somewhat idealistic. I am disturbed, however, by what he has called the standard method of interpreting the data. Although the bibliography indicates his acquaintance with the literature from both the Old and the New World (a circumstance all too rare among faunal analysts), he shows a certain temporal and spatial provincialism in his discussion of analytical techniques. It is quite correct that there are basic principles that may be applied to a site of any age, but the statistical approach used on material from a Roman villa or a Saxon farm is hardly applicable to long-term occupation sites such as are found in the Near East. Chaplin makes the dubious assumption that a large sample indicates a high preservation rate of bone (in fact, except in special situations, the preservation rate is very low). This assumption is implicit in his calculation of the grand minimum number of individuals per species (GMT), which he derives from the well-known minimum number of individuals calculation (MNI). The latter is a perfectly valid statistical technique, but it is inapplicable unless the sample is very large. Chaplin makes the error of thinking that the MNI calculation is an approximation of the actual number of individual animals killed, which it is not, and from this he evolves his GMT calculation, which is statistically invalid. He has lost sight of the primary objective of quantifying faunal material, which is not to determine the number of animals killed during the period of occupation (surely a Utopian goal) but to determine the relative frequency of each species and consequently its economic importance. It is high time that those of us in faunal analysis take a close look at our quantification methods (preferably with the help of a statistician) so that such errors will not be repeated.

Although the author emphasizes the necessity of close cooperation with the archeologist, his orientation is essentially that of the zoologist. He is not thinking in cultural terms and, indeed, he never discusses bone as an artifactual material. There are limitations in the "specialist" approach, and nowhere is this more evident than in faunal analysis. Let the archeologist beware: the specialist he hires must be part archeologist himself.

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Effects on Behavior

Pharmacological and Biophysical Agents and Behavior. ERNEST FURCHGOTT, Ed. Academic Press, New York, 1971. xii, 402 pp. $14.50.

This book can be divided into two portions. The first four chapters deal with the behavioral effects of ionizing radiation, nonionizing radiation, anoxia, and ambient temperature. The main concern of these chapters is with the possible behavioral toxicity of these environmental hazards. The last three chapters deal with the effects of stimulants, sympathomimetic agents, and muscarinic blocking agents (atropine and scopolamine) on behavior, but from the point of view of their possible therapeutic use in behavioral disorders. In addition there is an emphasis on the utilization of drugs having known pharmacologic effects in order to elucidate the role of various chemical systems in behavior.

These two sections of the book differ not only in subject matter and approach but also in style and quality. The first is quite disappointing in terms of the title of this volume and its intent. In the introduction, the editor states, "Since some of the original research reports [on the behavioral effects of environmental agents] were not written by psychologists, the terminology and conceptualizations are not compatible with current behavioral science. The literature is, therefore, in need of evaluation. This volume is an attempt to bridge this existing gap." Unfortunately, the gap is not bridged, nor are the terminology and conceptualization compatible with current behavioral science. Much time is spent in defining the physical nature of these environmental factors and describing their biological effects. Such information is easily available from other sources. In contrast less than a third of the first 179 pages deal directly with behavioral effects. The presentation of behavioral effects is moreover totally uncritical, leaving the reader lost in a series of references to experiments that the authors fail to evaluate or place in perspective. Effects on learning are cited without a concern for whether the observed changes are due to associative or performance variables. Furthermore, there is no attempt to abstract general phenomena that have a common feature with other biological manipulations. For example, many of the symptomatic effects of radiation on behavior are also obtained following brain damage or toxic dosages of drugs. Perhaps the authors are simply the victims of the paucity of experimental data within their fields. Certainly the impression gained by the reader is that virtually nothing is known in any systematic way concerning the effects of environmental hazards on behavior. Considering the current interest in the toxic effects of our environment on behavior of all organisms one might hope that systematic studies will be initiated in this area.

In contrast to the first part of the book, the final three chapters are well-written evaluations of effects of drugs on behavior. The chapter by Calhoun on stimulants is a gem of clarity and lucidity. The strengths and shortcomings of experiments are pointed out, problems of research methodology are made understandable, and the general conclusions that can be reached are clearly stated. Great care is taken to lead the reader through the maze of results and provide him with a coherent picture of what we know concerning the behavioral effects of stimulant drugs. The same comments can be made concerning the other two chapters in this section.

This volume could prove useful for those interested in a general handbook for this field. There are over 1200 references in it and a reasonably good index of authors and subjects.

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Acquiring Language

The Ontogenesis of Grammar. A Theoretical Symposium. DAN I. SLOBIN, Ed. Academic Press, New York, 1971. xiv, 248 pp. $14.50. Child Psychology Series.

Transformational generative grammar as developed by N. Chomsky and other linguists, as well as the philosophical orientation of these scholars, has challenged psychologists in the past decade to consider more carefully the structure of individual knowledge and the preconditions for speech and language. Much of this interest has centered on first language mastery. This book includes papers on that subject written in 1965, when the symposium that prompted it was held, additions to those papers, and other, independent papers written in the last five years.

The major characteristics of young

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.

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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.

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