Earth's Landscape

The Morphology of the Earth. A study and synthesis of world scenery. Lester C. King. Hafner, New York, 1962. xii + 699 pp. Illus. Plates. $13.50.

Lester King presents us with an extended discussion of the development of the earth's surface features. His preface characterizes this discussion as "set out in no spirit of idle iconoclasm but in bright seeking of the truth from the earth itself . . ." Whatever his intention, King's book is certainly a controversial and partisan effort.

As one would expect, the author espouses the concept of continental drift and seeks to explain the major features of the earth's landscape on the basis of the movement of fragmented portions of the mother continent, Gondwanaland, during the time since the Mesozoic. In supporting his argument, the author ranges far. The list of topics approaches the contents of an extended course in geology. One topic is the structure of the earth's crust, including isostasy, igneous action, convection currents, and paleogeography; there is a structural and stratigraphic treatment of the shields throughout the world, and a summary of geosynclines, orogens, facies, and the orogenic cycle. We have discussions of subaerial erosion, of pediplanation versus peneplanation, of loess, soils, duricrusts, and the methods of dating land surfaces. Three hundred pages are used to sketch the salient landscape features of the continents, and another hundred treat the ocean basins. Short conclusions follow many of the sections, and 20 pages are given over to a final summary in the form of King's "Model of the Earth."

Two intimately interwoven and basic arguments face the reader. One is that the modern continents have in fact drifted. The other is that the major landscape features of the world must be explained in terms of this drift.

Arguments adduced to support the theory of continental drift are basically geologic in nature. In one form or another they have been presented at previous times in previous places. A few lines only refer to paleomagnetic studies which, since World War II, have made the discussion of continental drift possible on this continent. King refreshingly credits the geologic evidence with more validity than the physical evidence.

King reaffirms his belief in the pediplane and the process of pediplanation, and he sees Africa as the locale for the "type" of this land form and this process. In the fragments of Gondwanaland he sees remnants of the original surface, and on these fragments—the new and smaller continents—he sees continuing pediplanation as the process responsible for the major landscape features.

Probably no "native" will be satisfied with the brief treatment given his own "preserve," yet space would not permit otherwise. Some will object to small errors. Thus, in western America there may be unhappiness that the Colorado Plateaus have drifted into northeastern Colorado.

In general, I feel that those who do not believe in continental drift will remain unconvinced, that those who believe in the mechanism will applaud, and that those who are uncommitted will remain so, and I join King in his valedictory (presented in another context) "that UNKNOWN is for the present the last word."

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Revolution and Evolution

The Computer Revolution. Edmund C. Berkeley. Doubleday, Garden City, N.Y., 1962. xi + 249 pp. Illus. $4.50.

The Thinking Machine. John Pfeiffer. Lippincott, Philadelphia, 1962. x + 243 pp. Illus. $5.95.

Since 1949, when Berkeley's first book, *Giant Brains, or Machines That Think*, sold better than its publisher had expected, new books about computers have appeared almost as regularly as new computers. Unfortunately, books written for the layman frequently fail to relate the world of computers to the world of the reader. The two books reviewed here are quite different and overlap very little, but they have one important feature in common—neither Berkeley nor Pfeiffer seeks merely to dazzle the reader with superficial accounts of present accomplishments or future possibilities, but each quite deliberately views thinking machines as part of a total world of which the reader is also a part.

From the time of his first experience with the computer Mark I, at Harvard, Berkeley has urged that we must squarely face the social consequences of the "computer revolution." The revolution that Berkeley is talking about is not something that might happen in the future. It is happening right now, not somewhere else, but here in the world we live in.

Berkeley devotes the first part of his book to an excellent layman's introduction to the nature and capabilities of present-day data processing machines, including examples of various military and commercial applications. (An appendix lists 500 computer applications, arranged under broad categories.) To give the reader a first-hand awareness of the unbounded future, the second part of the book is devoted to "the discussing computer." Verbatim accounts of conversations on weather are introduced; these are followed by a clear explanation of how the computer program was organized for such discussion. Although this part is not light reading, to be skimmed without thinking, neither is it heavy reading.

With all of this background, the remaining two parts of the book take up the matter of the social implications of automation and the "social responsibilities of computer people." Here many who may agree that the ideals are above reproach will question the practical adequacy of the suggested solutions.

John Pfeiffer makes a quite different and unique contribution in *The Thinking Machine*. In 1960 the Columbia Broadcasting System's television network presented a one-hour program with the same title. Following both the content and the aim of that presentation, Pfeiffer has added a considerable amount of his own reporting to produce a well-integrated account of research and development involving "thinking machines." What computers may be doing in the market place today or tomorrow is not the prime concern of this veteran science writer. In three chapters, he quite easily, and well, covers the basic principles of stored program computers; Pfeiffer then proceeds to mathematics and logic, the search for patterns, varieties of models, artificial intelligence, games, strategies, and learning. This necessarily emphasizes that the computer's role is one of the most powerful tools available for advancing scientific knowledge. Then, without complicated details, Pfeiffer leads the reader to an understanding of how research work in genetics, neurology, and other biological areas has given new insight into the functioning

of living brains. The parallels between animate and inanimate thinking machines are clearly shown, but they are not forced.

Berkeley is writing about revolution, but Pfeiffer is writing about evolution: "The evolution of all other living things has depended on changes in their bodies. But man could evolve indefinitely without any such changes, with the brain he has now. Our kind of evolution depends on cultural changes, on what we learn, on the things we build. In a basic sense, human evolution *is* the evolution of machines, and of these, computers are the most significant. Perhaps more than anything else, the design of artificial-intelligence systems will determine our future as a species."

These books have much to recommend them to both the scientific specialist and the nonscientific layman.

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Cognitive Dissonance

Deterrents and Reinforcement. The psychology of insufficient reward. Douglas H. Lawrence and Leon Festinger. Stanford University Press, Stanford, Calif., 1962. vi + 180 pp. $4.75.

This book provides the converse of the familiar and much-debated attempt to apply theories based on animal research to the behavior of humans; it applies the theory of cognitive dissonance, which was originally developed for human attitudes and opinions, to several aspects of the behavior of rats. It deals principally with resistance to experimental extinction, taking as its point of departure the assertion that no previous theory has satisfactorily accounted for the fact that partial reward, delayed reward, and high effort during learning produce responses that are extremely persistent in the fact of repeated nonreinforcement.

Illustratively and sketchily, the assumption is this: a rat that is rewarded on only some of its trial runs down an alley to a goalbox will experience cognitive dissonance on those trials when it is not rewarded because the facts, running-for-food and not-getting-food, are in a dissonant relationship to each other. The authors assume that the rat is motivated to reduce this dissonance and that it will do so, as best it can, by finding extra attractions in the goalbox or in the activity itself. Then, if the original reward is removed, these extra attractions will provide a form of secondary reinforcement to maintain the response.

The book explains this approach in various situations and reports the results of a series of 15 studies designed to evaluate it. By and large the results of these studies are consistent with the stated expectations.

Beneath the surface there are several difficulties, some of them serious. For example, it is not clear whether dissonance results from rewards that is insufficient to the work done or to the level of reward expectation. In any event, expectations play an important role, but their properties are not described. Furthermore, it is not always clear when extra attractions will develop; for example, rats rewarded on every trial during learning could find extra attractions in the goalbox as a result of dissonance encountered on early extinction trials. Such uncertainties make it impossible to draw rigorous conclusions.

However, the authors are aware of many of these problems, and they are reasonably modest in their claims. A tentative and incomplete theory may be very stimulating to researchers. This will almost certainly be true of dissonance theory applied to animal behavior.

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On Ways To Study Man

Methodology in Human Genetics. W. J. Burdette, Ed. Holden-Day, San Francisco, Calif., 1962. 436 pp. $4.

This is a collection of 15 papers presented at the symposia held in Salt Lake City, 13 and 14 May 1960. The date of the meeting is not mentioned in the preface of the volume; consequently, the reader may not realize that two full years elapsed between presentation of the papers and their appearance in print. Such publication lags must be remedied in the future.

One common characteristic of these papers is, as the title implies, emphasis on methodology rather than on factual findings. Space here permits only bare mention of the author's name and one or two key words from the title of his paper. Thus, Lilienfeld: sampling and tests; Morton, segregation and linkage; Crow: selection; Steinberg: special cases; Newcombe: linked records; Novitski: computers; Roberts: inherited diseases; Herndon: empiric risks; Cox and MacLeod: susceptibility to infection; Neel: mutations; Ford: cytogenetics; Puck: cell cultures; Sutton: metabolic defects; Hill: hemoglobin structure; Boyd: soluble antigens. Motulsky, Gowen, Tjio, Patau, and others, made substantial contributions to the discussion.

Of course, methodology, the unifying theme of the symposium, has no concrete meaning by itself. Hence, the methodology presented in this volume covers mathematical formulations, sampling procedures, systems of filing records, statistical grinding, clinical diagnosis, microtechniques, tissue culture directions, and biochemical analyses. The papers are no more and no less heterogeneous than those in many other symposium volumes. Most of the papers are very general reviews, but some are carefully organized; some are hastily written, and a few others could have been given a few years earlier without any substantial revision. Nevertheless, I think each review serves a useful purpose.

Reading Novitski's account of computer programming is like reading a story on jaguar hunting in Paraguay. Even those who have never hunted, do not know where Paraguay is, and cannot be sure whether jaguar is a big cat or a motor vehicle, will find the story interesting and understandable.

Earlier genetic studies on susceptibility to infectious diseases in man have not been as fruitful as those on plants and animals where strictly controlled experimentation is possible. The impression that infectious diseases are not amiable to genetic analysis is partially due to the fact that the resultant disease itself has been taken as the object of study. Cox and MacLeod, however, have collected a host of examples to show that, if we study the underlying conditions of a particular organ (presumably having a genetic basis), which lead eventually to higher incidence of infection, then the phenomenon is just as amiable to genetic analysis as any other conditions. Outstanding examples are: In the case hypogammaglobulinemic children, the susceptibility to infections is due to a defective immune mechanism that is genetically controlled; among children with cystic fibrosis of the pancreas the suscepti-