

The Triumph of Fragility

Summary

The reason American organizations have failed to imitate Toyota is that they have misunderstood the purpose of Toyota Production System techniques. *Lean* production and management techniques, while faithful replicas of Toyota's, have been unfruitful for this same reason.

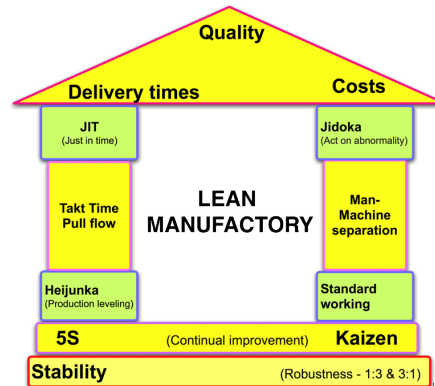


Figure 1 Model of the "lean production" system

In his book *Toyota Kata*, Mike Rother has answered two questions: how to use the lean production system techniques to facilitate continuous improvement; and how to manage people so that they engage in continuous improvement.

He shows how the techniques make a process more transparent and sensitive to change, much like a laboratory experiment or a piece of music. We learn how to see the habit of continuous improvement as the habit of continuous *exploration* into the unknown, and how to make this habit second nature. Rother also explains and illustrates why this is necessary: because the unknown always creeps into processes, no matter how well designed they are. This has always been a vexing challenge for groups of people—how to process the incessant formation of the unknown, before it grows large enough to disintegrate the society. Toyota, responding to existential threat, and under the guidance of visionary experimenters, came across some solutions to this problem. We have consistently misunderstood them. Even Deming didn't quite get what was going on. While the techniques are arguably a unique blend, none of the elements are new. They are among the oldest techniques documented. Ancient Mesopotamian Myths have allegorically illustrated them, as I will spend a few paragraphs talking about, and modern research into how experts develop reinforces their efficacy.

In this essay, I discuss a number of books that all cover apparently different topics, but which support the same conclusion: the principles Toyota developed, which we collectively call *lean*, when applied correctly, are transformative because they are among the oldest and most profound principles humans have developed. They aren't about minimizing waste. They are about developing skilled explorers.

Introduction

In Fall 1988, the Sloan Management Review published an article by John Krafcik (pronounced kraf-chick) titled, "Triumph of the Lean Production System."¹ This is the article in which Krafcik coins the term *lean*, as applied to process design and management practices.

The piece is primarily a summary of his research, with some history of Ford and Toyota and how postwar Western companies developed what he calls *buffered processes* while Toyota developed *lean processes*. He does not explain why lean processes correlate with greater efficiency and quality, just that they do. It appears few people knew at the time.

In it, Krafcik makes two interesting observations.

1. "...based on our experience of the high-performance multinational corporations in this study, effective production management policies can be shaped regardless of plant location. Further, lean management policy is most conducive to improved productivity and quality performance."

2. “It is clear [...] that lean management policies have inherent risks that must be managed with a great deal of discipline and skill. From the experience of Japanese and Western producers, it appears that this risk can be largely neutralized by developing a well-trained, flexible workforce, product designs that are easy to build with high quality, and a supportive, high-performance supplier network.”

With little ability to analyze or evaluate Toyota’s methods, US companies would learn and imitate them for the next three decades. They would use 1x1 process flow, kanban, takt time, and heijunka. They would form quality circles, write A3 reports, and draw value-stream maps. They would even assign personnel as mentors, and have them adopt mentees. There was a lot of 5S.

Almost nothing worked. Companies either experienced initial boosts, which then tapered off to diminishment, or their processes ground to a halt, because an engineer or manager had removed the necessary padding (or buffer) that had enabled it to run. So, companies either decided lean wasn’t for them, or they developed some modified version of lean that suited their process. Again, a lot of focus was put on eliminating waste. Some (General Motors, for example) denied that Toyota was outperforming them. The quality differences were fabricated, and the US was still producing the best cars in the world. Or, Japan just had better workers.

There’s a great episode of *This American Life*ⁱⁱ about the GM plant in Fremont, California, and its transformation into the legendary NUMMI plant, a joint venture between Toyota and GM. They interview John Shook, Jim Womack, Jeff Liker, and many of the former employees of the NUMMI plant—all of whom had first worked at the GM Fremont plant. The workers at the Fremont plant consumed alcohol and drugs onsite. And sold drugs. And there were prostitutes.

But besides that, an interesting fact is that the line rarely stopped at the Fremont facility. The way the employees describe it, it never stopped. It seems that management felt that if the workers could stop the line, it would never run. No work would get done at all. So instead, they produced a lot of defective cars. Some of the defects they describe are unbelievable. Motors installed backwards. Mismatched model parts. Cars with malicious defects, because an operator had been written up and was feeling resentful. The defective cars went to the yard, and then operators reworked them on overtime.

At Toyota, line-stops were frequent. Consequently, there was less rework. This is another behavior that other companies imitated.

After learning how bad the Fremont facility was and that, while it was the worst of the GM facilities, it wasn’t completely exceptional, it made me wonder, what’s the mystery with Toyota outperforming them? How could Toyota *not* do better? Simply by having a less toxic workplace, it would do better. Wouldn’t any facility that had good morale and a clean, safe workspace, where the employees felt empowered, thrive?

Was the imitation of Toyota misguided? A lot of CEOs thought so. Nonetheless, in the 90’s, the 00’s, and through to today, many companies have tried to get lean, only to fail and go back to their previous operating philosophy—or, arguably, never leave it—because the techniques did not work for them.

Karen Martin, author of *Outstanding Organization*, consulted for a lot of those companies. She helped launch their ill-fated lean journeys. Her assessment of the wreckage is that these companies all suffered from a deficit the following four characteristics:

- Clarity,
- Focus,
- Discipline, and
- Engagement.

What she means by each of these traits is the topic of her book. To summarize, clarity is honesty. Focus is prioritization. Discipline is sticking to strategic priorities when it hurts, and engagement is the natural result in the workforce of the first three characteristics.

This brings us back to the first Krafcik quote:

“It is clear [...] that lean management policies have inherent risks that *must be managed* with a great deal of *discipline and skill*. From the experience of Japanese and Western producers, it appears that this risk can be largely neutralized by developing a *well-trained, flexible workforce*, product designs that are easy to build with high quality, and a supportive, high-performance supplier network.”

[Emphasis added.]

So, it appears that what Martin observed was the failure of these organizations to cultivate the management traits necessary to maintain lean production systems.

The lesson many have taken from this is that a lean production system is desirable because it enables the manufacturer to provide their customer with a quality product while eliminating costly wasteⁱⁱⁱ but that it takes hard work to get it. In other words, a lean production system is worth the effort because of its efficiency.

What Mike Rother argues in his book *Toyota Kata: managing people for improvement, adaptiveness, and superior results* is that this understanding is essentially backwards. The necessity of these traits is the reason lean organizations thrive. What was seen as a necessary component is actually the desired result.

Lean, or Fragile?

Krafcik again:

“Rather than continuing to refer to the different paradigms as recent Fordism and TPS, I would like to introduce two new terms here—*buffered* and *lean* production systems. The reason for selecting these terms is obvious. The production systems of most Western producers throughout most of the post-war period were buffered against virtually everything. Inventory levels were high, buffering against unexpected quality problems; assembly lines had built-in buffers to keep production moving if equipment broke down; legions of utility workers were kept on the payroll to buffer unexpected periods of high absenteeism; repair areas were huge to buffer against poor assembly line quality, and so on.”

[Emphasis the author's]

There is a footnote attached:

“The buffered/lean typology builds on the work of International Motor Vehicle Program researchers Huro Shimada and John Paul MacDuffie, who use the terms ‘robust’ and ‘fragile’ to denote similar concepts.”

Researching Shimada and MacDuffie's work, I came across an article that claimed that the term “lean” was preferred to “fragile” because of the negative connotation of the latter term. Who wants a *fragile* production system? This choice of words may have contributed to the West's misunderstanding of what Toyota was doing. Or, it may give us a clue as to why the misunderstanding has been so persistent.

The Necessity of Continuous Improvement

A claim I want to make in this essay is that lean processes are conducive to Continuous Improvement and that this is one of their principle benefits, but to put that in context, we need to discuss why Continuous Improvement (hereafter, CI) is so important. The history of the concept of CI in Western culture was the original topic I wanted to write about, but the discussion was getting too philosophical, and I had to abandon it. I found the parallel while reading a book by Jordan Peterson, a professor of psychology at the University of Toronto, who spent fifteen years writing a book titled *Maps of Meaning*, which, in the process of answering the question why totalitarian regimes take hold, spends several hundred pages discussing the roles that Myths have had in informing the value-systems of societies and individuals.

According to Peterson, the question that some of the oldest known Myths have tried to answer is, “What do we do when we don't know what to do?” Commonly, these were foundation stories for a society—a complex blend of historical fact, metaphor, and allegory, that carried both cultural information and procedural knowledge for how to live. The Iliad, Gilgamesh, and the Enûma Eliš Myth are all foundation stories, as is the Hebrew Bible.

Peterson observes that a theme in all of these stories is the relationship between Order and Chaos (or, the Known and the Unknown). A related question is, “What can we do when our current way of living stops working?” This question is interesting because it pertains to how new civilizations began, how they grow out of the ashes of a failed civilization. Many of the answers, represented in Myth and in other forms, look contain three steps:

1. Learn from a master, by imitating what he or she does,
2. Then question and analyzing the techniques you have learned, to see how they work,
3. And finally develop your own technique, which is a combination of the tradition you learned and adaptations that address your personal characteristics self and the ever-changing situation out in reality.

Steps two and three can be more or less traumatic depending on the nature and intensity of the change going on out in the world or within ourselves. Humans have also known for millennia the problem of change occurring and amassing beyond our knowledge threshold, which is often presented metaphorically as city walls. Since we cannot see this change within the comfort of our current knowledge threshold, we do not learn the nature of the changes until they invade our city, by which time they are overwhelming.

A prescription for this problem that has been conveyed through stories and Myths is for one to be brave and make regular, purposeful excursions outside of their city walls, and face the change head on, so that it does not grow unchecked.}

According to Peterson (much of whose work is founded on Jung^{iv}) perhaps the oldest and most prevalent Myths ever told are about the relationship between three archetypes: the Unknown; the Known; and the Knower. They are procedural Myths, describing through metaphor the procedures humans must follow when their established ways of living no longer work.

The Known and the Unknown are always in struggle with one another, in a state of continuous flux. We build the Known around ourselves. It is our cities, our government structures, our families, our systems of power. It is often represented by the sun and by daytime and sometimes by the figure of the Father. The Known can also be described as Order.

In one of the oldest known Myths the Enûma Eliš^v, the Known (or Order) is represented by the god Apsû, who is the god of fresh water, and the Unknown (or Chaos) is represented by his wife, the goddess Tiamat, who is the goddess of the ocean, and who is a dragon. The hero of the story is Marduk, who is the god of wind and of change. In the story, Apsû and Tiamat get into a quarrel about what to do about the minor gods, who Apsû believes are planning an insurrection. Apsû wants to kill them, but Tiamat balks. After one of these gods slips Apsû some poison, killing him, Tiamat plans her revenge.

She amasses an army of demons to wage war on her husband's murderers, but they convince Marduk to fight Tiamat. He agrees, but only after they agree to seat him on the throne forever afterwards. He defeats her, and he divides her body in two halves, forming the earth and the sky.

This is an ancient document (between 1800 and 1100 BCE), and politics seem to have been relevant concerning which god took power, but Peterson's interpretation is roughly as follows: when competing human interests, concerns, and ways of life (minor gods) grow so divergent and calamitous as to threaten Order and the Known (in this myth, Apsû) then the Known/Order will grow increasingly intolerant in response, eventually threatening to destroy or imprison them—in other words, to become an authoritarian. Order always fails eventually, and during these periods of unrest, the Unknown reigns. It is Chaos, and if left unchecked, it will grow and grow, eventually consuming everything. In order to stop this, the Knower (Marduk, the god of change) must deliberately engage Chaos. It is during this period that the Knower must face, or explore, the Unknown, employing both its acquired mastery of the Known—the wisdom of its ancestors—and its Logos,^{vi} which is a Greek word, meaning reason, speech, discourse, and something like consciousness. The Knower must convert the Unknown into the Known, by plunging himself into it, despite terror.

There are other Mythic representations in which the moral of the story appears to be that the power to change and to perceive are essential, especially during periods of chaos. The myth of Osiris has similarities to the myth of Marduk, but is more complex. The thing to know about it is that Osiris and Isis have two sons, Seth and Horus. Seth is evil and kills Osiris, so Horus must plunge into the underworld to restore Osiris and defeat Seth. But Osiris doesn't then take the throne. Horus does—the son, not the father.

The Unknown is often represented by the Dragon, and in later Western myths, the Dragon typically lives in a dark cave, where it hoards piles of gold and treasure. This means that, when you deliberately choose to face the Unknown, you may be rewarded. However, if you ignore it, it will grow. It will come to where you live, rearing its head and breathing fire onto your city or town. You will put out the fires, but it will come back the next day and make more. If you let it grow long enough, and especially if you let it recruit and build an army of demons, it will raze society.

Humans set up systems (cities, monarchies, dictatorships, democracies, teams, corporations) to make order out of the chaotic world, and those systems work for a while, but eventually they become inflexible,

backwards-looking, and repressive. They must be either destroyed or redeemed by an *exploratory hero* who, having studied and assimilated the wisdom of his or her dying or dead culture (the culture of the Father), deliberately ventures forth into the unknown, suffering mental and physical torment, in some cases dying and then coming back to life, in order to present society with a breakthrough set of ideas—a new, adapted way of living, a new paradigm, that corrects for the crucial failures of the old system.

In premodern, prescientific, pre-experimental, societies, change was very traumatic. We construct our societies to be resilient. It takes a lot of Chaos to shake the foundations of a large society. They are buffered against the effects of change. Consequently, they are resistant to improvement. Eventually, this situation explodes. The tension between change and stability becomes too great, and a whole new scheme for living must be constructed from the ashes.

Toyota Kata lays out an evolved method for dealing with the same problem presented in these ancient Myths, but it offers a different resolution: change continuously, so Chaos never takes hold. Cultivate the practice of venturing outside of your city walls on a daily basis. The city walls represent your knowledge threshold. Do this in deliberate, exploratory attempts to achieve ever-more-challenging goals. While you do this, you will come across the Dragons, which you will slay before they grow large enough to make blazing incursions on your home.

If, instead, you only address the problems you are aware of, and which you are comfortable addressing (those already inside your city walls, or your knowledge threshold) you will not become aware of the growing dragons until they are large enough to come to where you live and set fires there.

Are you still with me? I know that got a bit philosophical. But, with that model of the Known, the Unknown, and the Knower in mind, please take the time to watch this video by Bill Constantino, “The Improvement Kata in 10 Minutes”. I think you will find that these two lines of thinking, coming from completely unrelated fields of research, resemble one another. <https://www.youtube.com/watch?v=uqZOu1D639Q>

I think this means that lean principles shouldn't be seen as set of faddish industrial engineering, or management, or even process concepts or techniques. They are a set of principles that we have known about forever, and which we forget over and over again, and reformulate in new language. Toyota came across them when they were faced with existential threat and had to either develop or perish, and that is why they resemble our oldest documented religious Myths.^{vii}

So far, I've presented two virtues of lean:

1. It can't be done without a highly trained workforce that is skilled at problem-solving.
2. It is conducive to Continuous Improvement.

I think these two attributes can be synthesized this way:

A principle virtue of a lean production system is its sensitivity to change. Management and Operators can do experiments on it, and can observe the results, and engage in daily learning.

This is a hard concept to visualize. To help, I want to discuss three examples in life that are accomplishing something similar to a lean production system:

- A laboratory
- A narrow, winding road,
- A catastrophe, and
- A trusted friend.

Manifestations of lean systems, the Improvement Kata and the Coaching Kata

To see how a lean process is like a laboratory, let's look at the Deming (or PDCA/PDSA) Cycle. We know that it is based on the scientific method, applied to practical problems. What you might not know is the philosophical movement of the 19th century called Pragmatism. The Pragmatists “Reject the idea that the function of thought is to describe, represent, or mirror reality. Instead, pragmatists consider thought an instrument or tool for prediction, problem solving, and action,”^{viii} A simplified history of what happened to Pragmatism is that the tradition pathed the way for Logical Positivism, which paved the way for what we now call Philosophy of Science. Philosophy of Science, as you may know, is the “branch of philosophy concerned with the foundations, methods, and implications of science. The central questions of this study concern what qualifies as science, the reliability of scientific theories, and the ultimate purpose of science.”^{ix}

Peterson agrees with the Pragmatists, and presents an explanation from neuroscience why it's accurate. Basically, your primary visual cortex, which is much newer than your amygdala, processes visual input after your amygdala,^x and that has a more potent effect on your mood and behavior than what you perceive as visual stimuli. Your brain perceives the threat or promise of visual input before you actually make out what it looks like.

The word affect^{xi} is an important term to understand here, and so is the word valence.^{xii} The valence of an object or phenomena refers to the emotional impact (or affect) that it has on an individual perceiving the object or phenomena.

The valence of an object or phenomena is always context-dependent. If you have been walking in a desert for hours, the valence of a cup of water is much different than if you are in your office, fully hydrated.

What this means is that our brain did not evolve to observe objects as objects, but objects as tools (a cup of a water is a tool for hydration), and while we have grown quite sophisticated at observing objects as objects, we have only been able to do so after having learned, collectively, as a culture, how to run scientific experiments, which are modeled after goal-oriented, problem-solving and predictive behavior, which is what our brains evolved to do.

In other words, the Materialist^{xiii} worldview is sort of right but sort of wrong. The world is made up of atoms, but our experience is that of a world made up of valence. And minor and major gods are excellent metaphoric representations of that. Anyway, someone following the Deming Cycle makes a falsifiable prediction (a hypothesis) and then puts it to the test. Then they study the results, and they learn something. They learn the most when at least one of their predictions is shown to be wrong. In general, the valence of a phenomenon is greater when it contradicts to your expectations, because you evolved to make predictions about the world around you, so you could act effectively in it. You notice what is out of order.

What happens is this: if an experimenter does their Planning correctly, they form a mental map, a visual and verbal (or mathematical) representation (or story) of what they believe reality to be like in this one aspect. Then they run the tape forward in their mind. Based on the conditions that they set up mentally, they guess what will happen. Then they play this same scene in reality, under carefully controlled conditions. If their prediction is shown to be false, then the person's story breaks, and they must go back and revise their mental representation to account for this newly revealed reality. This is how they learn.

A lean production system is like a laboratory because it is set up to provide fast, high-fidelity feedback to changes you make in it. A huge, messy, unstandardized facility (or process) is too difficult to do experiments in. A buffered process is *designed* to be unresponsive to change, to be so flexible that any number of things can go wrong and it will keep operating. This makes experimentation impractical. A lean process is one that you design to strategically break when your target condition is not achieved.

You can see now how waste is a huge problem for a lean process, but not exactly for the reasons we had previously thought.

The experiment doesn't work as a teaching tool unless the person doing it has bothered to flesh out a carefully constructed model of the world first. You learn best when you are surprised. Peterson explains why this is true. It has to do with the inhibitory effect of the prefrontal cortex on the amygdala, and what happens when your prefrontal cortex recognizes that its map lacks predictive power, or doesn't accurately represent the terrain. Basically, your brain's default mode is to be in a state of fight-or-flight anxiety. It is only through careful mapping out of our environment that we calm ourselves, and much of this mapping is done for us in our daily lives by society, in the form of paved roads, reliable rules, buildings, social norms, furniture, and so on and so on. (Or, if you are hunting in the woods, by knowing roughly what animals you can expect to see, and how you will react when you encounter them.) We implicitly form expectations about how one another will behave, and when those expectations are broken, it causes panic.

In their book *The 5 Elements of Effective Thinking*, Burger and Starbird, two professors from the University of Texas at Austin (who also wrote the book *The Heart of Mathematics*) advise their readers to make as many predictions as they can throughout the day, always testing their understanding, and preparing their brains to learn.

If a lean process is like a laboratory, then the Improvement Kata (one of the two kata introduced in Rother's book) is like the scientific method, as applied to one's daily working life. The Unknown that is always amassing and changing outside of our knowledge threshold is what we encounter when we deliberately make qualitative and quantitative improvement objectives and strive to reach them. If you aren't trying to improve your process, it will experience decline, even if you are actively trying to hold current state, because you can't notice the numerous subtle changes that occur in working conditions unless those changes get in your way as you are trying to make an improvement. The valence of phenomena is greater when it is an obstacle to the shared goal of a group than when it is merely unpleasant. Without Improvement Kata, we address and try to solve the problems we are aware of, or that we already know how to solve.

Kata is a Japanese word that isn't simple to translate, but it refers to a procedural learning technique by which a student internalizes the set of attacks and maneuvers of a fighting system. In the US, we often call it a Form. In his book *Kata and the Transmission of Knowledge*, Michael Rosenbaum explains that the kata is not just a procedure by which the moves of the fighting system are taught; rather in practicing the kata, the student, in concert with a mentor (sensei) deeply ingrains in himself or herself the attitude or mindset necessary to engage another person in combat, which is a difficult challenge, because most people want to drop their weapon and run away when another person is running towards them with a melee weapon. Seen this way, the kata is a way to habitualize a set of behaviors such that we do it without having to think about it. Once that is accomplished, we can use this habit in order to pursue higher-order goals. This model follows Bloom's Taxonomy, which I will mention again later.

A modern description of this is provided in the research of K. Anders Ericsson. In his book *Peak: secrets from the new science of expertise*, he explains his model of how skills are developed, which he calls "Deliberate Practice." Basically, a student and a coach analyze the current capabilities of the student. This can be accomplished by the coach simply asking the student to perform a certain routine, such as throwing a pass, or playing a melody on their musical instrument. This helps the coach assess the current condition of the student's training and skill. The coach will then set a performance goal that is out of the student's current capability. Then, the student and the coach struggle together, analyzing and synthesizing, practicing and becoming frustrated, until suddenly the student's brain has been given enough exposure to the information that it experiences a breakthrough, at which time the student is able to perform the new operation at new skill plateau. Ericsson's work has been influential in sports psychology and in positive psychology^{xiv xv}. His model is practically identical to the Improvement Kata.

This brings us to the necessity of a coach. A process does not teach you how to practice, or guide you in your exploration of the mechanics of your swing, or ask you helpful questions, or buck you up when you are discouraged. This is what a coach (or *mentor*) is for. In Toyota Kata, Rother spends half of the book explaining the second kata. The first kata is the Improvement Kata. It is what we have been discussing up to now. It is the learned habit and procedural model by which we integrate exploration and experimentation into our daily work life. The Coaching Kata is the set of habits that the mentor engages in to guide the student as he or she performs the Improvement Kata. Jeffrey Liker has a nice, brief explanation of it in this video. <https://www.youtube.com/watch?v=ZfZmcy7WgOk>

A simpler manifestation is a narrow, winding road, versus a wide, straight road. Imagine you are trying to improve your skill at riding a motorcycle. After you've gotten the hang of riding down straight roads, you will want to get on the winding country roads, to practice. People love riding motorcycles in part because it is an absorbing task, which can result in the mental state Mihaly Csikszentmihalyi researched and called *Flow*.^{xvi} Flow is what you call it when you are completely occupied by a task. It is most easily achieved when the task difficulty is great enough that it requires complete concentration, but is not so great that the individual feels overwhelmed or inadequate. This state can be achieved most easily when you receive fast, consistent feedback (out output) in response to your input. Video games are designed to help the player achieve this state, and we like playing games with spheres because they behave predictably, so that we can practice with them and gain mastery.

A lean process is like a catastrophe in that it requires that you change. B.J. Fogg is a behavior scientist at Stanford University. He coined the term "Tiny Habits"^{xvii} and has developed techniques for habit formation. He argues that we only change our habits in one of three circumstances:

- a) We have an epiphany,
- b) we relocate (change our surroundings), or

c) we take baby steps.

The Improvement Kata is an example of option c, but we set up our process to create conditions conducive to option a. In the This American Life story cited in the endnotes, an automobile industry analyst explains why American car manufacturers eventually changed the way they ran their facilities. It was because they were on the brink of extinction. Fear of death can promote epiphanies.

"When a man knows he is to be hanged in a fortnight, it concentrates his mind wonderfully."

—Samuel Johnson.

By deliberately creating controlled scenarios for ourselves that simulate catastrophes, we bring out our most ingenious intuitions.

The final manifestation is that of a trusted friend. The GM facility discussed above is like a relationship in which two friends aren't honest with one another. When one is heading down a dangerous path, the other says nothing. Or a dictatorial personality who surrounds himself only with people who agree with him. These relationships lead to hell. A lean relationship is one in which the partners have difficult, even painful, conversations with one another. They speak up when they see the other making a dangerous mistake.^{xviii}

Thinking again about a word

With these manifestations—and with this idea of Continuous Improvement—in mind, let's go back for a moment and look at how the word *lean* is used. We know it was considered a less pejorative term than fragile. Maybe what some of us think of when we hear lean is an athlete, someone who is in peak physical condition. I think this is the wrong image.

Rother illustrates this point by describing how four of the most well known lean techniques—takt time, kanban, heijunka, and 1x1 continuous flow—are used so management and employees can create new challenges (called Target Conditions) for themselves. They use these techniques as constraints, or strategic failure points. By reducing the kanban, they reduce buffer. By targeting a new takt time, they learn where work backs up, and where daily numbers are only met because of employee heroics. Heijunka and continuous flow are both used in part because they are difficult to achieve, and in part because they make the process more transparent. If the operators can't work with less buffer, then the improvement hypothesis is disconfirmed, and the student and mentor study the results to see where their mental map didn't match the terrain.

We have known that the transparency that a lean process offers is part of its benefit, but the challenge itself in achieving lean operating conditions has rarely been touted as one of its winning traits.

You can see how an organization that hopes implementing these techniques might improve its productivity, without being prepared to struggle and learn in order to meet these target conditions, is doomed.

Instead of thinking of lean as an athletic body, let's think of it as the cupboard of a family from the Greatest Generation^{xix}. We know that people who survived the Great Depression, and then WWII, had amazing resilience and creativity. They knew how to stretch a little bit a long way. They were emotionally resilient, and tended to be generous and pragmatic. They learned how to survive under very lean circumstances, and this improved them.

So, while many who talk about lean deliberately distinguish *scarcity* lean from *efficient* lean, I think that's a mistake. Creating scarcity deliberately is what drives the Continuous Improvement. Scarcity and cleanliness are strikingly similar in a laboratory and a production system.

Rother shows how coaching happens at Toyota, and describes how to run an Improvement Kata. He also has tons of free information (including slides) on his website^{xx}. That's partly why I turned my focus away from describing in detail the Improvement Kata, because I want you to go and look at his material. We need coaches to learn the Improvement Kata, and then teach it using the Coaching Kata^{xxi}. But, briefly: you design your experiment by defining your *vision*, then describing your *current condition*, and finally describing your next *target condition*, and how you plan to achieve it. You then run Deming Cycles in attempt to move towards the target condition. The problems you encounter in this attempt are what you study and develop countermeasures for. They are the raw material for your organizational learning. The four above-mentioned lean techniques are the methods by which you design your experiment.

Here's another example^{xxii}. It's from the comedian Louis C.K.:

1. One day, after 15 years of writing jokes, Louis C.K. threw them all away. Sitting in his car before a show, he listened to an interview with George Carlin, in which he described his routine of doing one comedy special per year, and, all year, writing his material for that special, then, throwing out all of the material, and starting from scratch for the next year's special. This forced Carlin to think harder and deeper about subjects. He thought about what embarrassed him, what confused him, and then about what terrified him. His material became more personal, and funnier. C.K. had been working for 15 years, and hated his routine and his career. Only after throwing away his entire stock of jokes was he able to begin the process of writing again.
2. C.K. also moved all his best jokes to the beginning of his set. Comedians typically build up the quality of their jokes throughout a set, so that audience members are left with a positive impression. They tell their friends how good the set was, and they themselves return. Kahneman and Tversky studied this phenomenon and called it the "Peak-end rule."^{xxiii xxiv} But even if a comedian isn't aware of this effect on the audience, it is more comforting to know your best jokes in your set are ahead of you than behind you. And by putting your best jokes at the front, you are motivated to write better material.

Lean and writing

I have developed my own techniques for doing continuous improvement. One of my hobbies is writing, and one of my heroes is the writer and long-time member of the Editorial Board at the New York Times, Verlyn Klinkenborg. He wrote a book titled *Several short sentences about writing*. I want to describe three pieces of advice he gives, but in order to put them in a lean context, consider this quote by Masaaki Imai, from his book *Gemba Kaizen*:

"The Next Process is the Customer

All work is a series of processes, and each process has its supplier as well as its customer. A material or piece of information provided by process A (supplier) is worked on and improved in process B and then sent on to process C. The next process always should be regarded as a customer. The axiom "the next process is the customer" refers to two types of customers: internal (within the company) and external (out in the market).

Most people working in an organization deal with internal customers. This realization should lead to a commitment never to pass on defective parts or inaccurate pieces of information to those in the next process. When everybody in the organization practices this axiom, the external customer in the market receives a high-quality product or service as a result. A real quality-assurance system means that everybody in the organization subscribes to and practices this axiom."

This cogent explanation shows how the Voice of the Customer (VOC) can be moved upstream, along with the scattered Chaos. Again, one of the innovations of Toyota is to send quality cars off the line the first time, with minimal rework.

With that in mind:

1. Start each sentence on a new line.
2. Start off by writing short sentences. It's hard to say precisely what you intend to in long sentences. Get good at writing short sentences, then practice longer ones.
3. Compose each sentence in your head before you put the first word to paper.

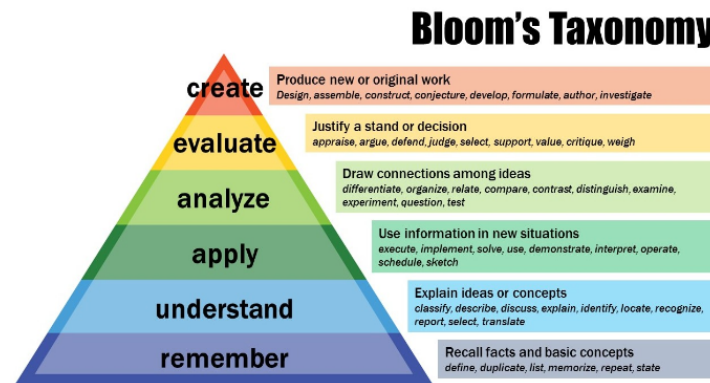
I could go on for another few pages about these three tips. I struggle especially with the third one. To pull a quote from the article I link in endnote ix, "It really doesn't matter how long. If you practice with your fingers, no amount is enough. If you practice with your head, two hours is plenty." This quote in a way gets at the heart of the Improvement Kata and the Coaching Kata. Traditional, buffered process design philosophy says *design an optimized process, and it will run well*. Lean process design philosophy says, *constantly update your mind with direct, intentional, high-valence experience of the process, so that you know what it's doing*. Forcing yourself to compose the sentences in your mind means that you stay creative longer, and have a better understanding of what you actually think. This principle is similar to the emphasis on the *Planning* phase of the Deming Cycle. You leave the planning phase early at your peril.

Deming famously said that "If you can't describe what you are doing as a process, you don't know what you're doing." Discovering how to lean out your processes takes creativity and a lot of failure. It also takes humility. Continuous Improvement doesn't work unless its operators are willing to repeatedly make their best guess, be proven wrong, and adjust their habits and beliefs as a consequence. Rother says that at

Toyota, one of the phrases you will hear most often is, “I don’t know,” followed by a description of how the speaker will empirically find out.

Analogies and parallels

Another important piece of information to know when thinking about the Improvement Kata and the Learning Kata is Bloom’s Taxonomy.^{xxv} It is a model of the learning process.



The two Kata work together because they move the student up this pyramid, without skipping tiers. It is a common habit of individuals to try to skip to *evaluating*, or even to *creating*, without first getting adequate experience *applying* and *analyzing*. In writing this article, I am attempting to improve my own *understanding*, both by doing the writing, and by asking others to engage in the process of *application* with me.

Strength training works because damage is done to the muscle. Without this damage, no growth occurs.

The Improvement Kata Mindset

<https://www.youtube.com/watch?v=Zhvd-oFqqhc>

In this lecture, Rother explains the Improvement Kata mindset. He uses a sports analogy. In sport, you practice in between games. In the Improvement Kata mindset, you practice during the game—that is, during your working day. He shows how the Improvement Kata introduces deliberate practice into your daily work.

He also explains how kanban is used as a context in which to do improvement. Another reason I am writing this paper is because we aren’t doing manufacturing, so I’m not sure what techniques to employ in setting target conditions. I have made some progress in setting Target Conditions for my department, but it is surprisingly difficult.

ⁱ <http://www.lean.org/downloads/MITsloan.pdf>

ⁱⁱ <https://www.thisamericanlife.org/radio-archives/episode/561/nummi-2015>

ⁱⁱⁱ https://en.wikipedia.org/wiki/Lean_manufacturing

^{iv} https://en.wikipedia.org/wiki/Carl_Jung

^v https://en.wikipedia.org/wiki/En%C3%BBma_Eli%C5%A1

^{vi} <https://en.wikipedia.org/wiki/Logos>

^{vii} A note on the word “Myth.” In common parlance, myth can be used to mean something *that isn’t true*.

I’m not using it that way. I’m using it this way: <https://en.wikipedia.org/wiki/Myth> to describe the most important stories upon which societies are founded. Peterson explains why Myths are so important.

Basically, throughout history, people have told one another useful stories like,

“I was walking down a path—you know, that one that cuts across the narrow part of the stream, that we use to reach the mound—and a snake slithered into the path right in front of me.”

“What did you do?!”

“Well, I just happened to be carrying a walking stick with me, so I froze, took a deep breath, aimed, and I struck its head, killing it.”

“That worked!?”

“Totally.”

“Good to know!”

The more important details stick in people’s minds, and the more general (more broadly applicable) details are the stickiest and spread across cultures. These details become increasingly symbolic. This comes as a result of a paradox of story telling. We remember what we can visualize in concrete detail. But anything we can visualize is specific, and therefore not general. We overcome this by creating persona (or gods) of general phenomena. That gives us a visual way to represent and tell stories about complex, abstract phenomena.

Myths, then are stories that have evolved for millennia, retaining only those details that could survive the evolutionary process of an oral tradition, and which had the most satisfying explanatory power for the listener, and which provided the most useful procedural knowledge for how to act in the world.

viii <https://en.wikipedia.org/wiki/Pragmatism>

ix https://en.wikipedia.org/wiki/Philosophy_of_science

x <http://www.nature.com/articles/srep25826>

xi [https://en.wikipedia.org/wiki/Affect_\(psychology\)](https://en.wikipedia.org/wiki/Affect_(psychology))

xii [https://en.wikipedia.org/wiki/Valence_\(psychology\)](https://en.wikipedia.org/wiki/Valence_(psychology))

xiii <https://en.wikipedia.org/wiki/Materialism>

xiv <https://hbr.org/2007/07/the-making-of-an-expert>

xv https://en.wikipedia.org/wiki/Positive_psychology

xvi [https://en.wikipedia.org/wiki/Flow_\(psychology\)](https://en.wikipedia.org/wiki/Flow_(psychology))

xvii <http://tinyhabits.com>

xviii And taxing situations tend to bring out the best in people.

<https://www.scientificamerican.com/article/how-the-stress-of-disaster-brings-people-together/>

xix https://en.wikipedia.org/wiki/Greatest_Generation

xx <http://www-personal.umich.edu/~mrother/Homepage.html>

xxi http://www-personal.umich.edu/~mrother/The_Coaching_Kata.html

xxii <http://calnewport.com/blog/2015/09/07/how-louis-c-k-became-funny-and-why-it-matters/>

xxiii https://en.wikipedia.org/wiki/Peak%E2%80%93end_rule

xxiv <https://passthehatforeddie.wordpress.com/2016/02/23/stand-up-comedy-and-colonoscopies-the-peak-end-rule-at-work/>

xxv <https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/>