children's speech derived from naturalistic observations as of 1965 are summarized by Slobin in the first chapter: the "pivot-open" construction of two-word utterances (a lengthy footnote makes clear that subsequent analyses have shown this characterization of early speech to be an oversimplification); hierarchical construction with phrase-structure replacement; overregularization of inflections; and the succession of brief stages in the development of the negative and the interrogative. Four psychologists discuss these phenomena in subsequent chapters from different points of view: McNeill as a psycholinguist for whom the linguistic tradition is dominant, Palermo with a traditional stimulus-response (S-R) orientation, which he has subsequently changed (as in his paper with Eberhart in this book), Schlesinger in an analysis of the consequences of putting meaning at the heart of both a performance model and the acquisition process, and Staats in a lengthy and detailed S-R analysis in the Hullian tradition.

McNeill's essay is primarily philosophical, with an emphasis on what cannot be learned; although his approach is similar to that of Chomsky in recent writings, Chomsky carefully distinguishes between philosophical bias and empirical questions whereas McNeill uses the former to prejudge the latter. The Palermo and the Staats papers are illuminating both in regard to what an S-R approach can do (account for overregularizations) and what it cannot do (account for appropriate generalizations); but they are more interesting as theoretical exercises than as contributions to understanding first language mastery.

The most valuable contribution will be, I predict, Schlesinger's essay, in which the assumption is made that the child has prior knowledge of concepts and the relations among concepts and that such knowledge of relations is innate and not necessarily limited to the linguistic domain. Thus the child has an innate potential for knowledge of relationships we could express as "—— is an attribute of ——," "—— is an agent of ——," and so on. This seems reasonable; if the infant "knows" anything he must know such things as "mother is warm" or "mother supplies milk." The infant's task is to learn the rules, aptly termed "realization rules," that permit such knowledge in the form of I-markers (input markers) to be realized in speech. Realization rules include category rules (which determine the grammatical category appropriate for elements in the I-markers) and relative-position rules. Since P-markers are derived from I-markers with realization rules, the findings of transformational generative grammar can be encompassed in this approach. These sketchy comments are intended to suggest the fruitfulness of Schlesinger's approach, which (i) encourages comparison of linguistic development and development in other cognitive areas, (ii) suggests specific hypotheses to be pursued with tests of children's linguistic comprehension (such as those developed by C. Chomsky), and (iii) offers a clear challenge to learning theory—namely, to account for the acquisition of realization rules.

Braine, in a nonsymposium paper, first argues against a claim he believes Chomsky and Miller have made, namely, that the child's task is to select the appropriate grammar for his native language from the set of all possible grammars (a hypothesis-testing process of grammatical acquisition). In addition, he suggests a "format" for a "discovery-procedures" acquisition model which would induce the correct grammar from samples of natural speech. The model involves a "scanner," which registers properties of utterances, and a memory system. Although it seems plausible that such a model could retrieve the pattern structure of the stimuli used by Braine in his experiment, the central question is whether a scanner can be specified with properties that would lead to the retrieval of a grammar for a natural language.

Ervin-Tripp presents a competent and generous summary and comparison of the preceding papers and a brief overview of some contemporary work in the field; especially useful are her reports of unpublished studies of mothers' language in the presence of their children.

The last two papers are an exchange between Slobin on the one side and Palermo and Eberhart on the other regarding the potential relevance of laboratory learning studies to the regularization of inflection phenomena. Slobin's previously unpublished studies of natural speech and Palermo and Eberhart's experiments should be of interest to those concerned with the specific problem of overregularization and the general problem of how naturalistic observation and laboratory experimentation are to supplement each other.

ELIZABETH SHIPLEY
Department of Psychology, University of Pennsylvania, Philadelphia

Dynamical Astronomy

Lectures on Celestial Mechanics. C. L. SIEGEL and J. K. MOSER. Translated from the German edition (Berlin, 1956) by C. I. Kalme. Springer-Verlag, New York, 1971. xii, 292 pp. $22.60. Grundlehren der mathematischen Wissenschaften, vol. 187.

A prominent dynamicist once remarked upon the obscurity of Wintner's *The Analytical Foundations of Celestial Mechanics* with the comment, perhaps only half in jest, that he would someday translate it into English. There are some respects in which Szebehely's *Theory of Orbits* might be considered a fulfillment of such a task, but that splendidly comprehensive work seems intentionally to favor the physical, the numerical, the operational over the function-theoretic aspects of the subject in large measure. The collaboration of Siegel and Moser on this revision and translation of Siegel's *Vorlesungen über Himmelsmechanik* has produced a work that seems destined to supplant Wintner and complement Szebehely. They have achieved the difficult combination of tight organization, brevity, and lucidity in presenting a rigorous mathematical treatment.

The authors choose not to consider any aspect of celestial mechanics which poses a trivial problem in the context of function theory. Thus, orbit determination and Keplerian motion are intentionally omitted as undesirable diversions. Attention is fixed upon Hamiltonian dynamics, the analytic aspects of the n-body problem, collision phenomena, existence and treatment of periodic motions, and questions of stability. These topics are pursued through proofs of existence and convergence as well as of numerous theorems concerning the solution of differential equations in general. Indeed, the book should be as important to the mathematical theorist as to the dynamical astronomer. This subject has seen a renewal of interest during recent years, and a number of the proofs, including several by the authors, have never previously appeared in book form. These demonstrations are presented with admirable clarity.

On first reading I discovered no flaws in the text, although the notation is occasionally troublesome. One can recommend this book with great confidence. It is in a class by itself.

J. DERRAL MULHOLLAND
McDonald Observatory and Department of Astronomy, University of Texas, Austin