

CHAPTER FOURTEEN

THE THREE DOMAINS OF CREATIVITY¹

Arthur Koestler

I *Introduction*

This paper attempts to give a condensed outline of a theory I have set out in detail in my book on creativity and to carry that theory to the next step.² The proposition I shall submit is, in a nutshell, that the conscious and unconscious processes which enter into all three forms of creative activity have a basic pattern in common. When I speak of *three* forms of creativity, I mean the domains of artistic originality, scientific discovery, and comic inspiration. I believe that all creative activity falls into one or another of these three categories or, more frequently, into some combination of them. If you speak, for instance, of cooking as ‘creative,’ you automatically imply that cooking is either an art, or a science, or both.

As a first step toward describing that pattern, let us try something simple like this: The creative act consists in combining previously unrelated structures in such a way that you get more out of the emergent whole than you have put in. This sounds like making a *perpetuum mobile*, and in a sense it is, because mental evolution, like biological evolution, seems to contradict the second law of thermodynamics, which contends that the universe is running down as if afflicted by mental fatigue. But we will not go into this; instead, let me illustrate by a few schoolbook examples what I mean by combining two previously unrelated structures.

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² Arthur Koestler, *The Act of Creation* (New York: Macmillan, 1964).

II *Association and Bisociation*

The motions of the tides have been known to man since time immemorial. So have the motions of the moon. But the idea to relate the two, the idea that the tides were due to the attraction of the moon, occurred, as far as we know, for the first time to a German astronomer in the seventeenth century, and when Galileo read about it, he laughed it off as an occult fancy.³ Moral: The more familiar each of the previously unrelated structures are, the more striking the new synthesis and the more obvious it seems in the driver's mirror of hindsight.

The history of science is a history of marriages between ideas, which were previously strangers to each other, and frequently considered incompatible. Lodestones—magnets—were known in antiquity as some curiosity of nature. During the Middle Ages, they were used for two purposes: as navigators' compasses and as a means to attract an estranged wife back to her husband. Equally well known were the curious properties of amber, which, when rubbed, acquires the virtue of attracting flimsy objects. The Greek word for amber is *elektron*, but the Greeks were not much interested in electricity, nor were the Middle Ages. For nearly two thousand years, electricity and magnetism were considered separate phenomena, in no way related to each other. In 1820, Hans Christian Oersted discovered that an electric current flowing through a wire deflected a compass needle, which happened to be lying on his table. At that moment the two contexts began to fuse into one—electromagnetism—creating a kind of chain reaction which is still continuing and gaining in momentum; forever amber.

From Pythagoras, who combined arithmetic and geometry, to Einstein, who unified energy and matter in a single sinister equation, the pattern is always the same. The Latin word *cogito* comes from *coagitare*, 'to shake together.' The creative act does not create something out of nothing, like the God of the Old Testament; it combines, reshuffles, and relates already existing but hitherto separate ideas, facts, frames of perception, associative contexts. This act of cross-fertilization—or self-fertilization within a single brain—seems to be the essence of creativity. I have proposed for it the term *bisociation*. It is not a pretty word, but it helps us to make a distinction between the sudden leap

³ I owe the term "*Haha* reaction" to Dr. Brenning James's paper, "The Function of Jokes," (unpublished), which he kindly sent me.

of the creative act and the more normal, more pedestrian, associative routines of thinking.

The difference between the two could be described as follows: Orderly thinking (as distinct from daydreaming) is always controlled by certain rules of the game. In the psychological laboratory, the experimenter lays down the rule: 'name opposites.' Then he says 'dark,' and the subject promptly says, 'light.' But if the rule is 'synonyms,' then the subject will associate 'dark' with 'black' or 'night' or 'shadow.' To talk of stimuli in a vacuum is meaningless; what response a stimulus will evoke depends on the game we are playing at the time.

But we do not live in laboratories where the rules of the game are laid down by explicit orders; in normal life, the rules control our thinking unconsciously—and there's the rub. When talking, the laws of grammar and syntax function below the level of awareness, in the gaps between the words. So do certain simple rules of common or garden-variety logic and of courtesy and convention, and also the complex and specialized rules which we call 'frames of reference' or 'universes of discourse' or 'thinking in terms of' this or that—of physiological explanations or ethical value judgments. All thinking is playing a game according to fixed rules and more or less flexible strategies. The game of chess allows you a vast number of strategic choices among the moves permitted by the rules, but there is a limit to them. There are hopeless situations in chess when the most subtle strategies will not save you—short of offering your opponent a jumbo-sized martini. Now in fact there is no rule in chess preventing you from offering your opponent a martini. But making a person drunk while remaining sober oneself is a different sort of game with a different context. Combining the two games is a bisociation. In other words, associative routine means thinking according to a given set of rules, on a single plane, as it were. The bisociative act means combining two different sets of rules, to live on several planes at once.

III *Three Kinds of Reactions*

I do not mean to belittle the value of law-abiding routines. They lend coherence and stability to behavior and structured order to thought. But they have their obvious limitations. For one thing, every game tends to become monotonous after awhile and fails to satisfy the artist's craving for self-expression and the scientist's search for explanations. In

the second place, the world moves on, and new problems arise which cannot be solved within the conventional frames of reference by applying to them the accepted rules of the game. Then a crisis occurs: The position on the scientist's checkerboard is blocked; the artist's vision is blurred; the search is on, the fumbling and groping for that happy combination of ideas—of lodestone and amber—which will lead to the new synthesis.

The Aha Reaction. Gestalt psychologists have coined a word for that moment of truth, the flash of illumination, when bits of the puzzle suddenly click into place. They call it the *Aha* experience. One may regard it as a synonym for the 'Eureka!' cry. Imagine it written on a blackboard, thus:

Aha

We shall see in a moment the reason for this display. There is an empty panel on each side—for the *Aha* response represents only *one* type of reaction after the bisociative click. There are others. Let me tell my favorite anecdote:

A nobleman at the court of Louis XV had unexpectedly returned from a journey and, on entering his wife's boudoir, found her in the arms of a bishop. After a short hesitation, the nobleman walked calmly to the window and went through the motions of blessing the people in the street. "What are you doing?" cried the anguished wife. "Monseigneur is performing my functions," replied the nobleman, "so I am performing his."

Well, some readers will be kind enough to laugh; let us call this the *Haha* reaction:⁴

Haha Aha

The Haha Reaction. Now let us inquire into the difference between the *Haha* and the *Aha* reactions. Why do we laugh? Let me try to analyze first the intellectual and then the emotional aspect of this odd reaction. The nobleman's behavior is both unexpected and perfectly logical—but of a logic not usually applied to this type of situation. It is the logic of the division of labor, where the rule of the game is the *quid pro quo*, the give-and-take. But we expected, of course, that his reactions would

⁴ I owe the term *Haha* reaction to Dr. Brenning James's paper, "The Function of Jokes."

be governed by a quite different logic or rule of the game. It is the interaction between these two mutually exclusive associative contexts, which produces the comic effect. It compels us to perceive the situation at the same time in two self-consistent but habitually incompatible frames of reference; it makes us function on two wavelengths simultaneously, as it were. While this unusual condition lasts, the event is not, as is normally the case, perceived in a single frame of reference but is bisociated with two.

But the unusual condition does not last for long. The act of discovery leads to a lasting synthesis, a *fusion* of the two previously unrelated frames of reference; in the comic bisociation, you have a *collision* between incompatible frames, which for a brief moment cross each other's path. But whether the frames are compatible or not, whether they will collide or merge, depends on subjective factors, on the attitudes of the audience—for, after all, the colliding or merging takes place in the audience's heads. The history of science abounds with examples of discoveries greeted with howls of laughter because they seemed to be a marriage of incompatibles—until the marriage bore fruit and the alleged incompatibility of the partners turned out to derive from prejudice. The humorist, on the other hand, deliberately chooses discordant codes of behavior or universes of discourse to expose their hidden incongruities in the resulting clash. Comic discovery is paradox stated—scientific discovery is paradox resolved.

Let me return for a moment to our poor nobleman blessing the crowd through the window. His gesture was a truly original inspiration. If he had followed the conventional rules of the game, he would have had to beat up or kill the bishop. But at the court of Louis XV, assassinating a Monseigneur would have been considered, if not exactly a crime, still in very bad taste. It simply could not be done; the chessboard was blocked. To solve the problem, that is, to save his face and at the same time to humiliate his opponent, the nobleman had to bring into the situation a second frame of reference, governed by different rules of the game, and combine it with the first. All original comic invention is a creative act, a malicious discovery.

The Emotional Dynamics of Laughter. The emphasis is on malicious, and this brings us from the *logic* of humor to the *emotional factor* in the *Haha* reaction. When the expert humorist tells an anecdote, he creates a certain tension, which mounts as the narrative progresses. But it never reaches its expected climax. The punch line acts like a guillotine, which cuts across the logical development of the situation; it debunks

our dramatic expectations, and the tension becomes redundant and is exploded in laughter. To put it differently, laughter disposes of the overflow of emotion which has become pointless, is denied by reason, and has to be somehow worked off along physiological channels of least resistance.⁵

I shall not bore you with physiological explanations because if you look at the coarse and brutal merriment in a tavern scene by William Hogarth or Thomas Rowlandson, you realize at once that the revelers are working off their surplus of adrenalin by contractions of the face muscles, slapping of thighs, and explosive exhalations of breath from the half-closed glottis. The emotions worked off in laughter are aggression, sexual gloating, conscious or unconscious sadism—all operating through the sympathicoadrenal system. On the other hand, when you look at a clever *New Yorker* cartoon, Homeric laughter yields to an amused and rarefied smile; the ample flow of adrenalin has been distilled into a grain of Attic salt. Think, for instance, of that classic definition: What is a sadist? A person who is kind to a masochist.

The word “witticism” is derived from ‘wit’ in its original sense of ‘ingenuity.’ The clown is brother to the sage; their domains are continuous, without a sharp dividing line. As we move from the coarse toward the higher forms of humor, the joke shades into epigram and riddle, the comic simile into the discovery of hidden analogies; and the emotions involved show a similar transition. The emotive voltage discharged in coarse laughter is aggression robbed of its purpose; the tension discharged in the *Aha* reaction is derived from an intellectual challenge. It snaps at the moment when the penny drops—when we have solved the riddle hidden in the *New Yorker* cartoon, in a brainteaser, or in a scientific problem.

The Ah Reaction. Let me repeat, the two domains of humor and discovery form a continuum. As we travel across it, from left to center, so to speak, the emotional climate gradually changes from the malice of the jester to the detached objectivity of the sage. If we now continue the journey in the same direction, we find equally gradual transitions into a third domain, that of the artist. The artist hints rather than states, and he poses riddles. So we get a symmetrically reversed transition toward the other end of the spectrum, from highly intellectualized art

⁵ For a review of the theories on laughter, see Arthur Koestler, *The Act of Creation* (New York: Macmillan, 1969), chap. 1–2; Koestler, *Insight and Outlook* (New York: Macmillan, 1949), pt. 1, Appendix 2.

forms toward the more sensual and emotive, ending in the thought-free beatitude of the oceanic feeling—the cloud of unknowing.

But how does one define the emotional climate of art? How does one classify the emotions which give rise to the experience of beauty? If you leaf through textbooks of experimental psychology, you will not find much mention of it. When behaviorists use the word ‘emotion,’ they nearly always refer to hunger, sex, rage, and fear and to the related effects of the release of adrenalin. They have no explanations to offer for the curious reaction one experiences when listening to Mozart or looking at the ocean or reading for the first time John Donne’s *Holy Sonnets*. Nor will you find in the textbooks a description of the physiological processes accompanying the reaction: the moistening of the eyes, perhaps a quiet overflow of the lachrymal glands, the catching of one’s breath, followed by a kind of rapt tranquility, the draining of all tensions. Let us call this the *Ah* reaction and thus complete our trinity.

Haha! Aha Ah...

Laughter and weeping, the Greek masks of comedy and tragedy, mark the two extremes of a continuous spectrum; both are overflow reflexes, but they are in every respect physiological opposites. Laughter is mediated by the sympathicoadrenal branch of the autonomous nervous system, weeping by the parasympathetic branch. The first tends to galvanize the body into action; the second tends toward passivity and catharsis. Watch how you breathe when you laugh: long, deep intakes of air, followed by bursts of exhalatory puffs—‘Ha, ha, ha.’ In weeping, you do the opposite: short, gasping inspirations—sobs—are followed by long, sighing expirations—‘a-a-h, aah.’⁶

IV *Self-Assertion and Self-Transcendence*

In keeping with this, the emotions, which overflow in the *Ah* reaction, are the direct opposites of those exploded in laughter. The latter belong to the familiar adrenergic hunger-rage-fear category; let us call them the *aggressive-defensive* or self-assertive emotions. Their opposites we might call the *self-transcending* or participatory or integrative emotions. They are

⁶ Cf. Koestler, *The Act of Creation*, 271, 284; and, for a bibliography on the psychology and physiology of weeping, 725–728.

epitomized in what Sigmund Freud called the 'oceanic feeling': When you listen to a Johann Sebastian Bach toccata thundering through the cathedral, you experience that expansion and depersonalization of awareness in which the self seems to dissolve like a grain of salt in a lot of water.

This class of emotions shows a wide range of variety. They may be joyous or sad, tragic or lyrical; but they have a common denominator: the feeling of participation in an experience which transcends the boundaries of the self. That higher entity, of which the self feels a part, to which it surrenders its identity, may be nature, God, the *anima mundi*, the magic of forms, or the ocean of sound.

The self-assertive emotions are expressed in bodily actions; the self-transcending emotions operate through the passive processes of empathy, rapport, projection, and identification. In laughter, tension is suddenly exploded, emotion debunked; in weeping, it is drained away in a gradual process, which does not break the continuity of mood. The self-transcending emotions do not tend toward action but toward quiescence and catharsis. Respiration and pulse rate are slowed down; 'entrancement' is a step toward the trancelike states induced by contemplative techniques or drugs. The self-transcending emotions cannot be consummated by any specific, voluntary action. You cannot take the mountain panorama home with you; you cannot merge with the infinite by any exertion of the body. To be 'overwhelmed' by awe and wonder, 'enraptured' by a smile, 'entranced' by beauty—each of these verbs expresses a passive surrender. The surplus of emotion cannot be worked off in action; it can be consummated only in internal, visceral, and glandular processes.⁷

The participatory or self-transcending tendencies, these stepchildren of psychology, are as powerful and deeply rooted in man's nature as his self-assertive drives. Freud and Piaget, among others, have emphasized the fact that the very young child does not differentiate between ego and environment. The nourishing breast appears to it as a more intimate possession than the toes of its own body. It is aware of events but not of itself as a separate entity. It lives in a state of mental symbiosis with the outer world, a continuation of the biological symbiosis in the womb. The universe is focused in the self, and the self *is* the universe—a condition which Jean Piaget called 'protoplasmic consciousness.' It may be

⁷ Ibid., 285–300.

likened to a liquid, fluid universe, traversed by dynamic currents, the rise and fall of physiological needs causing minor storms which come and go without leaving solid traces. Gradually the floods recede, and the first islands of objective reality emerge; the contours grow firmer and sharper; the islands grow into continents, the dry territories of reality are mapped out; but side by side with it, the liquid world coexists, surrounding it, interpenetrating it by canals and inland lakes, the vestigial relics of the erstwhile symbiotic communion. Here, then, we have the origin of that oceanic feeling which the artist and the mystic strive to recapture on a higher level of development, at a higher turn of the spiral.

V *Art and Self-Transcendence*

Children and primitives are apt to confuse dream and reality; they not only believe in miracles but also believe themselves capable of performing them. When the medicine man disguises himself as the rain god, he produces rain. Drawing a picture of a slain bison assures a successful hunt. This is the ancient unitary source out of which the ritual dance and song, the mystery plays of the Achaeans, and the calendars of the Babylonian priest-astronomers were derived. The shadows in Plato's cave are symbols of man's loneliness; the paintings in the Altamira Caves are symbols of his magic powers.

We have traveled a long way from Altamira and Lascaux, but the artist's inspirations and the scientist's intuitions are still fed by that same unitary source—though by now we should rather call it an underground river. Wishes do not displace mountains, but in our dreams, they still do. Symbiotic consciousness is never completely defeated but merely relegated underground to those unconscious levels in the mental hierarchy where the boundaries of the ego are still fluid and blurred—as blurred as the distinction between the actor and the hero whom he impersonates and with whom the spectator identifies. The actor on the stage is himself and somebody else at the same time—he is both the dancer and the rain god.

Dramatic illusion is the coexistence in the spectator's mind of two universes, which are logically incompatible; his awareness, suspended between the two planes, exemplifies the bisociative process in its most striking form. All the more striking because he produces physical symptoms—palpitations, sweating, or tears—in response to the perils

of a Desdemona whom he *knows* to exist merely as a shadow on the television screen or as dry printer's ink in the pages of a book. Yet let Othello but get the hiccups, and instead of coexistence between the two planes juxtaposed in the spectator's mind, you get collision between them. Comic impersonation produces the *Haha* reaction because the parodist arouses aggression and malice; dramatic stagecraft achieves the suspension of disbelief, the coexistence of incompatible planes, because it induces the spectator to identify. It excites the self-transcending and inhibits or neutralizes the self-assertive emotions. Even when fear and anger are aroused in the spectator, these are vicarious emotions, derived from his identification with the hero, which in itself is a self-transcending act. Vicarious emotions aroused in this manner carry a dominant element of sympathy, which facilitates catharsis in conformity with the Aristotelian definition—'through incidents arousing horror and pity to accomplish the purgation of such emotions.' Art is a school of self-transcendence.

We thus arrive at a further generalization: *The Haha reaction signals the collision of bisociated contexts; the Aha reaction signals their fusion; and the Ah reaction signals their juxtaposition.*

This difference is reflected in the quasicumulative progression of science through a series of successive mergers, compared with the quasi-timeless character of art in its continuous restatement of basic patterns of experience in changing idioms. I said 'quasi' because it can be shown that this, too, is a matter of degrees, because the progress of science is not cumulative in the strict sense. It is moving in a dizzy, zigzag course rather than in a straight line.⁸ On the other hand, the development of a given art form over a period of time often displays a cumulative progression.⁹ I shall return to this in a moment, but first let me briefly mention a few more types of the combinatorial activities which enter into the fabric of art.

VI *Bisociative Structures in Art*

When we listen to poetry, two frames of reference interact in our minds: one governed by meaning, the other by rhythmic patterns of sound.

⁸ See T. S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962); K. R. Popper, *The Logic of Scientific Discovery* (London: Hutchinson, 1959).

⁹ See E. H. Gombrich, *Art and Illusion* (London: Phaidon Press, 1962).

Moreover, the two frames operate on two different levels of awareness: the first in broad daylight, the other much deeper down. The rhythmic beat of poetry is designed, in the words of Yeats, 'to lull the mind into a waking trance.' Rhythmic pulsation is a fundamental characteristic of life; our ready responses to it arise from the depths of the nervous system, from those archaic strata which reverberate to the shaman's drum and which make us particularly receptive to, and suggestible by, messages which arrive in a rhythmic pattern or are accompanied by such a pattern.

The rhyme has equally ancient roots. It repeats the last syllable of a line. Now the repetition of syllables is a conspicuous phenomenon at the very origins of language. The young child is addicted to babbling, 'obble-gobble,' 'humpty-dumpty,' and so on. In primitive languages, words like 'kala-kala' or 'moku-moku' abound. Closely related to it is association by pure sound. The rhyme is in fact nothing but a glorified pun—two strings of ideas tied together in a phonetic knot. Its ancient origins are revealed in the punning mania of children and in certain forms of mental disorder and in the frequent recurrence of puns in dreams. 'What could be moister than the tears of an oyster?' The statement that the oyster is a wet creature and that therefore its tears must be particularly wet would not make much of an impression, but when meaning is bisociated with sound, there is magic. This is what I meant when I said that routine thinking involves a single matrix, whereas creative thinking always involves more than one plane. Needless to say, it is difficult to identify with an oyster, so the reaction will be *Haha*, not *Ah*.

Thus rhythm and meter, rhyme and euphony, are not artificial ornaments of language but combinations of contemporary, sophisticated frames of reference with archaic and emotionally more powerful games of the mind. In other words, creative activity always implies a *temporary regression* to these archaic levels, while a simultaneous process goes on in parallel on the highest, most articulate and critical level: the poet is like a skin diver with a breathing tube.

The same applies, of course, to poetic imagery. Visual thinking is an earlier form of mental activity than thinking in verbal concepts; we dream mostly in pictures and visual symbols. It has been said that scientific discovery consists in seeing an analogy where nobody has seen one before. When in the *Song of Songs*, Solomon compared the Shulamite's neck to a tower of ivory, he saw an analogy which nobody had seen before; when Harvey compared the heart of a fish to a

mechanical pump, he did the same; and when the caricaturist draws a nose like a cucumber, he again does just that. In fact, all combinatorial, bisociative patterns are trivalent—they can enter the service of humor, discovery, or art, as the case may be.

Let me give you another example of this trivalence. Man has always looked at nature by superimposing a second frame on the retinal image—mythological, anthropomorphic, scientific frames. The artist sees in terms of his medium—stone, clay, charcoal, pigment—and in terms of his preferential emphasis on contours or surfaces, stability or motion, curves or cubes. So, of course, does the caricaturist, only his motives are different. And so does the scientist. A geographical map has the same relation to a landscape that a character sketch has to a face. Every diagram or model, every schematic or symbolic representation of physical or mental processes is an unemotional caricature of reality—at least unemotional in the sense that the bias is not of an obvious kind, although some models of the human mind as a conditioned-reflex automation seem to be crude caricatures inspired by unconscious bias.

In the language of behaviorist psychology, we would have to say that Cézanne, glancing at a landscape, receives a stimulus, to which he responds by putting a dab of paint on the canvas, and that is all there is to it. But in fact, the two activities take place on two different planes. The stimulus comes from one environment, the distant landscape. The response acts on a different environment, a square surface of 10 by 15 inches. The two environments obey two different sets of laws. An isolated brushstroke does not represent an isolated detail in the landscape. There are no point-to-point correspondences between the two planes; each obeys a different rule of the game. The artist's vision is bifocal, just as the poet's voice is bivocal, as he bisociates sound and meaning.

VII *Extraconscious Factors in Discovery*

Let me return for a moment to science. I said at the beginning of this paper that the essence of discovery is the coagitation, the shaking together, of already existing frames of reference or areas of knowledge. Now we arrive at the crucial question: Just how does the creative mind hit upon that happy combination of ideas, which nobody had thought of combining before?

Artists are inclined to believe that scientists reason in strictly rational, precise verbal terms. They do, of course, nothing of the sort. In 1945, a famous inquiry was organized by Jacques Hadamard among eminent mathematicians in America to find out their working methods.¹⁰ The results showed that all of them, with only two exceptions, thought neither in verbal terms nor in algebraic symbols but relied on visual imagery of a vague, hazy kind. Einstein was among those who answered the questionnaire; he wrote:

The words of the language as they are written or spoken do not seem to play any role in my mechanism of thought, which relies on more or less clear images of a visual and some of a muscular type. It seems to be that what you call full consciousness is a limiting case which can never be fully accomplished because consciousness is a narrow thing.

Einstein's statement is typical. On the testimony of those original thinkers who have taken the trouble to record their methods of work, *not only verbal thinking but conscious thinking in general plays only a subordinate part in the brief, decisive phase of the creative act itself*. Their virtually unanimous emphasis on spontaneous intuitions and hunches of unconscious origin, which they are at a loss to explain, suggests that the role of strictly rational and verbal processes in scientific discovery has been vastly overestimated since the Age of Enlightenment. There are always large chunks of irrationality embedded in the creative process, not only in art (where we are ready to accept it) but in the exact sciences as well.

The scientist who, facing his blocked problem, regresses from precise verbal thinking to vague visual imagery seems to follow William Wordsworth's advice: "Often we have to get away from speech in order to think clearly." Words crystallize thoughts, but a crystal is no longer a liquid. Language can act as a screen between the thinker and reality. Creativity often starts where language ends, that is, by regressing to preverbal levels, to more fluid and uncommitted forms of mental activity.

Now I do not mean, of course, that there is a little Socratic demon housed in the scientist's or artist's skull who does his homework for him; nor should one confuse unconscious mentation with Freud's primary process. The primary process is defined by Freud as devoid of logic,

¹⁰ J. Hadamard, *The Psychology of Invention in the Mathematical Field* (Princeton: Princeton University Press, 1949).

governed by the pleasure principle, apt to confuse perception and hallucination, and accompanied by massive discharges of affect. It seems that between this very primary process and the so-called secondary process governed by the reality principle, we must interpolate a whole hierarchy of cognitive structures, which are not simply mixtures of primary and secondary, but are autonomous systems in their own right, each governed by a distinct set of rules. The paranoid delusion, the dream, the daydream, free association, the mentalities of children of various ages, and of primitives at various stages, should not be lumped together, for each has its own logic or rules of the game. But while clearly different in many respects, all these forms of mentation have certain features in common, since they are ontogenetically, and perhaps phylogenetically, older than those of the civilized adult. They are less rigid, more tolerant, and more ready to combine seemingly incompatible ideas and to perceive hidden analogies between cabbages and kings. One might call them 'games of the underground,' because if not kept under restraint, they would play havoc with the routines of disciplined thinking. But under exceptional conditions, when disciplined thinking is at the end of its tether, a temporary indulgence in these underground games may suddenly produce a solution—some farfetched, reckless combination which would be beyond the reach of, or seem to be unacceptable to, the sober, rational mind. The place for the rendezvous of ideas is underground.

Illumination and Catharsis. What I have been trying to suggest is that the common pattern underlying scientific discovery and artistic inspiration is a temporary regression, culminating in the bisociative act, that is, the bringing together of previously separate frames of perception or universes of discourse. I suppose that is what Ernst Kris meant by his frequently quoted but somewhat cryptic remarks about regression in the service of the ego.¹¹ The boundaries between science and art, between the *Ah* reaction and the *Aha* reaction, are fluid, whether we consider architecture or cooking or psychiatry or the writing of history. There is nowhere a sharp break where witticism changes into wit or where science stops and art begins. Science, the hoary cliché goes, aims at truth, art at beauty. But the criteria of truth, such as verification by experiment, are not as hard and clean as we tend to believe, for the same experimental data can often be interpreted in more than one way.

¹¹ E. Kris, *Psychoanalytic Explorations in Art* (New York: International Universities Press, 1952).

That is why the history of science echoes with as many bitter and venomous controversies as the history of literary criticism. Moreover, the verification of a discovery comes after the act; the creative act itself is for the scientist, as it is for the artist, a leap into the dark, where both are equally dependent on their fallible intuitions. The greatest mathematicians and physicists have confessed that, at those decisive moments when taking the plunge, they were guided not by logic but by a sense of beauty, which they were unable to define. Vice versa, painters and sculptors, not to mention architects, have always been guided, and often obsessed, by scientific or pseudo-scientific theories and criteria of truth: the golden section, the laws of perspective, Dürer and Leonardo's laws of proportion representing the human body, Cézanne's doctrine that everything in nature is modeled on the cylinder and cone, Braque's alternative theory that cubes should be substituted for spheres, Le Corbusier's modulator theory, Buckminster Fuller's geodesic domes. The same goes, of course, for literature, from the formal laws imposed on Greek tragedy to the various recent and contemporary schools—romanticism, classicism, naturalism, symbolism, stream of consciousness, socialist realism, the *nouveau roman*, and so forth—not to mention the intricate rules of harmony and counterpoint in music. The English physicist Paul Dirac, a Nobel laureate, said recently, "It is more important to have beauty in one's equations than that they should fit experiment."¹² The counterpart to this is the statement by Georges-Pierre Seurat on his pointillist method, "They see poetry in what I have done. No, I apply my method, and that is all there is to it." In other words, the experience of truth, however subjective, must be present for the experience of beauty to arise, and vice versa: An elegant solution of a problem gives rise in the connoisseur to the experience of beauty. Intellectual illumination and emotional catharsis are complementary aspects of an indivisible process.

VIII *Regression and Rebound*

I would like to conclude this discussion with a remark, which is no more than a hint, to place the phenomena of human creativity into a wider biological perspective. I have talked of temporary regression, followed

¹² P. A. M. Dirac, "Evolution of the Physicist's Picture of Nature," *Scientific American* 208 (1963): 45–53.

by a rebound, as a characteristic of the creative act. Now biologists are familiar with a similar phenomenon on lower levels of the evolutionary scale. I mean the phenomenon of regeneration.¹³ It consists in the reshaping of bodily structures—or the reorganization of functions—in response to traumatic challenges from the environment. It involves the regression of bodily tissues to a quasi-embryonic state and the release of genetic growth potentials which are normally under restraint in the adult organism—just as in the moment of discovery the creative potentials of the earlier forms of intuitive thinking are released from the censorship of the conscious adult mind. Psychotherapy reflects the same process on a higher level. It aims at inducing a temporary regression in the emotionally traumatized patient in the hope that he will regenerate into a pattern, which eliminates the conflict. The creative act could be called a kind of do-it-yourself psychotherapy where the traumatic challenge is intellectual instead of emotional, for instance, new data which shake the foundation of a well-established theory, observations which contradict each other, problems which cause frustration and conflict—or the artist's perplexities in trying to communicate his experiences through the blocked matrices of conventional techniques.

And finally, we find the same pattern reflected in the death-and-resurrection motif in mythology, in Toynbee's *Withdrawal and Return*, in Jung's *Night Journey*. Joseph is thrown into a well, Mohammed goes out into the desert, Jesus is resurrected from the tomb, Jonah is reborn out of the belly of the whale. The mystic's dark night of the soul reflects the same archetype. It appears to be a principle of universal validity in the evolution of individuals and cultures.

¹³ Koestler, *The Act of Creation*, 447–474.