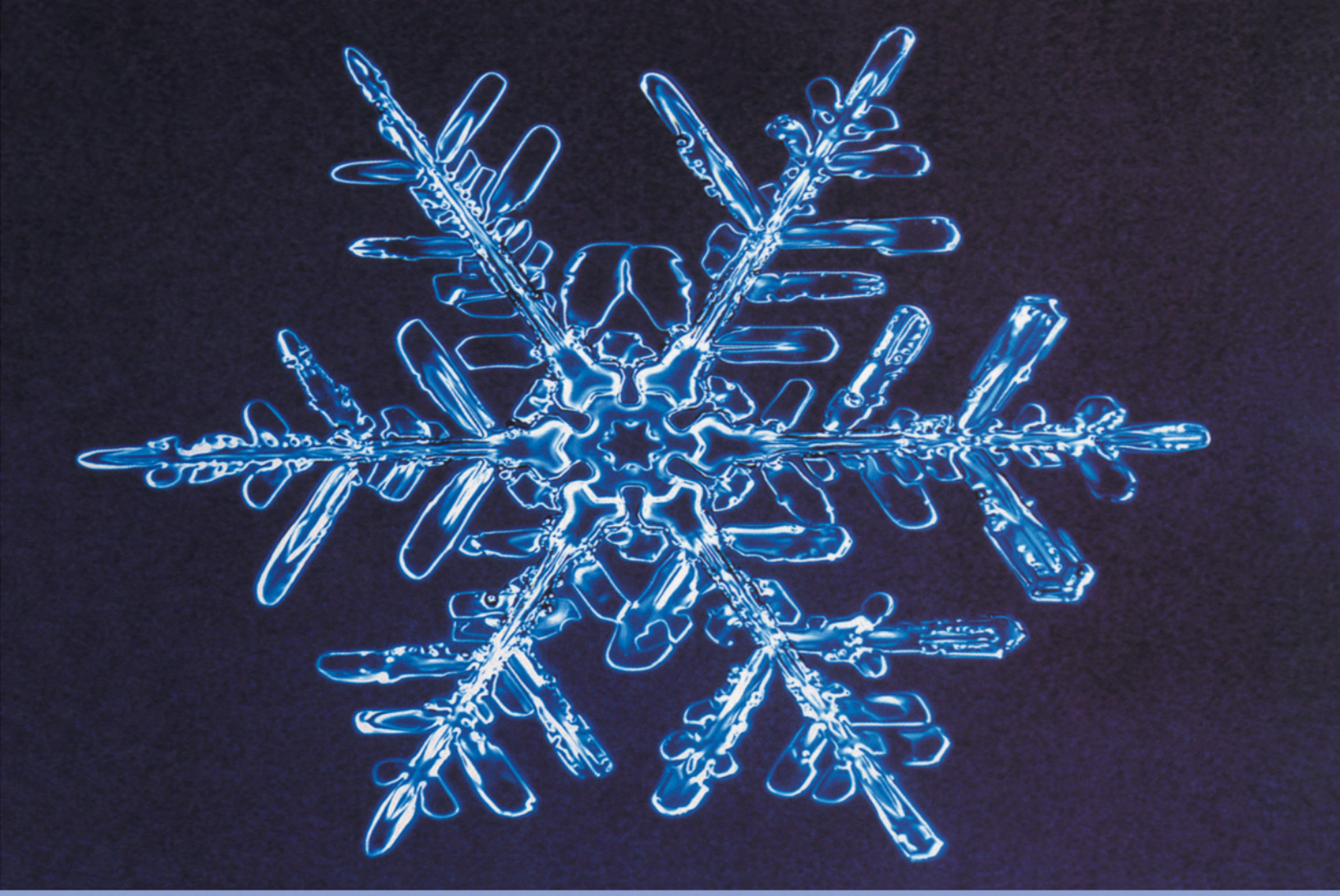

On Creativity

Edited by Lee Nichol

ROUTLEDGE

DAVID BOHM

ON CREATIVITY

David Bohm is widely recognized for his significant contributions to the discussion on the relationship between art and science. *On Creativity* is a collection of previously unpublished or unavailable essays by Bohm, which are all related directly to the nature of creativity. Bohm not only explores the latent creativity in the human mind, but he also examines and illuminates the presence of creativity in nature and the universe at large.

A significant portion of the material draws overtly from Bohm's perceptions as a practising scientist—his notions of what underlies a paradigm shift, or how laws of nature, theories and hypotheses are perceived, rationalized and axiomatized. However, the novelty and appeal of Bohm's views of these processes is the suggestion that the work of the visual artist is remarkably similar to that of the scientist. He explores these similarities at length and goes so far as to suggest that the creative processes of the scientist and the artist are at work in every person.

The late **David Bohm** was Emeritus Professor of Physics at Birkbeck College, University of London. He was the author of many articles and books including *Thought as a System, On Dialogue, Causality and Chance in Modern Physics, Wholeness and the Implicate Order,* and *The Undivided Universe* (with Basil Hiley).

Lee Nichol is a freelance writer and editor. He is also editor of Bohm's *Thought as a System* and *On Dialogue.*

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David Bohm

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FOREWORD

On Creativity surveys two decades of David Bohm's reflections on what distinguishes creative processes from those which are merely mechanical. While much of the material in the volume explores the nature of human creativity, Bohm throughout links mind to the realm of natural process, ultimately suggesting that manifestations of creativity in humankind are not merely similar to the creative processes of nature. Rather, they are of the same intrinsic nature as the creative forces in the universe at large.

The human being is thus in the unique position of perceiving the dynamism and movement of the world around him, while at the same time realizing that the means by which this perception takes place—one's own mind—is of an equivalent order of creativity, participating intimately with the world which it observes. To the extent that our perceptions of the world affect "reality"—and the evidence for this is considerable—we have a corresponding responsibility to attempt to bring into being a coherent relationship between our thought processes and the world they emerge from and interpret.

Bohm draws on a variety of sources for the formation of his views—his forty-five years as a theoretical physicist; his affinity for the visual arts, and his relationships with artists themselves; his conviction that art, science, and the religious spirit are intrinsically related; and his perennial aspiration to articulate a philosophy of mind with creativity at its heart, a philosophy that could be concretely explored in the context of daily life.

In inquiring into the nature of creativity, Bohm does not shy away from questions of beauty, truth, or "the good." Along the way, he excavates a series of western cultural dualisms—abstract and concrete, intellect and intuition, inner and outer, absolute and relative—always proposing a razor's edge of attention by

way of which one might "thread the needle" of these dualisms, avoid the crystallization of any thought process or paradigm, and engage in creative perceptions for which we currently have no definitions.

In the first chapter, "On Creativity" (1968), Bohm asks, Why are scientists so interested in their work? What inspires and motivates them? In essence, he says, a scientist is interested in learning something fundamentally new, in discovering new orders of lawfulness in the world he or she perceives. This lawfulness is not appealing primarily for its formalism, or for its utility in making predictions. Rather, the appeal is in the scientist's apprehension of "a certain oneness and totality, or wholeness, constituting a kind of harmony that is felt to be beautiful."

This theme—that at its inner core, scientific inquiry is richly aesthetic—is a recurrent one throughout *On Creativity*. But it is the impulse underlying this aesthetic—the impulse *to learn*—that is the focus of this first chapter. The learning which Bohm alludes to here is not the rote learning of established facts; it is learning about something truly new. Such "newness" is not, for example, acquiring information about a culture one had not previously studied, which would most likely be a simple additive process. The learning implied here is instead that of perceiving new orders of relationship, and hinges on a sensitivity to *difference* and *similarity*.

Sensitivity to difference and similarity exhibits varying degrees of creativity or mechanicalness. If, for instance, a coin is dropped on a highly patterned carpet, a certain perception is required to distinguish the coin from the patterns. However, this perception calls on essentially mechanical processes of recollecting the pattern of the carpet without the coin on it—a *difference*—or recollecting a surface with other small metal objects on it—a *similar difference*.

At the other end of this spectrum, to illustrate "the original and revolutionary nature of a genuinely creative perception," Bohm invokes the relationship between Helen Keller and her teacher Anne Sullivan. Keller—deaf, blind, and unable to speak from birth—was considered incapable of learning anything other than the most rudimentary physical routines. However, a deep transformation occurred in her consciousness when Sullivan helped her link a series of previously unrelated experiences to

the shapes *W A T E R* by scratching these shapes on Keller's palm every time she encountered water.

Eventually, Keller had a flash of insight. First, she saw the connection between her previous encounters with water, and was able to perceive their similarity and relate to them in a coherent way. Of immensely greater significance, however, was her perception of the meaning and power of a *concept*. She perceived not just that the symbol "water" could represent a collection of similar experiences, but also that *all of experience* could now be structured through the use of concepts, in an unlimited array of defined similarities and differences. She was thus able rapidly to acquire capacities for conceptual understanding and meaningful relationship that were impossible prior to her insight.

According to Bohm, such sensitivity to similarity and difference enables one to perceive new orders of structure, both in the "objective" world of nature and in the mind itself: "the order and structure of our knowledge of natural law is always evolving, by a principle similar in certain ways to that of the order and structure of nature." He goes on to suggest that both Newton and Einstein had creative insights similar to those of Helen Keller, insights resulting in entirely new conceptual structures with broad application in many fields of thought and experience—different in application from Keller's, but intrinsically similar in that they led directly to the perception of fundamentally new structure.

Bohm thus posits a hierarchy of nested orders, in which (a) similarity and difference define basic orders (for example, the arrangement of bricks in a wall); (b) the relationships amongst these orders result in new structures (the wall itself); and (c) the relationship of new structures results in comprehensive new totalities (the house built from the walls). From Bohm's perspective, the sense of wholeness and beauty we may feel in the presence of a magnificent painting, an elegant theory, the stars at night, the mind itself—underlying all of these is a similar process of order, manifesting equally in mind and nature.

Beauty, then, is not simply a matter of personal opinion, dependent primarily upon the eye of the beholder. It is the result of dynamic, evolving processes that consist of order, structure, and harmonious totalities. Consequently, Bohm suggests the need for a new language in which these processes are conceived in objective terms, asserting that their coherent interplay results in an

aesthetic perception of wholeness that is not strictly subjective. Following from this perspective is Bohm's view that creativity—typically ascribed to a select group of artists, thinkers, writers, and so on—is in fact not the province of the few. He suggests that, were it not for culturally sustained "blocks," the latent creativity in each person could be expressed to a degree well beyond that generally considered possible.

One of the primary blocks to such latent creativity is what Bohm refers to as "self-sustaining" confusion in the mind, in contrast to "simple" confusion. Simple confusion is that which we experience when, for instance, we don't understand directions we are given, or when we can't find the solution to a puzzle. Self-sustaining confusion, on the other hand, occurs "when the mind is trying to escape the awareness of conflict . . . *in which one's deep intention is really to avoid perceiving the fact,* rather than to 'sort it out' and make it clear." Bohm points out that this process creates an order all its own: a reflexive state of dullness in which the natural agility of the mind is replaced with torpor on the one hand, mechanical and meaningless fantasies on the other. Unfortunately, says Bohm, this has come to be considered a normal state of mind, and is therefore endemic in our culture.

Consequently, we need to give patient, sustained attention to the activity of confusion, rather than attempting to promote creativity directly. For Bohm, giving simple attention—a "finer, faster process" than confusion—is itself the primary creative act. From such attention "Originality and creativity begin to emerge, not as something that is the result of an effort to achieve a planned and formulated goal, but rather, as the by-product of a mind that is coming to a more nearly normal order of operation."

The second chapter, "On the Relationships of Science and Art" (1968), elaborates on themes raised in the first chapter: the nature of structure, the perception of fundamentally new forms, the formal properties of beauty—and raises new ones: the meaning of "truth" in science, art, and daily life; the breakdown of a "correspondence" view of reality in both science and modern art; and the cross-disciplinary implications of paradigm alterations.

Bohm frames this exploration in the context of early humanity, at a time when conscious experience likely entered rapid spurts of growth. At such a time, man would have had an increasing need to assimilate his experiences of a vast and awesome

universe—a need to make sense of and relate to this universe, rather than simply react to it. In these circumstances, the underlying impulses that we now pursue separately as science, art, and religion would likely have been one unified movement of perception and response to the surrounding world. This underlying relatedness still exists, says Bohm, but requires attention and inquiry in a manner fruitful for modern times.

Such relatedness is indicated in the broad meanings of the word "true." In one sense, truth means that which corresponds to facts: One can rightly say, "It is true that the sun has risen every day for the past week." More broadly, truth means "true to itself," as in a "true line" or a "true man," indicating unbrokenness and integrity. Bohm points out that a demand for this coherent wholeness—in which factual correspondence is a necessary but not sufficient criterion—is central to the formation of theory in science. In such formation, other criteria—simplicity, elegance, symmetry—play an equal or greater role than correspondence. In this way, the larger aesthetic considerations of science are closely related to those of the artist. Though the artist works in the domain of perceptible media, and the scientist proceeds with instruments and theoretical abstractions, the inner intent and impulse of each is strikingly similar—to ascertain and manifest a certain quality of coherent "truth."

There is, however, an even deeper relationship between art and science than what is suggested by this notion of truth, a relationship that is grounded in the very fabric of experience. To illustrate this deeper connection, Bohm first points to the gradual recognition that scientific theories do not reflect an objectively certifiable world. Rather, it is increasingly understood that "each theory and each instrument selects certain aspects of a world that is infinite, both qualitatively and quantitatively, in its totality." In addition, at atomic and sub-atomic levels, quantum theory indicates "the inseparability of the observing instrument from that which is to be observed": the observing process actively affects that which is being observed, generating a conundrum of meaning that makes it ever more difficult to assume that any description objectively corresponds with "reality." The net result, says Bohm, is the realization that science cannot provide "simple reflections of the world as it is."

What science does provide are *paradigms*—"simplified but typical examples" that abstract relevant features of the world, giving insight into "the essential relationships that are significant

for observation and experiment." These paradigms—operating pervasively throughout the community of scientists—become working models that serve to orient and organize data, interpretation, and the formulation of theory.

While Bohm's usage of the term "paradigm" is consistent with that of Thomas Kuhn, as expressed in the latter's *The Structure of Scientific Revolutions*, Bohm gives the term a radical slant, emphasizing the process of paradigm formation at two levels—the individual as well as the collective. For Bohm, the creation of paradigm structures is as much a phenomenological process—a dynamic internal activity that occurs prior to the threshold of conscious experience—as it is the result of meticulously collected data and consensual interpretation. In this way, paradigm formation can be seen as an individual, moment-to-moment construction—*and therefore not necessarily determined by prevailing orthodoxy*. To engage in a "paradigm shift," then, is sensorial and immediate, as well as epistemological and historical. It is this broadened definition of paradigm that enables Bohm to draw parallels between the "non-representational" aspects of twentieth-century physics and the perspective of non-representational art.

Beginning perhaps with Monet in late nineteenth-century France, the subject matter of classical painting underwent radical changes, culminating in what is now referred to as "modern art," or, perhaps more accurately, "abstraction." Though this process has had a long and varied evolution, its central thrust, in which the perceptual and intuitive processes of the painter compete with "objective" reality for display on the canvas, remains vital even today.

Bohm suggests that while any painting is in a sense abstract—even Rembrandt's portraits emphasize certain features at the expense of others—it is the particular orientation of twentieth-century abstraction that reveals a likeness to the work of physicists and mathematicians. Cubism, a defining force in the evolution of abstraction, presents radically abstracted images of the known world, yet retains components that anchor any given work in reality as we typically think of it. But in the work of Piet Mondrian, Kasimir Malevich, and Vasily Kandinsky, any recognizable reference to that known world—a body, a tree, a building—disappears, to be replaced by purely abstract or "structural" images. Such images often rely for their meaning only on what is *immediately presented*: they are considered

complete creations in and of themselves, by virtue of their own inherent structure, without associative references of any kind.

Bohm's view, drawn from personal experience, is that engagement with such abstract structural works can enable the mind to perceive freshly: the creation or viewing of these works requires an active process of distilling perception and experience to their essences, implicitly allowing one to reconsider the nature of perceptual experience itself—from the ground up, as it were. To experiment in this way with the formation of new structures is thus seen as a creative act, in part because it suspends the constraints of both personal and historical conditioning, thereby enabling one to acquire a new perspective.

Bohm suggests that a similar creative process is at work in the formation of theory in science. Here it is not sufficient to perform repetitions of the same underlying conceptual base (just as it is not sufficient to produce endless artistic variations of the same theme), but, rather, it is necessary to strive for fundamentally new perceptions and formulations, however radically they may alter existing paradigms. In one sense, it is just this that science does so well.

At the same time, the formulation of theory can easily fall into excessive conservatism, thereby inhibiting the development of new perspectives. It is here, claims Bohm, that science may perhaps learn from the perceptual milieu of abstract art. For while abstraction may have rejected representation in content, it is nonetheless a medium that works in perceptible space, light, color, and form. Indeed, one of the primary functions of such works of art is to provoke a new sensibility of perception itself. Bohm suggests that such a renewed sensibility can enable the scientist to return to the very core of his or her endeavor—the rigorous observation of the phenomenal world.

Such cross-disciplinary learning, however, is not available only to the scientist. Bohm suggests that artists would do well to explore "an unbiased objective approach to structure," using the spirit, if not the precise methods, of scientific rigor to determine the wholeness and integrity of their work. He asserts that any particular artistic composition possesses varying degrees of inherent wholeness, which, while not algorithmic, are also neither random nor accidental. Consequently, the artist may bring to bear a certain objectivity when assessing his or her work for its coherence, harmony, and beauty.

A further assessment of the relationships between imagination,

rationality, and intelligence comprises chapter three, "The Range of Imagination" (1976). Here Bohm outlines a four-faceted unfolding of perception in which intuitive apprehensions of new orders of reality are augmented by the clarity and precision of reason and logic. In addition, he inquires into the nature of the "intelligence" that he sees as the foundation of these various perceptual qualities.

Bohm's model posits two interpenetrating activities of mind—*imaginative and rational insight* and *imaginative and rational fancy.* In an *imaginative insight* one would literally apprehend images of a new and creative nature. An example would be the manner in which Isaac Newton resolved the contradictions in the medieval distinction between heavenly and earthly matter. In the medieval view, stars, planets, and other heavenly bodies were assumed to obey different laws from bodies on earth, which were bound by gravity. The theory of epicycles sustained the logic of the heavenly view up to a point, but eventually it became ponderously complex, and for Newton, unsatisfactory. Such questions as "Why don't heavenly bodies fall?" consequently took on renewed relevance.

While contemplating these questions, Newton had a flash of understanding, in which, according to Bohm, he apprehended "a new *kind* of image." Specifically, he had an image in which the moon *was* falling. This new image was complete, thorough, total—an imaginative insight which in essence was neither associative nor deductive.

From such an initial image, says Bohm, the mind will "unfold" to itself the basic features implicit in the insight, discerning essential relationships and meanings, or *ratios.* In Newton's case, the verbal expression of these ratios would be: "As the successive positions of the falling apple are related, so are those of the moon, and so are those of any falling material object." While the immediate totality of these relationships is what comprises the initial insight, it is the coherent explication of the ratios into objectively discernible form that constitutes *rational insight.* Here, the intrinsic meaning of the insight is tentatively formulated in a way that can be reflected upon internally, as well as provisionally communicated with others.

But to carry his insight into the domain of verifiability, says Bohm, Newton would have engaged in a process of a very different order from that occurring in the original insight and its initial explication. It is likely, Bohm claims, that in trying to

account objectively for the odd way in which the moon "falls" (it never falls *on to* anything!), Newton made associative links with the existing body of scientific knowledge. Specifically, he may have considered that gravitational energy behaves in a way similar to that of radiant light energy—that it decreases as a function of distance. In part through this kind of associative link, says Bohm, precise hypotheses emerge, through which various aspects of the original insight can be tested. This associative process, and the hypotheses that emerge from it, are what Bohm refers to as *imaginative fancy*.

To the extent that the original insight has established itself via tested hypotheses, it is natural for new lines of conjecture, reasoning, and logic to emerge which build upon the basic theory. The development of this reasoning is what Bohm calls *rational fancy*. An extreme form of rational fancy occurs in the axiomatization of a theory. As axioms are developed—be they mathematical or verbal—their strict formality and compression may serve to expose hidden contradictions or limitations in the theory, indicating the need for new insights of a fundamental nature. Thus, a cycle of complementarity is engendered in which insight and fancy give rise to one another. Conversely, the formality of the axioms may encourage a rigidity of thought in which the axioms themselves—and the necessarily limited reality they convey—are taken as a kind of final truth. When such reification occurs, Bohm suggests, genuine inquiry comes to an end, and the likelihood of new insights is significantly diminished.

We are presented, then, with a map of the processes of insight which consists of four distinguishable aspects—imaginative insight, rational insight, imaginative fancy, and rational fancy. For Bohm these aspects are ultimately unified; though from one vantage point they are qualitatively hierarchical, from another they are integral and mutually informative. Moreover, the unfolding of these processes is both an individual phenomenon and a socio-historical one: individual insights "echo" through time, engendering massive bodies of theory which impact society as a whole.

However, the potential for any individual or society to manifest this fourfold dynamic process is inhibited by the collective acclimation to a more pervasive, archaic mental pattern, referred to by Bohm as *reactive/reflective thought*. Reactive thought is that which establishes reliable patterns and regularities in experience.

Steeped in primitive roots that hark back to man's early awareness of the recurrence of day and night or seasonal cycles, reactive thought establishes a kind of bedrock equilibrium that is central to every aspect of our experience. The carrying out of many activities that require little or no conscious attention—the formation of a chord on a piano, the instantaneous retrieval of a mathematical concept, the act of dressing in the morning—are variants of the practiced repetition of reactive thought.

As long as the environment in which reactive thought operates remains stable, this thought is functionally sufficient. But when there is an anomaly in the environment (for instance, a child being burned when reaching out to touch a flame), a new process—reflective thought—is set in motion. The function of reflective thought, which involves the whole of the nervous system in an *imaging* process, is to accommodate the anomaly, reorient the pattern of reactive thought, and re-establish homeostatic equilibrium. In this respect, reflective thought is of a higher order than reactive thought, and is disposed toward a relatively higher degree of learning.

But the conservative power of reactive thought has the inexorable effect of orienting reflective thought toward its own demands for repetition and predictability. In this way the potentially higher-order learning of reflective thought is drawn into mechanical closure, albeit at a more functionally sophisticated level—a classic case of putting the cart before the horse. Consequently, asserts Bohm, reactive/reflective thought together become a structurally closed system with unlimited content. Only a process of yet higher order can keep this system open in a deep structural sense. It is this higher-order process that Bohm refers to as *intelligence*.

One salient aspect of this intelligence is that its perceptual field is free of conditioning by any of the established patterns of reactive/reflective thought. Such a quality of mind is able to discern the presence of functional or oppositional categories within the whole of its operations, and *thus determine the relevance or irrelevance of these categories*, at any given moment. In this way, says Bohm, the mind is kept free of the subtle domination of an "either/or" logic that steers perception and experience into mechanical reflexivity.

The fourth chapter, "The Art of Perceiving Movement" (1971), is an overview of Bohm's consideration of the fragmentary nature of thought, and the projections of such thought into the