Chapter 4. Conjugal Bliss

At its core everything is simple. (That is an asserted belief. Do you agree? We will see where you stand after this chapter.) There is a fundamental principle of Observer Physics that when you explore anything thoroughly enough with attention, you begin to uncover what Palmer calls "Corecepts," or core concepts.

Core Concepts have great generalizing power and often tunnel across disciplines in their generality.

For example, at the end of our discussion of Cantor and the real numbers we discovered that to resolve the diagonal question such that "binary real numbers" are countable, we needed the core concept or belief (definition) that every binary real number between 0 and 1, whether degenerate (ending in 0's) or non-degenerate (having an infinite pattern of 1's and 0's), has a complement, (or conjugate -- joined into a pair) "soul mate." Then we assumed that our list of infinitely long less-than-unity binary numerals contains all possible conjugates, and that the unflipped diagonal number is always on the list. If we make these conditions, we can "peek" into Cantor's "complete" list and see its completeness (and countability). The flipped diagonal will be the conjugate of the un-flipped diagonal and therefore definitely on the list. We demonstrated that by defining the first number on the list to be identical to the diagonal number, the flipped diagonal automatically becomes the "limit" of the infinite list that is like the end point on a line segment. This "last" number is the conjugate of the first number on the list and therefore must be in the infinite list. We recall that the property of the natural numbers is that no matter how far you count, you can always count one more number. And we can always map list n to list $(n + 1)$ in a 1-to-1 correspondence the same way Cantor maps the even numbers to the full set of natural numbers or $\mathbb{N}_0$ to $\mathbb{N}_1$.

Then you realize that Cantor has played a Zeno trick and trapped you with his un-countability "proof" by weakly and vaguely defining what he means by a complete list and getting you to accept that "rule of the game". The un-countability is due to the vagueness of his list, just as the non-algebraic non-periodic decimals are too vague to write down precisely and only act as poorly defined fillers of continuum gaps -- and thus do not even qualify as numbers (precisely quantified entities).

The binary conjugate principle is moving us toward the core concept of **wholeness**.

Postulate: Every binary sequence in the set of all binary numbers less than unity has a conjugate partner that also falls somewhere within the set.

Corollary: The two limit points of the binary interval $0<x<1$ (0 and 1, 0.00000... and 0.11111) also form a conjugate pair.

We call a "degenerate" binary a sequence that has an infinitely long tail of 0's or 1's. Let's look at how degenerate binary conjugate pairs relate, given the rule disallowing infinite 1 tails: (e.g., .1000... → .01111... → .1000....) This example simply oscillates back and forth with its partner. If a conjugate pair does not refer back to itself, it forms a pair of pairs, each with 1 tailed partners, that resonate with each other and collapse into a single pair when the 1 tailed partners convert back into ordinary degenerate decimals: (e.g., .11000... → .00111... → .01000... → .101111... → .11000....→ .....) The conjugate of a non-degenerate is a string of 0's and 1's with each digit reversed. It does not self refer, but in the case of periodic strings, the pair can be identical but phase shifted: (e.g. .10101010... ↔ .01010101....) Algorithmic strings may do interesting things when flipped: (e.g., .1011011101111011111O... → .01001000100001000001....), -- but they will have a conjugate algorithm. Non-periodic non-degenerates will just have a different, but conjugate, string with each digit reversed, by definition and by common sense, since we can't actually write any one of them out in full.

This business of conjugate binary numbers expands its territory of influence when we realize that the binaries between 0 and 1 map to any interval or space or to anything and everything in the universe. We have already mentioned the importance of conjugate forms in quantum physics. We may also corroborate our core concept of conjugate binaries with the even more (or at least equally) general finding in Fourier analysis that everything has its conjugate mate. Most of these pairs remain as yet undiscovered. For example, the conjugate mate of a pure continuous sine wave is an impulse function, the equivalent of a dot. We recall that a dot in the context of an arbitrary interval is the equivalent in geometry of a single infinite decimal. So we have connected these two principles.

* 0.0000000**1**000000000000.... (Impulse Function)
* 0.1111111**0**111111111111.... (Sine Wave Propagating from a Source)
* 0.11111111000000000000.... (Collapsed Wave)

Interestingly, in this model, only a "dense" periodic wave has an impulse mate. The mate of a "spread out" wave

* 0.010101010101010**0**010101010101....
* 0.101010101010101**1**1010101010101...

forms a conjugate non-degenerate wave. The "spread out" wave represents a compound wave, not a pure sine wave.

Through Fourier analysis we discover that we can make any shape out of a sum of iterations of a single sine wave superimposed on itself after various transformations of phase, frequency, or amplitude. In this manner you can make anything in the universe. But it takes an infinite number of such sine wave iterations to make a pure impulse function. These two forms, sine wave and impulse, are like the opposite poles on a sphere or on a range of possibilities.

The principle of conjugate pairs is even more general than that. You can make anything out of anything. In other words, you can take as your base generator waveform any form (an umbrella, a flower, a piano) and by summing iterations of it at various scales, phases, amplitudes, and frequencies, you can generate any other form. Each base form generator will have its own perfect conjugate somewhere in the universe that is made by so-to-speak turning itself inside out (or outside in). An impulse is a sine wave turned completely "outside in", and a sine is an impulse turned inside out.

Experiment: The inside-out/outside-in transformation process is controlled by the Observer's viewpoint. To experience this, draw a sine wave (an interval of course of an infinitely oscillating sine wave) on a piece of cardboard. As you hold it in front of you and look at it, your line of sight is orthogonal to the wave form. You see a sine wave of a certain wavelength and amplitude. Now, holding the cardboard on an axis orthogonal to the wave, rotate the cardboard until it is turned 90 degrees relative to your line of sight. As you rotate the card, you will see the wavelength appear to shorten. When the card is lined up parallel to your line of vision, the wave will become an impulse function. So, at least in this case, the two conjugate forms are the same, but observed from orthogonal viewpoints.

A viewpoint transformation of **some** kind can be done to go back and forth between each conjugate pair. Unfortunately we just don't know what all the transformations are for all the possible forms, nor do we even know what the pairs are. But there is apparently a (one-to-one?) dictionary mapping of everything in pairs. This includes people, states of consciousness, and so on. Maybe the Noah's ark story isn't just a myth!! Noah means quietness in Hebrew. Maybe if the mind is real quiet you can see all the pairs within the compass[ionate] arc of the mind, and the transformations that link them across space-time and consciousness.

Principle: Every relative creation has a conjugate mate.
Corollary: The conjugate of the whole relative world is the Absolute.

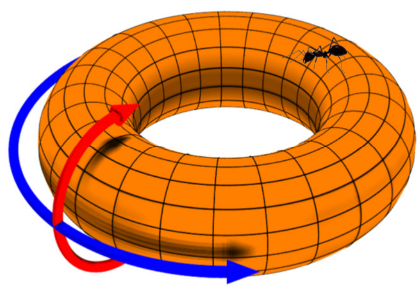
From this corollary probably comes the old saying: As above, so below. As you can see, it might also say: "As below, so above."

We recall that in our model an infinite mathematical sine wave is represented by a non-degenerate symmetrically periodic decimal (such as 0.101010101...). This corresponds to a point in geometry. Degenerate decimal waves are composites of overlaid periodic decimals in which the spaces after some point to the right are all filled with 1's, and then the 1's flip to 0's and stabilize. One wave is non-localized, and the other is localized.

Non-periodic non-degenerate decimals represent chaos in a system. For example, suppose we have a system with any two linked oscillators. We can describe it with a phase space that is toroid shaped. We can represent the operation of the system by a point spiraling around the doughnut like a crazy ant.

This way of looking at the pair of linked oscillators uses a simple mathematical concept called a Lagrangian, a very powerful and general descriptive tool that plays an important role in both classical physics and modern quantum mechanics. The Lagrangian method is a clever way of representing the time evolution of a complex ensemble given that we can identify its constituent components and their "initial conditions" at some arbitrary moment in the system's history. You can get the details on it from Donald Menzel, **Mathematical Physics**, (155-159, et al.) or other sources, but let's digress a moment and take a look at this mathematical method before we go back to our binary numbers.

In our example there are two oscillators. Each varies in such a way that it can be described as moving around in a circle. The Lagrangian idea is simply to represent the whole system with its two oscillators all at once as a single particle evolving in the context of a TWO dimensional phase space. Combining the two circles gives us a circle rotated in a circular way -- a torus, or doughnut. So we can represent the oscillators together as a single line meandering about on the toroid phase space plane. Thus we represent the evolution of the ensemble of two one-dimensionally varying objects as a single particle wandering in a two-dimensional space like an ant on a doughnut.



Doughnut from **Wikipedia**, "Torus" with an addled ant added

If we can describe that motion with a function, then we have a history of the motions of the two-object ensemble for all time. The only other information we need is the positions of the two particles at some arbitrary point in time when we decide to start the clock so we can anchor the system to our temporal reference frame. These are the "initial conditions". Theoretically a classical set of trajectories or a quantum wave function can take the form of a Lagrangian and describe the entire history of a collection of interacting particles. In practice it is not that simple. Partly this is because of the difficulty of pinning down initial conditions, and partly it is due to built-in uncertainty, and perhaps lack of some component information, not to speak of the problems of dealing with 10^{23} or more components in a system of atoms or molecules. That moves us into territory where we take recourse to other approaches.

Once we understand the general principle of the Lagrangian, we can adapt the mathematics to describe the motions of any ensemble or any other kinds of variation you can imagine in a multidimensional phase space. This procedure has significance for observer physics, because it demonstrates how an observer can shift viewpoints with regard to a system. Viewing from one perspective he sees a multiplicity of objects interacting in space/time in a complex way. By a simple shift of perspective the observer can "unitize" the multiplicity of objects, and then treat the unitized ensemble as a single particle without sacrificing any of the diversity inherent in the multiplicity. No information is lost, and at any point in time the observer can give you a status report on every component of the system by simply reading off its value in each dimension at that point in the phase space.

The Lagrangian approach simplifies a system in one respect, and at the same time maintains a vision of its complexity in terms of the dimensional size of the phase space. Instead of measuring entropy in terms of multiplicities of microstates of many particles, the observer then measures it in terms of a single particle in multiplicities of dimensions. It is simply a trade-off. Although the Lagrangian is a favorite tool of quantum physicists, I am not sure that much is gained by the juggling act required to use it.

An interesting sidelight is that the Lagrangian approach, when applied to number theory, can result in the representation of ANY real number between 0 and 1 expressible, for example, in base ten decimal format as a **whole number** in an infinite dimensional phase space. That is to say, we can think of each point on the real line as a projection of a single point somewhere in a denumerably infinite dimensional space of whole numbers in the same way that we can project each value of the function $y = x/2$ to a **single point** in an x-y grid (e.g., (4, 2) or (10, 5). For example, the irrational number π (3.14159....) can be recast as the value 3 in dimension one, 1 in dimension 2, 4 in dimension 3, 1 in dimension 4, 5, in dimension 5, 9 in dimension 6, and so on. Thus π changes from an irrational number into a whole number value between 0 and 9 reflected in an infinite number of dimensions. If the real number changes value, the single point jumps about in the infinite phase space, always with whole number values between 0 and 9 in each dimension. In other words, each digit of a decimal is viewed as a whole number value of some power of 10 (or whatever base we chose) rather than as a small fractional component of the decimal. An infinite decimal becomes an infinite dimensional cube with each side having the length of the base in which it is coded (2, 8, 10, 16, 32, and so on). A large set of such cubes with the base ASCII (256) could contain every book ever written in English as well as a lot of gibberish encoded as ASCII decimals.

<u>**Key Principle of Observer Physics**</u>**: The observer's attention defines the level of multiplicity apparent in a system. By zooming in far enough (to the Planck scale), macrostates disappear, and microstates reveal the unity and simplicity of a unified "field" state. By zooming out far enough, microstates disappear and the macrostates can unitize into a single particle with no apparent state changes**. (Refer to **ReSurfacing**, Exercise # 26, "The Expansion Exercise", # 18, "Viewpoints".) **In between the observer sets for himself the number of dimensions and "particles" that he wishes to observe.**

Let us return from our digression to consider an interpretation of the linked oscillator phase space example in terms of binaries. We can let the activity of the meandering point represent every possible binary decimal from 0 to 1. We can also see demonstrated the binary decimal conjugate pairs, which depend on the Observer, of course. The ant wanders around the torus in either poloidal small circle routes or toroidal large circle routes, or some mixture thereof. We will say the Observer calls a poloidal cycle (red arrow) a 1, and a toroidal cycle (blue arrow) a 0 in any given cycle around the doughnut. (A cycle that starts and ends at the same point is not counted since both routes complete at the same time. Also the ant never gets stuck in a local area going around in circles that never complete a poloidal or toroidal loop around the doughnut.) Each cycle around the doughnut by the immortal, indefatigable and thoroughly confused ant thus generates a 0 or a 1, producing an infinite string of 0's and 1's in our idealized system representing some portion of his endless journey. (See Briggs and Peat, **Turbulent Mirror**, pp. 40-41.) The set of all possible legal but endless ant routes gives us the complete set of binary decimals as an infinite set of endless strings of digits made of 0's and 1's.

Our Observer can shift his viewpoint and reinterpret the system: He can call a poloidal loop 0, and the toroidal loop can become a 1. The phase space system is the same, so the list of possibilities is the same, but each string on this second list is the exact conjugate of a binary decimal produced by the same string of cycles of the system viewed from the observer's first viewpoint. Both lists contain only 0's and 1's and are a complete catalog of all possibilities of the system's phase space operation (legal ant routes). Thus they both contain the same list of numbers. We see here a demonstration of how each binary number has its conjugate, and the two lists will be identical in contents, but with each binary swapped with its conjugate binary. The Observer looks at the same system doing the same things, but, from a different viewpoint, he gets the same list in a different sequence. The two sequences are paired one-to-one by conjugation. We can say that they have been "counted".

In chaos theory Benoit Mandelbrot and others have found that in any chaotic sequence, such as white noise, there are always embedded binary cascades of the strange attractors of orderly fractals buried inside them (and vice versa). Order and chaos are conjugate fractals. For a quick intuitive glance at this idea, think of Escher's drawings. Mandelbrot's classic work on the subject of fractals (**The Fractal Geometry of Nature** [San Francisco: W.H. Freeman, 1983]) is really worth delving into. Briggs and Peat's **Turbulent Mirror** also is a good introduction to fractals. A binary cascade is like our list spliced with alternating degenerate and non-degenerate binaries. The "chaotic" non-periodic binaries form gaps between "orderly" periodic and/or degenerate (i.e."terminating" periodic) binaries.

With our "gap" theory of non-degenerate numbers we can suppose that each degenerate binary represents a point in an interval, and each non-degenerate binary represents a gap of indeterminate size between points.

Principle: Each point in an interval has a gap partner, except the terminal at the end of the interval, so there's one extra dot. Or, if we don't include the two terminals, we have one extra gap, or it can be open with a gap at both ends, in which it becomes an interval floating between undefined gaps. If 1 is a point and 0 is a gap, then we have 101 (a gap between two terminals – note the extra terminal dot at end), 010 (a point between two gaps, extra gap at end), 10 (an interval terminating with a gap), and 01 (a gap ending in a terminal) as our possibilities, where 110 and 011 are variations of 10 and 01, and 000 and 111 are not intervals but pure gap and solid infinite line.

Let's now look at a binary cascade. Suppose we have a mathematically modeled system such as an iterated growth equation

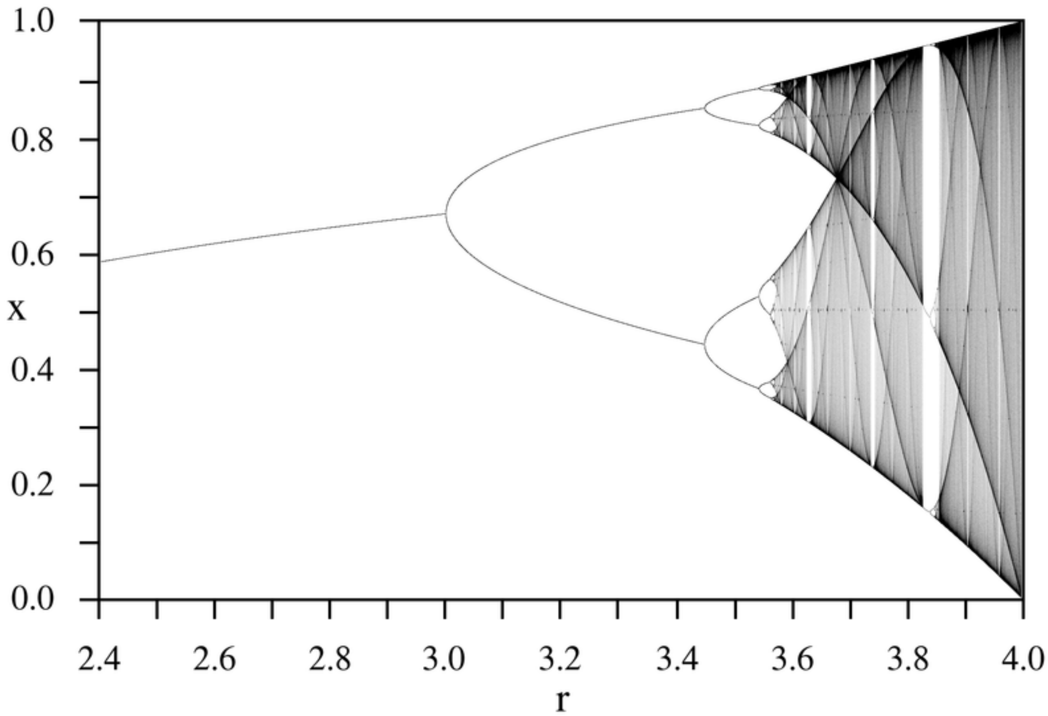
* $x_{(n+1)} = r\, x_n\, (1\text{-}x_n)$

The (n)s are subscripts indicating generations, and (r) is some rate-of-growth factor that shows how fast the growth goes per unit of time. We normalize the equation so all the (x_n)s occur only between 0 and 1. That means we are dealing with either degenerate or non-degenerate decimals from our list as outputs for the system. Now we multiply the right side by the Verhulst factor (1 - x_n):

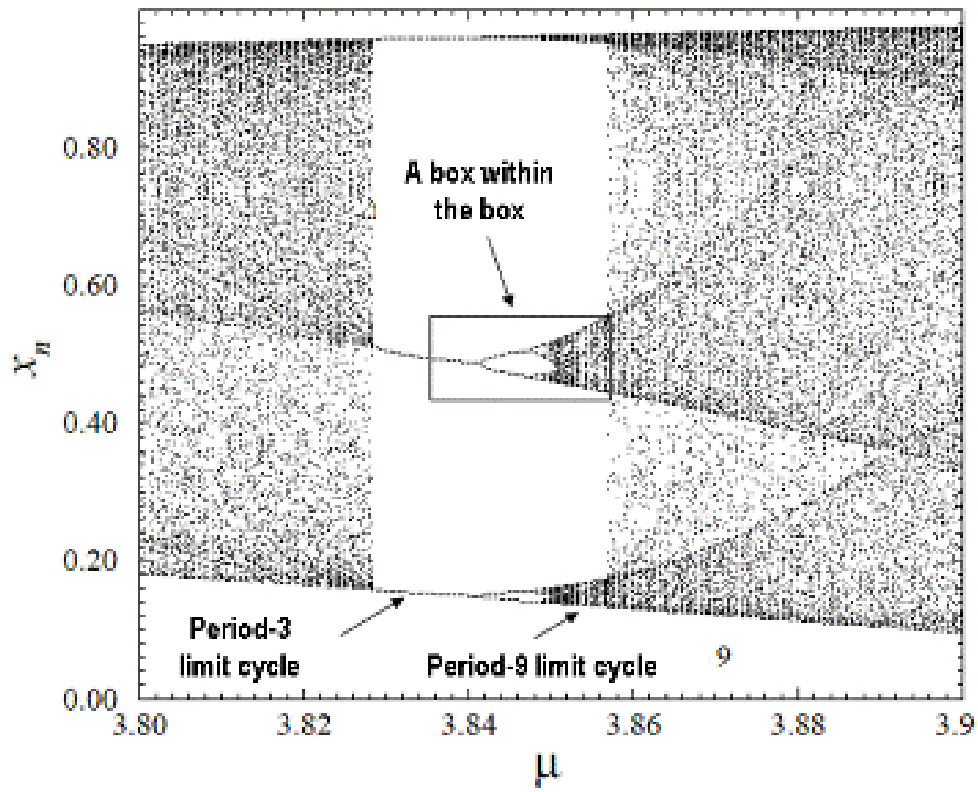
* $x_{(n+1)} = r\, x_n\, (1\text{-}x_n)$.

Instead of a continuous population growth, we get a nonlinear system that self-interacts. It will tend to oscillate around an attractor. If we increase the "birthrate" factor (r), we begin to put some stress on the system and the attractor oscillates, but then settles back down. It is stable at .66.
(0.1010100011110101110000101000111101011100001010001111010111 0000....) If we push (r) up more, the oscillations last longer but still settle down. At a certain (r) value (3.0) (binary: 11), the attractor bifurcates and we have two attractors governing the system's oscillations. Add more stress on (r) (above 3.4495),
(11.0111001100010010011011101001011110001101010011111011111001110...)
and the attractors bifurcate again. Continuing in this manner, when r = 3.56999,
(11.100100011110101011011110101011001000011000000101011010000001111...)
we get a cascade of bifurcations that goes to infinity as its limit. By the time we reach r = 3.7,
(11.1011001100110011001100110011001100110011001100110011001100...)
the population varies wildly, but when (r) is a little over 3.8,
(11.11001100110011001100110011001100110011001100110011001100110011...)
there's a sudden window of orderliness. Around 3.86
(11.1101110000101000111101011100001010001111010111000010100011 1101...)
the chaos returns. By 4.0 (binary: 100) it completely fills the phase space from 0 to 1.

Remember that this is a cascade of bifurcating values, all of which lie between 0 and 1. So we are filling the phase space interval with "dots" or binary values. At a certain limit for (r), the number of attractors reaches its limit of infinity. This process of increasing (r) and bifurcating attractors is sometimes called the "period-doubling route to chaos." When ecologist Robert May did computer plots of the Verhulst equation at Princeton, some surprising things showed up. He found that after the attractors went from four to infinity (which they do in a rapid cascade), the "infinities" regions reversed and went to four, and then to two, and then to one. The "infinities" regions of chaos in the same progression however also expanded their territories in orderly parabolic curves "eating" each other up. Furthermore, odd blank bars occurred where the system suddenly went from chaos back to normal for no apparent reason. These windows of orderliness recur fractally (at different scales) throughout the range of (r) values. Then, within each window of order, the bifurcation cascade process repeats in the same way, but fractally at different scales and speeds. This apparently chaotic intrusion of orderly bars of varying width is called "intermittence". Apparently a stable, orderly system fractally remembers chaos from time to time (like a radio broadcast with occasional static), and a chaotic system fractally remembers its original orderliness from time to time.



The above printout from **Wikipedia**, "Bifurcation Diagram" shows clearly how the bifurcations in the "Logistic Map" $x_{(n+1)} = r\, x_n\, (1\text{-}x_n)$ cascade into chaos, and at the same time periodically return to order (the blank bars), followed by period doubling back into chaos, gradually expanding and overlapping until the whole phase space is filled.. "The ratio of the lengths of successive intervals between values of *r* for which bifurcation occurs converges to the first Feigenbaum constant." Mitchell Feigenbaum discovered in 1975 "that the quotient of successive distances between bifurcation events tends to 4.6692...." (**Wikipedia**, "Mitchell Feigenbaum", "Feigenbaum Constants")
(100.1010101101010000101100001111001001111011101100101111110110001...)
Below is a detail of a Logistic Map, showing how the system periodically returns to order and then begins to bifurcate again. This gives the map a fractal structure. The image is from http://www.atomosyd.net/spip.php?article8. The symbol μ is the same as r in the other diagram.



The discovery of orderly bifurcation into "chaos" and the hidden existence of order within chaos destroys the thermodynamic hypothesis of ever-increasing inevitable entropy and chaos. Total chaos turns out to be a theoretical limit to a range, and total order is also its opposite theoretical limit. Real world systems have no "absolute" zero ground state of orderliness or "absolute" chaos of total never-ending disorderliness. These extremes are conjugate poles of a system, just as 0 and 1 are for fractions of unity. When the stress goes beyond a certain limit, the system becomes totally chaotic within the entire phase space. The attractors then overwrite themselves (increasing their density) and the occurrence of order bars appears to decrease. The window bars of order become un-manifest. But order is still buried deep inside the chaos as the other side of its nature that makes it possible for chaos to be chaos. This mathematical model gives very useful descriptions that apply to lots of real world situations.

On the other hand, if you systematically de-stress the above "chaotic" system, it becomes more and more orderly. This is what Maharishi liked to call lowering the level of excitation. If you decrease (r) until ($1 > r > 0$), then the Verhulst system inevitably becomes as "extinct" as dinosaurs and dodos. There are no attractors, because there is no population. Extinction is a very orderly condition. Death is a great "attractor." But just as there is no permanent life, there is no such thing as permanent death. Even after the thermodynamic "death" of the universe, there remain minute fluctuations, quantum fluctuations -- little Jurassic Parks -- that can roil the whole thing up again. A key finding of chaos theory is called the "butterfly" principle. Even a tiny fluctuation can cause an upheaval in a nonlinear system.

This brings up another key principle -- the **Poincaré Peak**. All quantum physicists must never forget the Poincaré Peak, especially because they believe so strongly in the magic of statistics, the greatest shell game going. A Poincaré Peak is an occurrence of the **LEAST PROBABLE** condition of a statistical system. It is also called a Poincaré Recurrence.

Principle: In any system involving random statistical fluctuations that recur at a certain average frequency, you will always have a Poincaré Recursion, the inevitable recurrence of the LEAST probable condition of the system, a window of pure orderliness. "In mathematics, the **Poincaré recurrence theorem** states that certain systems will, after a sufficiently long but finite time, return to a state very close to the initial state. The **Poincaré recurrence time** is the length of time elapsed until the recurrence (this time may vary greatly depending on the exact initial state and required degree of approximation). The result applies to isolated mechanical systems subject to some constraints, e.g., all particles must be bound to a finite volume. . . . If the space is quantized, an exact recurrence is possible after a period of time determined in part by the size of the space and the number of elements contained. If the space is continuous, no exact recurrence can be expected because there will be an arbitrarily large distance between any two locations, no matter how close together." (**Wikipedia**, "Poincaré Recurrence Theorem")

The universe almost certainly contains a finite amount of energy and matter, all of which appears to be quantized. Physical space is quantized by virtue of the fact that our only way of perceiving it is in terms of the quantized matter and energy in it. Hence the volume is probably finite and **defined by the contents**. Mental space is also quantized as thought impulses in consciousness, although undefined awareness is (by definition) continuous, thus giving rise to our subjective notions of continuity. Continuity of awareness allows for manipulation of recurrences within space and time to varying degrees of replication. (Hence, space and time travel are possible with some degree of reliability, but in practice can only approximate the feeling of a reiteration of a time or place). We have seen that continuity depends on observer viewpoint. We will explore the natures of space and time in more detail later.

Corollary: Fractal Poincaré Peaks (PP's) are flashing by at infinitesimal intervals all the time. We miss them because our attention is not directed there.

Corollary: If we put our attention on the PP's, we can "zoom in" and live on top of a Peak (for example, a Big Bang event) or anywhere on its slopes. We simply change lenses and change the movie -- any way we like.

Even though blind democracy seems to rule most of the time with its vastly superior population at the equilibrium macrostate, the "Minority Report" comes to light occasionally. Every dog has his day, even the least probable one. The **Avatar Materials** constitute a Minority Report of a highly improbable kind from one viewpoint. From Poincaré's viewpoint they are inevitable.

As long as conservation holds, and physicists really don't want to let go of that one, the system never forgets, even though it sure looks like all the data is erased by the scrambling of entropy. Physicists discount recurrence of a Big Bang after a Heat Death, because its improbability is so vastly, hugely, greater than any imaginable projected time frame for the universe. Not so. They are stuck in their habituated Observer viewpoints trying to look at something that requires a very different viewpoint. They forget that tiny quantum fluctuations can precipitate highly improbable statistical fluctuations in very large systems.

Look at all the macroscopic quantum phenomena we are getting used to these days!! Also, do not forget the role of Observer consciousness. Time is an inseparable artifact of consciousness. Dead men tell no time. Neither do enlightened ones. No one of our biological ilk lives in a Heat Death. It's like the "Big Sleep". Pure Awareness stays awake, but has no opinion about time. Consciousness of time is caused by resistance in the Observer and has no relation to phenomena except that the Observer who is unwilling to take responsibility for his resistance places the blame on "phenomena." Eventually slight perturbations wake the system up again. Any orderliness is always remembered by the system, because it is there inherently conserved by the very existence of the system in awareness. Of course, if there is no system, there is no orderliness. But then there is no chaos either. There **always** is undefined awareness.

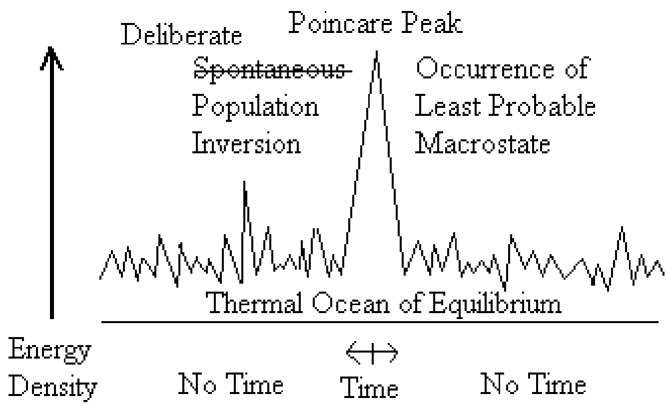
Principle: Poincaré Peaks can recur sooner than you imagine if you can imagine that they recur sooner than you imagine they do.

A great example of how the system never forgets even when erased with total chaos is the story of data going into a the extreme environment of a Black Hole. Physicists talk of the three hairs: mass, spin, charge -- that are all that remain of information attached to anything falling into a black hole. First of all, this notion suggests that really all information is just made of combinations of these three hairs, just like all colors are made from the three primary colors.

Let us just suppose that there is some information attached to this book and it falls into a black hole. Information is a form of energy. You can't have energy just disappear or that violates some of the basic ideas of physics about conservation. The situation is complicated by Hawking evaporation. An object goes in with information and material can come out -- but apparently without any information other than the three hairs -- when it emerges. Observer physics comes to the rescue. The problem is caused by the physicists shifting viewpoint without telling you. When the book falls into the black hole, we are on the outside watching it go in. When the electrons and other fully erased particles come radiating out, we also are on the outside watching. However, the information of the book remains intact, stuck on the event horizon from our outside Observer viewpoint. There it remains for all time. Only from the viewpoint of the cockroaches riding on the book does the data actually fall in, although the roaches probably are unable to comprehend the information. Perhaps the roaches get erased as roaches inside the black hole, but the roach-infested book remains stamped on the event horizon. Also, if Einstein is right in his assumption that the laws of nature hold everywhere, then all the laws that generate all the information of the universe are also valid within the event horizon of a black hole.

The black hole distorts space/time so that different observers get widely different interpretations of events that seem situated fairly close together. So as far as we observers can tell from the outside, the information remains intact and is stuck like a postage stamp on the event horizon. It remains there unless the black hole completely evaporates or joins with other black holes and swallows up the universe, but then it is still stuck on the periphery of the universal black hole. In the latter case the observer falls into the black hole and his viewpoint has shifted dramatically. In that case he may not see the information in the same way that you don't see the information of the wavelength of your sine wave when you turn the cardboard 90 degrees, although it is still there. He moves to a viewpoint where he may not be able to see it, though it may still be there in virtual form. If the black hole completely evaporates, the terminal phase is greatly accelerated and ends with an explosion. This rearranges the book's information pretty thoroughly as it scatters through our viewpoint in bits and pieces, but does not "destroy" anything. It is probably expanded and broken into little pieces and thoroughly rearranged. This is like incinerating your piece of cardboard with a firecracker or match. However, book or no book, the basic laws of the universe presumably continue to function as usual and will reiterate whatever combination of information appears to have been scrambled back into a pretty good facsimile of what was there before.

Principle: Conservation holds unless the Observer doesn't hold onto conservation. (The Observer decides.)



$$(\Delta E)\ (\Delta t) >= h$$

The above equation is Heisenberg's uncertainty relation expressed in terms of energy (E) and time (t), where h is Planck's constant. It suggests that during an extremely small time interval there can appear a huge peak of energy, perhaps big enough to generate a momentary wave the size of a Big Bang. For example, imagine (yes, you can **imagine** it, but would probably not want to experience it directly in your current physical body) an interval of time shorter than 10^{-134} seconds. That would summon up at least 10^{100} joules of energy, maybe much more, and perhaps even enough energy to generate a Big Bang and create a universe. Or imagine putting your attention into a space smaller than 10^{-134} meters. That would generate for you an experience of a momentous shock wave of at least 10^{100} kg m/s. . . . all according to Heisenberg's uncertainty principle. That much would be certain.

Gravity is a form of negative energy as are antiparticles. It is possible for positive and negative quantities of energy to randomly fluctuate into existence with a net energy of zero. Astrophysicists Alexei Filippenko at the University of California, Berkeley and Jay Pasachoff at Williams College suggest that "Quantum theory, and specifically Heisenberg's uncertainty principle, provide a natural explanation for how that energy may have come out of nothing."

(http://www.livescience.com/33129-total-energy-universe-zero.html)

The astrophysicists suggest quite persuasively that the universe simply fluctuates into existence as part of a random quantum process. This is one viewpoint. We will examine other viewpoints and let you decide which viewpoint you prefer, and, perhaps more fundamentally, whether you believe you have the option to prefer.

Later on in these discussions (Chapter 10) we will discuss in some detail a fundamental discovery regarding the principle of conjugation. This is known as Phase Conjugation, a remarkable and probably universal phenomenon with many applications that become apparent when systems become coherent.

NOTE: See Laurent Nottale's **Fractal Space-Time and Microphysics**, especially chapters 2 and 3, for discussions of fractal spaces, hyper-real numbers, and other fascinating new approaches to models of physical systems.