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The Two Opposing Types of Order in Nature

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August 27, 2005

Abstract

Rather than order and disorder, there are two types of order in nature. One type of order increases in the direction of the past, while another type of order increases in the direction of the future. What we refer to as disorder is purely an intermediary stage within the transition from one order to the other. There is no such thing as general disorder in nature, only irregular combinations of the two orders (chaos). The two orders are inversely proportional. The absence of one order creates the other. Recognizing these two orders provides a template for understanding all material structure and composition. The two orders will here be referred to as *Grouping Order* and *Symmetry Orde*r. Neither are unfamiliar concepts and once they are consciously recognized the ordered flow of time and the world of human events are visibly seen as an interplay of two contrasting orders.

Key Words: Self-Organization, Order and Disorder, Similarity Principle, Symmetry, Entropy, Second Law of Thermodynamics, State Space.

PACS Codes: 05.65.+b Self-organized systems, 05.70.-a Thermodynamics

MSC 2000 codes:74A99, 74A15

Introduction

In recent years the chemist Shu-Kun Lin [1], founder of Molecular Diversity Preservation International (MDPI) and the journal Entropy, has observed that the general measure of symmetry in the universe is increasing with time. In Lin's similarity principle, there exists a direct correlation between entropy and symmetry. Lin states that higher entropy results in higher similarity or sameness. Of course most see symmetry as an attribute of order, however, the ramifications of what

Lin is suggesting is that qualities of symmetry should be disassociated from what we otherwise define as order. This hardly seems possible unless symmetry itself is seen as a distinct type of order.

Most imagine that order exists relative to disorder. If we translate our general sense of order into an image, we would draw a single axis, with greater order in one direction and disorder in the opposite direction. Thus if the measure of order to a pattern increases the measure of disorder must decrease. Under this premise, the second law of thermodynamics was developed by Ludwig Boltzmann [2] which states that a closed system moves from an ordered to a disordered state. When applied to the universe in general the second law requires that the universe somehow originated in a state of high order. Existing in an ordered state, thereafter the preponderance of disordered possibilities leads the universe to become increasingly disordered with time.

Physicists are in wide agreement on referring to the extreme density and heat of the big bang as being highly ordered. However, is the universe we observe today simply less ordered than it was in the past? The order of density is simple and uncomplicated in comparison to the complexities of the Earth's biosphere, or biological systems. Chemical and cosmological order appears abundant throughout the entire universe. Could there be another type of order which is actually increasing in the direction of our future? Rather than simply a general order and disorder, might there be two specific kinds of order?

Both the Irish poet William Yeats [3] , who received the Nobel prize for literature in 1923, and the French philosopher Henri Bergson [4] who received a Nobel in literature in 1927, wrote of two fundamental kinds of order at work in the evolutionary processes of the universe.

In his book entitled *Creative Evolution* Bergson writes:

> The two orders are not organized into a linear hierarchy or a graduated spectrum in which one is on the top, the other beneath it, and absolute 'disorder' constituting a third alternative, at the very bottom of the hierarchy - 'one nature in graded powers', to use Plotinus's words. Instead, the 'absence of one of the two orders, consists in the presence of the other'. [Pg. 236]

Similarly, Yeats came to portray an inverse relationship between two different types of order with what he called gyres.

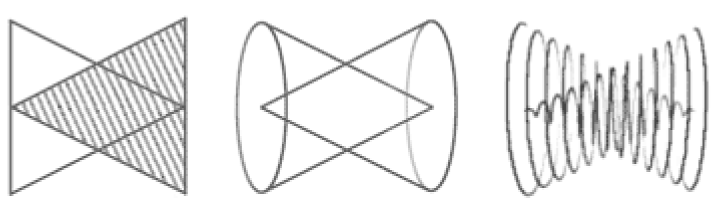


Figure 1: Gyres representing how the decrease of one order is an increase in the other.

More recently, in the nineteen sixties a highly respected scientist, someone whom Albert Einstein once referred to as his predecessor, argued there are two types of order in nature, this being the physicist David Bohm. Bohm himself challenged the classical order to disorder gradient by describing two concepts, *Implicate Order* and *Explicate Order* [5] . Explicate order was defined as the order we recognize in the world around us, while implicate order had an almost metaphysical character as an underlying order of wholeness that exists behind the surface of space and time.

In describing *Implicate Order* Bohm writes:

> This order is not to be understood solely in terms of a regular arrangement of objects (e.g., in rows) or as a regular arrangement of events (e.g. in a series). Rather, *a total order* is contained in some *implicit* sense, in each region of space and time. Now the word 'implicit' is based on the verb 'to implicate'. This means 'to fold inward' (as multiplication means 'folding many times'). So we may be led to explore the notion that in some sense each region contains a total structure 'enfolded' within it. [pg.188]

Might there be a connection between Lin's similarity principle, his recognition that symmetry is increasing with time, and Bohm's invisible implicate order? Lin's correlation between entropy and symmetry implies that symmetry is distinguishable from the order of the past which Boltzmann saw as decreasing. A system of two orders, one high in the past which decreases, and one low in the past which increases, seems to connect with the visionary writings of Bergson and Yeats, with their argument that the present is trapped in a sense between two kinds of order.

Today we are perplexed even over the order we observe plainly. Why is order such an elementary part of the universe in which we live? Why is there order rather than just disorder and chaos? Could we be making a fundamental mistake in how we view order and disorder? If the order of one type is the disorder of the other, or if the universe must pass through what appears to be disorder in transforming from one order to another, then the complex and systematic universe we experience would no longer seem unordinary or improbable, but rather exactly how the universe should be.

Although the following model of two types of order is more developed than our existing vague definitions of order and disorder, the basic ideas explained are extraordinarily simple. We all know a great deal more about this subject than we realize due to our immersion in nature and our participation in the ordered flow of time.

Grouping Order

If we extract symmetry from our ordinary sense of order we end up with an order exclusively related to density and form, referred to here as *Grouping Orde*r, which can be understood as any class, or similar kind of thing grouped together, and located in a specific area or separate place usually apart from another group. Grouping order is the precursor of material things and it is responsible for the definition we know as the finite world. It is the order of the past. Grouping order is very common and very easy to recognize. By nature, when like things are grouped together they become more pronounced, they stand out from their surroundings. For example, when we go to a store, there are groups and sub-groups of different products, each grouped separately from one another. At any grocery store the apples are separate from the oranges. Each of the fruits and each of the vegetables are collected together separately forming a pronounced group. Products are also grouped in the meat section, the bakery section, the dairy section. If all the fruit was displayed mixed together with all the vegetables only the largest individual items would stand out. Yet separated each group is more distinct and its identity pronounced.

We innately group things together as opposed to the chaos of individual items being randomly located throughout a room or a space. Grouping order exists in every store, every business, and every city. It exists in our homes where the dishes are grouped apart from foods and clothing.

Grouping is how we typically organize the world of objects, but also places and information. Books are grouped together in a library, where they are organized into sub-groups by subject or title. When we communicate with others, when we convey ideas in writing, we tend to discuss one topic at a time, and we prioritize our subjects. There are special places in every community where people congregate to do things, to shop, to eat, to pray, to play.

In explaining the second law of thermodynamics the classic example of order given is a concentration of gas particles contained within a flask, and disorder occurs as we open the flask and allow the gas to spread throughout a room. However, here we are recognizing a concentration of gas particles specifically as grouping order. Any concentrations of a material produces a more pronounced object than the same material spread apart.

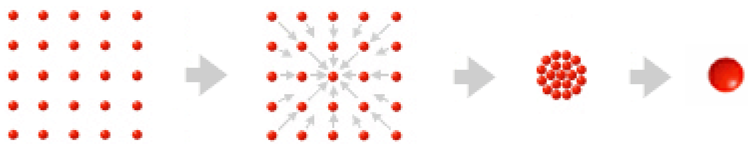
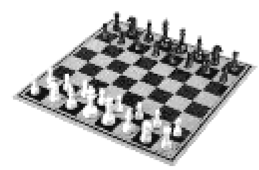


Figure 2: Generally Grouping Order increases the density of objects resulting in a more pronounced single object.

A prototype example that represents grouping order is to imagine setting up a game of checkers or chess. To begin the game we divide the pieces apart and place pieces of one color on one side of the board and the other color is set up on the opposite side of the board. With the pieces previously mixed together randomly inside a box we would say that they were disordered or mixed irregularly, until we separated them by color into two distinct well organized groups.



Symmetry Order

The other kind of order, a second fundamental type of order, is best referred to as *Symmetry Order* which if we simplify its definition to extreme is an even and regular pattern or arrangement in which all different types of things are combined together and distributed evenly throughout the entire frame of reference. Where grouping order separates things apart into many groups, symmetry order mixes and combines things together ever more evenly.

The perfect prototype example of symmetry order also is visible as part of the games of checkers and chess, that is, if we focus our attention on the checkerboard on which either game is played. A checkerboard pattern is obviously ordered but we normally might not reflect upon it as a unique type of order. The colored squares of the checkerboard are mixed together and distributed evenly, a white square, then a black square. The lattice of squares are arranged as evenly as is possible, which is completely opposite of the process of separating the game pieces by color into two distinct groups.

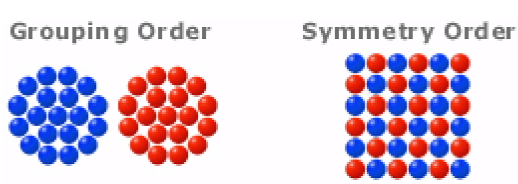


Figure 3: Grouping Order involves division and separation while Symmetry Order involves balance, integration, and unity.

In the process of creating grouping order we divide things apart, in the process of creating symmetry order we mix things together evenly. It can be surprising to notice at first how opposite these two directions of increasing order are to one another. In the image below, we see the final result of each direction of order. On the left side the contrast and pronunciation of the squares has increased as they are grouped on opposite sides. On the right side the individuality of black and white squares of the checkerboard have broken down and blended into a neutral gray. All definitive form has been given over to the uniformity. The differences here are mundanely simple, and yet critically important, as they define two very fundamental and yet opposite directions of increasing order.

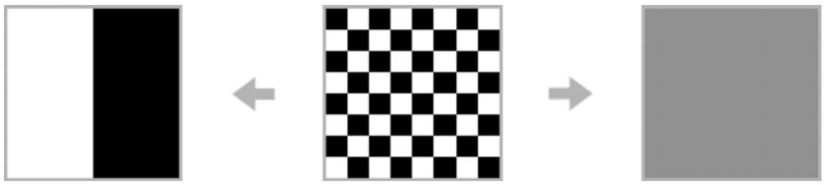


Figure 4: In one direction of order away from the checkered pattern the parts form two pure groups of difference and opposition while in the other direction the parts merge into one.

If we want to increase the measure of symmetry order in the checkered pattern, the squares invariably must divide into smaller squares and form a finer lattice, or we can more easily imagine the two colors mixing fluidly like paint. In either scenario the distinct colors and shapes merge to become a single shape and color. It is this process of definitive objects and colors merging into a singular form that is commonly unappreciated and misunderstood. Extreme symmetry order causes separate things to integrate into a single unified whole, moving from high to low contrast, one obvious example being the way primary colors integrate to create white light.

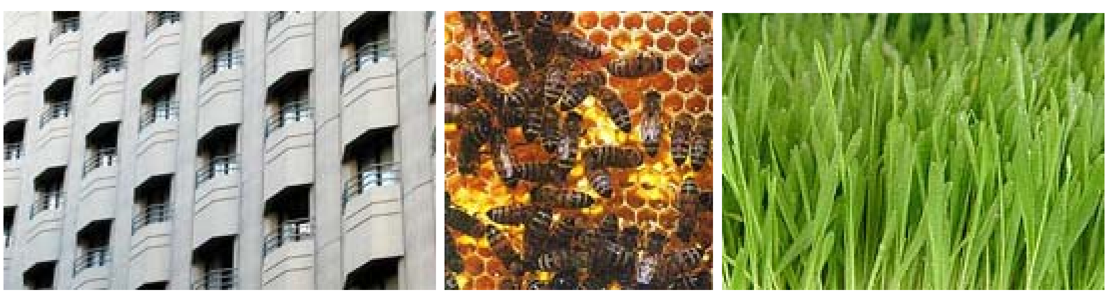
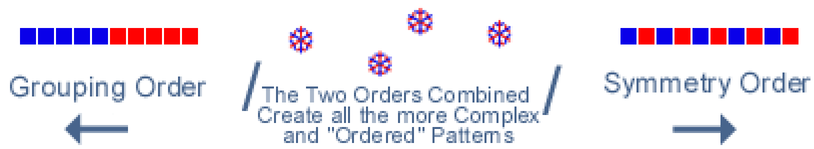


Figure 5: Balances, symmetries, and even distributions are common in our environment, both in nature and man-made. Recognizing the two orders forces us to specify balance as a separate component of the pattern distinctly separate from the order of grouping.

In now recognizing balance and symmetry apart from grouping, we can identify two directions of increasing order. The processes of separating apart and mixing evenly are clearly opposite of one another, which is what necessarily defines them as two very different types of order.

Exclusivity: Distinguishing Between the Two Orders

The key to distinguishing between grouping order and symmetry order involves recognizing properties of grouping and symmetry as entirely separate *components* of a pattern. Once the two orders are identified and understood it becomes apparent that the entire variety of simple to complex patterns in nature are forced to utilize two different types of order, this being true even of what we consider to be disorder. As a universal principle, material things can be separated into groups or mixed together to form a single whole. There simply isn't any other way in which to physically arrange things. The universe itself can only expand or contract. This exclusivity, this either/or direction of transformation along an axis reveals the unyielding difference between grouping order and symmetry order. As represented below, increasing grouping order is one direction, increasing symmetry order is an opposite direction.



As we begin now to identify each order separately, the hierarchy of grouping order begins with a star, the most common feature of the universe. Then our nearby star, the sun and its nearby planets, held together by gravity, form the group we call a solar system. The stars on the largest scale, are gravitationally grouped into galaxies, while galaxies themselves group into clusters and superclusters. The Earth is first a single collected mass, yet there are also groups and sub-groups of basic elements and materials, from its iron core to its diverse crust, true also of all planets and stars.

In the microscopic world, the chemical elements are first grouped apart to create pure gases, solids, and liquids. In a combination of grouping and symmetry order, when various elements are grouped they produce molecules, while groups of molecules produce compounds. All such order and structure exists in stark contrast to another universe we might imagine completely void of grouping; a cosmic soup of all particles blended uniformly throughout space so that there would be no stars or planets, just a vast uniform sea of particles, or further still, we can imagine even the absence of particle form where the universe is just a smooth fluidic material plasma spread evenly through the entire volume of space-time.

Groups of elements and solar masses give the universe its definition and seem to create order as we know it, however, grouping is not the only way in which the universe we observe is organized. Most of the materials we observe are combinations of pure elements, not separated apart but rather mixed together producing various patterns of increased integration. The oceans, the soil, and atmosphere of the Earth are each compounds created from varied and unique materials. Rock, glass, wood, soil, plastics, and metals such as bronze and steel are all admixtures of atomic materials. And on the largest scale there is an even and isotropic distribution of galaxies (and dark matter) spread throughout the universe as far as our telescopes can see. This integration is recognizably a completely unique type of order opposite to the more recognizable order of grouping.

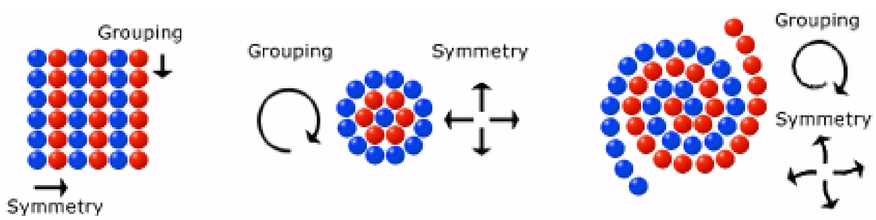
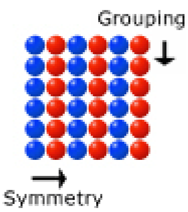


Figure 7: In the first example above, grouping is necessary to create the vertical rows, and mixing creates the horizontal symmetry. In the ringed pattern, grouping creates each ring, while mixing creates oscillating rings. In similar fashion a spiral is an elegant and attractive mix of grouping and symmetry.

Above in figure 7 we observe what are perhaps the three most common patterns we experience and in each the combination of the two orders is plainly evident. Note that what we would ordinarily describe as ordered rows, concentric rings, or spirals are now recognizable as two different types of order working together, cooperating in a unique way to create each pattern. In all the examples shown below, grouping and symmetry can be recognized to be a separate *component* of each and every pattern composition.

Fig.8 Orderly Rows
Even spacing of rows and lines is an elementary way grouping and symmetry combine.



Example 1: The design of flags must naturally utilize simple measures of grouping and symmetry.

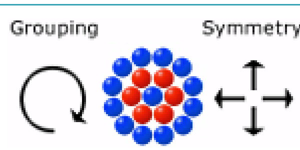
Example 2: The volume of a tree is grouped in the line of the tree while the trees are generally spread out evenly through a forested area.

Example 3:
Rows of sunflowers growing in a field are complimented by an orderly row of bicycle riders. Note how the irregular positions contrast the existence of rows.

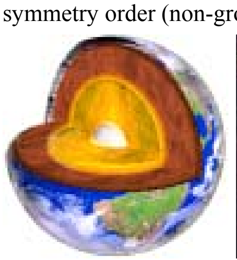
Example 4: Each standing mass is pronounced grouping order, like a row, while geographically the buildings are spread out evenly in the city.

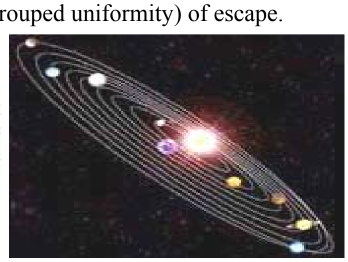
Generally in our culture, we idealize the way grouping order divides the world apart into separate and pronounced things, since this results in the diversity of form. In the opposite direction of increasing balance and symmetry, all colors, shapes, objects, and literally all that we define as form, integrates and unifies with the reference frame or background. The many become one. Since we identify with form, we generally devalue how this final stage of symmetry order integrates parts and interpret it only as a destruction or loss of form. We interpret the product to be nothing at all, even though we easily identify and appreciate the beauty of lesser symmetries.

Fig.9 Rings and Layers
Observing both symmetry and grouping in concentric layers or circular rows.

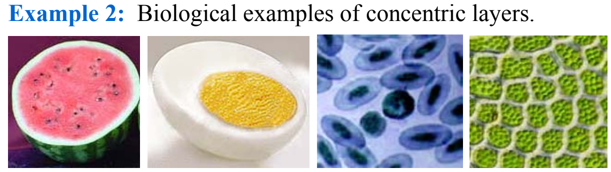


Example 1: The orbits of planets maintains a balance between the potential of further grouping (gravitational collapse) and the increased symmetry order (non-grouped uniformity) of escape.

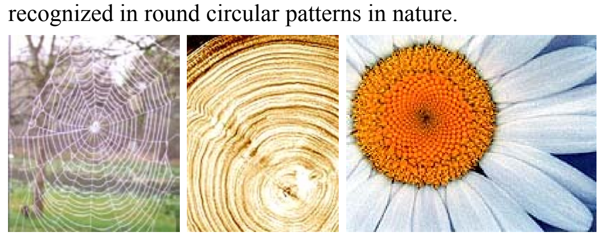




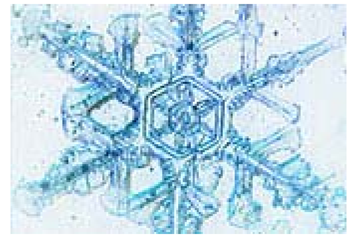
Example 2: Biological examples of concentric layers.



Example 3: Both grouping and symmetry are easily recognized in round circular patterns in nature.



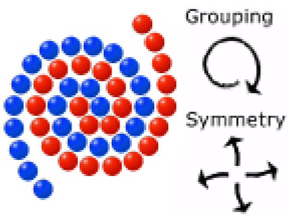
Increasing Complexity



In the pattern of a snowflake there exists both conflict and cooperation between grouping and symmetry.

Most people recognize that in contrast to the uncomplicated order of an increasingly dense past there also exists a complex *orderliness* that has increased as the universe has evolved forward in time. The reason for this is that a fundamental grouping order is decreasing, while a fundamental symmetry order is increasing. In the play between extremes, with both orders at a nominal level, there exists a wide range of highly cooperative orderly patterns to uncooperative disorderly patterns, both of which are produced only as the two orders combine. A prototype example of two orders cooperatively working together in pattern composition is seen in spirals. A spiral reflects the natural opposition of the two orders, with the absence of grouping giving way to the symmetry of the spiral. Yet each spiral requires that grouping and symmetry cooperate to create the pattern.

Fig.10: Spirals
The rotation of a spiral is the most common pattern in nature where we clearly see grouping order being manipulated toward increased symmetry order.

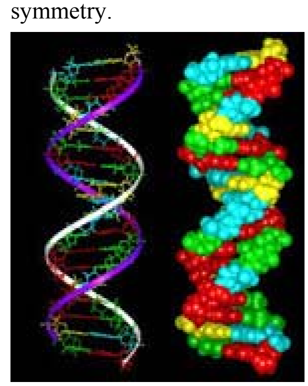


Example 1: A variety of spirals and fractals. The grouping and symmetry in each pattern can be recognized separately. As always, the grouping makes each spiral distinct and stand out.

Example 2: Spiral galaxies are the universal shape in nature that highlights the opposition of grouping and symmetry.

Example 3: Moisture in the air of a weather hurricane produced by the violent collision of various temperatures and densities.

Example 4: The atoms and molecules that create DNA utilize both grouping and symmetry.



The Two Types of Order Visible in Art

Life is acutely tuned to the discovery of order. It is our nature to develop structures and organize, categorize and store. It is also our nature to strive for beauty. We gravitate toward the arts, judging the complexities of music and painting, sometimes not knowing anything more than how it makes us feel, but clearly it is the complex combinations of order we are attracted to. The artistic mind tunes into the open world of possibilities looking for ways of combining forms and colors in some way that triggers something in the mind of the observer.

Figure 11. Seeing Grouping and Symmetry in Art. The composition of a painting can be more variegated and distinct or it can be more uniform and flowing. Colors of a painting can blend smoothly or they can stay pure, pronounced, definitive, and sharp in contrast.

In the wide range of visual art, there are compositions that are realistic, distinct, and bold, so the emphasis is on exacting definition and form. In art from Michelangelo, Picasso, or Salvador Dali, we see strong pronounced expressions aligned with the nature of grouping order. At the other end of the scale, there are also compositions in which distinctiveness is given over to the connectedness and commonality between things, where objects and colors flow together. Impressionistic artists such as Vincent Van Gogh or Winslow Homer painted more often with low contrast or blended colors and wide brush strokes. Van Gogh in particular unified his surroundings within his art. Such compositions relate more to the unifying nature of symmetry order.

It is only natural that there are artists who in exploring composition have learned to recognize and utilize two orders at an intuitional level years ahead of science. Some art work seems to capture the rules of an unseen underlying order, especially visible in the images below. In Charles Beck's [6] art we see an intense combination of two orders. Generally in Beck's work, distinct subjects are spread almost perfectly even in the painting, like a steady rhythm in music, sometimes with the only asymmetric element being a trace of human activity taking place, effectively conveying our place in nature between two orders.

Figure 12. Woodcuts of Charles Beck starkly reveal the combination of two orders.

Beck's work highlights the fact that grouping and symmetry combine together with varying degrees of intensity. In nature we commonly see balances and symmetries that are less rigorous and exacting as that portrayed in the artwork above. Compared to Beck's compositions the measure of orderliness we witness in nature is less intense, as shown in the natural landscapes below.

From galaxies to snowflakes, complexities in nature can generally be appreciated as masses ornamented with symmetries, most evident in man-made structures such as governmental or religious architecture, where designers carefully combine two orders. As we appreciate balance and symmetry separate from the grouping of parts, we can begin to recognize the necessary cooperation between both components required of high orderliness and increased complexity.




Grouping Transforming into Symmetry

We observe order in the universe and are amiss at why it exists over disorder, when in fact disorder is merely a temporary stage necessary in any transition from one kind of order to the other. It can be shown that all disorder invariably includes in its composition constituent parts of both grouping and symmetry, therein challenging the very existence of a generally disordered pattern. Imagine playing a game of checkers half way through and then stopping. Then we study the overall positions of the pieces against the backdrop of the checkerboard. They invariably exist in one of many possible irregular patterns. In what direction is the flow of the game evolving? With only half of the game visible we end up with a distorted view of the actual process taking place. True of the universe in general, it is only when we begin to study the transition of patterns from start to finish that we begin to genuinely appreciate the forward direction of cosmic evolution.

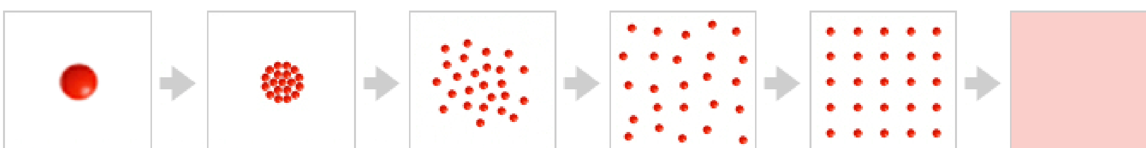


Figure 14. The typical way that we expect changes to occur involves order (grouping) becoming disorder as shown in the first four stages, yet the extreme of even spacing (symmetry order) exists in that same direction, as shown in the fifth stage, then finally perfect balance.

In the first four stages above we recognize a common portrayal of order becoming disorder. A single dense object breaks up and spreads apart randomly within the volume of the square. It appears the order of the single object has disintegrated into disorder, however, notice how the first four stages are in fact moving toward the pattern where the objects are perfectly balanced within the space of the square, seen in stage five. Then beyond that fifth stage exists the extreme of a final stage, where the individual parts are diluted and spread perfectly even. If this transition continues in the direction of an even distribution (increasing symmetry order or balance) the objects finally integrate fully with the reference frame.

The purpose of this transition of patterns above is to show that even if disorder seems to increase, the evolution of patterns in that direction are invariably moving toward another kind of order. In the direction of seeming disorder the conditions are transforming toward the symmetry order extreme.

In this spectrum of patterns, disorder is only a stage in the overall transition between two orders. In fact all patterns exist trapped between the two kinds of order, and thus each pattern exhibits a measure of cooperation between the two orders which varies in intensity. If the intensity of both orders is high, then the pattern exhibits a high measure of both grouping and symmetry, which we recognize as orderliness. If the intensity between orders is low, then the pattern exhibits irregularity which we perceive as disorder. The entire transition of patterns below displays a very high intensity between the two orders. This high intensity decreases the amount of irregularity (disorder) allowed in the transformation, making each stage of the transition appear orderly.

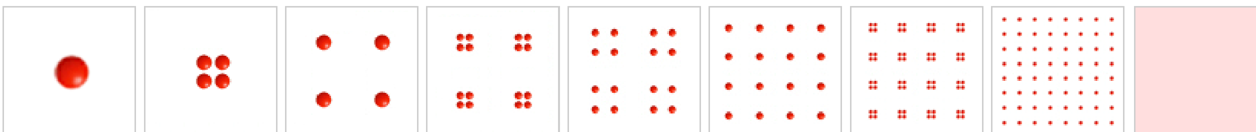


Figure 15. In this very simple transition between grouping and symmetry the tension between the two orders is high, so there is no irregularity. Each stage begins grouped, then breaks up, then spreads evenly. Once the objects are spread evenly they are forced to undergo a phase transition by dividing apart, this being necessary if the pattern evolution is to continue toward symmetry. Note how the influence of each order extends throughout the transition, as if the invisible influence from the extreme order on each side is reaching all the way across to the other side. In this transition the two orders are competing and yet cooperating with one another.

At each stage in this transition there is a high measure of both grouping order and symmetry order, the result being that the objects remain grouped yet evenly spaced. This is the same transition of two orders as shown in figure 14, except throughout the transition the influence of each order is intense, therein creating a lattice. Lattice structures are common in nature, particularly in chemical composition. Below we see these same two transitions shown together, reflecting how nature has two options when evolving from grouping to symmetry, one where the intensity of each order is low and another where the intensity is high.

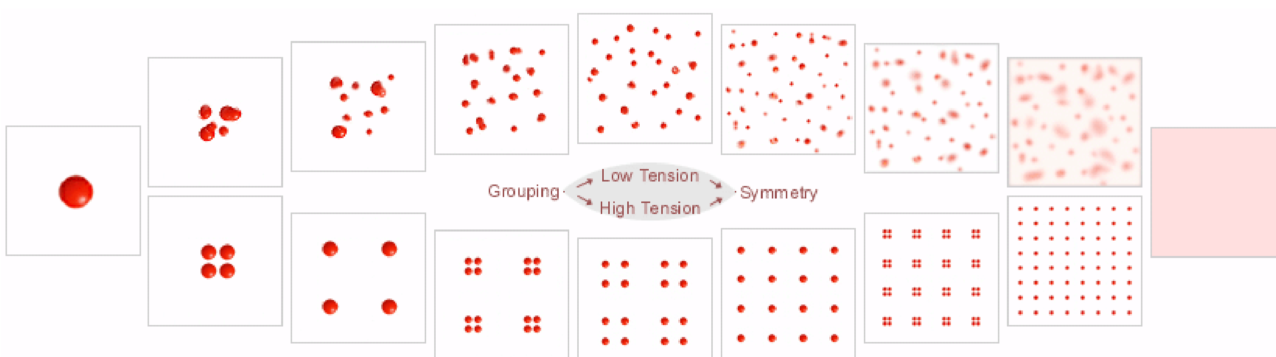


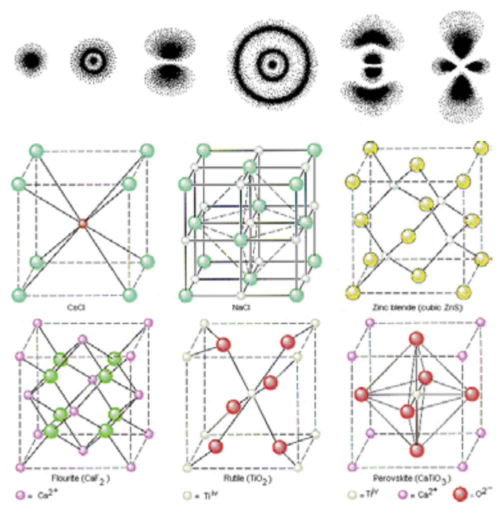
Figure 16. The entire library of possible patterns in between the two extremes of grouping and symmetry portray high and low measures of cooperation or tension.

The Intensity of Cooperation Between Orders

All of the more orderly patterns in nature are produced by the two orders intensely cooperating or competing with one another. Orderliness is created when two orders strongly cooperate, while disorderliness results when the two orders weakly cooperate. In the images below, a field of grass forms a large group of that plant and yet the even distribution of the grass in the overall field is symmetry order. An orchard or a grove is a group of trees, and yet the trees are spread evenly, extremely even in an orchard, and less intensely so in a natural grove where the competition between both orders is at a natural level, and so less intense.



The distinction between grouping and symmetry is plainly visible in the patterns of atomic orbitals. In molecular structure, amorphous solids reflect a weaker cooperation between both orders, while a crystalline structure, where atoms create a highly symmetric lattice built from square or hexagonal cells, reflects a more intense cooperation. Crystalline materials in which the intensity between grouping and symmetry is high include diamonds, quartz, salt, aluminum, gold, platinum, mica, graphite, nylon, polyester, polypropylene, sucrose, glucose, fluorides. Many crystallines contribute to the rigidity of plastics. Typically, round structures indicate grouping order while square or lattice structures indicate symmetry order.



In the distant future the complex orderliness of our present gives way to a more simple orderliness. It is widely known today that near the temperature of absolute zero a more strict and simple orderliness emerges. When supercooled in a laboratory, oppositely charged cesium gas particles magically arrange themselves into a checkerboard lattice of orderly columns and rows. At even colder temperatures, less than a millionth degree away from absolute zero, the waveforms of individual particles begin to overlap, causing the particles to unify into a single material. The many become one. This unified state of matter is called a condensate, a special form of matter predicted by Albert Einstein and Satyendra Bose in 1924, and was first produced in a University of Colorado laboratory in 1995[7] .

As the universe evolves toward zero all matter in the universe is moving toward the same wave density overlap. Near zero the wave state of all particles will eventually expand outward and unify with the waves of all other particles. Near the end of time what we call the universe will transform into a unified condensate. However, there is no reason to believe complex orderliness is presently on the decrease. Considering the advent of artificial intelligence and nanotechnology, there may be levels of super-complexity destined in our future, not merely in our own region of the universe, but higher complexity may be perfectly in synch with the natural evolution of patterns. The most important lesson to be learned from two orders is that the general evolution of the universe is not simply moving from order to disorder.

Re-wording the Second law of Thermodynamics

The second law is thought to explain the most fundamental way that the physical universe changes as time passes. If energy is neither created nor destroyed, what is changing with the passage of time? The second law states that the overall entropy of a system increases; which means the measure of stored (grouped) or usable energy in the universe always decreases. This aspect of the second law will likely never be overturned. However, the second law incorrectly correlates this loss of usable energy with increasing disorder, when the actual correlation exists with increasing symmetry, as Lin and others have also observed[8] . Rather than moving from order to disorder, all systems generally move from imbalance to balance.

In short time durations a system settles into an equilibrium state, in which measurable imbalances continue to exist. In a longer time duration any system, and the universe in general, is evolving toward the ultimate equilibrium state of absolute zero. In terms of astrophysics and cosmology, the temporal universe is in general evolving directly toward absolute zero, in fact the rate of change in that direction is increasing, as evidenced by the accelerating expansion rate [9] discovered in 1998. Neither open nor closed systems can move toward disorder, simply because there is no such thing as general disorder. There are only irregular combinations of two orders. As Bergson and Yeats recognized more intuitively, the absence of one order invariably creates the other. A decrease in symmetry order produces grouping order or imbalance. A decrease in grouping order invariably produces an increase in symmetry. Although there are patterns which we may define as disorder or disorderliness, such patterns are truly only an irregular combination of the two orders.

The way that each order contributes to an irregular pattern is plainly evident in the transition from one order to the other, where we see distinctly that disorder and irregularity is an intermediary phase in the transition from order to order; a temporary stage. Thus far we have only envisioned the transformation of grouping to symmetry using a single element or one color. The same transformation using two or more colors is more explanatory in that it requires a much more pronounced stage of disorder or irregularity.

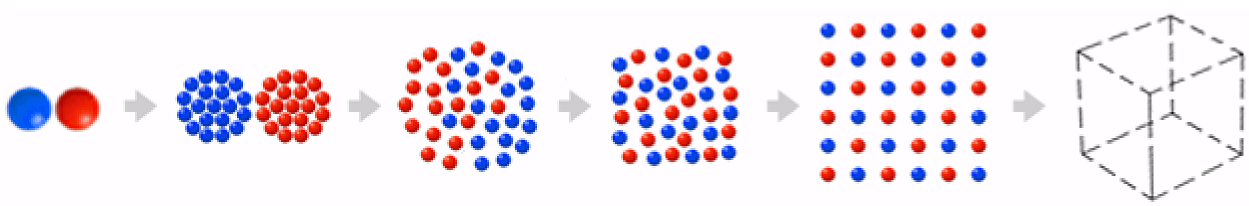
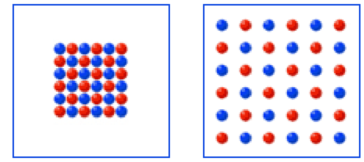


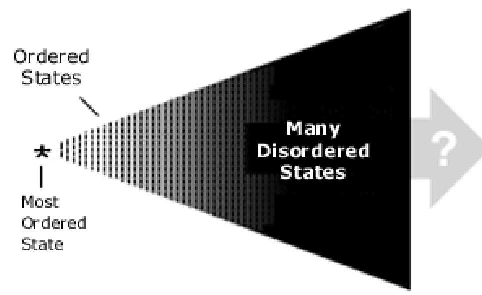
Figure 19. With two or more colors the transformation has to pass through a more pronounced stage of disorder, when the two groups begin to mix together. In the end, positives and negatives become neutral.

The patterns above portray two groups transforming into a single pattern of symmetry order. In order for balance to increase the two groups blend together, like the beginning moves of a chess game. Note that a two color transition is more reflective of the atomic world since ordinary matter reduces immediately to positive and negative particles. With blue and red representing an equal measure of positively and negatively charge matter the final result of the objects blending together is the simple neutrality of empty space. As charged particles annihilate one another the result is a summation to uniformity and singular form, not a cancellation to nothing. In the final stage objects are integrated with, and enfolded into space. Matter and energy are transforming into space. In appreciating symmetry order, it is critical that we recognize how an even distribution of objects spread throughout the entire frame of reference, has much greater symmetry order than the same group arranged in close proximity. The reason is because the more even distribution results in a greater overall balance throughout the reference frame. Contrary to our ordinary sense of increasing order, symmetry order increases as objects move away from one another or spread out evenly in whatever space they exist within. As gases disperse in a room, as space stretches sending the galaxies expanding away from one another, symmetry order is increasing.

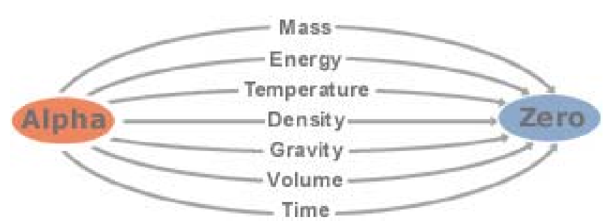


Redefining the Set of All Possible States

Generally Boltzmann argued that time chooses among a larger pool of disordered states over ordered states. If applied to the large-scale realm of all possibilities, the result of Boltzmann's thinking is a wedge-like model of states as shown here. Several noted scientists including Julian Barbour [10] have modeled the aggregate realm of all possibilities with a wedge model, imagining that the set of disordered states continues indefinitely. Now in recognizing that there are two kinds of order it is necessary to redefine how we envision all possible states. In the new model of states about to be presented there are limiting boundaries in every direction of possibility.



The most commonly recognized boundary in physics is the Alpha state of the big bang. With all matter in the universe collapsed inward, conditions reach an extreme beyond which no other possibilities exist. Although less acknowledged, absolute zero is another extreme of possibility in physics, beyond which no other possibilities exist. It is not possible for a state to have less density, less usable energy, greater flatness, or greater symmetry than zero. Therefore, absolute zero will be referred to as *Omeg*a.



A new model of all possible states based upon two orders includes three axes along which the two orders can be identified. The first axis exists between Alpha and Omega, which represents a gradient of density ranging from infinite to zero, identified here as the "x" axis. Both Alpha and Omega represent ultimate boundaries in state space beyond which no other possibilities exist. Within this first axis there naturally exists an expanding then contracting second axis. It is recognized in science that there is an extreme possibility of our present universe being smooth. After the big bang the universe could conceivably have remained perfectly smooth, rather than lumpy, so that no stars or galaxies formed. Mass would then have remained as a fluidic-like plasma, without particle form or any variation in density. This uniform gradient of states creates an outer boundary to what is conceivably possible. It is the most extreme case of symmetry order at each point between Alpha and Omega, at right angles to the “x” axis, as shown in the image below.

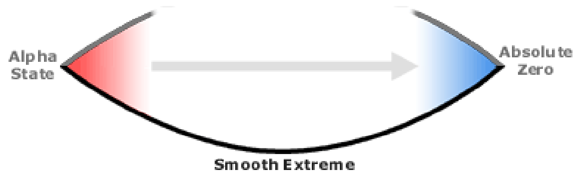


Figure 23: The “y” axis exists at right angles to the “x” axis. In one direction along the “y” axis smoothness increases. A gradient of smooth conditions between Alpha and zero form an outer boundary beyond which no other possibilities exist.

Opposite the smooth extreme, still at right angles to the “x” axis, we can also identify an extreme state of lumpiness, even if such a state is initially difficult to envision. The lumpy extreme is simply the extreme of grouping order existent at each point (average density) between Alpha and Omega.

We can imagine the extreme of lumpiness as all protons forming a single mass and all electrons forming a single mass, a single atom universe enclosed by a vast spatial curvature. Of course such an extreme doesn't seem physically possible, yet it is conceivable and deserves to be acknowledged as the outer extreme of what is possible when considering all that is conceivable. The gradient of patterns between smooth and lumpy extremes forms the “y” axis, and can be referred to as the contrast gradient.

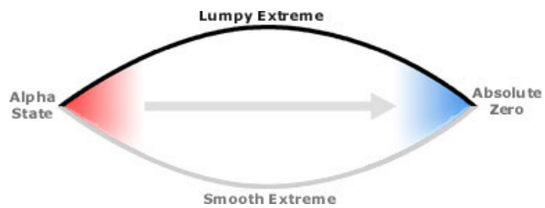
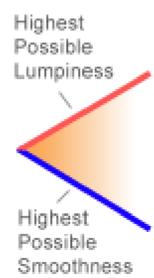


Figure 24: Opposite the smooth extreme is the lumpy extreme.



Note that the same boundaries are also inevitable in Boltzmann’s wedge model of states, as they necessarily form the boundaries of the wedge, which would otherwise be indefinite. Also note that smooth and lumpy conditions can be understood most simply in terms of contrast. The lumpy (grouping order) extreme is the highest possible contrast and the smooth extreme (symmetry order) is lowest possible contrast. We can refer to the variety of patterns between these extremes as a contrast spectrum.

Within this second axis there necessarily exists a third axis. The range of what is possible in the contrast spectrum includes the two orders both weakly and intensely cooperating. In some measure along the “y” axis both orders can be increased or decreased simultaneously. This produces a range of patterns along a “z” axis spanning from orderly to chaotic. Examples of orderly patterns include man-made constructions which have been carefully designed and created. Essentially man forces the two orders together in varied and complex ways, creating patterns which are less probable and more cooperative than those which the two orders manage in nature without human intervention.

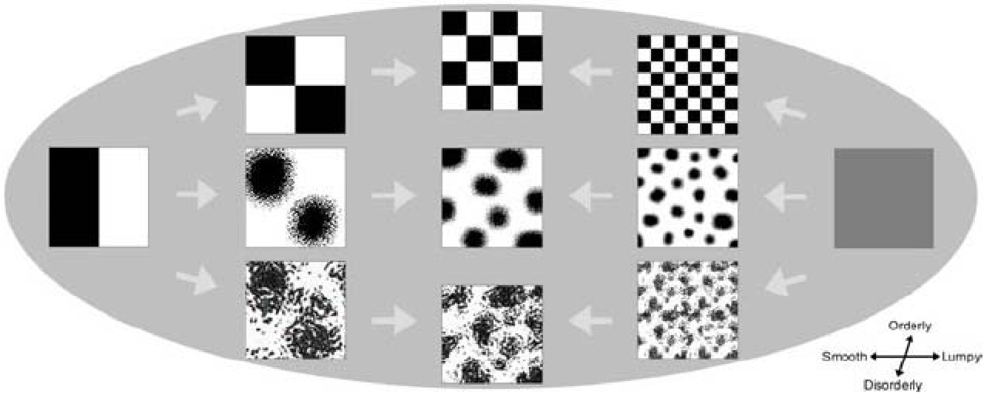


Figure 27: At right angles to the "y" axis between smooth and lumpy there exists the "z" axis of orderly to disorderly patterns, producing a contrast spectrum.

The image above indicates the range of high to low orderliness in the "z" axis of the contrast spectrum. The checkered pattern requires a blend of two orders that is more exacting, and so less probable. Balanced between extreme orderliness and chaotic, the calico pattern being moderately irregular is a less exacting combination of two orders. Similar 'imperfectly even' distributions are common in nature, as seen in the images below of raindrops, clouds, and sand dunes. We also find semi-even distributions of stars and galaxies throughout the universe. Such patterns represent a more probable middle ground in state space where the course of time is maintained, balanced first between the extremes of smooth and lumpy, then orderliness and chaos.



The model of states being created now represents six directions of freedom available to a dynamic system; opposite directions along the "x" axis toward either contraction or expansion, opposite directions along the "y" axis toward lumpiness or smoothness, and opposite directions along the "z" axis toward either orderliness or chaos. These directions of freedom are of course applicable to changes in any specific region of space as well as the overall evolution of the system.

Grouping	Symmetry	Description	Name	spatial
Low	High	Perfect symmetry – Symmetry order	Omega	x axis
High	Low	Positive-Negative split – Grouping order	Alpha	
Low	High	At each point along the gradient between Alpha and Omega there are extremes related to each order.	Smooth	y axis
High	Low		Lumpy	
Low	Low	Irregular combination of two orders	Chaotic	z axis
High	High	Regular combination of two orders (lattice)	Orderly	

Figure 29: Directions of Freedom in State Space

Two Orders and Chaos

What is most probable in this model is always the balance point between extremes. If a system somehow originates in an extremely lumpy state along the "y" axis, all other possible states are less lumpy and more smooth, so there exists a high probability for the extreme imbalances of the system to disintegrate. If a system originates in a perfectly smooth state, all other possible states are less smooth making fluctuations highly probable. Nature abhors a vacuum. Similarly, we don't observe the large-scale distribution of matter as giant evenly spaced squares, but this is only so because patterns of simple but extreme orderliness exist at the outer extreme of what is possible. Along the "y" axis there is also an extreme of irregularity or chaos which represents conditions which are just as improbable in nature.

Extreme irregularity is easy to envision when considering notes of music, or a drum beat, except notice that after becoming aware of two orders it is difficult to imagine how irregular the drum beat can become because any region where the notes accumulate grouping order has increased, and any region where the notes are distributed more evenly, symmetry order has increased. Chaotic or disordered patterns are an irregular or random oscillation between increased grouping and increased symmetry, a pattern which is necessarily forced, or like orderliness, requires work to create. The chaos that seems so probable in Boltzmann's ideology of more disordered states is seen here as a narrow set of possibilities dominated in its surroundings by the two orders. In fact a highly unpredictable pattern is equally as improbable as extreme orderliness. True chaos is difficult to produce or improbable, both for nature and man, because the number of such states reduces in measure toward a single state of extreme irregularity which exists pressured by and trapped between grouping and regularity.

Time's Arrow

If we consider the most basic probabilities for the general direction of time, the ultimate point of balance within the whole of all possibilities is absolute zero. The most imbalanced state, or the grouping order extreme, is all positives grouped apart from all negatives. So now in portraying the full spectrum of all possible states we disassociate the two individual groups of *all positive* and *all negative* and evaluate each as an independent state. With two orders fully integrated, the image below places the positive extreme and the negative extreme on either side of zero. Just as there are both positive and negative numbers in mathematics, the full spectrum of possible states includes both a positive body and a negative body of identical but opposite states.

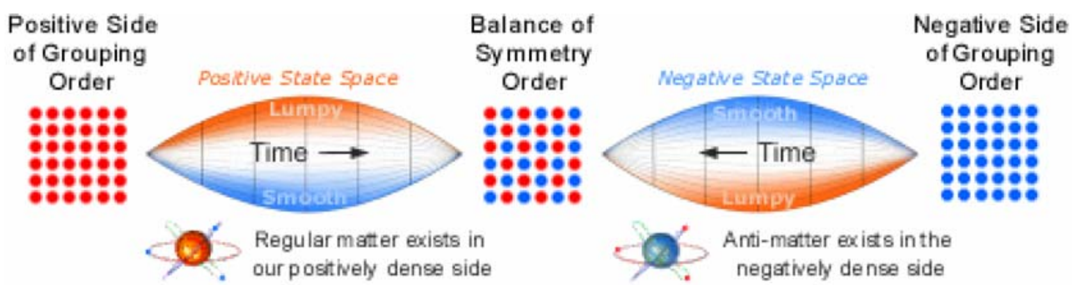


Figure 30: Two Probabilistic Directions of Time. Each travels from an extreme imbalance to balance.

This model of two orders applied to state space predicts that the Alpha state of the big bang is the positively dense side of a duality, and that a larger cosmological system includes two directions of time, as predicted in several other works [11][12[13] . This explains that matter exists over anti-matter because matter is compatible with a direction of time that begins positive and travels toward neutral, while there also exists a direction of time that begins negative and travels toward the same neutral state, in which case anti-matter is dominant. These two directions of time are inseparably connected. The process of moving toward zero requires that both systems integrate and so neutralize the form of one another. The collision between time and anti-time causes each universe to expand and move along the "x" axis toward zero.

One of the more profound conclusions necessary of acknowledging the implicate nature of extreme symmetry order is that all conceivable patterns or states exist embedded within a native perfect symmetry. To paraphrase Bohm, the total structure exists enfolded within every place. Each state necessarily exists distinctly, and yet all states simultaneously exist embedded in zero. It follows that every conceivable state is a physical space as real as any spatial moment we experience. All are required for the native symmetric whole to exist. Logically then, time as we know it overlays those real spatial states. It appears that in addition to all the spatial directions we expect within a three dimensional space, there also exists spatial directions that pass from one static space (a single moment of time) to another, producing a fourth dimension of spatial directions which we refer to as time. As Richard Feynman concluded similarly from his 'sum over histories' interpretation of quantum theory, time is simply a direction in space. In Boltzmann's ideology there exists the mystery of why time originated in a highly improbable state of low entropy and high order. In that two orders necessitates that all static states are physically real, it is now easy to resolve why time originates from the improbable extreme of Alpha. Since time probabilistically moves from imbalance to balance, any observer discovers that the course of time generally traces backward along the "x" axis to originate from the most improbable state, that being either the positive or the negative Alpha, while time traces forward toward the most probable state.

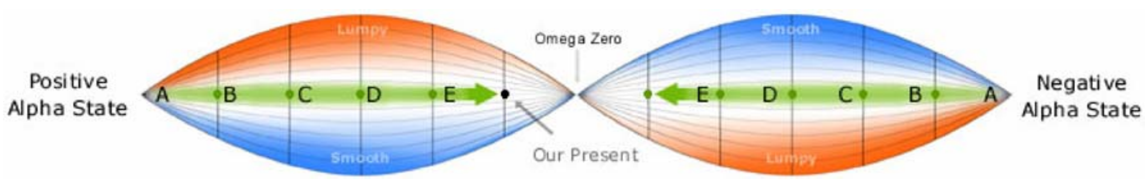


Figure 31: From position A there is a 100% probability for time to move toward balance and symmetry (expansion), while at each consecutive point that probability decreases and is countered by a probability for time to move backward toward imbalance and grouping (gravity). The "x" axis probability is accented by the counter probabilities for conditions to move toward increased lumpiness versus increased smoothness along the "y" axis.

At any given point in state space the probabilities for a system to move toward balance change. Relative to the location of being all positive, all other possible states are more negative, and from the inverse side, all other states are more positive. This high probability for change to move in one direction produces the big bang event. For an evolved system at position D in positive state space, one quarter of all states are now more positive while three quarters are more negative than the present, so although the dominant force remains toward balance there is also a strong and growing counter probability for conditions to move backward toward Alpha. We know that probability mainly as gravity countering the expansion of the universe.

The two Alpha conditions are like two pendulums swung upward which when released swing downward toward one another, except that the momentum of the swing begins without any need of escalation and decelerates in the initial stage first due to the equalizing of probabilities and also due to time entering an increasing measure of possible states, a period of divergence. Then in a second stage the system accelerates toward zero due to the narrowing measure of possible states approaching Omega. The period of divergence eventually turns to a period of convergence where the measure of possibilities decreases as time moves toward the single predestined state of absolute zero.

Features of our universe such as increasing symmetry and orderliness, the balancing force of electromagnetism, the break up of grouped particles by the weak force, and an accelerating cosmological expansion, can all be seen as influences of this convergence toward a predestined future.

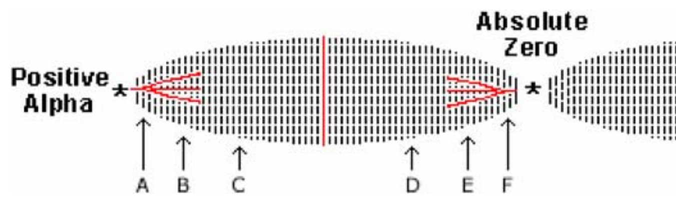


Figure 32: Divergence followed by Convergence: With the direction of time aimed at zero there is first an expanding measure of possible states which slows the progression of time then a decreasing measure of possible states which accelerates the progression of time toward zero.

Time is not a rigid dimension in which events take place. In our environment, time directions simply follow probabilities, following a basin of attraction formed by the attraction of zero and the balance between extremes along the “y” and “z” axes. Time simultaneously moves forward, backward, sideways, along each axis, with the entanglement of directions producing the world we observe. Gravity for example can easily be seen as time moving backward into the past toward Alpha, while cosmological expansion is time dominantly moving forward toward zero. Both time directions create the physical universe we observe. The one point where all the probabilities are equalized, where time has no direction and thus ends, is absolute zero. Zero is the great attractor; the common state of equilibrium for all temporal systems and all possible universes.

An entangled free flow of spatial directions builds the world we observe, however, the overall structure of all possible states rigidly governs which events are possible and impossible in space-time. In contrast to all that the imagination can serve up, recognizing two orders leads to a very conservative view of what is possible in the fourth dimension of time. The longstanding claim that possibilities are endless is obviously incorrect. The possible realm is very distinct and bounded, and if time is governed by probability then what is ultimately possible in other universes would not likely depart from our own physics. Even a scenario where all mass in the universe remains smooth and uniform after the big bang is so improbable as to be impossible. The course of time would necessarily choose that improbable condition repeatedly, analogous to the same person repeatedly winning the lottery. More improbable still is a big crunch future. The necessary coordination of individual time directions for such an event is so improbable that no observers in any universe could ever discover that gravity has overcome expansion.

Two orders is essentially a more detailed comprehension of physical composition. It serves as a map or blueprint for what is possible of definition or finiteness. In this application to state space we can recognize a special partition of states existing within the overall whole of all conceivable states, identified in this image as the Many-Worlds partition. A detailed study of this model depicts the four forces of nature, and thus validates the Many-Worlds [14] interpretation of quantum theory, while the model strongly indicates that only such other worlds exist, rather than a multiverse of randomly selected laws and constants [15] .

Summary

Grouping and symmetry is just as evident in our human world. One of the most identifying features of people is the myriad of ways that we group together. People group together when they associate with an organization, a religion, a sports team, a club or hobby, or an interest. There are baseball fans separate from auto racing fans, painters separate from sculptors, physicists separate from biologists. We group as a city, as a state, as a country, each distinct from other groups. We group by fortune, by health, by skills, by developmental stages, and by education. We group by class, by race, by wealth, by age, by fitness, and by sex. In this way grouping order divides us apart. Groups, identities, classifications, define boundaries and often times not only do such definitions divide up the world but they lead to opposition and conflict. Alternatively, at times, in ways, we also break down and cross those barriers, and come together as a whole. We see beyond individual or group differences. We come together as states, or regions, or cities, to form a larger government. We come together as countries that share the same ocean, or continent or region, or the same planet, making laws to protect and safeguard common interests. At times we forget our differences and unite together as people, as life.

Grouping order is the defining force in nature. It is the source of diversity, uniqueness and individuality. Since even the smallest individual particle or measure of density represents measurable grouping order, we can recognize it as the order responsible literally for creating finite objects and thingness. We naturally identify our existence with the physical reality of things and objects. Much of modern physics and modern mathematics and modern thinking is built upon the axioms of grouping order. It is as if our philosophy is the statement, *only imbalances are relevant* and *only imbalances really exis*t. However, as the measure of grouping order is disintegrating the resultant disorder is in fact another type of order increasing.

Symmetry order is the unifying force in nature. It is the great attractor, the great point of balance toward which all change naturally progresses. Symmetry order is the invisible backdrop, the blank canvas, the board on which the game is played. Each imbalance exists timelessly embedded within the universal balance of the whole, and in the passage of time imbalances naturally, or probabilistically, evolve toward the native state of balance. Such is a universal principle nearly all people recognize intuitively. And yet acknowledging the implications of symmetry order are more involved than seeing that balance leads to a uniform pattern. True symmetry order involves an integration of the world we see with all else, all the other worlds of quantum theory, all other times, even all thought and experiences, the extent of which must be in balance in order to not be a part of this world.

As Niels Bohr stated, “Opposites are not contradictory but complementary.” In the direction of increasing symmetry, the form of objects of this world are integrating with the underlying balance of the infinite whole. David Bohm called this process *enfoldment*. Many of these same ideas were introduced by Bohm to modern science in the 1960’s. In an interview [16] with Omni magazine conducted by F. David Peat and John Briggs, David Bohm explained his concept of enfoldment:

> "Everybody has seen an image of enfoldment: You fold up a sheet of paper, turn it into a small packet, make cuts in it, and then unfold it into a pattern. The parts that were close in the cuts unfold to be far away. This is like what happens in a hologram. Enfoldment is really very common in our experience. All the light in this room comes in so that the entire room is in effect folded into each part. If your eye looks, the light will be then unfolded by your eye and brain. As you look through a telescope or a camera, the whole universe of space and time is enfolded into each part, and that is unfolded to the eye. With an old-fashioned television set that's not adjusted properly, the image enfolds into the screen and then can be unfolded by adjustment.”

Ultimately we are forced to appreciate the extreme of symmetry order as a complete integration of all form, and all times, even all conscious experience, with the background or reference frame of simply existence, the result being what Bohm identified as implicate order. Appreciating the measure of integration and complexity within implicate order is tantamount to understanding the existence of and evolution of human life within a timeless infinite Universe.

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