Summary of *A New Physics*

Summary by Jim Oschman

Motion is not what we think it is!

Introduction

Those who explore the world of science know that the whole enterprise has but one permanent aspect: like it or not, what we know to be true is always changing. This is, of course, disconcerting to those who are emotionally attached to the explanations of nature they have learned in the past. Real progress in any kind of inquiry is always hindered by what we already think we know and, perhaps more importantly, our experiences that are shaped by this knowing.

Those who explore the worlds of bodywork and movement therapies are also familiar with uncertainty--when you have achieved some conviction about how the human body really works, there is a big surprise in store for you, often with your next client.

A New Physics is written by a chemist, William Day, and is published by a pioneer in the exploration of somatics, Marvin Solit. The reviewer attaches importance to this collaboration because of a belief that physics and the other sciences have suffered greatly from being detached from the wisdom of the living body.

The Publisher

Marvin Solit was trained first as an osteopathic physician and later by Ida P. Rolf, Ph. D. as one of the first practitioners of the Rolf method. Some 25 years ago, Marvin established his own organization, Rhombics, to explore the geometry of life. His group was recently renamed the Foundation for New Directions.

Marvin Solit has published Day's latest book, A New Physics (2000) and earlier works, Holistic Physics (1998) and Bridge from Nowhere II: The photonic origin of matter (1996). Day's first book was Bridge from Nowhere: A story of space, motion, and the structure of matter (1989), and was published by House of Talos, East Lansing, Michigan.

Revising Physics

Day's work over the past decade represents a bottom-up revision of physics. It leads to a set of new insights into the nature of our world. Every aspect of physics is virtually set on its ear by this revision. Yet the work is not undertaken lightly or without appreciation and respect for those who have gone before. Day acknowledges Einstein, for example, as someone who made enormous contributions to physics. As we shall see, though, Day believes relativity is not one of those contributions.

Physics has a rich and fascinating history that dates from ancient times. It is perhaps the most rapidly developing field of knowledge there is. And physics consists of a set of sophisticated sub-disciplines that focus on topics such as particles, atoms, motion, energy, and cosmology. A variety of engineering approaches derive from physics. Hence a bottom-up revision of a field as intricate as physics is obviously an enormous intellectual undertaking with many ramifications.

Day has digested and comprehended a vast amount of physical theory and seen behind it. He traces each of the major conceptual developments of the past and how they led to distorted pictures of nature. At each historical juncture, physicists were confronted with a choice between different logical courses. Often there was a choice between correcting previous misconceptions and developing new abstractions that maintained consistency with previous models. The effort to maintain consistency compounded errors.

Many of the supposed historic insights were, in fact, rejected on logical grounds by the scientists of the times. For example, Newton's law of gravity was considered "absurd" and "magical" by some of his most important contemporaries. Similarly, the reasoning developed in Einstein's theory of general relativity was challenged by the physicists of the period, including his most distinguished colleague and close friend, Max Planck. Serious errors in Einstein's derivation of E=mc2 are discussed by Day as well as by Ives in a paper reproduced in an Appendix.

All of Day's wirings are obviously snap-shots of a work in progress. His latest book, A New Physics, summarizes the current picture while giving hints about where he is likely to go next.

A revision of this magnitude may be too startling and revolutionary for most academic physicists to digest. But I suspect that body workers and movement therapists will welcome it openly because of it has practical application in their work and validates some of their most interesting experiences.

Motion

The worlds of physics and bodywork and movement therapies have a common mystery: motion. Just exactly what is motion, and what causes it? Physics and physiology texts have standard answers to these questions, but deep inside we all know there is more to the story.

For those who are fascinated by the mysteries of human motion, Day's work is deeply revealing. Conventional physics is based on Newtonian physics, which is entirely materialistic. The entire universe is made up of matter. Even space is defined as the absence of matter. Following on Galileo, motion or its absence became a fundamental property of matter. Kinematics and mathematical physics developed as types of engineering approaches to reality based on inertial motions and forces that can act at a distance across space.

Einstein's mass/energy equivalence shifted the focus to matter plus energy. In contrast, Day's world is entirely based on motion. According to day, light and fields and matter are all pure motion. Stop the motions and they cease to exist. Energy and force are abstractions that have created more problems than they have solved.

Day shows that these difficulties and confusions would have continued indefinitely were it not for the unresolved problems posed by the way light moves. Day's physics, then, is a physics that resolves the problems of the motion of matter and light. The result is a physics that more accurately represents the principles existing in nature. It is a new physics whose outcome is a realistic explanation of matter and motion in relation to space.

The Problems in Physics

Few academic physicists realize the magnitude of the transition their field is undergoing. Widely thought to be the most mature of the sciences, physics actually undergoes periodic upheavals that reach to its roots. The century-old quantum revolution is the most recent of these, and physicists everywhere are still struggling with it. What has been termed modern physics, even before the ink has dried, is about to undergo another giant metamorphosis into what has been termed post-modern physics. Fasten your seat-belt!

William Day is probably the most thoughtful and insightful guide to the physics of the future. His work over the last decade carefully examines each of the fundamental concepts of Newtonian mechanics, dynamics, relativity theory, and quantum physics, showing precisely where conceptual errors were made, how those errors compounded and confounded one another, and what can be done to sort out the confused state that characterizes the entire subject.

The story reads like an exciting detective novel, in which the clues to a fascinating puzzle are found and reinterpreted to find out what really happened, why it happened, and what it all means.

Day's conclusions go against virtually all that physicists are taught and believe:

The Galilean-Newtonian worldview left etched on scientific thinking deep impressions that have been too indelible to be easily erased.

Established scientific theory has a life of its own, with built-in survival mechanisms. Each paradigm surrounds itself with logic and abstractions and rationalizations that protect it from conflict with ideas and observations that do not match the current thinking. Yet there are some in the physics community who have a broad enough perspective on their field to see that there are problems that run deep and that require a large-scale revision. Each incorrect assumption and each erroneous abstraction leaves in its wake a trail of misimpressions and paradoxes. Because of this, the history of science shows that real scientific progress can eventually take place, not step-by-step, but through revolutions.

Day's conclusions are bound to open up great opportunities in many areas. Because of the nature of their work, body workers and movement therapists have the intellectual flexibility to benefit from Day's work long before mainstream academic physics wakes up to what is happening.

For those who find physics confusing, Day shows that explanations that have seemed irrational are, in fact, irrational. The world is not as complicated as science would have us believe.

What is most fascinating about Day's analysis is that it exposes how scientific concepts affect our everyday experiences. Change a concept, and your experiences change.

This review summarizes Day's main conclusions. All of his books are highly recommend for their wealth of rich and fascinating detail and insightful analysis. Regardless of how all of this turns out, Day's thoughtful dissection of the history of physics is of profound value and has to be reckoned with.

Problems with the S of Motion

It is such a common experience that thrown objects continue to move after they are released that we tend to forget that neither Newton nor Einstein were able to explain it. Why, for instance, is a batter able to strike a baseball and sent it sailing out into center field. On close examination we discover that current physics simply does not account for this phenomenon in real terms.

Day teaches us that there is a way of looking at motion that differs remarkably from what we have all been taught. It is no surprise that the first validation of these ideas comes from those who study our human experience of motion. In the reviewer's opinion, the human body represents real physics in action, and the answers to the deepest mysteries in science are to be found within us. Unfortunately this is not a place that most physicists choose to look.

Sir Isaac Newton's great insight was that gravity is a force that simultaneously causes the apple to fall from the tree, keeps the moon and planets in their orbits, holds objects on the earth, and causes the tides. As a result, we are taught that the moon's orbit arises from a balance between the attractive force of the earth's gravitational field and the centrifugal force that would otherwise cause the moon fly off in a straight line. The moon's orbital motion is a perpetual fall toward the earth.

At the time Newton conceived his laws they represented an entirely new and revolutionary way of looking at the world. Nobody had ever thought like this before. It was an idea that changed everything. Newton's mechanical model of the universe made sense and was easy to visualize. The universe became a vast dynamic equilibrium in which all of the celestial bodies move relative to each other and to space in a cosmic tug-or-war of forces. But were the underlying assumptions correct?

William Day's work actually demolishes and replaces most of Newton's concepts. And the replacement is not Einstein's relativity theory or quantum mechanics, both of which are also deconstructed by Day.

Newton's work gave birth to mechanics. Put into mathematical form, Newtonian mechanics predicts the movements of the celestial bodies with such incredible precision that we know exactly where the moon will be at any given second for the next 2000 years. So remarkably detailed is this information that we know the exact moments when every lunar or solar eclipse will take place, and where on the surface of the earth they can best be observed. Newton's algebraic approach was so successful that it remained unassailable for 250 years. It was a tremendous force in the technological developments of the industrial revolution.

Does the fact that all of this physics works, that we can predict the celestial motions, send ourselves to the moon, and make functional machines, prove that Newton's laws are correct? The emphatic answer is no!

Day teaches us that workable technology and engineering are not science; they are simply methods that work. It is theories that make science.

Our daily experience is that gravity is a force that causes objects to fall down. But this is something we are taught. There were periods in our history when gravity was not considered a force.

Einstein agreed that gravity is not a force. To get objects to move, Einstein curved space-time. This is an incomprehensible abstraction. It is not the geometry of nature. How, for example, can you curve space and, at the same time believe it is a void or nothingness. How can a nothing have a shape? Einstein's explanation was a set of tensor equations so complex that no one has been able to solve them except for the simplest cases. According to Einstein, light and matter lose energy to a gravitational field near a massive object, and this causes a slowing of time. Einstein created a balanced equation that kept track of the energy conversions between moving objects and the gravity field,

but when he threw out Newton's force of attraction he let go of any cause for motions.

Another mysterious phenomenon called inertia makes it hard to move heavy things, and hard to stop them once they are moving. Life can be experienced as a constant struggle against gravity and inertia. Many of our aches and pains and disabilities and medical crises arise from unfortunate encounters with gravity or inertia. But are struggling with the world as it really is, or are we struggling with our conceptualizations of the world?

Newton's laws of motion are so much a part of our every day lives that it is virtually unthinkable that there might be another way of looking at the world. They are also the foundation upon which a whole range of physics and engineering disciplines have been constructed: mechanics, dynamics, particle physics, astrophysics, and so on. But the therapists who teach us about human motion and emotion are aware that there is far more to this story.

It is widely believed that if a concept can be expressed with a balanced and workable mathematical equation, the concept must be true. One of the most important lessons Day teaches us is that a mathematical equation can work perfectly even if the conceptual basis is erroneous. Newton's law of gravity always works, its predictions are always accurate, but it is based on a flawed logic.

To understand how this can happen, Day reminds us that many of the equations of physics contain "constants" or "fudge factors" that are chosen to make the calculations work out correctly. Once the equation is brought into balance with one of these fictional factors, a concept must be devised to justify it. Often these justifications are entirely irrational.

Another problem is with algebra. While algebra is well suited for describing motion, it is capable of manipulating irrational or imaginary numbers, zero, and infinity. Therefore algebra can lead to abstractions, nonentities, and unreal relations.

Day shows us that much of modern physics is built upon mathematical equations that work every time even though they lack connection to logical concepts or real observations. This happened because theorists and mathematicians were not disciplined and logical in defining basic terms such as space, time, force, energy, the universe, and infinity. They also ignored important experiments that did not fit with their equations. As a result, the concept of a coherent nature became scrambled. Physics was thrown into confusion.

Day states that the problem is not with mathematics, but with the way it has been used. Mathematics is a method; it is not science or physics. Mathematics has no rules of rationality and causation. Fundamentally:

Physics is too important to be left to the physicists.

David Hilbert

Mathematics is apparently too important to be left to the mathematicians.

Tor Nørretranders

Mathematical physics must be physics to which mathematics has been applied, and not merely mathematical relationships uncontested by realism.

P. Marmet, 1993

Any model that is incomprehensible is irrational and does not represent either nature or science.

William Day

To unscramble the modern physical picture of reality, Day takes us through the history of the concepts of space, motion, and the structure of matter, explains the problems with the ways they were defined, and provides us with a fresh and vastly simpler and more logical picture.

The physical picture of the world we find in textbooks is the result of a confusing and torturous history. It is torturous because of the backwards order in which the various theories evolved. Physics began with the Galilean-Newtonian explanations of motion and gravity and progressed to light, electricity, and the structure of matter. Confusion arose because light, electricity, and space are more fundamental and are the logical beginnings for physical theory. By starting with erroneous explanations of space, motion, and gravity, the confusion was carried over into the explanations for light, electricity, and the structure of matter.

For two hundred years, physicists have been trying to fit every new phenomenon into Newtonian physics, which was actually developed to describe gravitational systems as seen from the worldview of the seventeenth century. The result is a set of bizarre theories to account for light, fields, and atomic and subatomic phenomena. The whole of physics became a chaotic mess, and Day is to be profusely thanked for his willingness to sort it all out.

Day takes us through the history of our conceptualization of space and motion.

Galileo thought that a force exerted on an object will cause it to move and that it will continue to move indefinitely unless it is interfered with (this came to be called inertial motion). But this was an abstraction that separated motion from any cause. It is such a common experience that thrown objects continue to move that we forget that neither Newton nor Einstein had an explanation for it. This abstraction put physical theories afloat in a sea of abstractions for the next three hundred years.

An ability to think abstractly is invaluable. However, abstractions usually express effects rather than causes. And one can get the impression that an abstraction is physically real, even if it really does not represent nature. A useful and practical and workable and erroneous abstraction can lead to successive theories that are even more unreal. Theories are built upon previous theories, and abstractions, like errors, compound themselves. When weak theories are perpetuated, the resulting confusion creates a space into which physicists feel free to insert other abstractions.

For Day, a comprehensive physical theory must include the causes of motions. We shall see that his approach is based on the composition of the whole system.

Newton's space was a void or unreactive nothingness through which light and matter move. It was a fixed or absolute backdrop against which all motions could be referenced. Orbital motions arose because of a balance of forces extending across the vast reaches of space. Gravity is one of these forces, but gravity, too, is an abstraction.

Newton was attacked by his contemporaries. Christian Huygens called the principle of attraction "absurd. "Leibniz thought Newton had turned gravity into a "perpetual miracle. "In his Principia Mathematica Philosophiae Naturalis (1686), Newton admitted that he had no idea of its cause.

Newton made a huge advance for his time that put physics and astronomy on a firm foundation. However, he did not leave an adequate theory of space or inertia. These are serious problems.

Dynamics is a branch of physics that arose from the study of how force (an abstraction) and mass (troublesome to define) interact. It is obvious in engineering that motion is a property of matter which can be added to or subtracted from by the application of a force. Force is needed to make something move, and force is produced when the motion of something is obstructed, such as by application of another force. Motion combined with mass gives rise to inertia and momentum. These abstractions gave rise to another one, energy.

Energy has been a valuable abstraction for calculating the motions of both matter and electromagnetic waves. The energy concept enables physicists and engineers to calculate exchanges between different forms of vibratory motion such as heat, sound, magnetism, radio waves, and so on. Problems arise when physicists use force and energy to define everything.

The confusion arising from carrying the incorrect notion of force into smaller and larger realms led physicists to choose mathematics over realism. This blocked the development of a rational theory of structures, from subatomic particles to atoms to gravitational systems. According to Day, matter does not arise from energy, it arises from motion. Just as light ceases to exist when it stops moving, so too do atoms and galaxies. At all levels, the universe is structured on motion.

In Day's physics, motion and structure are inseparable. Motions within subatomic particles create the space environment upon which atoms are built. Motions within atoms create the space environment upon which orbital systems are built. These, then, are the three tiers or hierarchies of matter that are based on motion: particles, atoms, and orbital systems.

The discovery of electromagnetism required that Newton's void be replaced with a medium or aether in which fields and waves could propagate. Maxwell, who integrated the works of Coulomb, Faraday, and Ampere, had to assume a medium consisting of an elastic solid. He concluded that light consists of transverse undulations of the same medium that causes electric and magnetic phenomena. His calculation of the velocity of light on the basis of his assumptions led to a value within 1% of the measured value. This was 140 years ago.

Einstein dropped the idea of a medium for light, but in the process created the wave-particle paradox. Physics was left with the struggle of rationalizing something that can be a wave and a particle simultaneously.

A space that is a void, with no properties and no resistance to the movement of bodies, cannot act as a medium for light and cannot account for the resistance of objects to an applied force. Waves must have a medium that can support wave action. Nothing can propagate on its own without a tremendous expenditure of energy. But if space contains a medium through which light moves, why don't solid bodies encounter resistance when they move through it?

This is where many problems began. These problems persist today. Physicists attempted to use the same theories to explain the movement of both matter and light through space. But Day points out that light is not matter and the motion of light is not related to the movement of matter through space. This is contrary to Einstein, who thought matter could move relative to light.

Day makes a simple and fundamental and profound distinction. Entities can move or propagate in a medium, by interacting with that medium. Other entities move through the medium without interacting with it. For example, light and sound can both move through air. The sound is propagated by the vibrations of air molecules. Take away the air molecules, as in a vacuum, and sound will not propagate. In contrast, light moves through air, but light is not propagated by movements of the air molecules. Take away the air molecules, as in a vacuum, and light will continue to propagate through it because the space medium is still present and light propagates in the space medium by

interacting with it.

This is simple enough, but physics never made this distinction.

An Experiment That Failed

Things got very confusing because of one of the most famous and significant experiments of all time. The experiment was done by Michelson and Morley in the summer 1887. In Bridge from Nowhere, Day recounts the fascinating events leading up to this dramatic but surprisingly unsuccessful experiment that changed the course of physics.

If light moves through space, light should have different velocities depending on the direction it is moving in relation to that space. A beam of light projected in the direction of the earth's movement through the medium (termed at the time the ether or aether or luminous ether) should move faster than a beam projected in the opposite direction.

In 1879, J. Clerk Maxwell considered measuring the movement of light in relation to the "ether wind. "This wind arises because of the motions of the earth through the fixed space medium. There are several of these motions. The earth rotates about its axis at a velocity of some 0. 3 miles per second (at the equator) and it moves through its orbit around the sun at 18. 5 miles per second. The earth is also carried with the sun in its galactic rotation toward Cygnus with a velocity of several hundred miles per second, and the galaxy itself is spiraling along at some thousands of miles per second. These motions through the space medium should give rise to a significant "ether wind" that should add to or subtract from the velocity of light moving in relation to it.

At the time, measurements of the speed of light were done by projecting a light beam from a source to a mirror and back again and measuring travel time. Maxwell, in a letter seen by Michelson, realized this setup would not be useful for measuring the velocity of light in relation to the space medium. While the velocity of light might be speeded in one direction, when it returned back over the same path, any gain or loss it had acquired would be canceled.

Albert Michelson realized that there was a simple solution to the problem. He would two send beams of light from the same source perpendicular to each other, for equal distances, and reflects them back to a common point. It would take longer for a beam to go against the flow of ether and back than to go across the flow and return (see Figure 1).

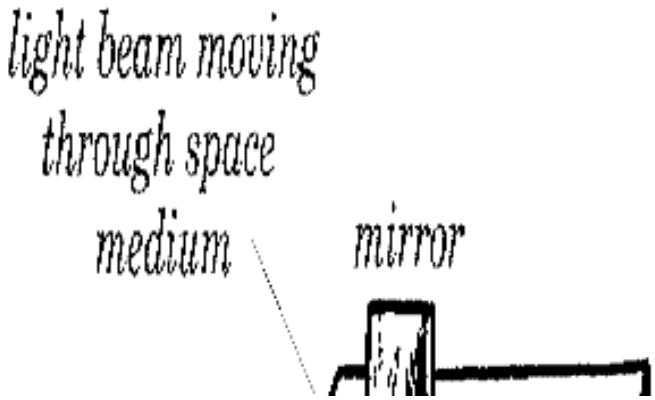


Figure 1.

Michelson carried out some studies of this kind in Europe, but the results were inconclusive. He published these results in 1881. Discouraged, he moved to Cleveland Ohio, where he eventually teamed up with Edward W. Morley to do the experiment with a much improved apparatus.

The research was carried out in the summer of 1887, using the best optical equipment available. A rotating table was used so that measurements could be made at various orientations in relation to the movements of the earth through space. Remarkably, the velocity of light was the same regardless of its direction of travel. Experiments were carried out at different times of day and at different seasons with different orientations of the apparatus, and no velocity differences were obtained.

This was an obvious experiment with a clearly predictable result. But the experiment failed to produce the predicted result. It should not have failed. At the time, physics was on the verge of providing a complete explanation for all of the phenomena in nature, a cause for every effect. To their amazement, Michelson and Morley found that the velocity of light was independent of its direction of travel through space. Light's velocity was the same whether the earth was moving toward the light source, or away from it. The movements of light and of matter seemed independent of each other. This means that regardless of how fast we might go to try to chase a light beam, we can never catch it. Regardless of how fast we are going in relation to other things, to a beam of light we are always standing still.

This was an incomprehensible and disturbing result that sent physics on a tangent for the next century. The Michelson-Morley experiment has been replicated by others, including Miller and, later, Townes, using more and more sophisticated equipment, but the results are always the same. The compounding of already existing confusions with irrational explanations that never accounted for the Michelson-Morely result caused physics to literally fall apart.

Before physics can ever mesh with reality, the Michelson-Morley experiment has to be explained. The explanation is not yet complete.

Michelson, troubled by his negative result, tried the experiment again 38 years later, near Chicago, in collaboration with Henry G. Gale. They used a much larger and therefore more accurate apparatus. Importantly, instead of measuring the movement of light in relation to the earth's movement through space, they measured light's velocity relative to the rotation of the earth on its axis. A positive result was obtained: the earth's rotation did, indeed affect the velocity of light. This publication and several other key papers are reproduced by Day in his Appendix.

The important difference between the 1887 and the 1925 experiments is that the earlier study involved the movement of light in a straight path, whereas the later study involved the movement of light at the edge of a rotating body, the earth. The measurements were made in clockwise and counterclockwise directions in a rectangular light path one mile long. The light beams were confined to one foot diameter Chicago water pipes that had the air pumped out of them to eliminate unstabilizing effects of air currents. The beam traversing the rectangle in a counter-clockwise direction was retarded relative to the beam going in the opposite direction. The amount of the retardation agreed with the value expected on the basis of the velocity of the earth's rotation through the space medium.

The differences between the 1887 and the 1925 experiments are important. The 1887 Michelson-Morley experiment attempted to measure the earth's movement in revolution around the sun. The Michelson-Gale experiment measured the rotation of the earth. They are different experiments. The first one wasn't inadequate. It was trying to measure something that doesn't happen. The null reading for this was correct, but it was incomprehensible because of the theory. The 1925 experiment measured the movement of light along a path that was rotating with respect to a fixed point. An edge of an object moving in rotation must move through and relative to the medium, the same as light.

Light and matter have unrelated motions because the motions are defined by different references, except when an edge moves in rotation and moves therefore through and relative to the medium, the same as light.

Day calls it linear motion if it follows a line and is not attached to something, as in contrast to rotational motion about a fixed point. The earth's revolution around the sun is linear, not rotational.

The Michelson-Gale data did not fit the currently accepted model of physics, therefore, the data was ignored and, unfortunately, still is. Dogma often takes precedence over facts.

For the history of physics, what is important is that the 1887 result was taken as fact at the time, and much confusion resulted. To explain the original null result, there were two possibilities: the motion of light and matter are not related to each other, or light has a constant velocity no matter how we measure it.

Astonishingly, Einstein took the second approach, and developed his theory of relativity. He kept Newton's idea that light moves through space the same way matter moves through space. Einstein believed that light is self-propagating and does not require a medium. We really can move relative to light, but we can't measure any differences in light's velocity because anything moving relative to light, including our measuring instruments, changes in a way that exactly cancels any apparent change relative to the velocity of light.

Einstein developed the fantastic notion that as matter approaches the speed of light, time slows, lengths contract, and mass increases. And light has mass and is therefore subject to the attraction of gravity. These are examples of concepts that can be created by the mind and explained with lucid logic, even though they have nothing whatsoever to do with the way nature really works.

Einstein's remarkable ideas followed logically from earlier theories of Lorentz and Fitzgerald indicating that objects shrink and time slows as velocity increases. The concepts also seemed to be verified by experiments. But the experiments were misinterpreted. Day takes us through the logic of relativity theory and shows the serious blunders made at each step along the way. The story is both fantastic and fascinating.

For example, in relativity theory an equation is developed for the Doppler effect for light based on the assumption that an imaginary right triangle, with one side a physical dimension of length, one side a non-physical dimension of time, and one side an imaginary line, can be solved with the Pythagorean theorem (Figure 2). But this theorem only applies when the sides of the triangle have dimensions of length. The mathematical technique was irrational.

Figure 2.

Another example involves the Lorentzian time transformation, which assumes that the flow of time along one axis of a reference frame can vary with respect to the flow of time along a perpendicular axis (Figure 3). This has no rational meaning, but the equation remains a fundamental of relativity theory.

Figure 3.

A final example comes from the accepted fact that as an object approaches the speed of light it becomes more and more difficult to accelerate it further. Einstein reasoned that accelerated objects become more and more massive the faster they go. There is no logical basis for such a suggestion.

To Einstein, it appeared that the speed of light was the upper limit for the velocity of any object. Experiments in which electrons were accelerated in magnetic fields seemed to bear this out. For example, an electron propelled in the 2 mile long accelerator at Stanford University to a velocity that is 99. 999 percent of the speed of light seems to emerge 40,000 heavier than when it started. To the electron, however, the 2 mile length seems to have shrunk to 3 inches.

But we cannot really look at something and tell whether it has gained or lost mass.

A carnival mirror can change the way you look, but not your weight.

The relativistic increase in the ill-defined property called mass at high velocity is an illogical hypothesis. It can only be accepted on blind faith.

Day gives a far more realistic explanation: as an object moves faster and faster it gets more and more difficult to apply a force to it. The limiting factor in accelerating anything is well known in engineering. It sets the speed limit to everything from bicycles to rockets. You cannot accelerate something faster than the speed at which you can apply a force to it. The idea that electrons gain mass as their velocity increases was simply a misinterpretation of an experiment.

Day accepts that the velocity of light is absolute and constant, but that this is not explained by relativity. Day also cites evidence that matter can move relative to matter at velocities approaching the speed of light, but the velocities of matter and of light are not comparable because they are not moving in relation to each other.

Einstein's concepts supposedly led him to the famous equation, E=mc2. In fact, Harriet Solit gave Day a reference to a book showing that E=mc2 was actually derived before Einstein by an Italian, Olinto De Pretto, without the benefit of relativity theory. De Pretto published E=mc2 in 1903. Einstein was told of this research and then published the equation himself as a footnote to his paper on the Special Theory of Relativity in 1905.

Einstein's paper in fact contained several conceptual errors that canceled each other, enabling him to obtain the right equation by the wrong logic. The reasoning developed in Einstein's 1905 paper on general relativity is discussed by Ives in a paper reproduced in Day's Appendix.

Like Newton's equations for gravity, Einstein's equations for relativity are workable, and give extremely accurate predictions, in spite of the lack of reality of the underlying assumptions. Newton's equations are still used, even though

gravity is not a force. And E=mc2is still used, even though there are no relativistic effects.

Key experimental predictions following from relativity, widely accepted as proofs of the underlying concepts, are readily explainable by simpler and more logical assumptions. Two of these are discussed by Day in A New Physics. One is the perihelion of Mercury. Einstein's relativistic equation for this phenomenon was published in 1916, but Paul Gerber had devised the same equation 18 years earlier, using classical physics and the assumption that gravity does not act instantaneously but propagates at the speed of light. Gerber's 1898 paper is reproduced in Day's Appendix.

A second prediction made by Einstein was that massive objects such as the sun would bend light beams passing nearby. We shall discuss this predication below, when we begin to detail Day's world.

Difficulties with the other observations that seemed to agree with relativity theory are discussed in Holistic Physics. These include studies of rotating magnetic fields, circumnavigating clocks, and the delay time of muons.

The idea of relativistic mass distorted all subsequent theories in physics, and prevented the development of a rational theory for the structure of matter at all levels, from subatomic particles to atoms to galaxies.

Newton's physics, with its concept of gravity as a force that acts at a distance were applied beyond the systems for which they were formulated, into subatomic physics. Dynamics, which is an engineering application of Newton's Laws, was misdirected into particle physics and astrophysics, and the entire field became dislodged from its logical base. For example, because of classical mechanics, dynamics, and relativity, a variety of virtual particles came into conceptual and mathematical reality as the "force bearing" particles needed to hold matter together. In Bridge from Nowhere II, Day navigates us through the world of subatomic confusion and shows that these unreal particles are unnecessary.

Since relativity theory was a failed attempt to resolve the paradox of the Michelson Morley experiment, there must be another explanation that resolves the paradox logically. Day's answer is that the motions of light and of matter are unrelated.

For there to be any motion, it must be relative to some reference. Light does not need matter to exist, so light moves relative to space. Matter moves relative to matter. Only motions relative to the same reference can be compared. Again, light moves in space by interacting with the space medium, through which it is propagated. Matter moves through space without interacting with space as a medium.

By getting away from the abstractions of force and energy and relativity, Day develops a logical explanation for the structure of matter that is based on motion. This comprehensive physical theory explains structure at all three tiers

of nature's hierarchy: particles, atoms, and gravitational systems. This theory is not Newtonian, relativistic, or quantum in nature. We shall see that it is holistic.

Movement Therapies

Some years ago I presented some of Day's ideas about post-modern physics to a Rolfing® class in Boulder, Colorado. I was astonished by the response.

When I mentioned that Day does not view gravity as a force, the teachers of Rolfing/Movement Integration literally cheered with excitement. I went on to tell them that Day thinks Newton's First Law of Motion is in error. Newton said, "Every body persists in its state of rest or of uniform motion in a straight line unless it is compelled to change that state by forces impressed on it. "In contrast, Day believes the fundamental movement in the universe is curved or orbital. This statement elicited another cheer from the movement therapists in my audience.

Apparently those who explore the world of human motion have an entirely different experience of gravity and motion than those of us who live in a world that obeys Newton's Laws. For the mature movement therapist, it would appear that gravity is not necessarily a linear force that must be overcome in order to do things in the world. There are ways of moving and lifting that are fundamentally different from this. And real motion tends to be along curved paths, not in straight lines. Day's work begins to provide a scientific validation and framework for these experiences. The practical implications are staggering.

I find the enthusiastic response of the movement therapists quite significant. Most of physics is done without reference to our experience of ourselves in the physical world. Some have suggested that any science that separates itself from genuine human experience is bound to be incomplete. Perhaps the physics of Day is a physics we can better relate to, using our bodies as references, rather than abstract ideas about things we can never see or feel.

Day's World

Now we visit the surprising world emerging from Day's physics. It is not a new world, it is the real world as it has always been, long before we were here to think about it.

A key aspect of post-modern physics is that it is holistic. To simplify their work, physicists and other scientists separate objects from their environment and study them in isolation. It must always be kept in mind that this is not the natural condition. Nature knows nothing of isolated things. Holistic physics incorporates the environment.

In Day's physics, gravity is an effect and not a force. To understand how this can be true, consider the nature of fields.

There are two definitions of the word field, and they give rise to different realities. The Newtonian application of the term, field, is as follows:

Objects modify the space around them in such a way that other objects, entering that space, experience a force exerted upon them.

The other definition of the word field is in keeping with Day's model:

Objects modify the space around them in such a way that other objects, entering that space, experience a change in their motions.

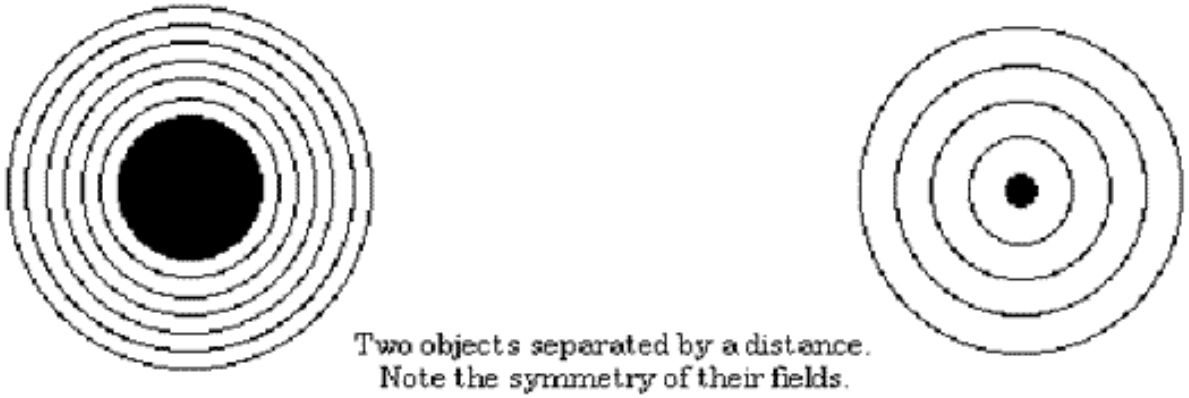
The way objects modify the space around them is by producing gravity, which is a field and not a force. The gravity field is a wave-like reverberation set up in the medium surrounding an object. It is produced by photons, which, in turn, are created by structural motions within particles and atoms and orbital systems. To say that gravity is a form of energy is to avoid the issue. Gravity is a photonic field with a frequency that travels away from objects at the speed of light.

The electrons and protons in an atom exactly or nearly balance each other so there is little or no net electrical charge in the space around the atom. In contrast, the gravity field always extends away from an atom or other orbital system, reaching indefinitely into space. Objects create waves that are propagated away from the object through the space medium at the speed of light. This was predicted by Gerber with reference to the unexplained perturbations of the orbit of Mercury, and confirmed by observation (although misinterpreted as a confirmation of Einstein's relativity).

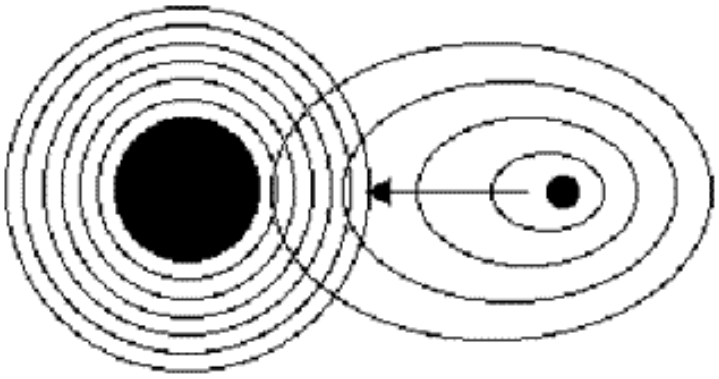
A balanced and stable arrangement is created when a set of components moves endlessly around a nuclear body. The atoms comprising the human body are stable arrangements of this type.

Gravity modifies the properties of the nearby space medium, making it uneven. Every object is surrounded with a gravitational gradient--the gravity waves are shortened the closer you get to it. Shorter gravity waves reduce the cohesion in the medium, slowing wave motions--their frequency drops. Hence massive objects reduce the cohesion in the nearby medium, slowing and bending waves, including light.

Because the tension is reduced in the space medium around massive objects, the gravity waves being emitted by smaller bodies become longer on the side facing the larger body. The smaller body is therefore compelled to move toward the larger one to equalize or balance its field--to become centered in a symmetrical environment (see Figure 4).



Two objects separated by a distance.
Note the symmetry of their fields.



When the smaller object is in the stronger field of the larger object,
its wavelengths are elongated in the direction of the larger object.
The smaller object begins to move spontaneously to equalize its waves.
As it moves toward the larger object, its waves on the side of the larger
object shorten by the Doppler effect.

Figure 4.

To Day the idea that things are under a compulsion to be at the center of their interactive environments is axiomatic. It is a holistic version of Newton's "for every action there is an equal and opposite reaction. "

If the field is "weakened" on one side, the object will move toward the "weakened" side to restore the symmetry and remain in what to it seems to be the. Stated differently, objects move spontaneously toward larger objects to shorten their waves by the Doppler effect. This is the effect you notice when a siren approaches, and the sound gets higher in pitch because the waves are being “compressed” as they approach you; when the siren passes and recedes from you, the pitch drops because the waves are getting longer.

The gravity field suspends objects in their medium. Nearby objects respond to the field around an object by moving until balance is achieved. Objects tend to maintain the gradient around themselves in a spherically symmetrical form. They center themselves to attain symmetry and balance. Motions arise in response to the properties of their nearby space medium, and not because they are being pulled toward other objects. This is completely different from forces acting at a distance.

The earth influences the course of the moon, not by forcing its motion, but by shaping the environment which guides it. Instead of action-at-a-distance, we have action-on-the-environment, which, in turn, affects the motions of other bodies.

According to Newton's action-at-a-distance view, the sun and earth would have no gravitational power if they were entirely removed from each other, but their power is supposed to suddenly arise when they are in relation to each other. Michael Faraday did not like this idea because it could not account for electricity and magnetism. Faraday was certain there is a medium for the propagation of electric and magnetic fields. He visualized fields as lines that could be drawn in all directions around a source. These "lines of force" in the space medium eventually replaced the purely mechanical pictures of Galileo and Newton.

Day's universe is a landscape of peaks and hollows, of highs and lows, mapped in the intensity of gravitational fields in the space medium. As bodies move through space, they freely and spontaneously ride the waves of other bodies and surf the contours of their fields.

Matthew Solit Adlai-Gail describes it this way: A gradient of the space medium is similar to air pressure gradients in the earth's atmosphere - in other words, like a weather map with "isobars" drawn - lines that demarcate places where pressure is the same - the motion of air (i. e. , wind) occurs when there is a gradient of pressure, and the air naturally and spontaneously moves from higher pressure to lower pressure, trying to equalize the pressure in the environment.

Einstein explained the bending of light by large masses as distortions in the geometry of space-time. This rather irrational concept arose from relativity, in which motions at the speed of light distort length, mass, and time. Einstein's hypothesis was supposedly verified experimentally in 1919 when A. S. Eddington showed that starlight passing near the edge of the Sun is displaced by the amount predicted by Einstein's general relativity.

But this phenomenon can be more simply and logically explained with Day's model.

The Medium

Without a medium, physics gets obscure and abstract. With a medium, the explanations become simple. Real space, Day says, is a medium made non-uniform by gravitational fields. We cannot perceive this medium because we cannot see the non-uniformities. We cannot see the causes of inertia and spontaneous motion. Instead we see a space in which objects seem to move relative to each other, and we assume, incorrectly, that space is uniform and objects are interacting with each other.

The last thing deep sea fish would discover is water.

Sir Oliver Lodge

Day states that for any motion to continue after it has been caused requires a medium. Once a motion begins in a medium, a wave is created that continues to move through the medium. Both a photon and a projectile make waves in the space medium and are carried with the wave.

Both light and matter move through and relative to the space-medium, but only light is part of the medium. Therefore the movement of light and matter, while relative to the space medium, are not relative to each other.

Light travels at a constant velocity, whereas the velocity of objects can vary. The reason for this is that the velocity of light, a wave, depends on the properties of its medium, whereas the velocity of an object depends on the way its gravity waves interact with the medium. The gravity waves produced by an object depend on its internal structure.

Inertia is simply due to matter's suspension in the medium by its gravitational field. Gravity is an effect and not a force--gravity is the effect that takes place when objects move spontaneously to remain centered by their fields in a non-uniform space environment.

All of this happens in a medium. We were not aware of this medium until experiments with light and electromagnetism revealed it. Humans have no direct interaction with this medium--to us, it is invisible, non-material, and unreactive. Yet in order for light to propagate in the medium, the medium must have high tensile strength and rigidity. Its strength is greater than that of the strongest steel. It is so rigid that only electricity can distort it.

A medium has a cohesion (tension) that is directly correlated to the velocity of waves in it. Make a deformation in the medium and it creates a wave that travels through the medium at a rate proportional to the tension. For light to have such an enormous velocity, the medium must be extremely rigid.

Here is a simple experiment (pointed out in a review of A New Physics written by Hal Fox, who is the editor of the Journal of New Energy:

Fasten one end of an elastic material, pull it out a specific distance. Pluck the elastic and note the frequency of vibration. Now using half of the elastic material, stretch it out to the same length as before. Note that when it is plucked the vibration is much higher. That is just a simple analogy that for a medium to allow light to travel so fast, it must be more rigid (more cohesive) than steel. The nature of the disengaged (from matter) medium is its high rigidity and its ability to carry light waves at such high velocities.

If the medium is so rigid, why can't we feel it?

At first it seems absurd that we are immersed in such a rigid inelastic medium and can still move about. But we move without directly interacting with the medium. The medium is non-material, and the electromagnetism that formed

the matter we are made of disengages us from the medium.

Orbiting bodies move through the medium, but not in the medium. Orbiting bodies do not interact with the medium, the way light waves do. Particles, atoms, and gravitational systems have self-contained structural motions that detach them from the medium. The human body moves through the medium, and not in it. But the gravitational fields of objects, including our bodies, move in the medium.

The gravity waves reverberating in the medium suspend matter in it and give rise to the property called inertia. Inertia is not a direct interaction with the tensile strength of the medium. Instead, our gravity waves interact with the tensile strength of the medium, and it is this interaction that resists motion.

Stated differently, the gravitational field generated by an object interacts with the medium in a way that resists displacement. To the extent that we experience inertia we are experiencing the interaction of our gravitational fields with the medium. We are not directly experiencing the medium itself.

The medium predates matter, and matter as we know it arises because of the properties of the medium. Properties of the medium therefore are the determinants of the properties of matter. All bonding, including chemical bonding, arises because of the tensile strength of the medium. All particles within matter are made of waves called photons, or parts of photons, separated and rearranged, condensed, and combined in different ways.

Day points out another fascinating aspect of a medium. By looking at the medium holistically, one can see that properties can be related to our perspective in terms of the scale of things. What appears to be very rigid on our scale of observation can be a fluid or gel at an astronomical scale. For example, a steel bar, which seems rigid and unyielding, will behave like a flexible wire if it is extended several miles. The same may be true of the space medium.

We refer to tensile strength and inelasticity in relation to material objects of our experience. The tensile strength and inelasticity of the space medium is in reference to non-material phenomena such as light and other forms of electromagnetism, which we do not experience directly.

From the astronaut’s perspective, a medium can not only propagate waves, but it can also have motions within itself. For example, water can serve as a medium for the propagation of sound waves. At the same time the water can have internal motions comparable to whirlpools and tidal currents. Day therefore sees the space medium at an astronomical scale as having the consistency of a fluid or gel. Waves generated by the structural motions within matter influence the geometry of the space environment. Like particles moving along in a stream of water, bodies move through space riding on the waves of other bodies and surfing the contours of their fields.

Matter and Space

In Day's physics, motion is fundamental to the structure of my body and all the objects in my environment. Motion is a fundamental component of the structure of matter at all levels, tiers, or hierarchies.

It is a natural tendency for nuclei to create an environment around them that establishes an orbital system. At each level there is a nucleus that creates a space environment in which other components move. It takes no force for a body to move spontaneously in response to its environment. The nucleus influences the course of its satellites, not by forcing their motion, but by shaping the environment which guides them. Each stage differs in the kind of nucleus, the properties of space created, and the component that moves in that space. Each system becomes the units for the next larger stage. Each system is assembled on motion.

Matter is mostly empty space. But it is also impenetrable. The moving components screen a volume and prevent general mixing. Atoms can be penetrated by things smaller, but seem hard and impenetrable to things larger.

Instead of the mechanistic image of bodies moving freely in a void, the universe takes on the nature of a solution. Electromagnetism is the "solute" or dissolved entity that can condense or crystallize into particles of matter. These particles remain suspended in the medium like particles in a solvent. Change the structural order within the suspended particles, and they dissolve back into the medium.

This analogy enables Day to compare his holistic physics with dynamics. In a solution, the suspended particles interact directly with their immediate environments. Change the environment and the particles will move relative to other particles suspended in the solvent.

If we want to revise physics and make it more rational, the space medium must be actively taken into consideration. Since the medium determines all, it is of paramount importance to understand it. The medium has a geometry, and the study of this geometry represents a fascinating and challenging enterprise. Marvin Solit is exploring the geometry of space that goes along with Day's physics. He has found that tensegrity is an invaluable model for the geometry of the space medium.

Experiencing Motion

A New Physics has a final chapter on the biological significance of all of this. To the reviewer, this looks more like a beginning than an end. I suspect that biology will become a significant part of Day's future explorations. The kinds of fields we are immersed in and the ways we affect the space medium around us are topics of enormous interest.

Materialistic Newtonian physics says I can lift my arm by exerting a force. The energy comes from metabolism, which is, in turn, powered by the chemical energy in the food I eat.

Holistic physics says I can lift my arm by radiating a field. Once the field is radiated, motion takes place passively in order to restore balance in the field arrangement.

Hence there are two models of human motion, and they lead to different experiences of the world. In my opinion, both of these models are correct. Which model we experience depends on which model we project mentally.

Some Conclusions

This review has summarized major parts but not all of the new physics being developed by William Day. I have gone to some length to organize and summarize Day's ideas in both his and my own language and logical order.

There are gems in Day's writings that I continue to ponder. For example, Day rejects the Big Bang theory for the origin of the universe, and this is welcome. For Day, the universe had to begin with a timeless unbounded medium. Matter can arise anywhere from the pre-material medium. Instead of beginning with an unimaginable primordial nothingness, as in the big bang, it is far more logical that the galaxies were spawned from the same medium that carries waves and fields.

The analysis of the Michelson-Morley experiment is unfinished, and Day leaves us with some tantalizing pieces of this fundamental puzzle. He explains the Michelson-Morley result by saying that matter moves relative to matter and that light moves relative to the space medium in which it is propagated. Matter cannot move relative to light.

But there is an exception. It is physically impossible for matter to move relative to light except for the edge of a rotation. Rotational motion can occur relative to the space medium, but linear motion cannot.

This is an extraordinary observation. It came about as follows. In 1913, an important French scientist, Georges Sagnac, modified the Michelson-Morley experiment.

Instead of directing light beams with and against the direction of the earth's rotation, Sagnac directed two simultaneously emitted light signals in opposite directions around the edge of a rotting disc. When the signals return to their point of origin, they have taken different times and have therefore traveled at different velocities. The light traveling in the direction of rotation moved faster than that moving against the rotation. This shows that light can move relative to matter at the edge of a rotating disc, and that the light is propagating through a relatively fixed space medium. The edge of the disc moved relative to light. This not only showed light and matter can move relative to each other, it confirmed the existence of the space medium.

As pointed out above, in 1924 Albert Michelson and Henry Gale repeated the Sagnac experiment on a larger scale, using a mile of 1 foot diameter Chicago water pipe formed into a rectangle. The air was pumped out of the pipe and light beams were directed around it, bouncing off mirrors at the corners. In contradiction of the original Michelson-Morely experiment of 1887, they were able to detect the absolute rotation of the earth with reference to the space medium.

The experiment was repeated by others, including Herbert E. Ives, in 1938. Again, Day has reproduced this important paper for us in the Appendix.

I have enjoyed the entire process of contemplating the work of William Day, and am grateful to Marvin Solit for introducing it to me. For anyone interested in the various ideas science has about how the world works, Day's writings are great fun.

About the author

"I always seemed to come up with an answer that no one wanted to believe," said the author. A native of Indiana, William Day is a graduate of Indiana University and McGill University in Montreal where he received his doctorate in chemistry. His research and writings have dealt principally with structural order and origins. He resides in Oxford, Mississippi, where he researches and writes on scientific problems.

About the reviewer

Jim Oschman has degrees in biophysics and biology from the University of Pittsburgh. After an academic career as a cell biologist, he has published extensively on the scientific basis of complementary medicine. Recently he published Energy Medicine: the scientific basis. Jim is President of Nature's Own Research Association in Dover, New Hampshire, and presents lectures and workshops world-wide.

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