, and the failure to do so is disappointing. The most striking omission is a discussion of related research and relevant theory.

All the findings reported in this book have been reported previously in the professional literature. The authors do not take advantage of the opportunity to integrate findings presented in different papers, but many readers will probably be grateful to find all the findings brought together in one report. To facilitate discussion of the findings, most of the tables of data are placed in an appendix, which also includes most important details of the methodology. This organization, supplemented by the inclusion of illustrative anecdotes, helps to make the book accessible to non-professionals without negating its value to researchers and scholars. This is a readable account of an important and interesting study. It should thus receive a great deal of attention.

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The Jovian System

Satellites of Jupiter. DAVID MORRISON, Ed. University of Arizona Press, Tucson, 1982. x, 972 pp., illus. $49.50. Space Science Series.

Io, Europa, Callisto, and Ganymede once excited only the pederastic god Jupiter. However, since the 17th century, when the names of the Roman deity's youthful lovers were given to the four major moons about the planet Jupiter, Io and cohorts have been delighting planetary scientists. Prior to the space age, astronomers could ponder only a few facts about the moons: all four had been studied photometrically, and the orbits of the inner three were known to be interlocked in a complex dynamical way. However, in the last decade, our information base exploded as planetary satellites were scrutinized by sophisticated ground-based instruments and Jupiter's system was surveyed closely by two Voyager spacecraft in 1979. This new knowledge has demonstrated that the Galilean moons are extraordinarily interesting objects capable of revealing much about the nature of the solar system.

Callisto, a dust-mantled ball of ice and rock, is perhaps the most heavily cratered object in the solar system. Ganymede, the largest moon about any planet, displays incredible tectonic variety. Europa, encased by a smooth thin crust of ice, is unusually free of craters and is instead crisscrossed by long arcuate markings of unknown origin. Io, covered by the most youthful, bright, and variegated surface of all, has numerous active volcanoes that apparently provide it with a palette of brilliant sulfur allotropes. This odd satellite also significantly interacts with its magnetospheric environment: it lies at the core of tori containing sodium, potassium, and sulfur; it supplies many heavy magnetospheric components, but is simultaneously an absorber as are its compatriot moons; and somehow it helps trigger Jupiter's sporadic decametric radiation.

In addition to the major satellites, other objects circle Jupiter. Two clusters of tiny, presumably captured, satellites orbit well beyond the Galilean satellites. Three other craggy moons, even smaller than the previously known Amalthea, were discovered by Voyager to lie just a few planetary radii from Jupiter. A faint ethereal ring girds the planet near two of the small satellites.

This book emphasizes the Galilean satellites, especially bizarre Io. Geological descriptions of Ganymede, Europa, and Io by Shoemaker and co-workers, Lucchitta and Soderblom, and Schaber, respectively, will be widely cited. Four discussions of impacts into the Galilean satellites provide valuable extensions of earlier work on cratering in the inner solar system. In addition, Ostro uses the anomalous radar returns to suggest the small-scale surface structure of the satellites. Our understanding of terrestrial volcanism will be broadened substantially by Kieffer's important contribution on the dynamics and thermodynamics of Io's volcanoes. Six additional significant chapters address various aspects of plumes of these volcanoes, and two others consider the associated Io torus. A study by Cassen and co-workers of the interiors of the satellites is a nice treatment of a difficult subject, as is Green-

berg's explanation of the elusive connection between satellite orbital evolution and thermal history. Sill and Clark compile laboratory data and employ them to interpret surface compositions of the satellites. Chapters on Amalthea, the outer Jovian satellites, and the rings of Jupiter are fine summaries of topics too often neglected. The book ends with a series of maps, a glossary, lengthy acknowledgments, and an index.

Graduate students and researchers in planetary science, geology, astronomy, and physics are most likely to benefit from *Satellites of Jupiter*. Most of the 24 papers in the book originated at an International Astronomical Union conference held just ten months after Voyager 2 passed Jupiter. The papers were revised and refereed following the meeting; the final submissions came in from July 1980 to October 1981, and hence some authors digested Voyager data for twice as long as others. The book is not the usual compilation of tried and true reviews. Prepared only a dozen or so months after the most startling observations of Jupiter were made, many chapters contain primary source material from the Voyager mission as well as attempts at synthesis. Interestingly, in view of the meeting's international sponsorship, 46 of the 47 collaborating authors are American or are based in the United States, no doubt reflecting that only U.S. spacecraft have flown into the outer reaches of space. Also, many authors are remarkably youthful for such an important book. Given recent NASA funding for planetary exploration, future volumes are likely to be the work of foreign or elderly authors.

Satellites of Jupiter deviates little from the unusually high standards set by the Arizona Space Science series. Morrison has chosen papers that are in depth, well balanced in outlook, and written by the appropriate experts and has placed the papers in context with an enlightening 40-page introductory chapter, which can be profitably read in conjunction with the final chapter, by Pollack and Fanale, who apply our knowledge of the Jovian system to constrain scenarios for the system's origin. Eight pages of color plates have been included, which in part accounts for a price higher than that of most other volumes in the series. Figure reproduction—critical for a book emphasizing geology—is somewhat uneven, with figures in chapter 9 and the appendix being below par, though the rest are quite good. A few typos are present, with incorrect names a minor annoyance.

The satellites of Jupiter have challenged our view of our cosmos ever since the first four were spied by Galileo and Marius in 1610. At that time, their discovery in orbit about a body other than Earth indicated a serious failing in the generally accepted geocentric model of the universe. As the present book well demonstrates, our modern investigation of the Jovian system may ultimately overturn many prevailing tenets concerning the operation of the solar system. It will do this by forcing us to extend ideas into new realms—volcanologists now have a whole new system to consider, geologists have to appreciate non-silicate surfaces, students of tectonics have complex puzzles to unravel, ring enthusiasts have a different form to investigate, and cosmologists at last have another example of a "planetary" system, albeit a miniature one, to contemplate. The current watchword of planetary science—that much is to be gained from comparative studies of objects and processes—is surely receiving its severest test from the diverse array of objects that surround the solar system's largest planet.

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