What is Missing? The Dynamics!

From the above description, we begin to understand that organic gardening is really all about the biological eco-system. For gardening to work, we need to feed and develop the entire soil food web -- an intricacy of mutually cooperating micro-organisms. This is a relatively new understanding for biologists. Only in the last few decades, has their understanding of eco-systems grown. Rudolf Steiner, who founded biodynamics, anticipated this finding many years before by pointing out the importance of soil life interactions and the farm as a complete organism. So now that biology has caught up to Steiner, why do we still continue with a distinct practice of biodynamics? Because Steiner's lessons revealed more than just the importance of ecology. Steiner also proposed a philosophy that explains what is life and how living beings interrelate.

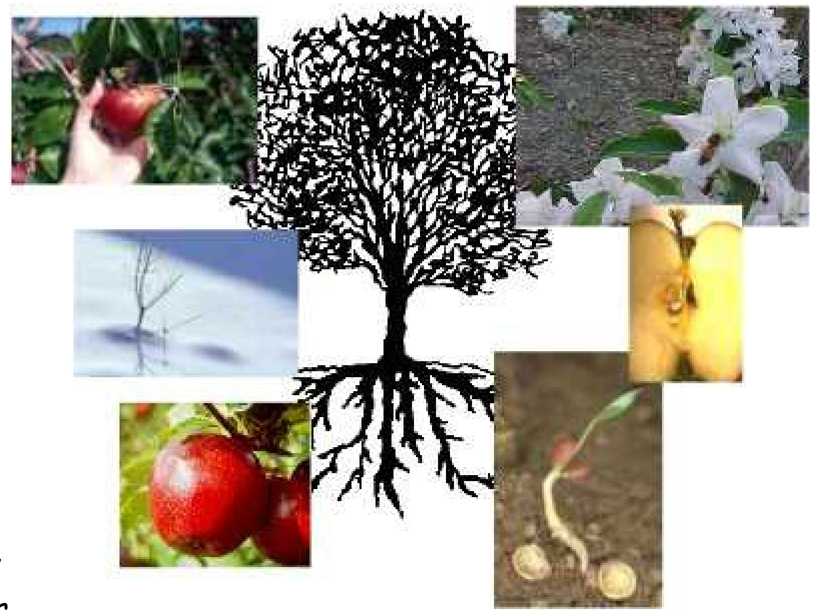
Let's think for a moment about how we approach and solve problems. The modern scientific approach is to dissect the problem into manageable pieces and then solve the pieces. The process is one of reductionism. But does it always work? What happens if the sum of the parts has different qualities from all the little pieces? If we make that error, we are overlooking the holistic approach. And since biological systems are so complex, we really need a holistic understanding.

If we want to understand living systems, what is it that we need to study? What is it that separates the living and the non-living? This is by no means a trivial question, but has raged back and forth in the scientific community.

The way we think about our world is a function of how we think the world ought to be assembled. Thomas Kuhn formed the notion of a scientific "paradigm", a "constellation of concepts, values, techniques, etc. shared by the scientific community". These shared concepts are used not just by scientists, but throughout society as a way to think about problems and solutions. The influence is so subtle that we often don't realize how our expectations are colored by the prevailing concepts. For example, the Victorians were enamored of their industrial revolution and structured their thinking around the model of railroads, mass production and heavy industry. In our time, the rise of the computer has brought a new paradigm -- some would tend to formulate all problems and observations as information theory.

And modern age has brought a new set of problems. We are more aware now of the danger posed by climate change, species extinction and ecological destruction. This, in turn, has the beginnings of a new paradigm -- one that requires a radical shift in thinking and values. Part of the new paradigm could be called a holistic worldview, the world is an integrated whole rather than a dissociated collection of parts, and it also includes what Fritjof Capra describes as deep ecology. "Deep ecological awareness recognizes the fundamental interdependence of all phenomena and the fact that we are all embedded in (and ultimately dependent on) the cyclical processes of nature. Deep ecology recognizes the intrinsic value of all living beings and views humans as just one particular strand in the web of life."

One thing we can say -- living things are in a process of change. As in this picture of a flower, they are in a constant process of change -- growing, maturing and ding over time. Seeing life as dynamic is crucial to recognizing what it is. Reductionist science is focused on taking a sequence of short-term snapshots, then assembling them into a sequence. Is this approach adequate? Perhaps the piece-meal model serves the narrow purpose for which the scientist has developed it. But it should be no surprise to realize that reductionism is inherently unsatisfying -- it feels like something is missing if we aren't looking at the whole picture.



Here's another example -- which picture is the apple? Answer: all of

them! The apple tree goes through all these stages, of growing, flowering, producing fruit and seed and going dormant for winter. Is there any one stage that represents "appleness"? No, because we have to carry the thought of all these stages occurring at different points in time when we think about an apple tree. So the concept of the "apple-nature" really can only exist in our imagination. Steiner refers to the "apple-ness concept" as an "archetype" -- the fundamental idea standing behind all those partial examples of which we can only see one at a time. With our imagination, we start to gain an understanding of the human's role in gardening. Nature proceeds over time to form living systems. But nature is not able to anticipate and plan ahead. So human imagination can assist the process by providing conscious planning and direction.

Toward an Open Philosophy

Our way of understanding or philosophy exerts a large influence -- the way we think about our world is a function of how we think the world ought to be assembled. Thomas Kuhn stated the notion of a scientific "paradigm", a "constellation of concepts, values, techniques, etc. shared by the scientific community". These shared concepts are used not just by scientists, but throughout society as a way to think about problems and solutions. The influence is so subtle that we often don't realize how our expectations are colored by the prevailing concepts. For example, the Victorians were enamored of their industrial revolution and structured their thinking around the model of railroads, mass production and heavy industry. In our time, the rise of the computer has brought a new paradigm -- we tend to formulate all problems and observations as information theory. All these paradigms true or false? No, they are just looking at the same observations with a different perspective.

We are more aware now new problems, dangers posed by climate change, species extinction and ecological destruction. This, in turn, has the beginnings of a new paradigm -- one that requires a radical shift in thinking and values. Part of the new paradigm could be called a holistic worldview -- that the world is an integrated whole rather than a dissociated collection of parts -- what Fritjof Capra describes as deep ecology. "Deep ecological awareness recognizes the fundamental interdependence of all phenomena and the fact that we are all embedded in (and ultimately dependent on) the cyclical processes of nature. Deep ecology recognizes the intrinsic value of all living beings and views humans as just one particular strand in the web of life."

As an example, consider how systems exhibit complexity in ways that would not have been expected. We can describe the chemical characteristics of carbon, hydrogen and oxygen atoms. But would you know that when assembled into sugar molecules, the aggregation tastes sweet? The system has a new characteristic that was not obvious in the pieces. It has been suggested that such characteristics are "inherent" in the components. That is, we could say that the "definition" of the atoms includes the property that they could form sugar molecules. It isn't too hard to see the problem here -- does that mean we also have to expand the "definition" to include the property of forming proteins, fats and every other kind of molecule? If so, that's a "definition" that would take far more than an encyclopedia to write. Such a "definition" is so overblown that it becomes useless and a sort of circular argument. Ironically, Godel's Theorem uses formal logic to prove that one can never develop a complete logical system. When logic tries to explain everything, it still fails to be able to fully explain itself.

So the reductionist approach has inherent limits and will, at some level, fail to provide a complete and adequate explanation. Why then is it so popular that it dominates scientific thinking? Because, like most of our technology, it is very useful most of the time. If one tries to solve a problem, it is often helpful to break it down into manageable portions. Of course, a different person could view the problem in a different way, breaking it into a different set of components. Does that mean one perspective is right and the other wrong? Not necessarily -- both approaches can have their own strengths and weaknesses -- they are merely looking at the same set of facts using a different focus. Given that reality is more than can be held in a single thought, every attempt to think is a partial abstraction. That is, in order to think, we develop conceptual models about things. The model is not the full reality -- just as the map is not the territory. Any model can be useful in formulating an understanding of how things work; the difference in perspective just means a difference in which components get emphasized.

How then does one know whether a conceptual model is correct? The answer lies in pragmatic experience. What do you want to use the model for? Does it work in that context? If so, okay. How do we decide if a model is working for us? The most pragmatic way is practical applications -- can we use the model to develop "testable hypotheses"? That is, can the model predict a fact that we can go out and test? Is the model complete at explaining a wide range of observations? We can also ask if the model's explanations are consistent and don't involve logical contradictions. We can ask if the model is accepted by others -- but we want to avoid the trap of falling into a group-think dogma. So it may be more productive to ask ourselves if our own intuition accepts how the model explains things. Steiner emphasized that his students should always test his explanations against their own experience and by meditation without accepting even his own opinions as fact.

The reason for discussing conceptual models is that biodynamics is just such a model -- one that departs from conventional understanding in key aspects. Nevertheless, biodynamics has proved a useful model for understanding living systems from a perspective that emphasizes the dynamic process of life. This emphasis is not a new one -- Western science has historically struggled between the reductionism and holism.

The conceptual framework of the world as a machine was completed by Isaac Newton. In the Newtonian world, every event happens by necessity -- it has to happen; the universe has no choice. Everything is predetermined if we know the initial conditions and the physical laws. For example, if the marksman knows precisely the angel and velocity of his bullet, he knows it's trajectory and exactly where it will hit. As stated by Leon Lederman, director of the Fermi Lab, "We hope to explain the entire universe in a single, simple formula that you could wear on your T-shirt." Newtonian mechanics worked well at describing the physical universe. Other bodily functions, like digestion and metabolism, required the development of modern chemistry. At that point, it appeared that animals could be described as machines, albeit more complicated than mere mechanical clockwork.

If clockwork strikes you as an incomplete explanation, you are not alone. The same time period saw the rise of the Romantic Movement in opposition to the mechanical paradigm. The Romantics returned focus of the nature of living pattern or organic form. Goethe coined the term "morphology" for the study of biological form from a dynamic, developmental viewpoint. He pointed out nature's "moving order" and developed a very modern concept of form as a pattern of relationships within an organized whole. "Each creature", wrote Goethe, "is but a patterned graduation of one great harmonious show." As an artist, Goethe felt that visual perception was the door to understanding organic form. Steiner was very much influenced by Goethe's perspective and philosophical approach.

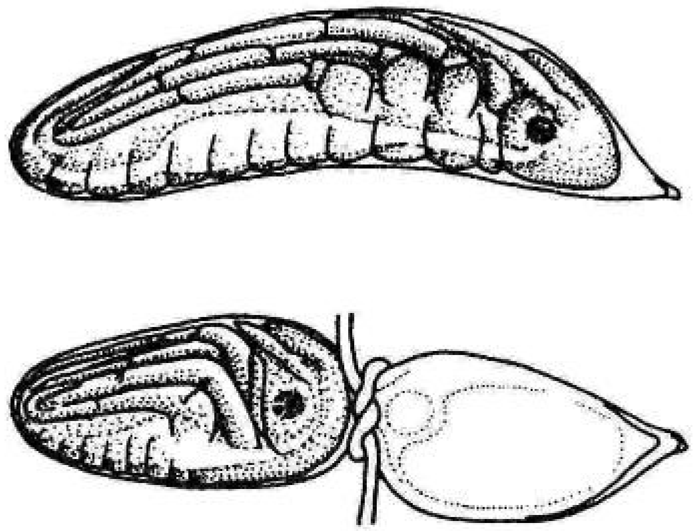
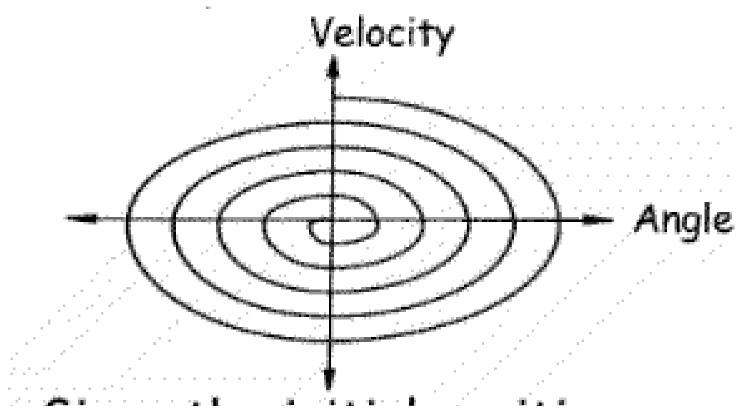


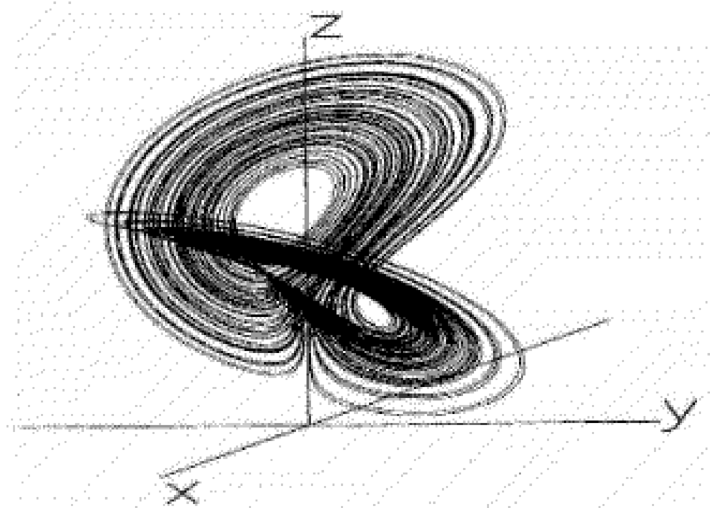
Illustration: Above is a normal embryo of the dragonfly Platycnemis pennipes. When the posterior of the egg is ligated, it develops a small but complete embryo.

Then the tide turned. Further advances in science established the mechanistic conception of life among biologists. Yet these advances carried within themselves the seeds of the next wave of opposition. Cell biology was unable to fully explain all the coordinating activities necessary for the cell as a whole to properly function. The German embryologist Hans Driesch initiated the opposition to mechanistic biology with pioneering experiments. He found that if one divided an embryo at a very early stage, one would get -- not half an embryo -- but a complete embryo of half size. Somehow, the cells maintained a pattern and did their best to develop within that pattern. It is hard to resist the impression that there exists somewhere a blueprint or plan of assembly. There is a strong sense of purpose. It seems as if the growing organism is being directed towards its final state by some sort of global supervising agency. This sense of destiny has led biologists to use the term "fate map" to describe the seemingly planned unfolding of the developing embryo. Driesch postulated a causal factor that he called entelechy -- a force that acts on the organism without being part of it, ie. from the outside.

Embryonic development exposed limitations of the reductionist model. As an organism grows from an initial cell, how can those cells specialize in different ways, becoming muscle cells, blood, bone cells and so on? How can one account for all these biological forms in terms of reductionistic physics? The scientist can clearly see organizing factors at work, but has little idea of how these organizing factors relate to known physics. The development of the embryo embodies the central mystery of all biology -- how can totally new structure emerges in the progression from inanimate to the animate? It seems that some concept of a nonphysical entity or life-force must be added to the laws of physics and chemistry to understand life itself.

Investigations into systems found another problem with the deterministic viewpoint. Under Newton's mechanics, we can predict a system's position at any time if we know the starting conditions. For example, if we look at the path traced by a pendulum, if we know the initial speed and movement and the amount of friction, we develop a mathematical expression that will perfectly predict the pendulum's position.

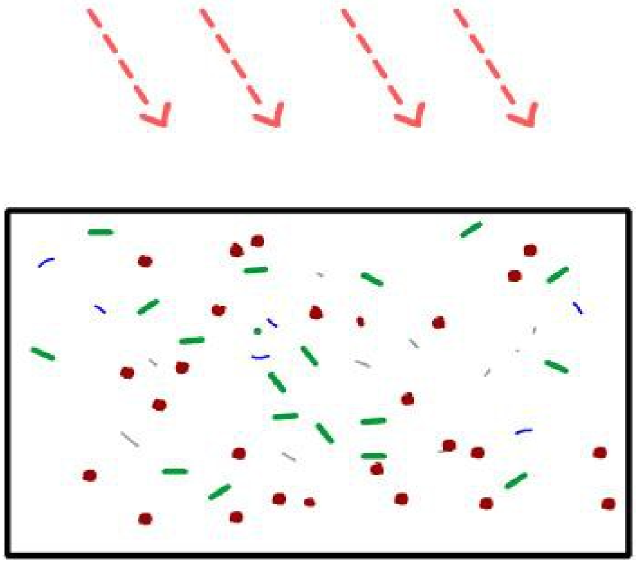




The Lorenz attractor is not completely random, it stays inside a certain envelope. But within that envelope, it is not possible to predict.

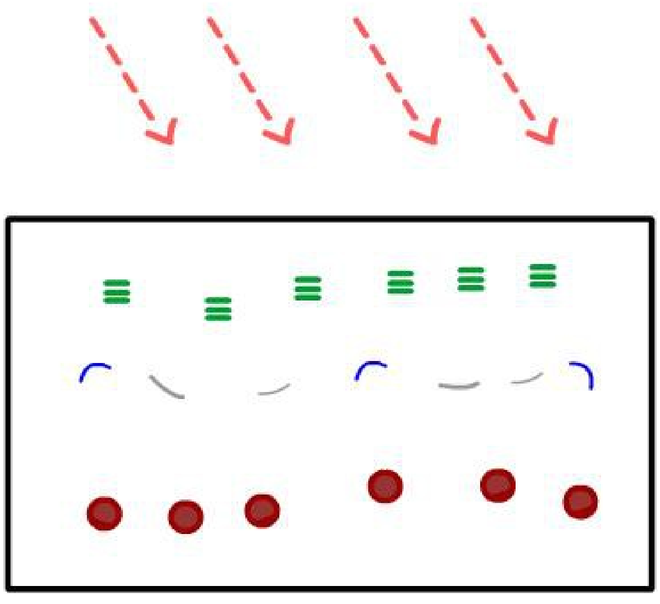
But scientists found there were other types of systems that also could be described with a mathematical expression but were not predictable. The figure shows one example of what is called a "strange attractor". The system is not totally random -- it always stays within a particular envelope. But within that envelope, its behavior is not known. This is because the mathematical relations are complex. Even very small differences in the starting position are magnified into uncertainty in future position. This example was found when scientists were trying to build a global model of weather systems. The discovery lead to the statement that "a butterfly flapping its wings in China" could influence the weather across the ocean. This statement is not really an exaggeration because the even very small perturbations in the starting conditions can lead to exactly such large changes in the overall system.

With this in mind, let's generalize about how natural systems behave. Consider the black box as representing a system. Within is undifferentiated stuff -- chaos, in a word. From the outside, energy comes hurtling through the system and out again.



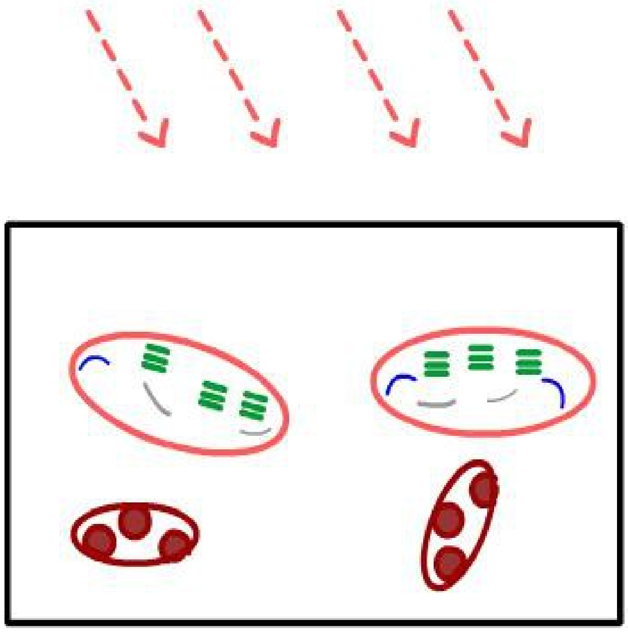
A system starts as undiffertiated chaos, under incoming energy

Now a strange thing happens. As the energy passes through, some of it is retained and the stuff inside the system begins to form into some kind of order. This is a surprise because under the natural laws of physics, things don't get more organized -- they are supposed to get less organized. (Entropy, the amount of disorder, is supposed to increase.) But there is a loophole. This is an "open" system, meaning that energy is passing through it. And some of that energy can be captured temporarily to assemble an ordered structure inside the system boundary even though the disorder will eventually be manifest outside the system.



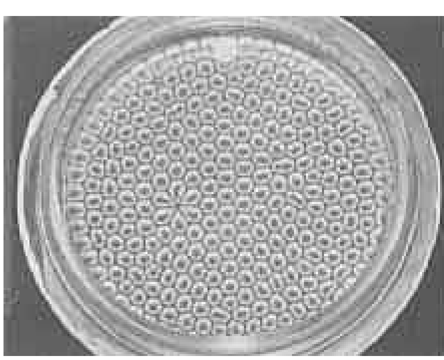
The system borrows from the energy flow and self-organizes.

Eventually, the system can be come organized in ways that are quite complex and unpredictable.



Organization evolves into unique and unexpectedly complicated forms.

Notice two key parts of this illustration - (1) there is a skin or boundary for the system -- there has to be an "inside" and an "outside". The outside serves as the source for the incoming energy and as the place where "disorder" can be thrown away. (2) The inside starts as chaos; later the disorganized stuff falls into some sort of pattern. (3) Change happens over time; there is history. The pattern formed today can mature into a different pattern tomorrow. So the pattern at any time is a function of how it got there.



Here is an example of that sort of organization. Imagine that you are looking down into a pot of water boiling on the stove. Since water is transparent, we can't see the organization set up as thermal energy passes through. But other liquids have visible color changes. This picture shows what are called Benard cells. As the liquid is heated, it forms colored convection cells that we can see. These cells arrange themselves looking like a living cell culture.

Open systems of this sort were studied by Ilya Prigogine as he formed theories of what he called "dissipative structures". The interesting thing is that under these open energy conditions, it is the natural event for systems to self-organize and turn their undifferentiated chaos into some sort of ordered structure. It is even possible for that structure to refine and evolve and develop an increasing level of complexity. Sometimes the systems evolve in ways that are completely unexpected. And complex systems do not always evolve the same way each time -- the unexpected changes can take the system down alternative paths of development.

So there can be two alternative paths and no way to predict which will be chosen. It looks like nature has "free will". After a series of such choices, the system has developed a history that would be unlikely to be repeated under similar circumstances and is not pre-determined or predictable. Systems reach critical "choice points" at which they may leap abruptly into new states of greater organizational complexity. Statistical assumptions fail because a single fluctuation can become amplified and stabilized, altering the system dramatically and suddenly. Suddenly, the future is not predictable after all.

Discovery of these systems has created a revolution in scientific thought. These systems cannot be understood by analysis of the little parts. The properties of the parts but can be understood only within the context of the whole. The key characteristics of systems -- sensitivity to small changes in environment, the history of critical points of choice, the uncertainty and unpredictability of the future -- are revolutionary new concepts. Nature turns out to be more like human nature -- unpredictable, sensitive to the surrounding world, influenced by small fluctuations. In the deterministic world of Newton, there is no history and no creativity. In the world of dissipative structures, history plays an important role, the future is uncertain and this uncertainty is at the heart of creativity.

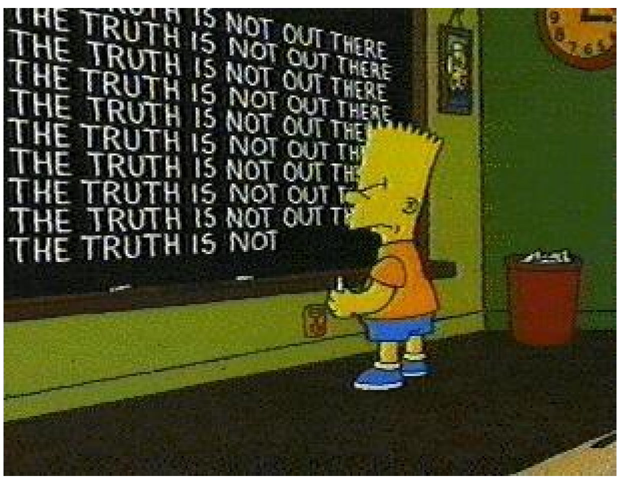
"The hope that physics could be complete with an increasingly detailed understanding of fundamental physical forces and constituents is unfounded. The interaction of components on one scale can lead to complex global behavior on a larger scale that in general cannot be deduced from knowledge of the individual components." (J. P. Crutchfield, et al., Scientific American, December 1986, p. 38.)

Dissipative structures bring a series of interesting questions. From where does the system get its pattern? Is it inherent in the components? If so, we have the problem of trying to include all the possible complexity, even unrealized pathways, into the definition. Or does the organizing pattern come from outside? In that case, what is the mechanism? And regardless of where the pattern comes from, how is it transmitted or communicated to the components? And finally, how does one explain evolution? Why do the systems develop increasingly refined complexity over time? Is there an overall guiding force or purpose that directs the evolution? Can the natural world be said to have purpose?

System science brings a series of interesting questions. From where does the system get its pattern? Is it inherent in the components? If so, we have the problem of trying to include all the possible complexity, even unrealized pathways, into the definition. Or does the organizing pattern come from outside? In that case, what is the mechanism? And regardless of where the pattern comes from, how is it transmitted or communicated to the components? And notice that the all-important pattern is pure information -- that is, it is non-material. Who would have thought that the non-material world would influence our existence?

And finally, how does one explain evolution? Why do the systems develop increasingly refined complexity over time? Is there an overall guiding force or purpose that directs the evolution? Can the natural world be said to have purpose?

So pervasive is the mechanistic paradigm that ascribing purpose to nature would be an enormous taboo for any scientist. When James Lovelock proposed his Gaia theory -- that life on Earth regulates the whole planet as a giant organism -- biologists attacked his hypothesis because they could not imagine how life could create and regulate these conditions without being conscious and purposeful. Conventional scientists could not accept the idea that the causal agent is purposeful -- that there is a purpose and design in nature.



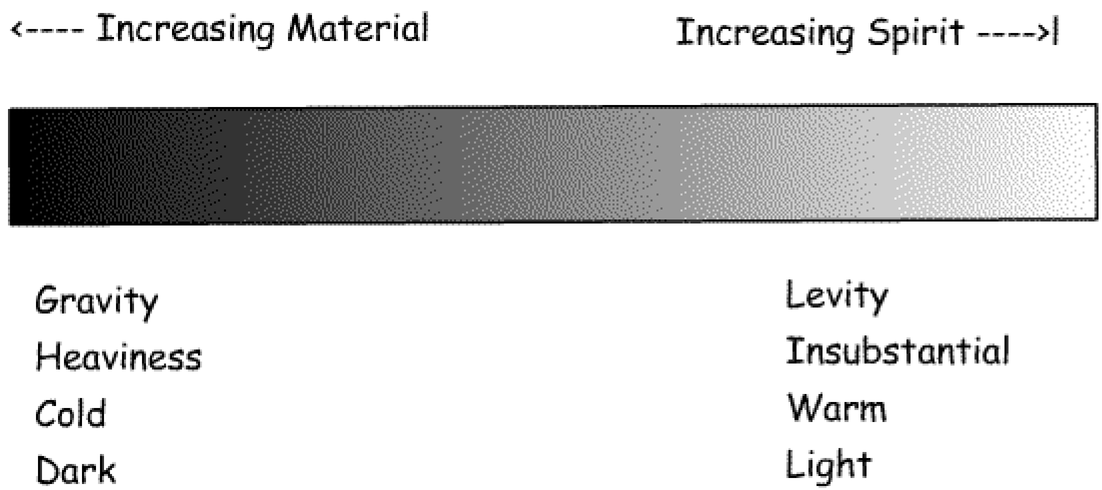
The PATTERN is out there. Yeah, whatever...

Keeping an open mind to new concepts is the challenge -- our educational institutions train against such possibilities. Paul Davies says, "Mysteries such as the origin of life and the progressive nature of evolution encourage the feeling that there are additional principles at work which somehow make it easier for systems to discover complex organized states. But the reductionist methodology of most scientific investigations makes it likely that such principles, if they exist, are being overlooked in current research."

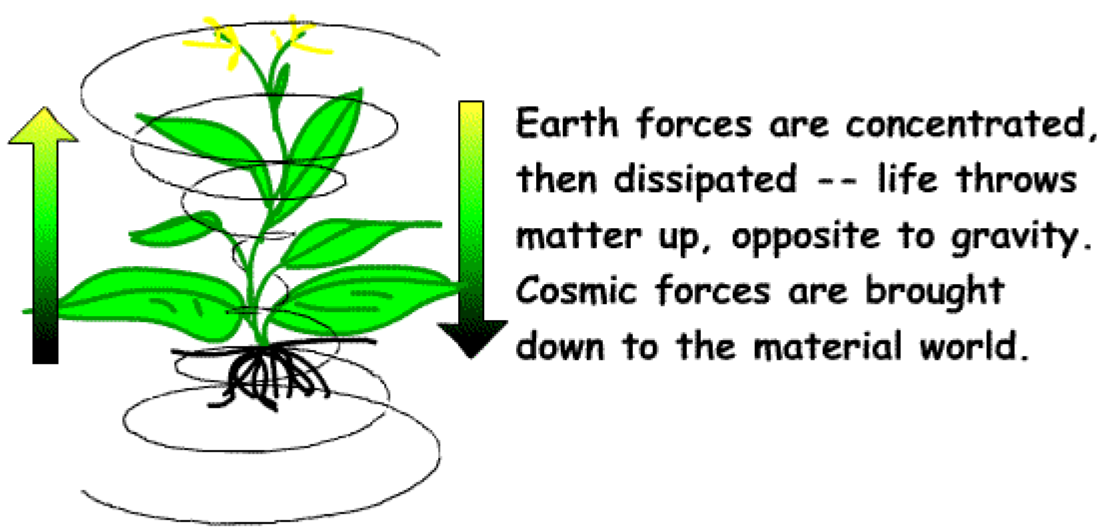
Philosophical Foundations

First, let's understand some of Steiner's thinking about how the world works. For thousands of years, people (including some very smart ones) have been thinking about how things work. Without the benefit of our detailed technical knowledge, they assembled their own conceptual models. And because these were empirical for their level of technology, they are still logical models for anyone outside of a science lab. That is, their observations and interpretations form a consistent, logical framework still valid at the level of a farmer standing in the dirt.
One such observation has to do with the material world and the immaterial. One observes the effects of forces and energy - the pull of gravity, the warmth of sunlight, the change of substances due to heat or cold. Yet these are immaterial forces; we can't see whatever it is

that makes them happen.
Also we can observe that material objects occur in a variety of forms, from the heaviness of a rock to the light touch of a breeze. So it seems logical to see the "stuff" exists in a continuum - ranging from heavy, dense hard matter (say a rock) to matter that changes (solids melt to liquids) to light, insubstantial forms (vapor and gases) to immaterial energy (light, warmth). The material world and the immaterial worlds interpenetrate each other. At one end of the continuum, we have cold, heavy materials, subject to gravity. At the other end, we have increasingly less substantial matter, like air.



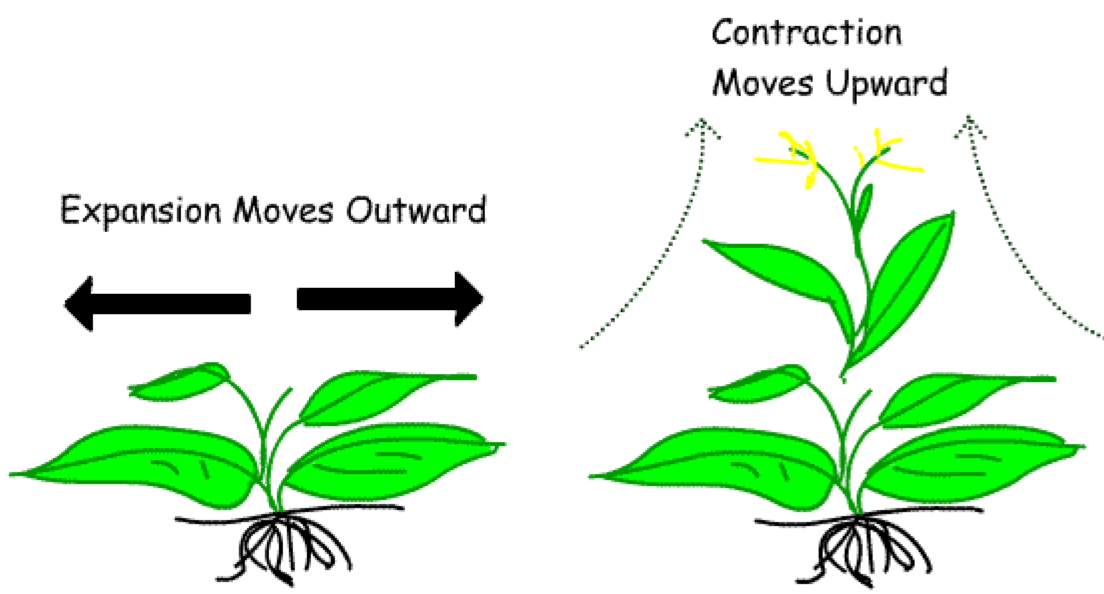
Now if we call the immaterial world "spirit", we find one part of Steiner's framework: "Matter always in spirit; spirit always in matter." It is part of Steiner's belief system that matter seeks to escape and become spirit, while spirit seeks to incorporate into the material world. Together these two tendencies define how the universe works.



The other part of Steiner's framework has to do with a piece of the "immaterial" world. As we mentioned earlier, modern science has been forced to the understanding that the patterns of organization are critical to understanding how the world works. And we don't fully understand these patterns - where they come from, how they get transmitted to living things. But we do see that important patterns are repeated time after time in the world. Each pattern can be viewed as a constellation of recurring themes. A theme that organizes a healthy body for use, organizes a recognizable pattern in a plant's body or in the growth of natural forms. So, for example, if we take the plant as a medicinal herb, we may find that the pattern information comes through as improvement in our own health. Thus, the idea of congruency - that pattern information can be recognized and used to guide the immaterial forces that, in turn, shape the material world. Steiner used this concept to develop special herbal preparations designed to guide natural processes or "formative forces". These forces, while invisible, are recognized by the effects they produce in living beings.

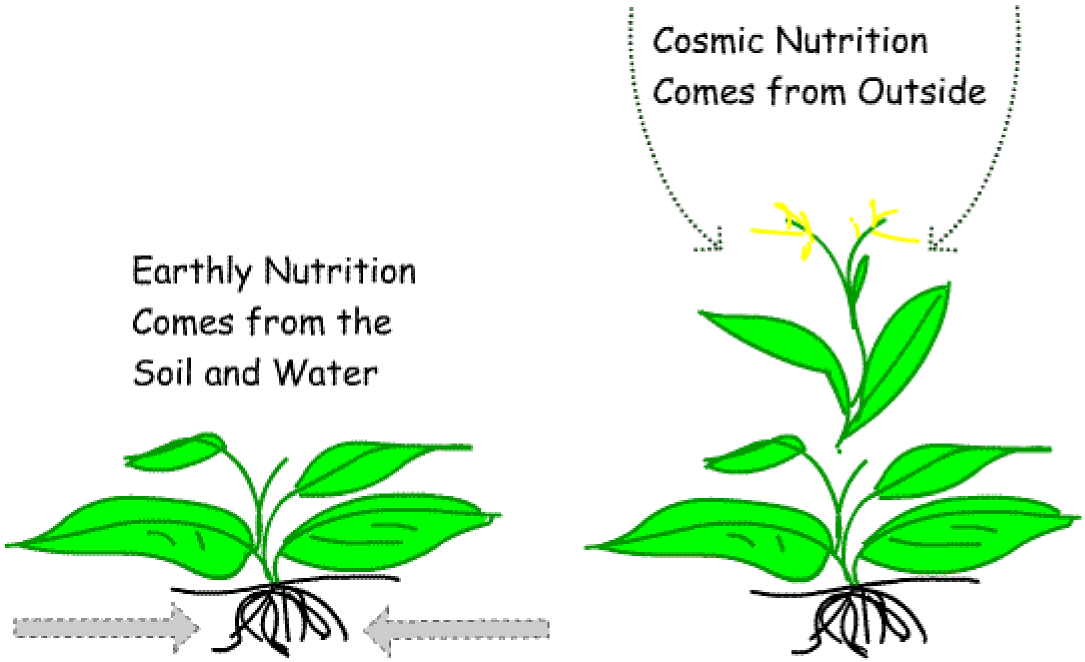
The Dynamics of Growth

So with an open mind, let's consider how a philosophy of plant dynamics works. We start with observing how plants operate.



When we look at how a plant grows, we see two different kinds of growth. Of course, these don't happen at quite the same time. First, there is an expansion as the plants burst forth in the spring. This growth is lush, vegetative and forms the bulk of the plant's substance. But then there is a qualitative change -- later growth is of a different kind. Under the warmth and light of summer, the plant becomes harder and dryer. It develops an upright growth form. The vegetative leaves become smaller and finally disappear completely, The plant moves into produces flowers and fruit. It's substance becomes dissipated into airborne pollen, fragrance, color and taste. It effect the plant has moved from creating material substance of the earth and water to creating more refined substance -- that of the air and light. Behind these two manisfestations of growth, we can visualize two difference types of growth forces; one of lush, watery, vegetative growth and one of dry, hard maturity.

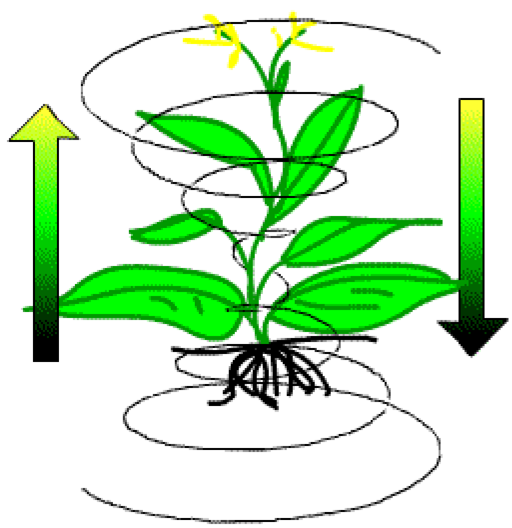
But these forms of growth are just the what we see as visible. We can also imagine processes that we can't directly see. For the plant growth to occur, the plant must be taking in food or energy from it's surroundings. In fact, we can see that there are two different streams of nutrition involved.



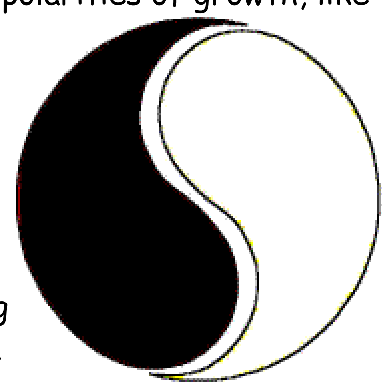
Indeed, the plant is pulling in water and nutrients form the soil in order to form its vegetative body. And then it pulls in light and warmth for the maturing process. It is only with the light and warmth of summer that the plant ripens fruit and sets seed. Here is where the information of the plant's pattern becomes important. The seedling starts out with an initial pattern (the seed embryo) but adjusts form and function to fit its own internal information (genetics), the nearby environment and subtle information coming from the far-distant outside. We call the idealized pattern of the plant the "archetype". Each plant has some idea of that basic pattern but modified according to the specific circumstances. The archetypal pattern information is especially important as seed formation sets up the embryo and pattern for the next generation. And certain patterns from plants are useful when our own body gets out of kilter -- hence medicinal herbs. If one thinks of what is being conveyed as the pattern information, one can understand how even a small amount of a substance can have a great effect.

So we can understand two different gestures in how the plant forms itself. Underground, the root develops as an expanding sphere. New rootlets grow radially outward. But the root also becomes a hard, concentrated substance. All the roots are organized to either to bring in water and nutrients from the outside to the center and to store concentrated nutrients. To do that, the root quickly becomes hard and woody. The vital areas of the root are short-lived -- only the tiny and delicate root hairs in the outer periphery are growing and renewing. These harden rapidly into the woody roots. Overall, the root sphere is organized as pulling inward to a center focus point.

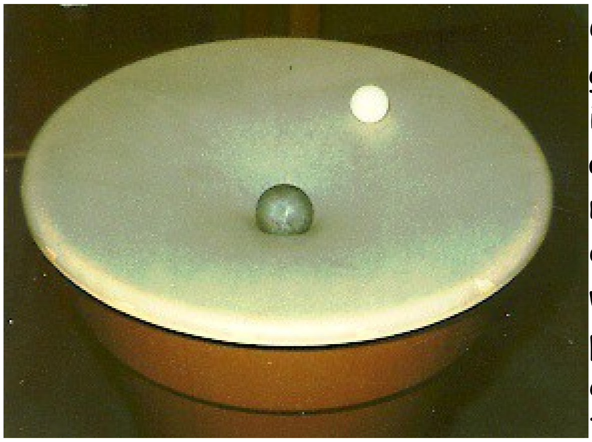
Above ground, we see a different picture. The stem goes upward, reaching to the sun. The leaves expand outward in the horizontal plane -- so that they can intercept as much sunlight as possible. There is a spherical structure to the new growth, but it is open to the heavens. The organization is one of being open to receive from the outer world. There is a gesture of reaching outward, curving around a focal point as if to embrace it from the outside.



From this observation, we can describe two opposite but interacting polarities of growth, like the yin-yang in Oriental philosophy. Examples occur in all sorts of contexts. The solid sphere is a case of forces pulling in, the same way the sun's gravity pulls in the planets of the solar system. Here we have gravity waves coming out from the center, and matter being attracted and falling inward. The hollow sphere represents the different kind of force -- one that reaches out and around rather than toward the center. One has only to look at the upward thrusting form of the plant to observe that life-force tries to be the opposite to gravity. Think about how when we "feel heavy" we are depressed and low-energy while when we "feel light" we are joyous and full of life. "Levity" is what we call this tendency for life-force to be opposed to gravity.



Gravity is a good example of the centering type of force. The sun exerts a pulling force that holds the planets in their orbits. We know that gravity is an attractive force pulling toward a mass. But where is the polar opposite? How can there be such a thing as anti-gravity?

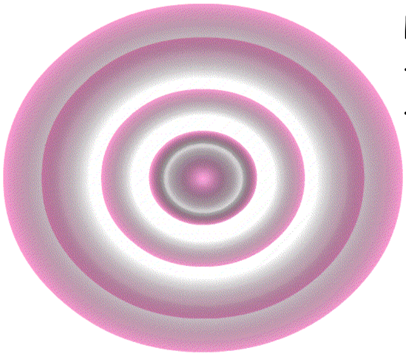


One explanation comes from Einstein's explanation of gravity. He pointed out that gravity causes a curvature in space. Imagine that we set up a elastic rubber sheet as in the picture. We can set a ball bearing or heavy marble in the center. See how the elastic sheet deforms due to the weight of the ball? In the same way, the mass of the sun deforms so that an orbiting planet, as shown by the lighter white ball, must keep circling in order to avoid falling into the sun's well. The elastic sheet analogy illustrates some other principles.

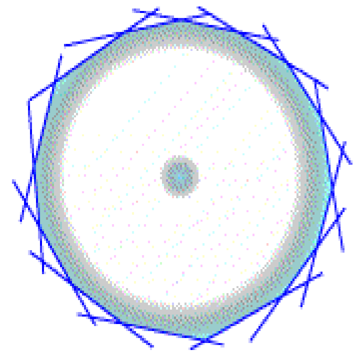
(1) What holds up the heavy marble at the center? Obviously the elasticity of the rubber sheet. The elastic force must provide enough force to counter the weight of the marble, otherwise the marble would just drop all the way through. We can imagine that elastic lines of force are distributed throughout the sheet in direct opposition to the gravity forces of the heavy marble. These forces can be considered as levity, the opposite of gravity. In the case of the solar system, the sun's curvature of space is opposed by something -- namely the resistance of the fabric of space itself.
(2) In the picture, the elastic sheet is covering only a small circle -- the elastic forces pull out until they reach the outer circumference where they transfer the marble's weight to the rim. Imagine that in the case of the solar system, the space-time sheet is infinite in size -- then the sun's weight is transferred to infinity or at least the entire rest of the universe. Similarly, the lines of levity are imagined to stretch to the farthest reaches of the cosmos.

Solid Center	Hollow Center
Centripetal -- seeks the center, solid in the middle	Centrifugal -- embraces around the center, hollow in the middle
Forces radiate outward to the periphery	Forces come inward from the periphery
Gravity -- Substance falls in	Levity -- Substance grows out
Yin, earthly	Yang, cosmic
Concentrating inward	Dispersing outward

Projective Geometry Applied To Plant Forms



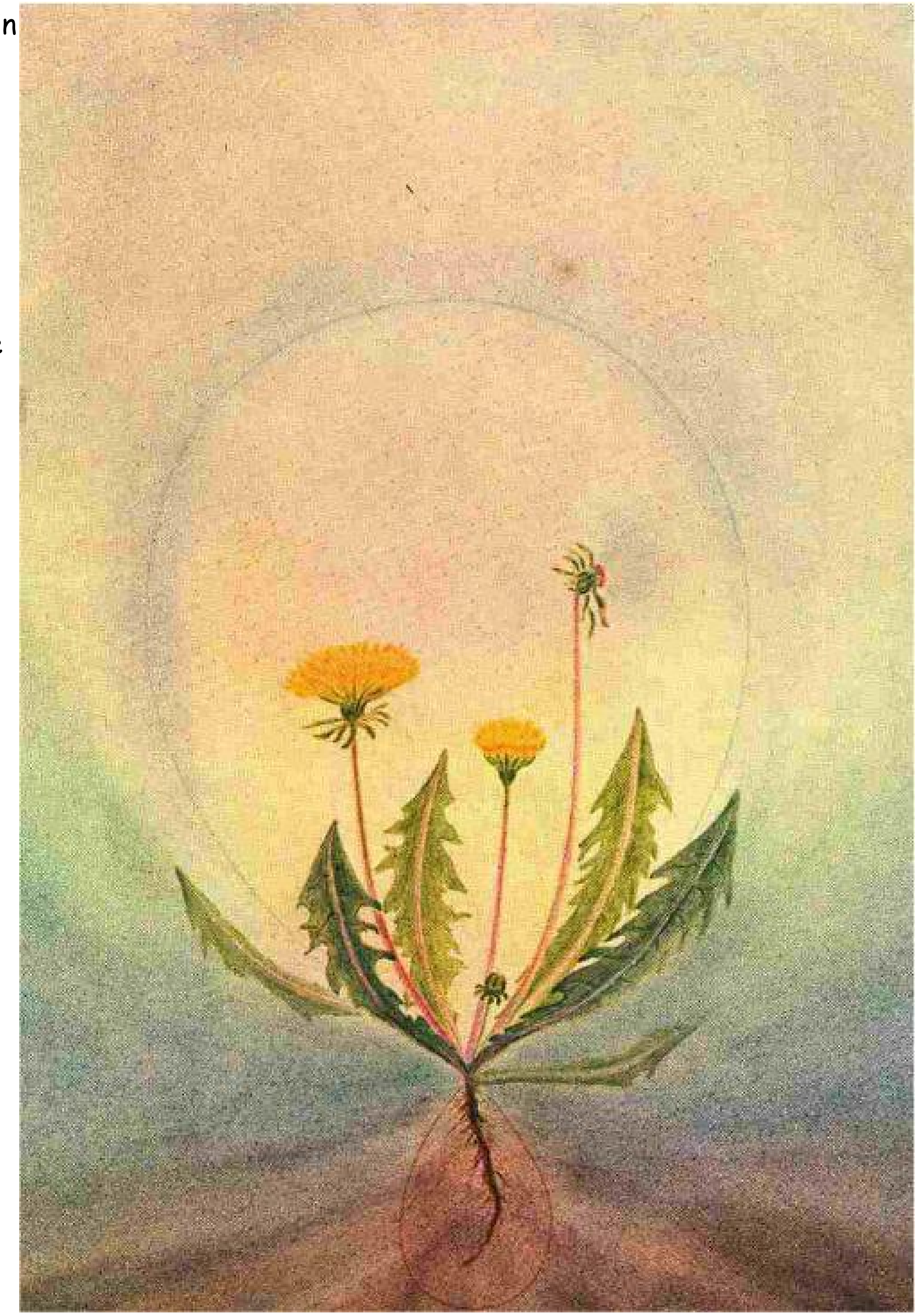
Perspective geometry is a study useful for illustrating the types of forces. First, the geometry can describe a point focus, where all the lines converge into the solid point, radiating like a sun.



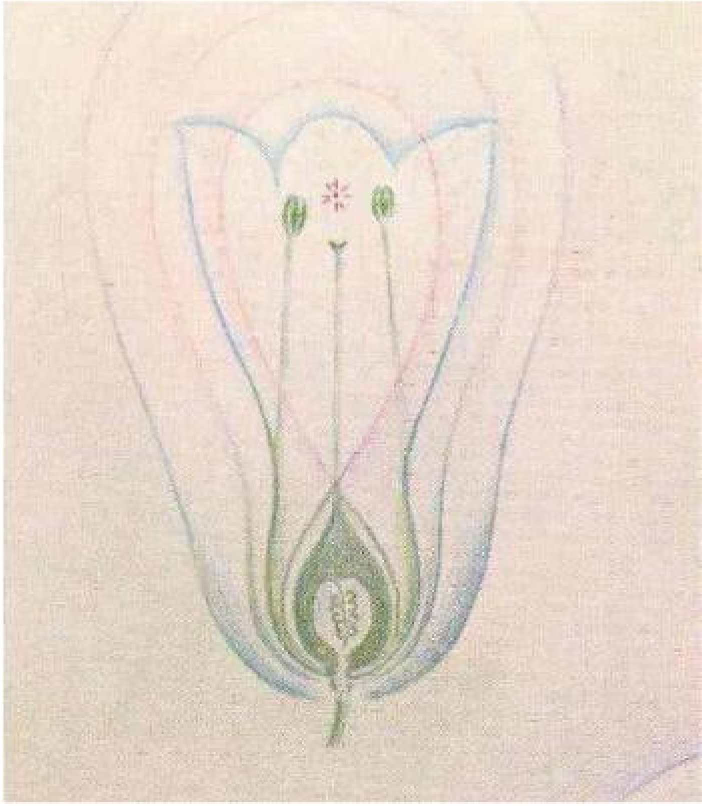
But there is another way for geometry to create a point as well. Imagine a series of lines that sweep in and form a series of tangents to a circle. As the circle gets smaller, it converges on a point. But this point is different. It is a hollow point, one formed by the tangent lines coming in from the distant periphery. Now perhaps you see why this relates to biodynamics. We have here the model of two kinds of forces -- those coming from the center point and those coming from the outside, converging on the center point.

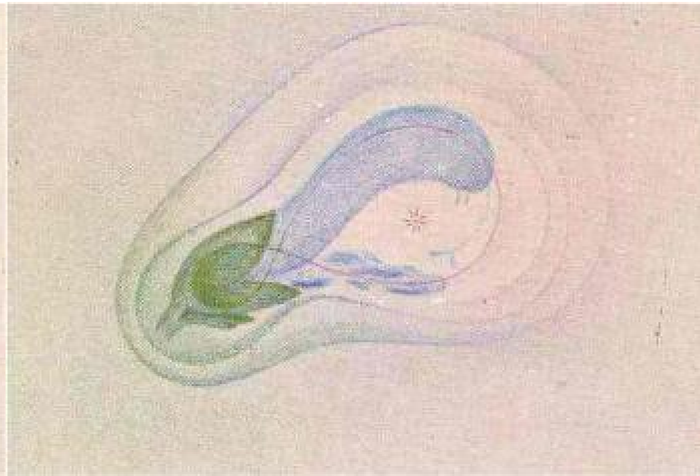
What happens when we put the two points in proximity? The dynamic lines form a lemniscate shape, like a figure eight. (These wonderful pictures come from Olive Whicher and George Adams, The Plant Between Sun and Earth.)

We find this same shape in natural forms. We see a solid center in the root. Here the plant draws in and stores substance and forces. We see the plant seeking, but never quite reaching, the hollow center where it sends the stored forces.



Flower forms offer further examples of the solid and hollow points.

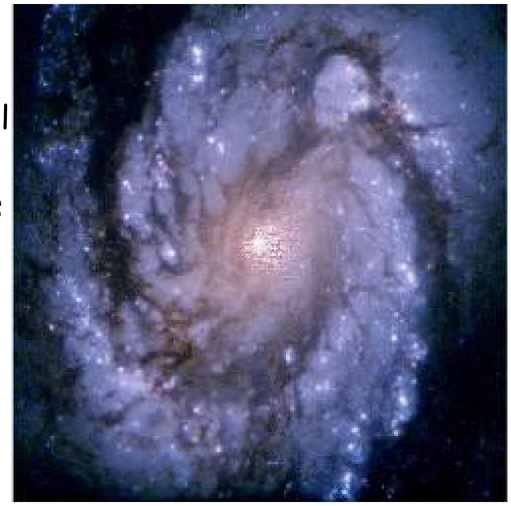


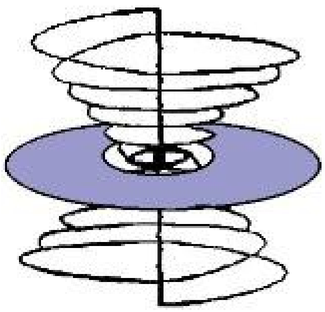


Creation of the Stars and Planets

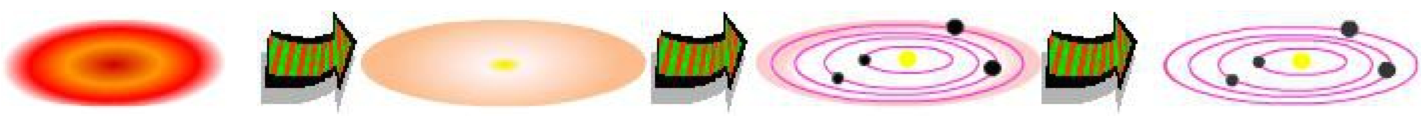
And the same sort of patterns occur on the largest scale. This beautiful picture taken by the Hubble Space telescope shows a spiral galaxy called M100, that is much like our own Milky Way galaxy. Notice how the matter arranges itself in swirling, rotating arms. This is one example of a system self-organizing.

Suppose we start with a swirling, disorganized cloud of matter. Over time, some of the mater will clump together, creating a gravitational center. Slowly moving matter will fall into the center; while rapidly moving matter will orbit around the center. What is curious about the organization is that, over time, it tends to form a disk-shaped aggregation. Matter around the vertical poles is moving slower forms an in-falling vortex. Matter around the equator is moving faster and tends to squirt out in the horizontal plane. Thus, the galaxy develops arms that are spinning outwards.



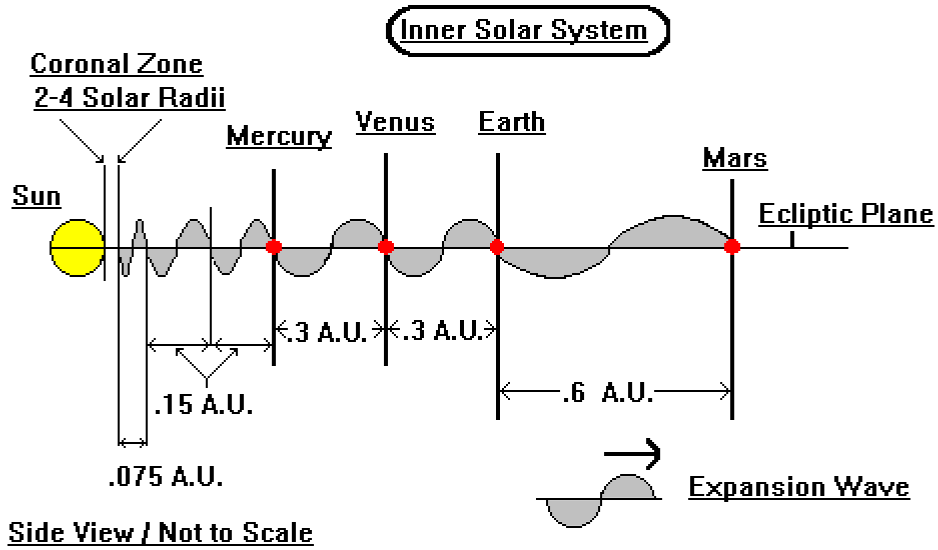


The spinning disk exists in a universe pervaded by energy fields including gravity as well as levity. Glen Atkinson draws from Hindu creation mythology, "Now it is with Lord Brahma that our story can start. All the universes breathed into creation by Brahma are 'swimming ' in a sea of chi or cosmic ether. This force is said to permeate all of creation and when it comes into manifestation appears as a growth process." As the disk spins through the cosmos, it intersects with chi or the life-force energy. The rotating edge picks up the energy, just as the windshield of a moving car picks up the rain. So the chi energy appears to be entering from the direction of rotation and in the plane of the disk.



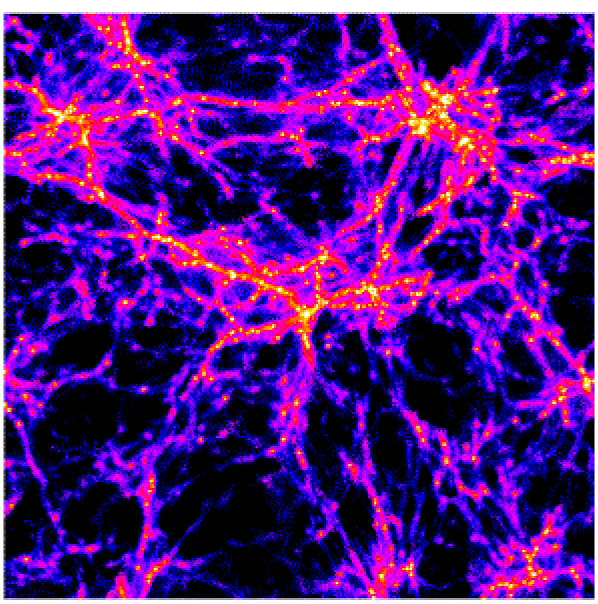
A cloud of matter... | forms a center and disk. | Outer clumps form planets. The central star ignites and blows the dust away. | Leaving a solar system.

A similar process led to the formation of the solar system. In this case, the disk of matter coalesced into planets, each circling the sun. Once the sun ignited as a star, the "solar wind", a flow of charged particles and light, pushed any remaining dust and gas out of the solar system. Note that the distances between the planets are not arbitrary. The planets are set up as a series of resonance nodes in the cloud of matter and become separated according to a distribution known as Bodes' Law. These resonance patterns mean that the orbits of the planets are related as integer ratios (to be discussed later).



Center-Periphery Interchange

The interchange between center and periphery is a recurring theme in biodynamics. The sun has an interchange with the surrounding solar system, the organs of animals interchange with their outside layer, even the compost pile has a relationship with it's skin. This is an important principle and surprisingly consistent with modern system theory. Remember in the generalized system we discussed earlier, the system needs to have a boundary and an "outside". The outside serves as the source of energy (negentropy) that the system uses to create order within its own boundary. How is it possible that the system finds a pattern for self-organization? It does not seem entirely satisfactory to expect that the elements of the system contain an inherent pattern. Biodynamics teaches that the pattern comes from outside the system. Hence, the importance of a center-to-periphery-and-back exchange.



The Universe - Two Billion Years after the Big Bang
(Computer Animation - T. Theuns, MPA)
ESO PR Photo 19a/01 (15 May 2001) © European Southern Observatory

Interestingly, science has come to understand that the periphery is not a uniform object. This picture shows a simulation of what the universe looked like shortly after it was formed in the "big bang". We see that the promordial matter has begun to arrange itself into clusters and filaments. It is these formative forces, however faint, that are considered to still be coming at us from the far periphery. (Source: This simulated image was computed by Tom Theuns at the Max-Planck-Institute for Astrophysics, Garching, Germany.)

Space is curved near the planets, diverting the lines of gravity and levity that reach to the sun. Thus, the planets serve as nodes in the plane of the disk, focusing the incoming lines of chi as they fall toward

Earth and the sun. The chi comes in opposite to the Earth's rotation, so it acts as if coming from the eastern horizon. Toward sunrise and sunset, the lines are sweeping right across the Earth's surface, headed toward the sun -- so at these times chi is especially active.

Summary

Recent discoveries of self-organizing systems expose failures of the mechanistic, deterministic approach. Systems science finds that systems can self-organize but has no satisfactory explanation for where the organizing pattern comes from. As we have seen, the conventional way of thinking is not always true. The test of conceptual models is to see if they work -- by improving understanding, suggesting explanations and practical, testable actions. The conceptual model proposed by biodynamics can be rich in practical applications without being "true" in terms of science.

Biodynamics is not alone in pursuing a holistic, ecological perspective. It differs, however, in emphasizing the dynamic phenomena of growth and development. In observing growth patterns, we can discern two polarities in how growth patterns manifest. Biodynamics asserts that "pattern" comes from outside, carried by vital formative forces. The polarities of center-seeking or periphery-seeking are a general principle that can be recognized in at many levels of natural systems. Together, they characterize the center/periphery interaction that defines systems as well as emphasizing the wave-like nature of many system phenomena. One sees the physical body as focused on a solid center while the life-body unfolds dynamically, developing over time, and receiving from the far-distant outside through the hollow center of counter-space.

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