6 The Physics of Spontaneity-Creativity

I puzzled over Moreno's concept of spontaneity for many years. Like fellow psychodramatists, I observed behavior on the psychodrama stage and in life that certainly fit the definition of spontaneous behavior as a novel response to a familiar situation or an adequate response to a new situation and labeled it spontaneous. I wanted a better understanding. I could not figure out how one could measure either dimension, novelty of the situation, or adequacy of response, other than by subjective judgment. Another question was how these two criteria of spontaneity were related. Was one unit or degree of novelty equal to one unit of adequacy? Moreno's solution to measurement was subjective evaluation by observers. Other attempts at measurement of spontaneity (Keller, Treadwell. & Kumar, (2002); Kipper & Hundal, 2005) have only identified individuals who report the frequency of experiences that were considered spontaneous. Above all, I found Moreno's description of spontaneity as an unconservable energy incomprehensible.

Although my grasp of physics was limited, I was quite aware of the concept of conservation of energy, the second law of thermodynamics. This is as powerful a law of nature as any ever proposed. Energy can be transformed from one kind to another, electric energy to light energy, for example, but energy cannot be either created or destroyed. Unconservable energy is therefore absolutely an oxymoron. There can be no such thing.

Moreno, however, was not unsophisticated or naive and he was always convinced that his theory of Spontaneity-Creativity was valid. He had no doubt that this energy that he called spontaneity did exist and that it was an unconservable form of energy. He suggested that quantum research might eventually substantiate his ideas:

> Atomic nuclear research seems to confirm in principle, or at least does not contradict, the picture of the universe which the theory of spontaneity-creativity has envisaged. Its structure is not permanently set but when novel situations emerge, the responses to the surrounding field take the form of creative acts. As long as the universe was visualized as dominated by eternal, rigid laws, there was no place for "uniqueness" and for "explosive" changes and with it no place for creativity as the ultimate principle, at least not for the on-going, here-and-nowness of it. But a revolution has taken place on the highest level of conceptualization. We can say with greater certainty than ever that the supreme power ruling the world is Spontaneity-Creativity. It has created a rational cosmos which coexists interdependently with man's perception of it but amenable

> to his intervention as long as he knows and abides by its rules. (1955f, p. 373)

I first discovered the ideas of David Bohm in *Looking Glass Universe* (Briggs & Peat, 1984). This book, subtitled *The Emerging Science of Wholeness*, suggested that a paradigm shift in the natural sciences is under way. This shift is from a Newtonian perception of a mechanical universe composed of interacting parts that can be understood by analyzing its basic units (once conceived of as atoms) to a vision of the universe that can only be comprehended as an undivided whole. Einstein's theory of relativity and the quantum theory of Bohr, Heisenberg, and Schrödinger signaled the beginning of this shift, Briggs and Peat wrote. In addition to David Bohm's theory of the implicate order, Prigogine's concept of dissipative structures, Sheldrake's morphogenetic fields, and Pribram's holographic brain are additional examples of theories from divergent scientific areas that all point toward a truly holistic universe.

I found Bohm's ideas fascinating and read some of his books: *Wholeness and the Implicate Order* (1980), *Science, Order, and Creativity* (Bohm & Peat, 2000), *The Undivided Universe* (Bohm & Hiley, 1993), *Unfolding Meaning* (1985), *Thought as a System* (1994), and *On Creativity* (1998). Although my elemental familiarity with calculus was insufficient to understand much of the mathematical reasoning in some of his works, Bohm included enough expository material to give the layman a reasonable comprehension of his ideas. Discussions of his work by other authors: *The Essential David Bohm* (Nichol, 2003). *Turbulent Mirror* (Briggs & Peat, 1989), *Bridging Science and Spirit* (Friedman, 1990), and *Infinite Potential*, a biography by David Peat (1997) increased my comprehension of Bohm's work. All of these publications serve as sources for this chapter.

I recognized immediately that there were many commonalities between Bohm and Moreno. Both proposed a holistic approach. Both rejected the doctrine of absolute determinism. Neither was limited to his respective discipline. Both exhibited an intense interest in creativity. The contributions of both tended to be ignored or rejected by colleagues of their respective disciplines. Both engendered some degree of hostility from colleagues. Bohm's concern about the mechanistic conceptualization of the universe in classical science, and its negative effect on human society seemed to echo Moreno's concern about the effect of materialism on humankind. Eventually I discovered a more important similarity: Bohm's theory of the implicate and explicate orders provided a physical basis for understanding Moreno's Canon of Spontaneity-Creativity.

David Bohm earned his Ph.D. from the University of California, Berkeley, working under the supervision of J. Robert Oppenheimer. He began work on plasma theory, became well known for his discoveries in this field. In 1951, he became a member of the Department of Physics, Princeton University. While there, he wrote a textbook on quantum theory (Bohm, 1951) in order, he said, to better understand Niels Bohr's Copenhagen interpretation. He also met Albert Einstein, who was at the Institute for Advanced Study, and the two became friends and colleagues. Einstein told Bohm that he had not really understood quantum theory until he read his, Bohm's, book.

In the same year, Bohm was called before the House Un-American Activities Committee to testify against former friends and colleagues. He refused, was indicted, tried, and cleared. However, Princeton refused to renew his appointment and he could not find another position in the United States. He held positions in Brazil and Israel, and finally was appointed as professor of theoretical physics at Birbeck College, University of London. He produced two scientific theories considered radical by his discipline during his lifetime, the causal interpretation of quantum physics and the theory of the implicate order. For Bohm, prediction and control were not the ultimate aim of science. He believed that physics was about understanding nature, and for him, as it was for J. L. Moreno, meaning and creativity were what was most important.

BOHM AND THE IMPLICATE ORDER

David Bohm and Albert Einstein shared a sense of frustration with the science in which both had made significant discoveries. The two most powerful theoretical contributions to physics in the 20th century were Einstein's theory of relativity and the development of quantum theory. Both theories add predictability and accuracy to classical Newtonian physics, a benchmark of effective theory. Both led to new advancements and discoveries in physics. Both make the observer a variable in experimentation. Both emphasize the holistic nature of the universe. In these respects, the two theories are congruent and consistent with each other. But paradoxically, there also exist irreconcilable incompatibilities. For example, Einstein's universe is a deterministic one. The universe of quantum theory is a probabilistic one in which indeterminism is inherent. Quantum mechanics requires reality to be discontinuous, noncausal, and nonlocal. Relativity theory requires reality to be continuous, causal, and local.

These contradictions bothered Einstein and Bohm (as well as many other physicists). There must be, they believed, some way to reconcile the two theories. Einstein believed strongly that there must be what he called "a hidden variable," an explanation or theory at a deeper level of reality that could account for both relativity theory and quantum theory and resolve the apparently irreconcilable differences between them.

Relativity theory deals with the macro world, the physical world that we experience. It is a world of things and beings. It has long been held that the universe is dynamic flow, always in action, as Greek philosopher Heraclites thought when he noted, “You cannot step twice into the same river.” The earth turns on its axis and circles the sun while the moon circles the earth. Even inert objects are perceived as composed of atoms in constant motion. Originally considered to be indivisible bits of stuff, atoms were then discovered to consist of electrons, protons, and neutrons, arranged as tiny planetarian systems with electrons circling a nucleus of neutrons and protons. The physical world is conceived of as consisting of matter and energy.

Newton discovered that gravity tethered the moon to the earth and the planets to the sun. Einstein’s theory of relativity superseded that idea with the notion that space was curved by the mass of the earth and the sun. Relativity theory also established the constant speed of light and consequently that observations were dependent upon the position and movement of the observer. This brought the observer into science in a new way. In classical physics the observer and the observed are considered as independent of each other. Now they must be considered together as aspects of the act of observation. Relativity theory deals with the same world as does classical physics, but it improves the accuracy of scientific observation in this macro world.

Quantum theory, on the other hand, deals with the micro world of subatomic particles. It is highly formal, providing a calculus that can predict with great accuracy the results of quantum experiments. In other words, it predicts rather precisely how the instruments will read in quantum experiments. What it does not do is describe an individual quantum process. The conventional interpretation of quantum theory, the Copenhagen interpretation, says nothing about reality itself, about what a quantum system or a particle is. Philosophically, this means that it does not provide an ontology of quantum processes. It is epistemological, providing knowledge about the behavior of quantum systems. While this can be very useful for prediction and control in technical processes, it fails to describe the nature of the world that underlies this knowledge.

There are several interpretations of quantum theory, the most widely accepted one being the Copenhagen interpretation associated with Niels Bohr, Werner Heisenberg, and Erwin Schrödinger. Despite the contradictions between quantum mechanics and relativity theory, Bohr remained adamantly against the notion of hidden variables, insistent that quantum theory was basic and that there could be no underlying theory that would resolve the contradictions. One physicist, John von Neumann, published a paper demonstrating that a hidden variables theory was mathematically impossible.

The search for reality, for unseen causes behind the vagaries of nature, has been a feature of human behavior perhaps forever. Spirits, mythological gods, God, the natural elements of fire, water, air, and earth, atoms, and gravity have all been called upon to explain what is hidden behind what we can perceive, a deeper theory with greater power to explain current events and to predict future ones. And always there is something left unexplained that calls for a still deeper theory. As Gödel established, no system can be completely explained from within that system.

Bohm did not allow Bohr's and von Neumann's rejections of a deeper theory deter him from developing one. He proceeded to publish just such a theory in the *Physical Review* (1952). Bohm continued to work out his ideas and published *Wholeness and the Implicate Order* (1980), a collection of papers spelling out his theory of the implicate and explicate orders.

Bohm's theory takes the view that reality is an unimaginably vast sea of energy comprising a spectrum of increasingly subtle orders. At one pole of this spectrum, the most manifest, is the explicate order, the physical universe that we know through our senses and instruments such as telescopes and microscopes and other sophisticated devices that increase the sensitivity of our senses. This explicate order, Bohm maintains, unfolds from the subtler implicate order. As a matter of fact, it is continuously unfolding from and enfolding into this implicate order. The implicate order is, in turn, unfolding and enfolding into a super-implicate order that itself unfolds and enfolds into a super-super-implicate order, and so forth, continuing through an infinite number of ever more subtle orders.

This summary of Bohm's theory requires considerable elaboration and the following discussion can only be considered as relating some of the major features of Bohm's thinking. This is my understanding of his ideas and is based on the following references: Bohm (1952, 1980, 1985, 1990). We begin with the concept of order because order is a very important notion to Bohm. He writes that the notion is so vast that it is hard to convey in words and he takes most of a chapter in *Wholeness and the Implicate Order* (1980) to discuss and illustrate the meaning of order. It is especially important because quantum theory signals a new order or paradigm in physical science.

In his exposition of order, Bohm uses the concept of subtlety. He refers to the derivation of the term from Latin, where it means "finely woven." He gives this example of subtlety with respect to order. Insurance companies use actuarial tables to predict how many people within a certain age range can be expected to die and use that information to determine life insurance rates. They do not know who among these people will die, but they can predict how many life insurance policies they will have to pay out. By collecting information on the health and life habits of the individuals in a particular pool of people, it would be possible to make predictions about which ones are likely to die. Such information would represent a more subtle order of data. We will deal with the concept of subtlety in more detail as we proceed in this discussion.

Bohm uses many analogies to illustrate his concepts. He found an analogy for the concept of enfoldment while watching a science program on television. The apparatus consisted of two cylinders, a smaller one inside a larger. The space between was filled with a viscous fluid like glycerine. A drop of nonsoluble ink is inserted into the fluid and the inner cylinder is rotated a number of times. The drop of ink is pulled out into a thin thread, which becomes thinner and thinner as the cylinder continues to be turned. Eventually, it becomes invisible to the eye. This represents enfoldment. The ink drop is enfolded into the glycerine. Now, if the cylinder is turned in the opposite direction, the thread reappears and eventually the drop of ink is reconstituted. It has been unfolded.

The drop of ink is stretched out so that it no longer occupies its original little space in the glycerine but is spread out over a lot of space, enfolded. When the rotation is reversed, the drop of ink is unfolded and pulled back together. Bohm further noted that if one inserted a drop of ink, rotated the cylinder a few times, then inserted a new drop of ink, rotated that a few turns, and inserted a third and maybe a fourth drop of ink, in the unfolding process, the first drop of ink would reappear and, as the cylinder continued to be rotated, would enfold again and the second drop of ink would be reconstituted. Then the third and the fourth in turn would do likewise. Bohm points out that it could look like a single drop of ink was moving from one place to the next. This suggests an explication of how electrons in an atom move from one orbit to another without occupying the space between, the so-called quantum leap.

Locality and nonlocality are important concepts in Bohm's theory. Locality is a feature of the explicate order. "No two things can occupy the same space" is a familiar expression of the notion of locality. More important is that an object can only affect another object at a distance through the action of some form of energy. Furthermore, no form of energy can travel from its source at a speed greater than light. Light from the sun has a powerful influence on what happens on earth. However, it takes light between eight and nine minutes to reach the earth. Events such as solar flares do not instantly affect the earth. The implicate order, on the other hand, is characterized by nonlocality. This means that points at a distance can instantaneously influence each other.

Bohm found that holography provided a way of explaining the concepts of enfolding and unfolding as well as locality and nonlocality. In conventional photography, the light from a scene is focused by a lens and projected onto a film plate in the camera. Although the image is reversed, objects in the scene maintain their relationship to each other. If Aunt Alice is to the right of Uncle George when the picture is taken, she will be on his right on the film. Once we have developed and printed the picture, we could cut it in half, one half containing Aunt Alice and the other showing Uncle George. This illustrates locality.

The holograph is a very different way of creating an image of an object. Typically, a half-silvered mirror divides a beam of light from a laser,. One half of the beam is so directed that it reflects off the subject toward a film plate. The other half of the beam is so aimed that it meets the light so reflected at the film plate. The two beams of light interfere with each other. This means that the light waves combine where they meet. If two wave peaks coincide they add together. If a peak meets a trough, the result is a leveling out. The combined light hitting the film results in an interference pattern on the film. When it is developed all one sees are very fine lines on the plate. There is no image as in conventional photography. However, if the laser is then directed through this film plate, an image of the original subject appears in front of the plate. It is a three-dimensional image composed entirely of light. One can look at it from different angles and see exactly the same thing as if looking at the original subject. However, you can stick your hand into the holographic image, something you cannot do with the original. Furthermore, although the image is quite stable, the photons composing it are constantly changing at an incredible rate as they leave the laser and pass through the holographic plate at the speed of light.

Perhaps the strangest difference between the holograph and the conventional photograph, however, is this: If we cut the holographic plate in half and then shine the laser through one half of the plate, we do not get an image of half of the subject; we get the whole image. And if we cut the half into quarters, again we get the whole image. As a matter of fact, the whole image is everywhere embedded in the holographic plate. We could also say that the image is *enfolded* everywhere in the plate, and that shining the laser light through the plate unfolds the image. This aspect of holography illustrates nonlocality, a quality of quantum theory.

The world we know, the world of classical physics and of relativity theory, is a world in which there is locality. That is, things are separate from each other. No two things can occupy the same space. If an object influences another object, it is because of a flow of energy from the one to the other. For example, the picture on your television set is there because of a signal from a transmission source, a television station or studio, and, according to physical law, that signal can travel from the source to the receiver at a speed not exceeding the speed of light. In a quantum experiment, on the other hand, a change in one particle can result in an *instantaneous* change in another particle at some distance from the first. This experimentally demonstrable fact establishes nonlocality in the quantum world.

With those illustrations in place, we are ready to return to Bohm's conceptualization of physical reality. He began with a new interpretation of quantum mechanics. A central element of quantum theory is the Schrödinger equation, which is necessary to arrive at the probabilistic solution of a quantum problem. Bohm mathematically transformed this equation into two terms, one of which describes a subatomic particle in the classical scientific sense. The other describes a wavelike term that Bohm called the quantum potential. *Potential* is a common term in classical physics, where it refers to the capacity of energy to move matter. Matter may be an automobile or train, or it may be atomic or subatomic particles moved by electromagnetic energy. We can illustrate with an easily pictured example. Imagine that we drop a stone into a pond. Gravity is the source of kinetic energy that is transferred to the water when the stone enters the water. This energy moves the molecules of the water, creating a series of waves, ripples in the water that spread out in all directions from where the stone enters the pond. These ripples describe a sine wave with troughs and peaks, and as they spread farther from where the stone entered the water, they become smaller and smaller. The potential is represented by the height of the wave and is proportional to the distance from the source of energy.

The quantum potential is quite different from the classical potential in that it does not have a source in the physical world, nor does it force the particle to move. Instead the quantum potential provides information to the electron, information that links it to the whole universe. It is sometimes referred to as a pilot wave in that it guides the particle. Bohm uses the example of a ship guided by radio waves to illustrate the nature of the quantum potential. The radio waves, by which information on how fast or slow to move, or when to turn left or right, provide no power to propel the ship. Instead they provide information to guide the ship, which moves under its own powerful engines. A more familiar current example is the drone plane of the military. It flies under the power of its own engine but is controlled from thousands of miles away by radio waves. In a similar manner, Bohm considers the quantum particle to move under its own energy, guided by the quantum potential. The quantum potential accounts for the wave-particle dual nature of particles and is responsible for the strange phenomena of quantum theory, including the nonlocal character of quantum reality, according to Bohm.

The quantum potential arises from the quantum field. We have envisioned what happens when a stone is dropped into a body of water. Now we will drop two stones in, a few feet apart. Waves go out from each. Some of them intersect with the waves from the other stone. When two peaks or two troughs come together, the wave doubles in amplitude. But if a trough and a peak coincide in the same space, they cancel each other out and the amplitude is zero. This is an example of interference and occurs with other energy waves, such as electromagnetic waves, as well. Now, if we drop a bunch of stones into our pond, many waves are created and they intersect each other in numerous ways, forming very complicated interference patterns. In holography, light waves reflected off the subject meeting the light beam from the laser create a similar complex interference pattern, which is captured on the holographic film plate. In the implicate order, all the quantum potentials intersect with each other, forming what Bohm labels the “quantum field.” In this quantum field, *the quantum potential of every particle interacts with the quantum potential of every other particle. This means the quantum potential of any particle is interdependent upon all the particles in the universe*. Everything is thus interconnected with everything else. As a result, we have Bohm’s concept of unbroken wholeness. “This view calls into question the validity of a space-time continuum as being the foundation of reality” (Friedman, 1993, p.47).

As we have noted, Bohm hypothesizes that the ultimate reality is a vast sea of energy. Quantum theory indicates that such an energy exists. It is derived from the concept of zero-point energy, the lowest possible energy that a quantum system possesses. Calculations indicate that there is more energy in a cubic centimeter of empty space than there is in the known physical universe. This energy is undetectable by today’s instruments because it is of a wavelength too small to be measured by today’s instruments. We can only detect wavelengths longer than 10^{-16}cm, although wavelengths as small as 10^{-33} can have meaning. This provides a very wide range of scale in which an immense amount of structure may be waiting to be discovered, Bohm says.

The holograph gave Bohm the concept of enfolding and unfolding. The holographic image roughly corresponds to the explicate order, the holographic plate to the implicate order, and the laser to the implicate order that is necessary for the image to unfold. He paints a picture of an enormous amount of activity as the explicate order unfolds and enfolds from and back into the implicate order continuously while the implicate order unfolds and enfolds into the super-implicate order, the super-implicate similarly interacting with the super-super-implicate order, and so on, for an infinite number of orders. An article by Will Keepin (2008), posted on the Internet by Alex Paterson, offers an analogy that helps depict these relationships. He writes:

> To clarify these concepts with an analogy, consider a video game. The first implicate order corresponds to the screen, which is capable of producing an infinite variety of explicate forms or images. The images on the screen, which constitute the explicate order, can be regarded as manifestations of the first implicate order. The second implicate order corresponds to the computer, which provides the information that organizes the various forms in the screen, or first implicate order. Finally, the player of the game represents a third implicate order [the super-implicate order], whose actions and inputs organize the second implicate order. This creates a closed loop, and creative possibilities can emerge over time.

Bohm summarized his theory of the implicate order in an article on the relationship of mind and matter:

> In this work [*Wholeness and the Implicate* Order], which was originally aimed at understanding relativity and quantum theory on a basis common to both, I developed the notion of the enfolded or implicate order. The essential feature of this idea was that the whole universe is in some way enfolded in everything and that each thing is enfolded in the whole. From this it follows that in some way, and to some degree everything enfolds or implicates everything, but in such a manner that under typical conditions of ordinary experience, there is a great deal of relative independence of things. The basic proposal is then that this enfoldment relationship is not merely passive or superficial. Rather, it is active and essential to what each thing is. It follows that each thing, is internally related to the whole, and therefore, to everything else. The external relationships are then displayed in the unfolded or explicate order in which each thing is seen, as has already indeed been indicated, as relatively separate and extended, and related only externally to other things. The explicate order, which dominates ordinary experience as well as classical (Newtonian) physics, thus appears to stand by itself. But actually, it cannot be understood properly apart from its ground in the primary reality of the implicate order. (1990, p. 273)

SOMA-SIGNIFICANCE

In *Unfolding Meaning*, Bohm seeks to mend the “Cartesian split,” the separation of mind and body initiated by René Descartes in the 17th century, which has pretty much been a doctrine of natural science since. Descartes concluded that mind and body (matter) were different substances that could have no interaction. Although that proclamation seems to defy common sense, materialistic science has widely considered mind and mental activity to be an epiphenomenon of neurological activity, a by-product that does not actually influence the body or matter.

The problem of the relationship of the mental and the physical is further complicated by relativity theory and quantum theory, both of which involve the observer with the observed, eliminating the classical science's position of independence of the observer from the observed. A number of thinkers have been convinced that Descartes was wrong (e.g., Penrose, 1989; Damasio, 1994). Bohm believes that his approach to quantum theory provides a way to understand the relationship between mind and matter that does not reduce one to a function of the other. For him, they are two aspects of the same reality.

Bohm rejected the terminology of mind and body, which he feels fragments what actually is holistic, for the term "soma-significance." *Soma*refers, of course, to the body and by extension to matter, and *significance* is a broader concept that includes meaning as well as substance. Everything, Bohm insisted, from a particle to a galaxy, has both matter and significance.

Bohm introduces the terms *soma-significance* and *signa-somatic* as substitutes for mind and body. Every kind of significance is carried by some kind of somatic arrangement and organization of distinguishable elements. That is to say that meaning is anchored in matter. The words that involve the arrangement and organization of distinguishable letters of the alphabet carry a meaning to the reader just as electrical signals in a television set carry a meaning to a viewer. These meanings are carried somatically by electrochemical processes into the brain, where they are apprehended and unfolded as meanings on a higher level. These in turn generate wider neurological activity, which enfolds and caries meaning to higher intellectual and emotional levels of meaning.

> As this process takes place these meanings, along with their somatic concomitants, become ever more subtle. The world subtle is derived from the Latin sub-texere, signifying woven from underneath, finely woven. The meaning is rarefied, delicate, highly refined, elusive, indefinable, intangible. The subtle may be contrasted with the manifest (which latter means literally what can be held in the hand). The next proposal is then that reality has two further key aspects, the subtle and the manifest, which are closely related to soma and significance. Thus, as has already been pointed out, each somatic form (such as a printed page) carries a meaning. This meaning is clearly more subtle than the form itself. But in turn, such a meaning can be grasped in yet another somatic form; electrical—chemical and other activity in the brain and the rest of

> the nervous system—which is evidently more subtle than the original somatic form that gave rise to it. This distinction of subtle and manifest is clearly only relative, since what is manifest in one level may be subtle on another. (Bohm, 1985, pp. 74–75)

A television broadcast offers an example. The camera picks up the physical scene and transforms it into more subtle electrical signals. These give form to a still more subtle radio wave that is spread out into space. The wave is detected by an antenna, which converts it back into electrical signals, which go into the receiver and are projected onto a tube to be transformed into a manifest picture. Here we see a content being transformed again and again into ever more subtle levels and then back into more manifest levels. Seen by a viewer, the picture carries a meaning that goes through all the transformations described above.

Both somatic and significance aspects are present in every experience. One does not have meaning unless it is associated with some physical process nor does one have a physical situation that does not have meaning for anyone who experiences it. So far the emphasis has been upon the soma-significance relationship as we have traced changing levels of significance through levels of increasingly subtle soma. Bohm also points out that meaning at a given level actively affects the soma at a more manifest level.

An example is a shadow seen at night. If this suggests an assailant to the one who perceives it, the soma is immediately and directly affected as adrenaline flows; the heartbeat increases and other bodily changes take place. The body prepares to take appropriate action. If, on the other hand, the shadow is seen simply as a shadow, the somatic response is very different. Whatever the meaning of a physical situation is to an individual, that meaning eventually turns into a response that alters some physical aspect of the situation. That may result in alteration of the position of the perceiving individual or some aspect of the situation outside the perceiver.

> From each level of somatic unfoldment of meaning, there is then a further movement leading to activity on to a yet more manifestly somatic level, until the action finally emerges as a physical movement of the body that affects the environment. So one can say that there is a two-way movement of energy, in which each level of significance acts on the next more manifestly somatic level and so on, while perception carries the meaning of the action back in the other direction. (Bohm, 1985, p. 77)
>
> You can see that ultimately the soma-significant and signa-somatic process extends even into the environment. Thus, meaning may be conveyed from one person to another and back through sound waves, through gestures carried by light, through books and

> newspapers, through telephone, radio, television, etc., linking up the whole of society in one vast web of soma- significant and signa-somatic activity. And similarly, even simple physical action may be said to communicate motion and form to inanimate objects. Most of the material environment in which we live (houses, cities, factories, farms, highways, etc). can thus be described as the somatic result of the ever-changing meaning that material objects have had for human beings over the ages. Going on from here, even relationships with Nature and with the Cosmos are evidently deeply affected by what these mean to us. In turn, such meanings fundamentally affect our actions towards them, and thus indirectly their actions back on us are influenced in a similar way. Indeed, insofar as we know it, are aware of it, and can act in it, the whole of Nature, including our civilization which has evolved from Nature and is still a part of Nature, is one movement that is both soma- significant and signa-somatic. (p. 78)

This back-and-forth movement, enfoldment of significance into the somatic and unfoldment of significance from the somatic, with each continually changing the other, parallels the enfoldment and unfoldment of the implicate and explicate orders. Meaning is unfolded from the somatic and enfolded back into it just as the matter of the explicate order unfolds from the implicate and enfolds back into it. Just as the implicate and explicate order are in continual enfolding and unfolding, so are the somatic and significant.

PARALLELS: IMPLICATE ORDER AND CANON OF SPONTANEITY-CREATIVITY

We are now ready to look at some of the parallels between Bohm's concepts of the explicate, the implicate and the super-implicate orders, and Moreno's Canon of Spontaneity-Creativity.

For Bohm, the basis of reality is the immense body of energy that includes the implicate order, which is, in Bohm's terms, a generative order. From this is unfolded the universe, the world that we live in and of which we are a part, the explicate order. And, of course, the explicate order includes not only the galaxies, the stars, the planets, and especially planet Earth, but everything on the earth, the continents, the oceans, the plants and animals, and the human species with all its inventions and discoveries, its thoughts, theories, hopes, fears, and dreams. All of these unfold from the implicate order.

In the earlier discussion of the Canon of Spontaneity-Creativity, I pointed out that Moreno's concept of the conserve includes everything that has ever come into existence and everything that will eventually come into being. That includes both things and mental products, such as alphabets, languages, theories, and whatever can be imagined. Moreno's concept of conserve is very much like, if not identical to, Bohm's concept of the explicate order.

The implicate order itself, in which every thing is enfolded in every other thing, is the quantum field from which the explicate order unfolds. It carries the potential for everything that we find in the explicate order, everything that has been unfolded, and everything that will eventually be unfolded.

I have interpreted Moreno's concept of creativity as the potential for becoming. Included are all the conserves that have ever existed plus everything that could have come into existence but didn't or hasn't. Creativity seems to me to be very like Bohm's implicate order.

This leaves the important notion of spontaneity in Moreno's scheme of Spontaneity-Creativity and the super-implicate order from Bohm's theory. And just as the conserve is the result of spontaneity, an "unconservable energy" serving as a catalyst to creativity in the Canon of Spontaneity-Creativity, it is the enfoldment and unfoldment movement between the implicate order and the super-implicate order that results in the explicate order unfolding and enfolding into the implicate order.

This correspondence of the major elements of Moreno's Canon of Spontaneity-Creativity and Bohm's theory of the implicate order is impressive. It suggests that these two scholars, starting from very different points of origin, have discovered essentially an identical theory of reality. Moreno seems to have "received" the Canon of Spontaneity-Creativity during the experience that gave rise to *Words of the Father*. Bohm worked out the notion of the explicate, implicate, and super-implicate orders in a very strict scientific process. And both suggest amazingly parallel systems for understanding how the universe works.

The fact that Bohm's work provides a solid scientific foundation for Moreno's concepts of Spontaneity-Creativity probably makes very little difference to most practitioners of the Morenean methods. For some, however, especially those who come to psychodrama with a strong research background, it is comforting to know that basic Morenean theory can be supported with a theory based on quantum theory—just as Moreno predicted.

HOSTILITY FROM COLLEAGUES

There is another similarity between the work of Bohm and Moreno. Although David Bohm had made significant contributions to physics from the time of his Ph.D. dissertation research, he felt that his identification of the quantum potential was by far his major contribution. He anticipated that the scientific community would receive it with considerable excitement. At the same time, he worried that the major figures of quantum physics might react unfavorably since he had, in fact, defied some of their dictums and had produced something that they had said was impossible, a hidden variables theory. Bohm's fears were realized. His work was variously called "juvenile deviationism," "ingenious, but basically wrong," and "foolish simplicity" by the giants of quantum theory. J. Robert Oppenheimer, who had been Bohm's mentor at one time, is even reported to have said, "if we cannot disprove Bohm, then we must agree to ignore him" (Peat, 1997, p. 133). Not all reactions to Bohm's work were negative, of course. His ideas, especially about thought and its place in the universe, may have gotten more attention from nonphysicists than from his colleagues.

In a recent book, Huston Smith (2001), highly regarded philosopher, relates a revealing experience concerning Bohm and physicist colleagues. A professor of philosophy at Syracuse University, Smith had occasion to invite a distinguished visitor to the campus. His choice was David Bohm. As was politic, he checked with the Physics Department to see if they would approve of him, a philosopher, inviting a physicist to campus. The department declared itself delighted with his choice and only asked that Bohm attend a Physics Department colloquia. Smith relates the following tale of Bohm's visit.

Bohm first gave a presentation for the general public, a presentation that was heavily attended by members of the physics department. The colloquium was two days later. As Smith and Bohm arrived, the chairman of the department pulled Smith aside and told him that he expected that Bohm would not have a very warm reception. It seems that things he had said in the prior presentation had not sat well with the members of the physics department.

There was a huge turnout for the colloquium. After being introduced, Bohm talked, Smith writes, for an hour and a quarter, all the time covering blackboards with what to Smith were "incomprehensible equations." At last he stopped and the chairman asked for questions:

> Instantly the arm of a senior professor in the front row shot up. "Professor Bohm," the questioner said, "this is all very interesting philosophy. But what does it have to do with physics?" I glanced at the solid bank of equations that stared out at us from the blackboards, with not a single*word* in sight. Without batting an eye, Bohm replied, "I do not make that distinction."
>
> A pall fell over the hall. With one or two polite questions, the afternoon ended. (2001, p. 191)

It is curious that the contributions of two extraordinarily creative minds meet with as much rejection as did the theories of Bohm and Moreno. We are accustomed to thinking that people of science are unusually rational and objective. We would expect them to examine novel ideas with skepticism, perhaps, but not hostility.

Moreno provided a sociometric analysis of the development of a science that provides at least a partial answer. Advances in science come from the intuitions of the rare genius. "These men of inspiration do not provide tangible proof for the correctness of their intuitions, they are all based on their authority" (Moreno, 1953c, p. 23). Confirmation is the task of the scientific collective. Moreno developed a kind of sociogram by examining quoting behavior of scientific writers. He selected a group of individuals deemed pioneers in their fields of endeavor. Then he inspected their bibliographies and reference lists and noted all the people that they had quoted. Next he searched the bibliographies and reference lists of these people to see whom they had and had not quoted. Then he constructed sociograms where being quoted equaled attraction, unquoted equaled indifference, and unfavorable or critical reference equaled rejection. He found mutual quotations and chain structures, just as in sociometric testing.

Moreno found that there were positive and negative pair relations with respect to the pioneer. The rest of the individuals fell into two groups, one of which was attracted to the pioneer either directly or more often indirectly through key individuals positively related to the pioneer. Moreno called this creator love. The second group was rejecting of the pioneer, either directly or indirectly through key individuals who were negative toward the pioneer or in the pioneer's disfavor. "A chain reaction produced a social network of negation which might be called antipathy for the pioneer or *creator envy*" (1953c, p. 27). Psychodramatic production, Moreno writes, revealed profound hostility reinforced by key individuals. This hostility resorts in creating a distorted picture of the pioneer and his contributions.

Moreno's depiction is reminiscent of Kuhn's (1962) description of scientific progress. Introduction of a new paradigm is a threat to the existing state of affairs. The initial reaction is rejection and even hostility toward the originator. The new vision slowly gains acceptance as key individuals support it and demonstrate its value.