25, and in appendix H it is stated to be a consequence of general relativity that, if the material content of the universe is increasing, its extent must be doing so. This is false because a basic postulate of general relativity is that mass cannot be created or destroyed, in Kapp's sense, though it is convertible into energy. Moreover it can be logically deduced from general relativity that the volume of space may be increasing or decreasing while the material content remains constant in amount. This occurs in the model universes of constant positive curvature. In other words, general relativity predicts no connection between the expansion of space and an increase or decrease in its material content. The interpretation of the red shift given on page 58 and the calculations on page 112 constitute an arbitrarily selected, special case from among the logically deducible predictions of general relativity. The statements on pages 73 and 74 imply that the intensity of a light source and the intensity of gravitation both fall off as the inverse square of the same "distance." That this is untrue is one of the most remarkable consequences logically deducible from general relativity. Lastly, it is to be noticed that, whenever a mathematical argument involving mechanics is carried out, the argument presupposes that classical mechanics is applicable, that is, that space must necessarily be Euclidean. Examples occur on pages 100, 101, 112, 113, 114, 183, 184, 220, and 221 and in chapter 21. Thus conclusions drawn from these arguments are not shown to be valid if Einstein's minimum assumption is adopted; they follow in fact from the Newtonian nonminimal assumption.

It is perhaps illegitimate in discussing a theory of this type to point out where basic starting points in the discussion are contrary to observation. One only will therefore be mentioned. It occurs on pages 126, 127, and 131 where it is said that spiral nebulae rotate as though they were composed of a viscous fluid and that they are in uniform rotation. Measurements have shown that these statements are untrue; indeed the nonuniformity of the rotation, for different distances from the axis, is one of the problems to be solved in any theory of the rotation of these objects.

The foregoing examples of the nonapplication by Kapp of his own rules and of his free use of the entries in the (forbidden) Cosmic Statute Book are far from exhaustive. Indeed there is hardly a page in the book on which the reader can fail to find an instance. These internal self-contradictions may perhaps be one of the reasons for the lack of interest in his ideas that Kapp has detected among scientists.

We have seen that Kapp expressly states a principle which Bondi, Hoyle, and Lyttleton also seem unconsciously to follow. It is the dictum that what is logically possible is also physically possible. At first sight the principle appears to be quite harmless, for it seems merely to say that we must examine any idea that occurs to us. In practice, scientists are human; it is as unpleasant for them as for the next man to admit that an idea, once formulated and published, is, after all, either useless or unimportant in science. Assuredly one of the remarkable features of science is that logical possibility is by itself insufficient; one may even say that three or four hundred years ago the founders of modern science were struggling to establish this insufficiency. They had grasped the notion that the physical world had to be closely and continuously inspected if it was to be understood. The temptation to substitute logic for observation is peculiarly hard to resist in astronomy. This is because astronomical data are very difficult to come by, and the data rapidly diminish in number and accuracy as the objects we observe recede from the earth. We need only reflect on the scantiness of the information we possess about our nearest planetary neighbors, Venus and Mars, compared with the wealth of physical data which geophysicists and meteorologists can supply about the earth. Nevertheless, the fact that data may be scarce and inaccurate is no reason for failing to use them as our main guides in the formulation of theory. Perhaps I may be allowed to close this long review with one final comment. Once upon a time British science was sometimes criticized for being too empirical. During the past 30 years a number of a priori theories of cosmology, of which the steady-state theory is one, have completely reversed the trend, which is a curious and unexpected development.

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Social Sciences and General

The Future of Mankind. Karl Jaspers. Translated by E. B. Ashton. University of Chicago Press, Chicago, Ill., 1961. ix + 342 pp. $5.95.

The problem of this book is what Jaspers calls "the new fact"—the possibility of the thermonuclear termination of human history. What is his solution? That takes a little longer to say, but it may be said briefly that there is no "solution," if solution means some new and cleverer plan, strategy, law, or institution based upon our present thinking. It is the thinking itself which must be changed. And the change in question is not a mere shift of ideas, but a change that will involve our deepest sense of life.

The great merit of the book lies in the earnestness and humility with which Jaspers faces the new fact, unmasks spurious solutions, and searches for the attitude that would make hope reasonable. To recover reason in a situation maddening enough seemingly to defeat all reason is the principal aim of the book, but the reason which is found is hardly anything that can be encapsulated in a phrase. The reader who expects a new plan of action comparable to existing alternatives will be disappointed; but it is exactly that expectation which Jaspers regards as profoundly mistaken and which must be seen through if any hope is to be justified.

Nuclear Extinction

The first step must be to face the new fact squarely and in its depth. The new fact is not the death of an individual man or the disappearance of a nation; it is the possible extinction of humanity through its own action. But everybody "knows" this; and yet Jaspers feels we do not know it at all. "Today we see politicians whose countenance and deportment baffle us. Do they know where they stand, what they

are doing? What are they thinking of? Invariably they show us laughing faces" (page 237).

Jaspers himself presents no "laughing face." He characterizes his attitude as beyond either pessimism or optimism; it is the resolute exploration of the possible, grounded on an absolute conviction of the worth of reason, freedom, and human dignity. We do not "know" the new fact until we have been shaken to the core by it. The idea of the imminent extinction of humanity is so shocking to our practical and vital intelligence that our instinctive attitude is to interpret it out of existence. On the one hand, since it is after all a mere possibility, we adopt the attitude that it is virtually impossible; it would never really happen. Or, on the other, when we take the possibility seriously, we sink into fatalistic despair: nothing can be done, it will either come of itself or not come at all; and if it comes, then that's it, the world is bound to perish anyway.

When these attitudes are perceived as essentially blinding and despondent, we look for "concrete solutions." Is not this a problem like any other? Intelligent men will find a way out. If science has created this new fact, more science will be able to cope with it. Or, if the inhuman uses of scientific discoveries are beyond the competence of science itself either to define or to control, political means will avail. "Moral progress must catch up with science . . . ." The United Nations, disarmament, treaties, individual sacrifice, or a new balance of terror will serve to ward it off. Everyone will see that it is to no one's advantage. No one will initiate the holocaust, out of self-interest.

And yet men so seldom are guided by anything like "self-interest." Thus, we find a profound ambiguity of thought on the highest political level; at one and the same time, we have integrated human annihilation into national policy as our supreme threat, and we continue to comfort ourselves that it will never be used. What, Jaspers asks, is the meaning of a threat which we intend never to use? Or of the United Nations? For Jaspers the U.N. is magnificent in words but in fact is nothing but the institutionalization of old politics, of "the principle of falsehood." The veto unmasks the lie; it is nothing but an elaborate device of national sovereignties to preserve their sovereignty.

Coupled with the possibility of total nuclear extinction is another of an equally absolute character. Men profoundly disagree on the sort of life worth living. If the new bombs could make life biologically impossible, the new totalitarianism could make it humanly worthless. Human freedom is the very essence of human dignity, and it is the only atmosphere within which men can live lives worth living.

Freedom itself is not, in Jaspers' view, a "natural faculty," like the web-spinning instincts of spiders. It is not inherent or inevitable. It has frequently been extinguished in the past and has risen again only from external sources. But now there are no external sources; the history of the past can be altered, and the globe is essentially occupied. Gandhi's action was meaningful only within the context of the British Empire, already permissive of forces which opposed it. The crushing of the Hungarian revolt in 1958 shows what can happen now. Freedom then is inherently precarious; and it is well within the possibility of present totalitarian methods to extinguish it altogether, once and for all. Human history would then terminate in another sense: we should no longer recognize the survivors as genuinely human.

The gravity of this problem is, needless to say, hardly met by the slogan of Bertrand Russell's movement: "Better Red than dead." One of the many refreshing virtues of Jaspers' book is the total absence of such simple and sloganistic formulas. Jaspers says: "Man is born to be free, and the free life, in the sense of existence—individual life as well as all life—can be staked and sacrificed for the sake of the life that is worth living" (page 169). But: "In all these arguments for and against the final risk, it must not be forgotten that both parties reckon with certainties that do not exist: with the total extinction of mankind by the superbombs or with the total corruption of humanity under total rule. Neither decision is *sure* to destroy either human life or a life worth living. No situation is absolutely hopeless" (page 167).

Man's Work and Nature's Work

Where then is the hope? Jaspers sees it alone in the cultivation and spread of what he calls "reason." Reason is not a new solution, but rather the inner attitude and atmosphere which must control every solution if it is to be a solution. Reason is not an affair of experts, logicians, scientists, technologists, or calculating machines but rather that final honesty which seeks to clarify our ultimate and common situation. It conceives of truthfulness as "what exists only in common. The individual can not be rational by himself." It is not "to agree with everyone, but to understand his meaning, and allow him his due." It is radically open: "The very adoption of final positions is already irrational." And, although radically open, it is yet the very principle of decisiveness: "The paradox of reason is to be open and to preserve freedom while binding itself so as to lead to a decision in the concrete historical moment." It is intolerant of intolerance alone.

Reason cannot be taught as though it were a doctrine, but it can be elicited by example and by appeal. At least such is the inherent hope of every reasonable man. Reason keeps its eyes on the whole, although that whole can never be adequately grasped. It is mere intelligence that loses sight of final ends, of life itself, of the totality of conditions of life in its pursuit of particular, realizable goals. It is reason that must control as well as animate mere intelligence if the great common disaster is to be held off.

Reason, for its part, is ultimately animated by a philosophic faith in Transcendence. We are human only through faith in what transcends the merely human, in God if that term could be stripped of all dogmatic connotations. We do not and cannot *know* God or God's will; but the faith and hope of human reason, its earnestness, honesty, search for the whole, and its inherent desire for freedom and communication are themselves manifestations of a philosophic faith in Transcendence. The impatience of reason with every form of dogmatism, whether scientific or religious, is a consequence of the perception of reason that Transcendence cannot be grasped, and yet it is the final value and reality.

In a word, then, Jaspers feels that human existence is facing a historically unique extremity; it is the magnitude of this extremity which, if explored, can possibly awaken us to the meaning of the human life that is now threatened. Only in the most earnest realization of the extremity will we recover that reason which is the basic condition of any possible solution. We must therefore become more human if we are to remain human at all.

The present extremity is not hopeless, since it is not a necessary event in nature but only a possibility, and a possibility which lies strictly within

man. "Atomic doom is not a necessary process that comes over us and has to be accepted. Every step depends on men who take it on the road to disaster. . . . We must recognize the difference between man's work which is up to us, and the work of nature which we can master only to a degree. We must not fail in what is up to us, by submitting to fate from the outset" (page 231). What we do with the new fact then is up to us—that is, up to our freedom, or, up to our ultimate reason. Hence the radical importance Jaspers places upon the development of reason in the individual and in society.

It is impossible in this brief résumé to give much of an idea of the inherent realism of Jaspers' thought; his analyses of the end of colonialism, of the corresponding changes in national economies, of truthfulness in politics, and of the questions of national sovereignty, disarmament, and the possible elimination of war as such, all show concretely his perception of the dilemmas involved in all partial solutions. Nothing will work reliably unless it is undertaken in the spirit of reason and freedom. But if the spirit of reason is dominant, then indeed, we cannot hope to continue as before; reason is not a new and more sophisticated interpretation of our old political life; if it is reason, then it is honest, and the old political life must be transformed profoundly and genuinely from within.

In all of this Jaspers does not speak from on high, but humbly presents the book as one contribution to the discussion of this most extreme of all problems. It will disappoint those who expected a new, unthought-of, and more clever plan. But it is written exactly against such modes of thinking. It will also disappoint those who expect a "philosophical" justification for their own religious, political, or scientific dogmatisms. Instead, the book itself is an example of the reason Jaspers is urging; it presents an earnest and relentless analysis of the situation, always to reveal at the end the basic condition on which solutions depend: the rational faith which must endlessly be cultivated and pursued.

Perhaps the book is too long and too repetitive; but Jaspers' point cannot be made quickly or through brilliant single phrases. E. B. Ashton has translated the book beautifully and idiomatically; there are only very occasional oddities of expression—"glacis," "cognoscibilities."

My own final feeling was that too much of the total analysis rests upon a contrast between "mere intelligence" which is "unreliable" and "reason" which is honest reliability itself. Mere intelligence cannot be guaranteed to assure us of the continuation of the human race. All strategems, institutions, laws can be misused by those not thoroughly penetrated by the spirit of reason, which, for its part, must live in the continuing awareness of extremity and must be animated by good will. But if we must count on such a magnificent inner transformation in mankind for human beings to survive at all, then indeed are we not already lost? For on the one hand, such honest reason is already the basis of the thinking of responsible statesmen, who do not *all* present "laughing faces"; and on the other, if we can only survive through the spread and intensification of reason, then indeed the future of mankind is staked exactly on those men of reasonable good will who would not endanger it in the first place.

Let us then imagine we have done our uttermost to cultivate the reason of extremity, the honesty and clarity about our total situation which Jaspers calls for; as such imagined reasonable men, what do we do now?

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An Elementary Russian Science Reader. I. B. Faden. Methuen, London, 1960. 62 pp. $1.

This unpretentious reader could be a happy discovery for those who, having mastered the essentials of Russian grammar, would like to start reading scientific Russian but do not yet feel up to tackling the "solid stuff."

Included are 46 very brief passages on a variety of topics involving elementary concepts of general science as presented to Russian school children. While one could hardly expect such contents to be excitingly interesting for adult scientists, many will appreciate the opportunity to amass a good deal of basic vocabulary, without pain, while they enjoy the satisfaction of finishing a given reading at one relatively short sitting.

Each passage is accompanied by a word list, and there is a useful word index at the end. The translations in the word lists are extremely well done. However, го́рная поро́да (page 10) should be translated as "rock," and the Russian expression for "until such time as" should be expanded to до тех пор, пока́ . . . не. It seems unfortunate that some eight words are not translated in the word lists of the passages where they first occur. These words are translated in later word lists. Incidentally, those who want to understand everything will undoubtedly need to use a dictionary, but perhaps not too often.

Trivial criticisms aside, this is a valuable little manual which should soften many an initial plunge into scientific Russian.

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Iceland Summer. Adventures of a bird painter. George Miksch Sutton. University of Oklahoma Press, Norman, 1961. xviii + 254 pp. Illus. $5.95.

Here is a delightful book about a 1958 adventure in Iceland, in company with the Olin Sewall Pettingills and such Icelandic naturalists as Finnur Gudmundsson and Árni Waag. George Miksch Sutton, professor of zoology at the University of Oklahoma, is an authority on boreal birds and a bird painter second to none. One aim of this voyage was to make a series of drawings showing the natal plumage of the many waterbirds and the juvenal plumage of the few song birds that breed in Iceland. Summer's end found over 30 drawings and two large boxes of bird skins prepared. The volume contains a magnificent colored frontispiece showing the gyrfalcon or *fálki*, Iceland's national bird, as well as superb portraits of the young of 17 other species. It is a pity that some of the latter were not also reproduced in color. Eight photographs (by Pettingill) help to depict the exotic country.

The text is equally charming, for Sutton writes with a gifted pen of this weird and beautiful country of contrasts—of hot springs and lava beds, of modern Reykjavík and remote Mývatn, of "the majesty of shining lakes and great white swans, of mountains rising abruptly from the meadowlands like huge cathedrals, of distant glaciers gleaming in the sun." He describes the celebration of Independence Day on 17 June, the day on which the Norse vikings first established their Althing (legislature) in the year 930. He tells

of a great black-backed gull attacked by a pair of whimbrels; of finding a redshank's nest deep in the grass. He recounts his thoughts while using a puffin chick as a model: "Though not quite shapeless, it looked as if evolution had been leading it headlong in that general direction for quite a while." Along the Fnjóská River a rare bird was discovered: "The gyrfalcon sat there with wings loosely folded, looking calmly, regally, off in the direction in which it had been headed, then toward us. Its perch was not dramatic in the least. The whole area was flat. The scene was not in any way 'composed'; there was nothing balanced about its few simple elements. But so beautiful was that single bird as it stood there, so majestic and powerful, that it needed no special lighting to give it appeal, no background of crag to make one hungry for a further look."

There is much else besides—of bird lore and general natural history, travel and adventure, good fellowship with true friends. Though quite unintentional, this sort of writing is the best diplomacy between diverse peoples today. Characteristically, Sutton has thoughtfully included a list of the common and technical names of all birds mentioned, with the Icelandic names of the 69 species found there—all but 14 of them waterbirds.

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The Export Economies. Their pattern of development in historical perspective. Jonathan V. Levin. Harvard University Press, Cambridge, Mass., 1960. 347 pp. $6.75.

The export economies are made up of a subset of underdeveloped countries whose advanced sectors (characterized by specialization of function and monetary exchange) are engaged primarily in the production of raw materials for export to advanced countries. These countries have received worldwide attention of late because many of them are currently going through substantial internal changes bordering on chaos, as in the case of the Congo, or they are actively engaged in wholesale expropriation of foreign owned enterprises within their control, as in Cuba. Levin has attempted to advance the understanding of their development, or lack of it, through the method of historical generalization. By investigating the economic history of some of these countries, Peru and Burma in particular, he hoped to distill a framework of behavior that could be considered as typical for this type of country.

The origin of the export trade usually sprang from the discovery of a natural resource crucial to the production of a product already greatly desired in the advanced countries. The areas where the resource was found, however, were backward in the extreme and were unable to supply the capital, the entrepreneurship, and in some cases the labor to transform the resource into an earning asset. These needed factors of production quite naturally came from abroad and had the effect of grafting an advanced foreign sector onto a primitive economy. Except for the payment of local taxes, the domestic economies gained very little from this development. The foreign factors of production either remitted their returns to the originating country or consumed imported products, but they did not stimulate production in the export economy. Within recent years, these countries have learned to capture a larger share of the export value through government regulation of the foreign factors or by direct government participation in the export industry, replacing the function and thereby earning the rewards previously going abroad.

Levin has no doubt adequately described the major factors in the development of the export trade in the countries he studied. I would disagree with him, however, as to the interpretation of why the indigenous labor of Peru did not respond to the opportunities of employment in the guano mines. He attributes this to the culturally determined unwillingness to leave their subsistence way of life. This evidence just as easily, or preferably, could be interpreted to mean that the wage incentives offered were too low to attract them. The major criticism that I find with Levin's work, however, is that it fails to explain why some other countries that have had all the pre-existing conditions of the countries described did in fact develop much differently in response to the export trade stimulus, namely the United States, Canada, and Australia. While it is true that many countries did follow the described pattern, the crucial question of why they did remains unanswered.

The book is quite readable, particularly the descriptive chapters 2 and 5. The historical generalizations in chapters 3 and 6 are also well done. The theoretical treatment, primarily in chapter 4, however, is disappointing, for it tends to be repetitious and Levin insists on fighting a battle over a nonexisting difference with traditional theory concerning the location of export industries.

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Trends in Government Financing. Morris A. Copeland. Princeton University Press, Princeton, N.J., 1961. xxvi + 210 pp. $5.

The National Bureau of Economic Research initiated, 10 years ago, a major study of the trends and prospects in capital formation and financing in the American economy. Copeland's volume is part of this project. It is, however, also of value in its own right. Copeland presents governmental—federal, state, and local—expenditures, receipts, and financial requirements covering the period from 1890 to 1950 for most of his data. Simon Kuznets points, in a preface, to the rising absolute and relative importance of government as a borrower. From 1900 to 1955 the liabilities of the government sector increased from 9 to 28 percent of total liabilities. In the same period the government's share in all tangible assets (excluding consumer durables) increased from 9 to 17 percent. On the basis of Copeland's study Kuznets concludes that "the role of governments is bound to become greater." I personally would limit this prediction to the nondefense sector of government because there is little basis for making long-term predictions about the relation of defense programs to the growth of the economy as a whole.

Copeland's study not only presents the facts but also demonstrates the need for clarification of basic concepts. For instance, the federal government publishes four different deficit or surplus computations. Copeland questions the political use of the term *deficit financing* and suggests that, in line with business practices, a distinction should be made between government borrowing to finance capital outlays, to meet emergencies, and to bridge temporary budget deficits. Because deficits or surpluses cannot be used as the criterion for good or bad policy, Copeland in-

troduces the qualitative terms *orderly* and *disorderly finance* and applies these terms quite successfully to a characterization of the financial policies of various local governments. While this is essentially a historical study, it offers many stimulating ideas for improvements in fiscal accounting, fiscal procedures, and fiscal policies.

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Fights, Games, and Debates. Anatol Rapoport. University of Michigan Press, Ann Arbor, 1960. 400 pp. $6.95.

Rapoport distinguishes three basic types of human conflict. The first, which he calls "fight," is dominated by a blind, destructive impuse to eliminate an opponent with whom one has nothing in common. In the second, opponents sharing a common set of rules seek to get the best of each other by applying appropriate strategies; for this kind of conflict, Rapoport uses the label "game." Finally, in a third variant of the basic theme of conflict, the objective is to reorient the opponent's thinking, to make him agree with *our* point of view which he rejects: this is what a "debate" is about.

In the first two parts of the book, dealing with "fights" and "games" respectively, Rapoport does not analyze fight-type and game-type conflicts but discusses two different theoretical approaches to the problem of human conflict: L. F. Richardson's mathematico-physical approach, and the theory of games. His treatment of both is a model of lucid exposition and judicious critique. The uninitiated will find in these parts of Rapoport's book an excellent introduction to Richardson's ideas and to the basic concepts of game theory, but those familiar with either will also learn much from his critical remarks.

The third part, devoted to "debates," represents an original venture into uncharted seas; necessarily so, since no formally elaborated theories comparable to Richardson's analysis of armament races and "deadly quarrels," or to the von Neumann-Morgenstern theory of games, exist in this field. Nor does Rapoport attempt to construct a rigorous axiomatic-deductive model of "debate" as a type of conflict; the subject indeed does not seem to lend itself well to this. Rapoport chooses the clinical approach instead. He distinguishes three types of debate, "brainwashing," "explaining the image away," and "removing the threats associated with alternative images." These correspond to Pavlovian conditioning, Freudian psychoanalysis, and "non-directive" psychotherapy (C. R. Rogers), respectively.

By distinguishing the "debate" as a separate category, Rapoport has made an important addition to the theory of conflict. It is clear that when our aim is to persuade or convert, we are neither acting "blindly" nor applying payoff-maximizing strategies. What Rapoport has to say about reorientation in general and Pavlovian, Freudian, and nondirective reorientation techniques in particular is also instructive and illuminating. Yet it seems to me regrettable that he put the analysis of "debate" in a framework of clinical psychology. Conflict is not of the essence of the clinical (experimental or therapeutic) situation; it may only be incidental to the clinical setting. The basic model of "debate" as a form of conflict is still the Socratic dialogue, and we need an elucidation of the logical and existential structure of this before we can fruitfully turn to the "debate" aspects of clinical psychology.

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Taylor's Encyclopedia of Gardening. Norman Taylor, Ed. Houghton Mifflin, Boston, Mass., ed. 4, 1961. xiv + 1329 pp. Illus. $15.

With limited review space available in journals and almost everyone pressed for time, new editions of standard reference works customarily receive no more than a citation. In this instance, however, something more should be said.

Those interested in gardening probably know that Norman Taylor's one-volume encyclopedia is an authoritative, helpful reference volume for both amateurs and professionals. This new edition is a substantial revision in that the entire text, before resetting, received the editor's scrutiny; the number of plant species and varieties was increased by about 10 percent (over 9000 are now included); new gardening techniques and products are described. For example, the articles on pests and insecticides have been simplified and updated, and throughout the text references to sprays and dusts are given by key numbers. In addition to the 500 line drawings, maps, and diagrams, there are now 48 handsome color plates—nearly 100 flower paintings by Eduardo Salgado and over 60 photographs of gardens. Doubtless the photographs are intended to encourage all readers to realize what gardens can be under optimum conditions. One hopes the price will not discourage those interested. After all, for *each* of the 15 dollars, there are over 1000 entries or about 66,667 words.

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The Emerging States of French Equatorial Africa. Virginia Thompson and Richard Adloff. Stanford University Press, Stanford, Calif., 1960. 595 pp. $8.75.

Of all those arbitrary regions by which Europe affixed its claims to the African continent, one of the least known is French Equatorial Africa. The name, which has a precise and firm ring to it, suggests a cohesive entity, a people sharing a common tradition and shaping a common future.

Concerning things African, our vocabulary is frequently misleading; our labels conceal reality rather than illuminate it. French Equatorial Africa is a vast, inchoate area nearly one-third the size of the United States, strung out from the Congo River, well below the Equator, to the Tropic of Cancer. No more than 5 million Africans live there (about five to every square mile), representing a potpourri of tribes and having the most questionable of credentials for statehood. Yet such is the power of an idea in this age of the territorial state and independence-for-everyone that French Equatorial Africa, almost against its will, has suddenly been transformed into four sovereignties: Gabon, the Republic of the Congo (Brazzaville, not Leopoldville), the Central African Republic, and Chad.

It is high time we knew more of this area—the more so because it abuts the strife-torn Congo (the former Belgian territory). Thompson and Adloff's book, *The Emerging States of French Equatorial Africa,* is thus remarkably timely.

This is a ponderous book, perhaps unnecessarily so. Parts of it arouse as

much interest and enthusiasm as would a reading of the Manhattan Telephone Directory. But the book, like its predecessor and companion work, *French West Africa*, does not claim to be more than it is—not an interpretative study and not a political history (though the more important developments are well recorded), but a reference book. As such, it is the useful result of patient clipping, gathering, filing, and collating —a massive catalog of basic information; and thus an indispensable volume for scholars and analysts.

Part 1 is a review of institutions and development at the regional level, including all the principal categories in political, economic, and social analysis. Part 2, with some unavoidable duplication, arranges many of the same materials within the context of each of the former territories and summarizes the main developments in territorial politics. The volume includes a comprehensive bibliography.

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The Application of Quantitative Methods in Archaeology. Viking Fund Publications in Anthropology, No. 28. Robert F. Heizer and Sherburne F. Cook, Eds. Quadrangle Books, Chicago, Ill., 1960. x + 358 pp. Illus.

In 1959 the Wenner-Gren Foundation sponsored a 9-day meeting in Austria for the editors of this volume and ten other scholars selected by them. The results are published here in the form of 12 articles, along with discussions by the participants and a short list of "recommendations." The latter are primarily a plea for more rigorous analytical methodology.

Of the articles, six have their major emphasis on chemistry (of bone, soils, metals, and stone); four are primarily statistical (descriptions of artifacts and prehistoric populations); one is on chronology; and two are general (dealing with ceramics and habitation refuse). The unifying feature is that all the papers are concerned with the central problem of extracting a greater amount of information (and inference) from the scrappy residues of human activity collected from archeological sites. Since this is the major problem of archeological methodology, a broad-scale contribution such as this is most useful and most welcome.

Except for the over-all goal, however, there is little linkage between the individual contributions, for they treat several specialized techniques, each having separate laboratory methodologies, vocabularies, and research objectives. In this case uneveness is intensified because a small number of scholars have tackled an extremely broad subject, which here includes nearly all aspects of archeological collecting and analyzing. The expression of individual research interests in the papers is only partly offset by the group discussions at the end.

Despite the fact that all archeology is a sampling operation and an attempt to interpret the whole from the parts, archeologists have been remarkably resistant to the ideas of the few scholars who have stressed better control of the archeological sample and better use of sampling in interpretation. A principal contribution of this volume is its attention to sampling procedures, mentioned or referred to throughout the papers. A. C. Spaulding's paper on statistical description and comparison of artifact assemblages provides a good basis for more sophisticated analysis of archeological samples. As he points out, and as the rest of the papers affirm, archeology has now come to that stage of development which requires increased attention to quantitative methods.

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Museum Directory of the United States and Canada. Erwin O. Christensen, Ed. American Association of Museums (Smithsonian Institution), Washington, D.C., 1961. xx + 567 pp. $8.

The more than 4500 entries cover institutions in the entire museum field —art, history, science, and special fields, as well as college and university museums, botanical gardens, art centers and associations, and the like. Arrangement is alphabetical, by state and within each state by city. Alphabetical lists of institutions by categories are included. The main entry for each institution provides such information as the date founded, mailing address, name of the director, classification of major collections, publications, and visiting hours and fees.

Abstracts of New World Archaeology. vol. 1, 1959. Richard B. Woodbury, Ed. Society for American Archaeology, University of Utah Press, Salt Lake City, 1960. vi + 127 pp. Paper, $3.50.

The scope and aim of the abstracts is to include all published titles dealing expressly with New World archeology, including master's and doctor's theses. Presentations on theory, methods, and techniques will be included if they are pertinent to New World problems. The arrangement is geographical, with titles arranged alphabetically by author. An index of authors is included.

Visual Space Perception. William H. Ittelson. Springer, New York, 1960. 212 pp. $6.

This monograph ranges over the area of space perception, maintaining the general view that is characteristic of Adelbert Ames (to whom the book is dedicated). The attitude is said to be *functional* or *transactional*, and may be characterized by this direct quotation: "Perceiving is that part of the process of living by which each one of us from his own particular point of view creates for himself the world in which he has his life's experiences and through which he strives to gain his satisfactions" (page 19).

The monograph is divided into three parts. The first three chapters discuss the perceptual process and are, in a sense, an elaboration of the quotation given above. Part 2, the body of the monograph, covers the conventional visual space cues, but in a fresh manner that stems from Ames's fundamental question, "Given a perception, what is the related physical world?" (page 113). Part 3 brings out the role of attitudes and motivation in perception. It starts with a discussion of the possible resolutions of conflicting perceptual cues, such as size and convergence, and ends with a discussion of experiments with a stereoscope in which two faces of varying degrees of familiarity and emotional value are found to exhibit characteristic degrees of fusion and rivalry.

In the introduction Ittelson states that several sections of the present book have been adapted from his previous publications made with associates. This may account for the fact that many of his most significant statements seem

overly terse, abstract, and dogmatic. He also has an annoying habit of citing people without keying the citation to the list of references at the end of the book. The failure to document experiments outside the "in-group" is especially serious in view of Ittelson's arbitrary summaries of these experiments. He spends more space on the details of the experiments of his own group, but warns that the reader should examine the original experiments. I second this warning.

Incidentally, a rough count of his 144 cited references shows that more than a quarter of them belong to what may loosely be called the Ames group and that Ittelson was author or coauthor of a dozen of them. So we may be led to accept this as a definitive summary of the neofunctional or transactional approach to perception. However, we may question whether it does full justice to the important insights that this approach has achieved.

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College Textbooks. Compiled by Jane Clapp. Scarecrow Press, New York, 1960. 1096 pp. $25.

A classified listing of 16,000 textbooks used in 60 colleges, with author-title and subject indexes. The books are classified under three major headings: humanities, sciences, professional and technical fields.

Biological Sciences

The Wellsprings of Life. Isaac Asimov. Abelard-Schuman, New York, 1961. 238 pp. Illus. $3.75.

The Long Road to Man. Robert L. Lehrman. Basic Books, New York, 1961. 200 pp. Illus. $3.95.

These two books are both intended to convey present knowledge of organic evolution to laymen, but otherwise they are extraordinarily different. Lehrman's book is simple both in language and in thought, at times to the point of naiveté, and it is pitched at a low scholastic level. It is published in a series advertised by the publisher as intended "for teen-agers (and grown-up readers as well)." Asimov's book, although equally comprehensible, is a sophisticated, intelligently adult work. Lehrman tells a straightforward story of the long phylogeny of man. Asimov slides quickly over that subject and is almost entirely intent on underlying functions, for the most part in terms of the research that has revealed them. The juxtaposition of the two books emphasizes the great complexity of their common subject, for there is little duplication between them and both together still omit large and important parts of the subject.

After an introductory chapter, Lehrman devotes the next 10 of his 14 chapters to a summary of the fossil record of the groups in or near the human ancestry. The 12th chapter deals with ways of supplementing the fossil record by evolutionary interpretation of recent animals, especially of their embryology, and then briefly discusses the origin of the chordates. Chapter 13 reviews the whole story from the origin of life to *Homo sapiens,* by a combined approach. The themes of the last chapter are that man's coming was an evolutionary revolution, that our biological evolution ends here, and that purely cultural evolution now takes over and alone determines our future.

This storybook restatement of the evolutionary history of man is welcome. Lehrman's book is also generally up-to-date, and it is admirable in some other respects, for example, in much of its handling of sequence and local variation in fossil hominids. It is usually accurate, but by no means wholly so. I noted more than 40 errors, by which I do not mean statements open to misunderstanding, exception, or dispute (which are also rather numerous) but such downright mistakes as the remark that reptiles have their skulls supported on two bony projections (occipital condyles) and amphibians on one, or that *Cynognathus* had flat-topped molars—not world-shaking errors, but they do count up.

It seems to be almost inevitable in popularization of this sort that a few pseudo-Lamarckian and anthropomorphic or teleological phrases slip in: the environment converts a creature into something else; an animal retains such of its heritage as it finds useful. Lehrman's remarks on evolutionary processes do properly stress the interplay of mutation and natural selection, but he misrepresents natural selection as tending always to eliminate variation and leading inevitably to overspecialization. His belief that no natural selection or indeed no biological evolution is occurring in modern man is shared by few biologists and will be considered a dangerous doctrine by many of them. The book would have been more satisfactory if it either had stuck entirely to its main, descriptively historical theme or had given a more adequate and more insightful interpretation of the history.

The book by Asimov, quite different in approach and intellectual content, has also different merits and shortcomings. Asimov is one of our natural wonders and national resources. By profession he is listed as a university professor of chemistry. It is presumably in his spare time that he turns out three or four books and one or two dozen articles per year. He was once one of the prolific pioneers of modern, literate science fiction. He has gone on to become probably the most prolific and certainly among the best of the literate popularizers of science fact and theory. He is most at home in the physical sciences, but his works now embrace practically all fields of natural science and some others.

In the present book, with important omissions to be noted later, Asimov briefly spans much of the field of evolutionary biology. Here, as usual, his style is clear without sacrifice of solid content. He is continuously interesting and occasionally amusing without condescension or jocular superficiality.

The organization of the book is by decreasing levels of complexity and integration, starting with species and higher aggregations of populations of whole organisms and ending at the molecular level and, in particular, with deoxyribonucleic acid or DNA, presented as the ultimate physiochemical basis of evolution. The approach at each level is in the main historical, in terms of the successive discoveries of about 100 biologists and physical scientists. An appendix telegraphically lists workers and events in the history of evolutionary biology chronologically from 1630 ("Archbishop James Ussher calculates date of Creation as 4004 B.C.") to 1960 ("O. Struve plans radio telescope survey to detect life in other stellar systems").

The bulk of the book is in three parts of five chapters each (a symmetry achieved at some sacrifice of logic): Life and the Species; Life and the Cell; Life and the Molecule. A final part, headed simply "Life," deals in one chapter with the origin of life, on earth and speculatively elsewhere. The scope and trend of the story may be suggested by a partial list of topics and authorities discussed in sequence. Spontaneous generation: Aristotle, Redi, van Leeuwen-