Valuable Novelty: A Proposed General Theory of Innovation and Innovativeness

by

Dennis A. Stauffer

reprinted from

International Journal of
Innovation Science

Volume 7 · Number 3 · September 2015

Multi-Science Publishing

1757-2223

already exists and has specific attributes. In any intellectual pursuit, some set of beliefs, scientific theories or paradigm is already at play.

4.2.2 Iterative

The Innovation Cycle is iterative in the same sense as non-linear mathematics. It repeats the same steps over and over, but in a way that acquires new inputs and produces new outputs, constantly adjusting and redirecting itself. The cycle's underlying pattern is preserved, but in a way that adapts and evolves.

4.2.3 Attractive

In the terminology of complexity theory, the Innovation Cycle appears to be an *attractor* [13] in at least a conceptual sense if not a strictly mathematical one. The Innovation Cycle persists in the natural world because it is advantageous. Living organisms are effectively drawn to it because it is an adaptive mechanism species need to survive in a dynamic environment. Those without it eventually die out. The existence of life itself is unlikely if not impossible without it. In the same way, successful innovations adapt a business to its environment, provide competitive advantage, and ensure its survival.

4.2.4 Self-reinforcing

The Innovation Cycle has an internal logic that propels it from one phase to the next. New possibilities (Idea Phase) must be acted on (Action Phase) if they are to produce any value. That generates real world consequences (Reality Phase), which produces feedback (Feedback Phase). That feedback impacts the generation of future possibilities (Idea Phase) and so on. Research data confirms substantial correlations among these four phases [14].

4.2.5 Effectal

This is a term I coin here as an alternative to causal. The crucial determinant of whether a new possibility becomes an innovation is outcome. Does it work? Is any value created? So, rather than being driven solely by a series of *causal* factors, this pattern is *effectally* guided by outcomes.

In complexity theory, some types of phenomenon are highly sensitive to initial conditions, what has come to be referred to as the *butterfly effect* [15]. While cause and effect still apply, the Innovation Cycle is somewhat insensitive to specific causal factors because it does not necessarily matter where a new possibility originates; e.g., whose idea it is, or what specific organism mutates. Yet it is highly sensitive to its effect. That may be whether or not an organism survives to reproduce, a scientific theory gains acceptance, a technology works, a new product appeals to customers, or a new venture becomes profitable. When it comes to innovation, outcome is absolutely crucial. Again, this is analogous to an attractor in a complex system—an outcome that agents in that system are drawn to.

4.2.6 Probabilistic

The Innovation Cycle's future course is not knowable in advance. It behaves like a chaotic system that originates from determinant mechanisms yet becomes increasingly indeterminate (deterministically chaotic) as it iterates. It's prone to failure and amounts to a roll of the dice in which there are multiple potential impacts, outcomes, and solutions. This cycle is probabilistic, not in the sense that we can only approximate a causal relationship, but in the sense that its impact is fundamentally non-linear, that all it can do is shift the probabilities, never guarantee any particular outcome.

4.3 Systematic Guessing

The Innovation Cycle is a way to systematize guessing, and it is astoundingly efficient even when those guesses are made entirely at random. Some simple probability calculations illustrate how powerful this pattern can be.

Suppose we want to spell the word *innovation* based on random attempts, perhaps keystrokes on a computer. For simplicity, let us assume that this keyboard contains only the 26 letters of the alphabet and we are equally likely to hit any key. There is a 1 in 26 chance of getting the correct letter with any attempt and 10 letters, so we have an even chance of succeeding in 26^{10} or more than 141 trillion attempts.

At one keystroke per second, that would be expected to take almost four and a half million years—to correctly spell just one ten letter word!

But if the computer tells us what "works" or does not work after each attempt, and we keep each letter that happens to be correct, then we have an even chance of succeeding in 26×10 attempts—just 260 tries. At one guess per second, that will take less than 4½ minutes. This is what reality does in the Innovation Cycle. It answers the question: Does this work? It does this not by telling us what to guess but simply by responding to our guesses. It is as though reality is a genie with a puzzle. It "knows" the solution, but won't tell us. But it will answer yes/no questions…in the form of consequences. So we must invent and attempt possibilities in order to see what happens as a result. The Innovation Cycle is a strategy for playing this genie's game and solving the puzzle, and it appears to be the only way to play this game effectively.

When feedback is received in this way letter-by-letter, the letters can be chosen at random and the word innovation will emerge without any recognition of it as a target in advance. All that is needed is a test of what (letter) works and what does not, and the ability to recognize and retain that feedback (the Innovation Cycle).

The problem with guessing without feedback is not just how long it takes; it is that there is nothing to indicate when a solution has been found. To determine that, one would already have to know what the solution is in order to recognize it. If that is the case, there is no need for guessing. If the solution is not already known, random attempts may stumble onto it but will not retain it. The guessing will just continue. Nothing will be gained or learned. With the Innovation Cycle, the solution can emerge from random trial and failure. It will be discovered because it works.

The Innovation Cycle does not require any purpose to be effective, which is one reason why it serves as a way to describe innovation in all its forms. Even choosing possibilities based on a roll of dice can still drive innovation—provided that the Innovation Cycle is followed. Nature has been doing it for billions of years. I am not suggesting that innovation never has purpose. Human-fostered innovation is almost always purposeful, but innovation can and does occur without it.

Certainly life and science and other innovation challenges are more complex than spelling a 10-letter word. It may, of course, take longer than a second to determine what works. But as complexity increases, the comparative power of this pattern grows exponentially. If we make innovation plural, so it now has 11 letters, spelling it without any feedback would be expected to take 26 times longer. That is more than a hundred million (116,385,854) years. With the feedback provided within the Innovation Cycle, it would be expected to take an additional 26 seconds. Spelling a 12-letter word solely at random will take more than 3 billion (3,026,032,204) years. With this kind of feedback, it should take a little more than 5 minutes.

It is no accident that when the Innovation Cycle has been introduced into domains where it previously did not occur—such as the development of the scientific method and the introduction of research and development as a business process—the effect has been to dramatically accelerate value creation.

In the real world, we often do not get clear "yes" or "no" answers. The feedback we receive is ambiguous and requires processing and further exploration. Still, the dramatic gain in efficiency that the Innovation Cycle produces, justifies all the resources and effort, the experimentation and risk that innovation entails. In nature and in business, the Innovation Cycle is advantageous because it so dramatically improves the probability of successful value creation.

To put this in more formal terms, the Innovation Cycle is neither necessary nor sufficient for innovation to occur. Innovation can occur by pure happenstance without this cycle and this cycle does not guarantee that innovation will always happen. Rather, it makes it more *probable* that innovation will occur—a lot more probable.

4.4 Possibility Space

The reality we confront (and are part of) is a Possibility Space[3]. As we increase our capabilities, either through natural evolution or through our human technologies, we gradually occupy that space. We discover what is possible within this space by "figuring out" how to do it, and that appears to be the only way we can come to know what is or is not possible. This possibility space may be finite or infinite (we do not know) but clearly some things fall within its scope and some things do not. However, it is not possible to say definitively what cannot be done—only what we are not yet capable of doing (or

[3] Possibility space is similar to Daniel Dennett's concept of biological Design Space [11], but the two are not quite the same. Dennett's Design Space refers to the specific context that determines whether an innovation (biological adaptation) is feasible at a particular time and place, whereas Possibility Space is more expansive. It refers to what may be attainable anywhere by any means at any point in time. Possibility Space is the ultimate Design Space in which we exist.

what has not yet occurred in the natural world). For example, we now know that controlled powered flight has always been possible in the sense that the rules of the universe permit it, but only in recent human history has it become possible in the sense that we have developed this technological capability.

The whole notion of possibility has these two meanings, what is *ultimately* possible, and what is *currently* or *imminently* possible. (Perhaps that's three meanings, but here I treat those last two as the same.) Once something has been accomplished, we know it satisfies both criteria, but until something has been accomplished we cannot know which of those criteria are not being met. For example consider teleportation, beaming someone from one location to another as in Star Trek. Is that something that is utterly impossible ever or is it something that we have not yet figured out how to do? We do not know and the only way to find out is to try to do it. Innovation requires stepping into that uncertainty to discover what may be beyond current capabilities yet ultimately attainable. The Innovation Cycle gives us an efficient way to do that, by transforming that quest from a series of random guesses into a systematic process, one that dramatically improves the likelihood of success—of creating new value. The Innovation Cycle's principle benefit is this ability to improve the odds.

4.5 AN ALTERNATIVE PATTERN

For each of the four phases of the Innovation Cycle, there is an alternative and these alternatives are more than just deviations. They combine to form an alternative pattern that is an equally coherent way of navigating the world, one that is no less logical than the Innovation Cycle. At its extreme, this alternative pattern produces no novelty, no exploration, and no new insights or discoveries. In other words: no new value and therefore no innovation. It is a classic closed loop feedback system that prevents change and minimizes variability and it can be quite effective. I call this alternative pattern the Status Quo Cycle (Fig. 3).

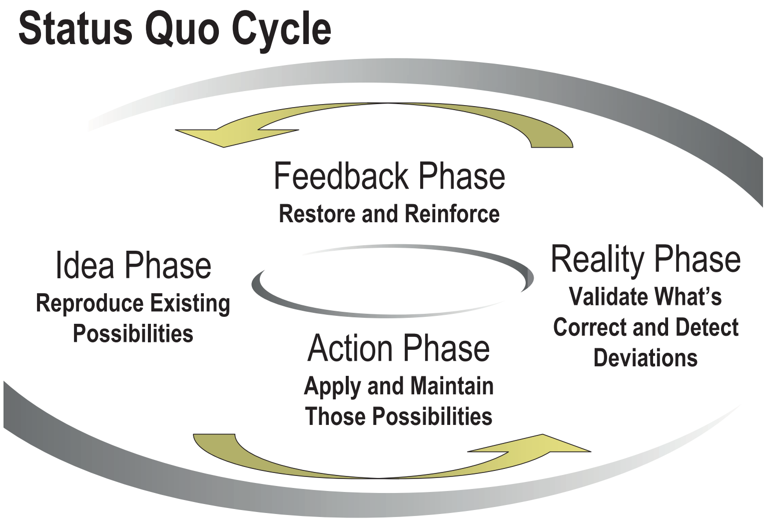

Figure 3. Status Quo Cycle

In the Idea Phase of the Status Quo Cycle, instead of generating new possibilities, existing capabilities are reproduced. In the Action Phase, instead of exploring and experimenting with new options, existing mechanisms and practices are applied. In the Reality Phase, instead of testing new possibilities, the Statue Quo Cycle seeks to validate what has occurred and eliminate any anomalies. In the Feedback Phase, instead of discovering what new possibilities work, this pattern serves to restore and reinforce what is already working.

The Status Quo Cycle is a proactive process that maintains itself despite the dynamic forces it may encounter, providing stability and continuity. It is a generalized description of all the biological processes that sustain life. These feedback processes dynamically maintain things like our body temperature and the oxygen and glucose levels in our blood within an appropriate range, even as our activities and environment change [16].

The same is true of any complex system or enterprise. Business processes need to be maintained or the business will likely fail. Products need to be actively managed in the marketplace in order to compete. Much of the science of management is about how to design and maintain business processes that will produce products and services, generate revenues and sustain the life of the organization. This is more than just the retention of lessons learned, which is part of the Innovation Cycle; it is the active preservation of existing processes.

Just as the Innovation Cycle has four critical components, so does the Status Quo Cycle.

4.5.1 Consistency (Idea Phase)

Instead of diversity, what is needed is consistency, whether that is an optimum body temperature, sustained revenues, or a shared scientific paradigm. It can be any essential characteristic that must be maintained to assure the survival of an organism, idea, enterprise, etc. Like the ideal temperature in a room or a product's specifications, this is a target that must be hit with minimal variability.

4.5.2 Action (Action Phase)

Activity is directed at guiding and correcting rather than experimentation. It is the steps taken to proactively maintain things as they are or need to be. That might be increasing metabolism to raise body temperature when it is cold, inspecting manufactured components for flaws, or punishing what may be seen as deviant social behavior.

4.5.3 Reality Check (Reality Phase)

In the Innovation Cycle, the reality check serves as a test of new possibilities. It is an outward sensitivity to signals from the environment. With the Status Quo Cycle, the reality check is used to sense when things are not as they need to be so that adjustments can be made to continue to hit the desired target. It is an inward sensitivity to the state of the entity, to detect variations in things like glucose levels or manufacturing processes in order to sustain and correct them. External realities are treated as dynamic inputs that need to be managed or resisted, rather than as indicators of value, because what is valued and therefore reinforced is what already exists. The business equivalent of external orientation (Innovation Cycle) is being sensitive to trends, market shifts, and consumer needs. An internal orientation (Status Quo Cycle) is being focused on maintaining established business processes and profitability.

4.5.4 Feedback (Feedback Phase)

In the Status Quo Cycle, feedback is not about "learning" from the environment, data, or experience and retaining new information as it is in the Innovation Cycle. Rather, it is about reinforcing what already exists. It can be in a sense almost mechanistic: If this happens, do this…, if this happens, do this…, etc. The meaning of the data and therefore the appropriate response, have already been determined.

4.6 Symbiotic Patterns

These two cycles are commonly found together, but in nature they do not balance or counteract each other. On the contrary, they have a symbiotic relationship in which both are sustained. The Status Quo Cycle maintains important biological processes and when this cycle is functioning properly, it does so without compromise. The survival of the organism depends on it. Yet this cycle does not undermine the ability of the species to experiment with new possibilities through genetic mutations.

Unfortunately, in human affairs, these patterns often conflict. The impulse to sustain a business enterprise and its existing business model, products, and revenues often conflicts with attempts to innovate, which may be seen as a threat. This impulse is particularly strong in domains like religion and politics, where ideologies may actively preclude any variability or change. So instead of complimenting each other, these two cycles compete in ways that optimize neither of them, and can create tremendous tension and discord. The Innovation Cycle is capable of adopting new inputs and adapting an entity to its environment, but the Status Quo Cycle is not. Beneficial changes may be actively resisted in the name of reliability and preservation (or due to far more human and cynical motives).

In human endeavors such as science and business, which pattern we follow is discretionary and a matter of degree. We may have novel ideas but often we do not. We may or may not take action, and when we act we can experiment to learn new things or just apply what we already know. We may make astute observations or be oblivious to the consequences of our own actions. We may take time to reflect on our experiences in order to learn and gain new insights, or we may believe we already have the answers we need.

As with the Innovation Cycle, the Status Quo Cycle has characteristics that are produced by this larger pattern, and that correspond to the characteristics of the Innovation Cycle. They are:

4.6.1 Cyclical
Like the Innovation Cycle, it is a feedback loop, a continuous sequence that is always ready to respond to any disturbance or variability. That response is dynamic and changes depending on what it encounters, but in a way that controls and limits.

4.6.2 Linear
While "linear cycle" may appear contradictory, it simply means that it repeats itself in a way that reproduces a predetermined outcome, just as a linear (as opposed to non-linear) formula in mathematics consistently produces the same answer. It repeats but does not iterate.

4.6.3 Attractive
The Status Quo Cycle is an attractor in the same sense as the Innovation Cycle. Nature has many closed feedback mechanisms that maintain all sorts of essential functions, and these cycles are critical to an organism's survival. So living organisms acquire these mechanisms or perish. Similarly, closed feedback mechanisms perform essential functions in human affairs. The criminal justice system, for example, is a closed feedback loop designed to restrict the range of behaviors that individuals may engage in, and we could not function as a society without it.

4.6.4 Self-reinforcing
As with the Innovation Cycle, the Status Quo Cycle has an internal logic that flows from one phase to the next. Minimizing variability tends to eliminate new possibilities (Idea Phase). That means only existing capabilities are acted on (Action Phase), which reduces the likelihood that anything new will occur (Reality Phase). When anomalies do occur, they are eliminated (Feedback Phase). So there is a strong tendency to stay in this pattern once in it. As with the Innovation Cycle, research data confirms a substantial correlation between phases [14].

4.6.5 Causal
The Status Quo Cycle not only follows a causal sequence, it is arguably "super linear" because it actively resists any deviation from that sequence. It responds to its environment so as to minimize change and maintain existing processes, rather than adapt and evolve.

4.6.6 Determinant
Because the Status Quo Cycle is driven by established causal relationships, it works as reliably as a machine. There is one right answer, one optimum state, one best solution, one best approach.

4.7 Commonalities
Both the Innovation and Status Quo Cycles enable an entity to operate in a stochastic environment, yet produce a non-stochastic outcome (and thus reduce the stochasticity of that environment). The Status Quo Cycle does this by resisting or compensating for change and reducing variability. It increases the probability that things will be more predictable and deterministic. The Innovation Cycle does it by increasing the probability of making successful adaptations. Gregory Bateson [17] observed this same duality in nature and noted that what he termed convergent sequences [4] (a characteristic of the Status Quo Cycle) are predictable, while divergent sequences[4] (a characteristic of the Innovation Cycle) are not predictable (p. 40-45).

Both patterns are symmetrical. That is to say that any organism, technology or idea may impact and be impacted by another, so an entity might logically be placed on the left side of the cycle (Idea Phase) as a source of possibilities, or right side (Reality Phase) as a source of feedback. Just the act of

[4] I agree with Bateson's reasoning but I have not adopted his terminology because his usage differs from the way these terms are used in applied creativity, a potential source of confusion in this context.

attempting a new possibility can potentially be a source of environmental cues, even when it ultimately fails to create any new value.

Table 1 summarizes the terminology and characteristics that define these two patterns.

Table 1. Characteristics of Innovation Cycle and Status Quo Cycle

	Status Quo Cycle	Innovation Cycle
Common Characteristics	Cyclical	
	Feedback Loops	
	Attractive	
	Self-Reinforcing	
	Symmetrical	
Distinguishing Characteristics	Closed Feedback System	Open Feedback System
	Internally Oriented	Externally Oriented
	Linear	Iterative
	Causal	Effectal
	Determinate	Probabilistic
Parallel Concepts	Counter-Clockwise Thinking	Clockwise Thinking
	Knowledge Loop	Insight Loop

While both cycles have the same phases in the same sequence, they follow this sequence in very different ways. I have mapped the Innovation Cycle clockwise and the Status Quo Cycle counter clockwise because in a sense they flow in opposite directions. The Status Quo Cycle is based on a string of linear causal relationships that proceed from the status quo and are propelled by the need to maintain it. The Innovation Cycle is propelled by the success or failure of the outcomes it generates.

In previous writings [18], I have referred to the Innovation Cycle as an Insight Loop and following it as Clockwise Thinking to denote this directionality and because it produces new insights. I have referred to the Status Quo Cycle as a Knowledge Loop and following it as Counter Clockwise Thinking to denote its different directionality and because it is bound by existing knowledge. Just as innovation in all its forms can be mapped onto the Innovation Cycle, a failure to innovate and resistance to innovation can be mapped onto the Status Quo Cycle.

4.8 Types of Feedback

I have now laid sufficient foundation to more precisely define how I am using the term "feedback" and how I am distinguishing between different types of feedback in this context. These cycles do not fit neatly into traditional categories.

In *Feedback Systems: An Introduction for Scientists and Engineers*, Åström and Murray [19] give this definition:

> Feedback refers to a situation in which two (or more) dynamical[5] systems are connected together such that each system influences the other and their dynamics are thus strongly coupled [19].

Its breadth is great enough to encompass a usage they may not have contemplated. The dynamical systems I am talking about are (1) any specific entity (e.g., organism, person, company, etc.), and (2) reality itself (which is certainly a dynamical system). That is to say, the realities of any context in which innovation may occur (or fail to).

In control theory, a closed loop system responds to feedback and an open loop system is not sensitive to feedback [19]—a schema that makes "open feedback" an oxymoron. My use of these terms makes a different distinction. "Closed feedback" means using feedback to preserve a specific dynamic state, to maintain stability and continuity as the environment changes. So while closed feedback can adapt an entity to a changing environment to some degree, it does so in order to maintain an existing dynamic state, and in that sense resists change. "Open feedback" is open or receptive to change because it

[5] As Åström and Murray use it, "dynamical" simply means a system whose behavior changes over time, not the more specific definition found in complexity theory.

modifies rather than preserves its own dynamic state in order to adapt the entity to its environment.

To offer a brief high tech example: a guided missile uses a variety of sensors and adjustments to maintain speed and altitude and maneuver around obstacles. So while, strictly speaking, it is dynamically "changing" itself, those adjustments are for the purpose of reaching a predetermined target and operating as designed. That's classic closed feedback. If we were to redesign such a missile, perhaps adding laser guidance to a missile that relied on radar in order to enhance its capabilities or overcome problems, those changes would be open feedback.

The Innovation Cycle is an open feedback system and the Status Quo Cycle is a closed feedback system. Both may exhibit positive and negative (or amplifying and dampening) feedback mechanisms, but in ways that produce these two very different patterns.

4.9 Interaction

These cycles are intimately interdependent in the same way that science and technology are interdependent. The Innovation Cycle effectively tests and retests the viability of the systems that the Status Quo Cycle maintains. The Innovation Cycle then relies on the Status Quo Cycle mechanisms to preserve beneficial changes that the Innovation Cycle generates.

The Status Quo Cycle is, in a sense, the technology that makes further progress by the Innovation Cycle possible. It is the backbone that gives structure to life forms. It is the structure of sails that propelled Columbus' ships. It is the CERN Large Hadron Collider that enabled the discovery of the Higgs Boson. In business, it is the products, business model, business processes, and all the business capabilities that maintain revenues and sustain the organization. It is what we already know how to do that works reliably, enabling us to further explore in order to discover what else works.

The Innovation Cycle appears to be the more fundamental pattern of the two. It seems plausible that it would over time develop the preservation mechanism that is the Status Quo Cycle. Whatever the state of the art may be, it was at some point in time a new mutation, invention, or discovery. It seems much less plausible that the Status Quo Cycle would ever produce the Innovation Cycle. It does not appear to have that capability.

5.0 IMPLICATIONS

The Valuable Novelty theory of innovation can inform and enhance innovation practices in a wide range of domains. It maps out a cycle that innovation processes should optimize, and helps explain why innovation sometimes fails to occur. These two patterns have recognizable characteristics that indicate when a person or practice is fostering innovation and when it is resisting it. These patterns can also guide business processes and personal, leadership, and decision-making strategies to leverage the Innovation Cycle and reduce the resistance of the Status Quo Cycle.

The Innovation Cycle exhibits a number of the characteristics of complex systems, including feedback and iteration. It is dynamic and its outputs are deterministically chaotic. Its self-similarity at different scales can be described as fractal. It may be that the Innovation Cycle is a defining characteristic of complex adaptive systems, or that these two cycles may provide a useful distinction between two different types of complex adaptive systems. These are aspects of this theory that merit further exploration. This theory also raises interesting questions about how to define and explore business, social, and economic phenomena and the mechanisms that drive them.

The pattern of the Innovation Cycle appears to be universal, a common thread progressing from the most primitive origins of life through our greatest technological advances, and beyond. The companion articles explore some implications of this theory that are testable hypotheses.

ACKNOWLEDGEMENTS

I want to thank Bettina von Stamm for her encouragement, feedback, and editorial judgment in reviewing and improving this article.

REFERENCES

[1] Klausen, Soren Harnow. 2010. "The Notion of Creativity Revisited: A Philosophical Perspective on Creativity Research." *Creativity Research Journal* 22 (4): 347-360.

[2] Sternberg, Robert J, and Todd I Lubart. 1999, 2004. "The Concept of Creativity: Prospects and Paradigms." In *Handbook of Creativity*, 3-15. Cambridge, UK: Cambridge University Press.

[3] Gopnik, Alison, Andrew N Meltzoff, and Patricia K Kuhl. 2001. *The Scientist in the Crib, What Early Learning Tells Us About the Mind*. New York: Harper Collins.

[4] Darwin, Charles. 1859. 2004. *The Origin of Species*. New York: Barnes and Noble Classics.

[5] Wallace, Alfed Russel. 1858. "On the Tendency of Varieties to Depart Indefinitely From the Original Type." Accessed June 1, 2014. http://people.wku.edu/charles.smith/wallace/S043.htm.

[6] Montgomery, Steven. 2009. *What About Wallace?* Accessed June 1, 2014. http://darwin200.christs.cam.ac.uk/pages/index.php?page_id=d8.

[7] Anthony, Scott D. 2012. *The Little Black Book of Innovation, How it Works, How to Do it*. Boston: Harvard Business School Publishing Corporation.

[8] Carpenter, Hutch. 2010. *25 Definitions of Innovation*. Accessed June 1, 2014. http://www.spigit.com/blog/25-definitions-of-innovation/.

[9] Kuhn, Thomas S. 1962, 1971. *The Structure of Scientific Revolutions, Second Edition, Enlarged*. Chicago: University of Chicago Press.

[10] Dawkins, Richard. 1989. *The Selfish Gene*. 2nd. Oxford University Press.

[11] Dennett, Daniel C. 1995. *Darwin's Dangerous Idea*. New York: Simon & Schuster Paperbacks.

[12] Dennett, Daniel. 2009. "Darwin's "strange inversion of reasoning"." Irvine, CA: National Academy of Sciences. Accessed June 1, 2014.
http://www.pnas.org/content/106/Supplement_1/10061.full.

[13] Gleick, James. 1987, 1988. *Chaos, Making a New Science*. New York: Penguin Books.

[14] Stauffer, Dennis A. 2015. "Evaluating Mindset as a Means of Measuring Innovativeness", accepted, IJIS December, 2015, 7(4).

[15] Stauffer, Dennis A. 2016, Innovativeness as a Predictor of Entrepreneurial Value Creation, accepted, IJIS March, 2016, (8)1

[16] Lorenz, Edward Norton. 1972. "Predictability: Does the Flap of a Butterfly's Wings in Brazil Set Off a Tornado in Texas?" Boston: American Association for the Advancement of Science.

[17] Hoagland, Mahlon. 2001. *The Way Life Works (reprinted)*. Sudbury, MA: Jones and Bartlett Publishers, Inc.

[18] Bateson, Gregory. 1979. *Mind and Nature*. New York: E. P. Dutton.

[19] Stauffer, Dennis A. 2005. *Thinking Clockwise, A Field Guide for the Innovative Leader.* Minneapolis: MinneApplePress.

[20] Åström, Karl J, and Richard M Murray. 2008. *Feedback Systems: An Introduction for Scientists and Engineers*. Princeton University Press.