Creativity: The Juxtaposition and Integration of Disparate Categories

In **The Act of Creation** (Macmillan, New York, 1964. 751 pp. $8.95) Arthur Koestler has picked up and extended, after 15 years, the theory proposed in his *Insight and Outlook*, a return postponed by his desire to base the theory on a broader foundation. The new foundation is broad indeed, and the author's erudition in biology, psychology, the history of science, literature, and the arts makes this an impressive volume, justifying the words of admiration by Sir Cyril Burt, who writes a foreword for it.

The exposition proceeds in two stages, the first a patterned collection of literary essays (Book 1, in three parts with 24 chapters covering 409 pages), the second better described as a critical scientific treatise (Book 2, with 18 chapters covering 247 pages). There are also two major appendices, the first on the history of electricity as an illustration of the scientific mind at work, the second giving some vignettes from the lives of scientists. Finally there is the scholarly apparatus of references to sources used in each chapter, an alphabetical list of works mentioned, and a special set of references on the psychology and physiology of weeping.

The central theme that emerges, although it is often lost in meandering digressions, is that creativity is the result of combining two modes of thought or categorizations (matrices) that do not normally belong together. This combination, named *bisociation*, confronts disparate ideas and permits the detection of analogies where they were not noted before, and out of this confrontation, juxtaposition, or synthesis of unlike matrices comes the creative act. A *matrix* is governed by a *code* of fixed rules, but the matrix is flexible. A spider that can suspend its web from various anchorage points illustrates the flexibility inherent in a matrix; its web-building is governed by a fixed code, however, so that the web form must turn out in every instance to be polygonal. Within a matrix everything is self-consistent because of the rules of the code, but two matrices may be incompatible. These incompatibilities provide the occasion for bisociation and the creative act.

In human creativity it is common for the juxtaposed matrices to represent the ancient contrasts between the rational and the irrational, the conscious and the unconscious. Thus, out of the playful fantasy of snakes grasping their own tails in his dream as he dozed before the fire, Kekule discovered the ring solution for the formula of benzene. Those who worship the rational over the irrational may object to Koestler's emphasis on the role of "underground games," yet I think they miss the point that one has not abandoned rationality when he turns to poetry for inspiration, or to dreams for a fresh approach. The rationality comes later, in sweeping up and in ordering and testing the fresh insights that have appeared. It is one of the awkwardnesses of psychology as a science that owing to the anticipations of philosophers and thinkers throughout the ages profound discoveries are very rare; the problems of psychology are too close to home to have been neglected, although by the same token the solutions to psychological problems are slow to achieve objective verification because every thinker is his own psychologist and clings strongly to his own interpretations. Koestler's solution to the problem of creativity is bolstered by many anticipations (by Alexander Bain, William James, Jacques Hadamard, Ernest Jones, and even A. F. Osborn, to mention only a few); these anticipations give his ideas support, without detracting from the originality with which he has assembled evidence from far flung sources. James cites Bain, for example, as saying that a native talent for perceiving analogies is the leading fact in genius of every order. James goes on to say that the genius can perceive in an unhabitual way. Here are early recognitions of the idea of bisociation.

The first book, admittedly less thorough as science than the second, has more of the writer's flair, and it does for psychologists what they cannot do for themselves. This is what we ask of the humanist turned scientist; perhaps we are a little snobbish (by Koestler's own definition of a snob as someone who mixes up standards of value by misapplying one standard where another is appropriate) when he writes as we do, hence poaches on our territory; he ought not to know so much psychology. When he writes as a psychologist he invites criticism where we can use our sharpest tools, for then we know what, with all his erudition, he has left out.

The first book marches, as the second book does not; it moves from the comic, through the scientist, to the artist, in three bold steps. Here there is some whimsey, but the ideas are more novel and the insights deeper than in his learned forays into genetics, developmental biology, and systematic psychology in the second book. In this first book we see the comic as a self-assertive and essentially aggressive person; he is creative as critic, well exemplified in the court jester or the caricaturist, and, indeed, "the Jester is brother to the Sage." The scientist, although affectively more neutral, combines self-assertion and self-transcendence, as at once the Mad Professor and the Benevolent Magician. Koestler, whose knowledge of the history of science is profound, is against the separation of the "two cultures," and he sees that the creative acts of scientists and humanists are very similar, although "technical jargon, antiquated teaching methods, cultural prejudice" give the scientist's creativity less audience appeal than the humanist's. Finally, the artist is at the pole of self transcendence; if laughter is the sign of the comic, the moist eye of rapture introduces the essence of the esthetic experience; the one pole is that of *bathos*, the other that of *pathos*.

The discussion of laughter takes off from a very astute observation that laughter is a physiologically lopsided phenomenon: a complicated activity "like the reading of a page of Thurber" can produce a quite specific motor response of essentially reflex type. Usu-

ally the events go the other way: a conditioned stimulus of specific sort can be the signal for varied activity, while here the stereotyped activity takes place to a great variety of cues. There follows a brilliant discussion of laughter and the nature of the humor, and here our psychology textbooks are very weak by comparison.

Weeping is distinguished from crying, and the occasions for weeping are discussed in detail. Here again we find topics searchingly examined that ought to be, but are not, found in experimental psychology, and the special bibliography is provided to call attention to the lack.

Many of these discussions are only marginally related to the central topic of creativity, although an occasional summary attempts to show their relevance. The lack of a strong pattern of organization that lets the reader know where he is in the argument is one of the book's weaknesses; the author has much to say and says it where it occurs to him (and I am pleased that he does), but the book is lacking in classical quality as a result of this divagation. One summary (among many) places the creativity of the comic, the scientist, and the artist in this perspective: "We have seen how laughter is sparked off by the collision of matrices; discovery, by their integration; aesthetic experience, by their juxtaposition" (p. 408). Such a condensed statement is gradually enriched in meaning as one reads through the book; there are many such *prägnant* statements for the reader to ponder over.

The second book, which the author notes could not be written without some pedantry, is an ambitious effort to root the thesis of the first book in the facts of biology, to show that the basic principles of creativity are exhibited at all levels of biological organization from the fertilized cell to the adult brain. At all levels there is unused potential, whether in the material latent in the genes which is used when the organism faces new demands upon it, or in the possibility of returning again to the growth processes of the embryo as when, following injury, regeneration is demanded. A favorite way of summarizing these effects is *reculer pour mieux sauter* (to draw back in order better to advance), so that experimental results with primitive organisms give a scientific underpinning for what the psychoanalyst Kris has called regression in the service of the ego. An amazing amount of scientific knowledge is crammed into these pages, but, as I have already indicated, they were not for me the most illuminating. That is not to say that the evidence is superficial or inadequately mastered; there is no doubt that Koestler has been to the sources and has talked with many of those who have done the primary experiments. It is rather that there is something very tricky about the notion of hierarchial organization, with each succeeding stage somehow anticipated in the earlier ones; one is reminded of some of the romanticism associated with the doctrine of emergent evolution in the 1920's. The restitution of function with nerve transplantation is a case in point; Koestler is most optimistic about reorganization of function when he wishes it to support his theory (pp. 457 to 460), but, where the evidence runs counter, he finds this limited flexibility a beautiful illustration of autonomy (p. 444). How does one pick and choose, when by analogy we move to higher mental processes?

The examination of psychology takes him through instinct, imprinting, motivation, perception and memory, motor skills, learning to speak, learning to think, and critical chapters on psychological theory. This is a large order. In keeping with his critic's role, familiar whether he is looking at Communism, the Kibbutz of Israel, or oriental religion, we find him casting a cold eye on much of academic psychology. He notes the decline of the reflex (yet its persisting influence upon S-R psychology), the pitfalls of learning theory ("rarely in the history of science has a more ambitious theory been built on shakier foundations"), and the pitfalls of Gestalt (which, despite its acknowledgment of insight, misses the boat because of Köhler's nativistic emphasis upon isomorphism). The issues that he raises all seem to be legitimate ones; it seems too much to ask of him as critic that he should present an entirely balanced argument or be kind to everyone. Even though he fails to cite much of the contemporary psychological literature on creativity, it would take a hearty spirit to say that he would have been much edified by what he missed.

Reading the book is a rich experience, for the author wanders widely through science, art, and literature, uses charming and varied analogies, and says countless quotable things. If his book is not the last word on creativity, that is not much of a weakness. It is a serious work, immensely learned and thoughtful; if perhaps a little pretentious as a work of science, it places at the disposal of psychologists and other scientists the matured thoughts on creativity by one who himself possesses the creative gift.

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Botany

Common Trees of Puerto Rico and the Virgin Islands. Elbert L. Little, Jr., and Frank H. Wadsworth. U.S. Department of Agriculture, Washington, D.C., 1964 (order from Government Printing Office, Washington, D.C.). x + 548 pp. Illus. $4.25.

The authors have selected 250 species of "the commoner and more important native and exotic tree species, those most likely to be seen" to illustrate and describe in their book, and with these they compare an additional 130 related species. The 72 exotic species that are included are of pantropical distribution and, as only 28 species of native plants are endemic, this book will be useful in many areas throughout the Caribbean region.

The plan of the book provides, for each of the 250 selected species, an illustration of approximately natural size, accompanied by a page of excellent descriptive material, and, for 100 of these species, a distribution map that indicates the municipalities in which each occurs. For each species a single scientific name, which does not necessarily agree with the most recent taxonomic revisions, is given as well as a "preferred common name" in both English and Spanish. Additional common names used in Puerto Rico and other areas of the American tropics are also listed. Botanical synonyms, including the names used in Britton and Wilson's *Flora of Puerto Rico and the Virgin Islands*, are given. Keys are provided for the species illustrated in each family. The botanical descriptions emphasize the characteristics useful in recognizing the family, genus, or species; consider the size and appearance of the tree, its leaves, flowers, and fruit; and include original and compiled notes on bark, latex, fiber, odor,