Valuable Novelty: A Proposed General Theory of Innovation and Innovativeness

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Valuable Novelty: A Proposed General Theory of Innovation and Innovativeness

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ABSTRACT
A general theory of innovation is proposed based on an analysis of the common characteristics and dynamics of two innovation archetypes, natural selection and the scientific method, along with innovation in other contexts such as business and technology. This *Valuable Novelty Theory* posits a probabilistic pattern of innovation called the *Innovation Cycle* and a complimentary pattern called the *Status Quo Cycle*. This approach is designed in part to enable the measurement and comparison of innovativeness across a variety of activities, disciplines, and contexts. Two companion articles apply and test this theory.

This paper is one of three published in series, following a hypothetical deductive approach. This first article lays a theoretical foundation. The second article, "Evaluating Mindset as a Means of Measuring Innovativeness," explains the creation of an evaluation instrument that applies this theory. A third article, "Innovativeness as a Predictor of Entrepreneurial Value Creation," uses that instrument to test the theory's predictive capabilities.

1.0 INTRODUCTION

This article proposes a theory to explain universal mechanisms that characterize innovation. That is, innovation not just as a business practice or an economic or social trend, but innovation as manifested in science, technology, nature, business, the arts, and society as a whole—innovation in the broadest sense as a phenomenon unto itself.

This model describes how specific mechanisms interact to foster innovation, forming an *Innovation Cycle*. I argue that this fundamental pattern is intrinsic to all types of innovation, providing insights into how innovation occurs, what conditions are required, and how to most effectively promote it.

Some of the concepts that comprise this theory have been explored previously. This contribution is about combining these concepts into a coherent framework and identifying salient characteristics that can be used to recognize, measure, compare and enhance the capacity to innovate.

2.0 DEFINITIONS

2.1 Defining Innovation and Innovativeness

The theory I propose is itself a detailed definition of innovation. However, I begin with some minimalist definitions of key terms. I define innovation as V*aluable Novelty,*[1] and innovativeness as *the capacity to produce Valuable Novelty*. For the sake of clarity, I need to also explain some related terms. My purpose is not to resolve the long-running debates about the meanings of these terms, but rather to simply make clear my usage.

2.2 Creativity

In an effort to account for all the ways that the term creativity is used and our intuitive sense of what it means, researchers have offered definitions that include things such as originality, usefulness, social acceptance, expert judgment, process, person, product, and varying combinations of these [1].

One broadly accepted definition among contemporary creativity researchers, often called the standard definition, is that:

> Creativity is the ability to produce work that is both novel (i.e., original, unexpected) and

[1]Clay Shirky, Asst Arts Prof of New Media, NYU ITP (Interactive Telecommunications Program), uses this term to define creativity in a presentation at the 2012 PSFK Conference: http://vimeo.com/41492835

appropriate (i.e., useful, adaptive concerning task constraints) [2].

This is very close to my "Valuable Novelty" definition of innovation, but depending on exactly how one defines "novel" and "useful," it can be too restrictive to describe many instances of creativity. There are often occasions when creativity produces no value or usefulness. (It is called being a starving artist.) A child's crayon drawing is a creative act, but that product is not necessarily of any particular value even to the child. A highly creative idea may be impractical to implement, producing nothing valuable or useful. So, I adopt an alternative definition. In keeping with my expansive approach to innovation, I broadly define creativity as *the production of something that is cognitively original,* something that may be novel only to its originator.

In this definition, original does not mean first in any absolute sense, but simply that it is something that is not a conscious duplication. This is a low bar that is intended to account for even the simplest creative act or idea. Something may be creative if someone comes up with it themselves, even if others have come up with it before, but outside this person's awareness. This occurs frequently with young children first learning about the world [3], and occurs in adults as well. An example of this in the sciences was Darwin [4] and Wallace [5] each developing the theory of natural selection independently and initially unaware of each other's work [6]. It makes no sense to say therefore that one (or both) was not creative because the work was not, strictly speaking, novel.

I do limit creativity to those things that are cognitive in origin, the result of some mental processes (and perhaps simulated mental processes such as artificial intelligence), rather than random or inadvertent actions. These mental processes can be, and often are, unconscious or semiconscious, but they are cognitive nonetheless. Innovation, however, can and frequently does originate from mindless and non-human mechanisms, especially in nature.

This definition of creativity does not require that to be creative, the product (i.e., that which is created) is useful, valuable or accepted by anyone ever. Here I differ with some thinkers who argue that the product rather than the person is the most appropriate bearer of creativity, or or that some form of social acceptance is necessary to determine whether something is creative [1]. A brief thought experiment illustrates why I disagree: If Renoir had a personality disorder that led him to fear any attention from others, so he destroyed the impressionist masterpieces he painted without ever showing them to a soul, that does not make his work any less creative. It would be an unfortunate loss to the art world, a loss we might not even be aware of, but it takes nothing away from his creativity.

2.3 Innovation

Rather than creativity, it is innovation that must be, if not new to the world, certainly new to some context or application. It is innovation that must gain adoption or acceptance in order to produce value. It is innovation that must have some discernible impact [7].

To be innovative, something must be new and different from what has previously existed in that context. And it must somehow benefit someone or something (although it may also be detrimental). Implicit in this definition is that to be an innovation, something must be effective; it must somehow work. Otherwise no value is produced. However, I define value broadly to mean anything from cost savings and consumer benefits, to gaining business insights, or even simply satisfying one's curiosity. So an intangible idea such as a fresh market insight, or a new way of answering an intriguing question may qualify as innovation (and are often important ones).

The innovation can come from any source: human, natural, computer, or other. Value can accrue to the source of the innovation, to another entity such as a customer, or to the larger context such as an organization, system, market, environment, or society.

2.4 Innovativeness

My definition of innovativeness is not a substitute for creativity. It is possible to be creative without being innovative, when no value is produced. And, it is possible to be innovative without being creative, especially with non-human sources of innovation that may rely on mindless or random mechanisms, yet innovate with great success (e.g., natural selection). However, these two concepts do overlap. What we generally recognize as the highest forms of creativity are achievements that are also novel and valuable—when creativity and innovativeness occur together.

I intend innovativeness to include all of the activities that innovation entails, activities that may occur apart from creativity (e.g., experimentation, observation, analysis…even guessing).

Theorists have debated whether creativity is possessed by the person or the product [1]. My definitions attribute creativity to the person and innovation to the creative output. We routinely calibrate some person or product or act as being more or less creative than another. I am arguing that these calibrations are in fact a reflection of the degree of innovation that results; the greater the innovation (novelty and value) of a product or process, the greater the perceived creativity (cognitive originality) that fostered it. Figure 1 shows how I am relating these key concepts.

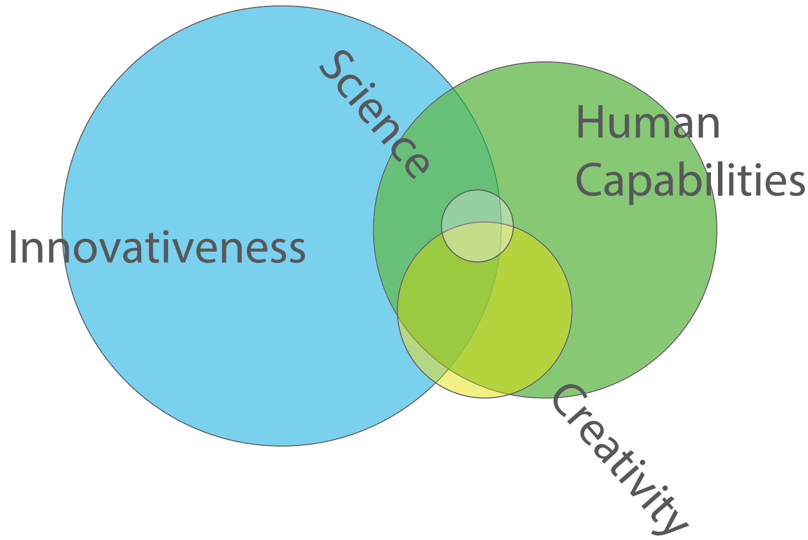

Figure 1. Relationships between Terms

> *The large circle on the left is all types of innovativeness, including human capabilities, the natural world, and other actual or potential sources of innovation such as computers and artificial intelligence.*
>
> *The large circle on the right is all human capabilities, including innovativeness and also those that do not drive innovation per se (walking, talking, reading, etc.).*
>
> *The medium circle at the center bottom is creativity; a subset of human capabilities with some spillover to account for non-human instances of creativity, such as by computer or other species (e.g., tool-making by some primates).*
>
> *Science (the final circle) requires the application of a number of human capabilities that frequently include creativity and it is predominantly but not always innovative. Some scientific work, such as data gathering and laboratory techniques, requires little if any creativity or innovativeness. Yet, scientific breakthroughs are both creative and innovative.*

Valuable Novelty is a high level abstraction that is intended not to refute the many other definitions or specific approaches to innovation that others have offered [8], but rather to encompass them along with activities and outcomes associated with innovation, including such things as invention, new product development, process improvement, research and development, and social and economic change.

3.0 ARCHETYPES

3.1 The Scientific Method

In his seminal work, *The Structure of Scientific Revolutions*, Thomas Kuhn [9] lays out a theory of science as something that progresses by unpredictable jumps and shifts rather than as a continuous cumulative process. He observes that throughout the history of science, breakthroughs have come not as extensions of pre-existing theories but as significant revisions, as one paradigm replaces another. Kuhn observes that, "…a new theory…is seldom or never just an increment to what is already known" (p.7). He paints a picture of science as being constrained by empirical observations but driven by human imagination, by fresh ideas and new hypotheses.

Kuhn argued that this was not to say that science was relativistic or irrational, but rather that it is necessarily tentative. Because our knowledge is incomplete, there is always a degree of uncertainty about that knowledge, an uncertainty that even the most rigorous science cannot escape. That incompleteness leaves considerable room for scientists to disagree yet remain entirely rational.

To restate Kuhn's observations in slightly different language, science is not a linear process but rather an iterative one. It does not progress from A to B to C and so on, but branches in unforeseen directions and makes leaps onto new paths. At times it builds on itself, but it also refutes itself and the occasions when it does are often its greatest accomplishments. Developments like germ theory and the theory of relativity shattered previous scientific conclusions. Such shifts require a wholesale rethinking of what scientists previously believed. Yet those shifts are a product of the same underlying methodology—the scientific method—not a departure from it. There is a pattern that is maintained, even as what that pattern creates changes—a phenomenon now widely recognized under complexity theory, which I will return to. This is the essence of innovation: successful change driven by an underlying pattern, a pattern that remains consistent yet produces surprising and unpredictable outcomes. Science is a robust example of such an innovative process.

Kuhn's description of science is not universally embraced, but I find it to be a particularly good fit with how this theory will describe the dynamics of innovation. Another example is natural evolution.

3.2 Natural Evolution

Kuhn [9], like others, saw parallels between scientific progress and natural evolution. Not a perfect match, but definitely similar in key respects. In science, ideas compete much like organisms do in nature, with only some surviving. The result in both cases is a dynamic interconnected web of increasing capabilities…of innovation.

This conception of ideas as analogous to changes in living organisms is similar to Richard Dawkins' [10] concept of meme, but I think Kuhn saw a broader similarity. I am further generalizing this concept to include any novel possibility that can be made manifest and therefore has the potential to become an innovation.

Working independently, Charles Darwin and Alfred Wallace were the first to articulate the mechanism of natural selection as the means by which evolution occurred, the idea that the environment in which an organism lives will reward those changes that are adaptive and penalize those that are not. Embedded in this concept is one of the most brilliant insights in the history of science, what Daniel Dennett [12] has quoted one of Darwin's critics as calling Darwin's "strange inversion of reasoning." It is an insight that transforms cause and effect from a linear progression into a cycle.

The genius of the concept of natural selection is that it explains how innovation can be achieved by nothing more than trial and failure—provided that the right mechanisms exist to guide it. In such a process, effect becomes cause and cause becomes effect. The science of evolution reveals that it is not just that we eat because we are hungry, but that we become hungry because it is so important (for our survival) that we eat. We do not just have sex because we feel romantic; we feel romantic because it is imperative that we have sex (and therefore reproduce or humans will cease to exist). These behaviors persist (and provide value) because of their *effect* rather than their origins.

The fact that innovation can result from randomness does not mean that certain types of adaptations or ideas are not better than others or that there is no need to be thoughtful in forming hypotheses. If those possibilities that turn out to be successful will be retained and those that are not will be lost, it is more efficient to pick the successful ones in the first place…but it is not essential. What is crucial is what happens *next*, what becomes of those inputs. Are there mechanisms to detect environmental cues to assure an adequate fit? This is true whether that input is a change in the structure of a beak that may permit finches to eat more diverse seeds, a new scientific theory (such as this one) facing experimental scrutiny, or a new product that needs to gain customer acceptance.

In the natural world, the mechanisms that provide for natural selection are already in place. Indeed they appear to be part of the very fabric of the universe. What we have had to learn in the sciences and in other forms of innovation, is how not to interfere with these mechanisms, how to fully leverage them to maximize our ability to create valuable novelty. The theory I propose explains both how to leverage these mechanisms and why we often fail to.

4.0 THE VALUABLE NOVELTY THEORY

4.1 The Components of Innovation

When I compare science to evolution and both to other innovation processes, I am suggesting much more here than an analogy. I am not equating birds with butterflies simply because they both fly. My argument is more on the order of saying that an internal combustion engine and a jet engine are both driven by the explosive ignition of liquid fuel and that fuel is a critical causal mechanism that can be observed and measured. The question I seek to answer is: What is the common fuel that propels innovation? What then are the key mechanisms that drive natural evolution, the scientific method, technological advances, and other types of innovation? What essential characteristics do they all share? I suggest that there are four key components. None of them are surprising, but there is more to this theory than its component parts, as I will explain.

4.1.1 Diversity (Idea Phase)

One essential characteristic is a source of novel inputs, of diverse new possibilities. That may be new product ideas, scientific hypotheses, or genetic mutations. Darwin spends the first two chapters of *On the Origin of the Species* discussing the incredible variety of species and the variability of individuals within species, both wild and domestic. He saw this as the foundation of the ideas that would follow. What was clear to Darwin was that without diversity, nature's innovations would stall, and the same is true of other types of innovation. As Nobel laureate Linus Pauling is famously quoted as saying, "If you want to have good ideas, you must have many ideas." This need for new ideas to drive innovation is trivially obvious (and therefore one of the most minimal phenomena that a theory such as this must explain). But we tend to value those ideas that have proven successful with the benefit of hindsight much more than we value them when first proposed. Darwin recognized the value of diverse possibilities per se…as have companies who maintain portfolios of innovation projects because those projects inevitably include both successes and failures.

4.1.2 Action (Action Phase)

In the natural world, changes in the genetic code must be expressed in some actual change to the organism. A genotype must be reflected in a phenotype. Otherwise, it is just unused information with no way to evaluate its consequences (because there are none). In the sciences, this is experimentation. A well designed experiment attempts to make an idea real in a way that will reveal the consequences of that idea. In other types of innovation, this may simply be having the courage and the resources to act on one's ideas—in order to gauge how well they work. This again may seem obvious, yet it is frequently not done. In all sorts of settings, ideas are ruled out without ever being tried. This may be for very practical reasons, but a willingness to take risks and experiment is essential to innovation because it is the only definitive way to determine what works and what does not.

4.1.3 Reality (Reality Phase)

A third crucial piece is that any would be innovation must be subjected to reality, to the larger environment. Whether it is a genetic mutation or an idea, it must be sent out into the world to fend for itself. This was Darwin and Wallace's conceptual breakthrough. The context or environment, including all the other organisms or ideas that may be present is ultimately what determines whether or not an innovation succeeds. The test is entirely pragmatic: Does it work? Does it create some competitive advantage or other benefit? Can it survive? It is through the interplay between some possibility's tangible manifestation and its context that it becomes an innovation, or fails to.

4.1.4 Retention (Feedback Phase)

A fourth vital mechanism is some way to capture and retain what has been "learned." Our genetic code keeps what works, and what does not work is lost (because the organism does not survive to reproduce and therefore its genetic code is not passed along). In this way, future organisms benefit from the trials and failures of previous generations. No cognitive capabilities are required and yet those "lessons" are kept and passed along. The analog in the sciences is data analysis, publication, the creation of shared paradigms, and the textbooks that transmit those findings. In business, it is things like established technologies, processes, and brand equity. It is the accumulated tools, knowledge, insights and capabilities that we have developed within any discipline or endeavor.

4.2 The Innovation Cycle

This theory holds that these four components form a pattern, and that pattern drives innovation. I call this pattern the Innovation Cycle and it is composed of four phases. An Idea Phase[2] in which diverse new possibilities are generated, an Action Phase in which new possibilities are explored, a Reality Phase in which the consequences of those actions are felt, and a Feedback Phase in which the lessons learned are captured, processed, and utilized. Those "lessons" provide a foundation for generating more possibilities and the cycle continues.

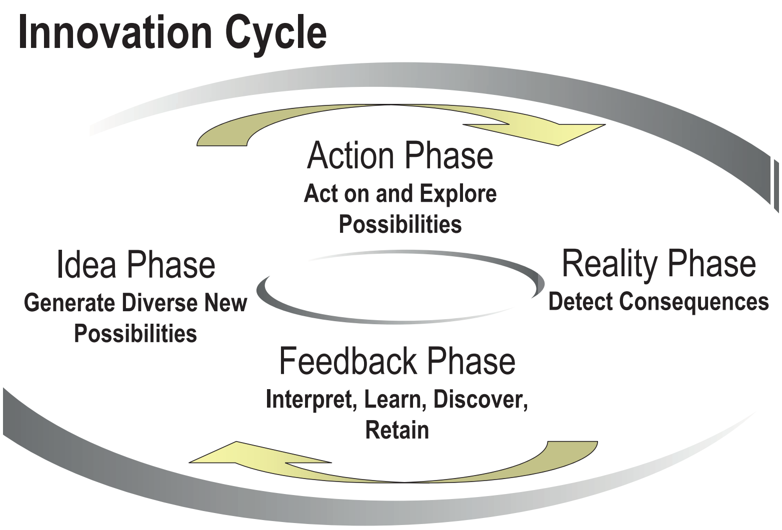

Figure 2. Innovation Cycle

The Innovation Cycle (Fig. 2) is a type of feedback loop, connecting new ideas or possibilities on the left with the larger realities or environment on the right, in mutual causation and influence. An entity taking action impacts the environment and the environment in turn impacts that entity. The Idea Phase provides the novelty that innovation requires, while the Reality Phase determines whether any value results. When a novel possibility is actively introduced, is successful in its environment and retained, the result is innovation.

In his original letter to Darwin on the subject, Wallace [5] was the first to explain natural selection in terms of what we now call feedback.

> "The action of this principle is exactly like that of the centrifugal governor of the steam engine, which checks and corrects any irregularities almost before they become evident; and in like manner no unbalanced deficiency in the animal kingdom can ever reach any conspicuous magnitude, because it would make itself felt at the very first step, by rendering existence difficult and extinction almost sure soon to follow." (p. 62)

Natural evolution, science, and indeed all innovation are best understood as manifestations of this cycle, which has additional characteristics that result from this larger pattern. It is:

4.2.1 Cyclical

It is sequential, but has no start or end point. One can logically pick up the cycle anywhere and we have no choice but to join it "midstream." There is always some prior state-of-the-art. A living organism

[2] The names of these Phases are those used in an instrument developed to measure mindset, based on this theory [14, 15]. They are used here for the sake of consistency. These names should not be taken to imply any anthropomorphic characteristics of non-human types of innovation.

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).

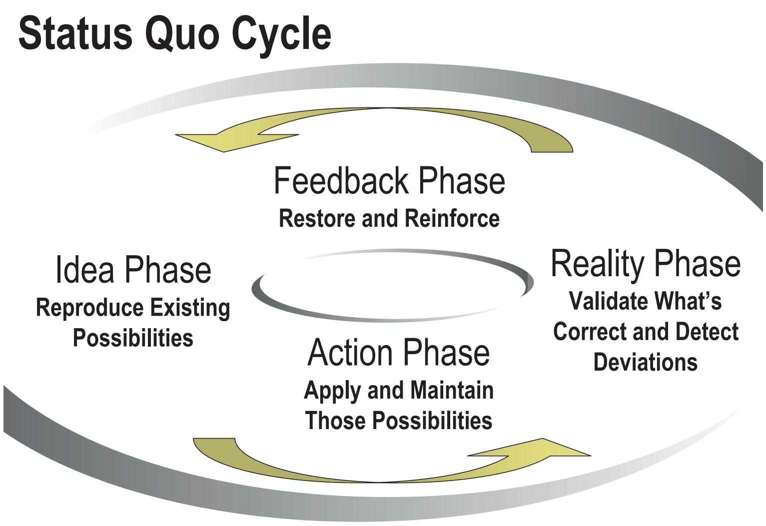

Figure 3. Status Quo Cycle

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.

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