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“Efficiency is not the winning card. The competitive game is won by businesses that know how to balance entrepreneurial and managerial modes of organizing in the innovation process.”

**— Daniel Hjorth,
Guest Editor**

What’s the Art in the “Art of Innovation”?

We Need Science

The trial-and-error approach to innovation is risky, ambiguous, and offers uncertain ROI. We need to take a more predictable approach to developing innovative solutions.

Let There Be Art!

Art combines the masterful application of knowledge and technique with the creative impulse to produce new things of value and meaning. To innovate, we must be willing to take chances, to be inspired by possibility, and to bring forth in real time.

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by Daniel Hjorth

Opening Statement

Business and art are two — or some would argue, *the* — primary sites where innovation happens in our societies. They are, however, also structurally ordered into a dichotomy that often has business on the “useful” side and art on the “amusement” side. In its present form, this order is not older than the changed attitude toward nature and culture that took place in the 17th century. In the 1940s, this change was given the name “The Scientific Revolution,” which of course confirmed the seriousness and importance of science (controlling nature) while art was simultaneously relegated to the realm of play and leisure.

Traditionally, business is understood as applying economy (and social sciences) as knowledge to harness science (in everything from R&D to applied technology) in analyzing, organizing, and managing resources into competitive arrangements of collective work in a market. Art is instead approached, understood, and explored by means of aesthetic knowledge (in its modern form since the 18th century) and associated with beauty or entertainment achieved through mastery or perfection. Business and art thus also represent the knowledge domains of economy and aesthetics, respectively. Historically, these are regulated according to views of society that designate the ordinary/work/everyday as a place proper for economy, and the extraordinary/leisure/weekend as the place proper for art. There is a battle here between “Lent” and “Carnival” — between, on the one side, the interest-driven, self-controlled human who is subject to management and, on the other, the passionate human of desire and spontaneity, who threatens the predictability of life.

When we ask “What is the art in the art of innovation?” we thus open up a vast question in the history of Western thinking — the distinction between art and science. But we do so to seek an approach to innovation that refrains from reinstalling the suffocating dichotomous order noted above. Instead, we seek to grasp innovation as a practice based upon invention. Invention is a creation. It literally means “to fabricate,” to make up, by imagination, to be fabling. This is an absolutely central faculty of humans, indispensable for art and, lately, also for business. However, the

emergence of the urgent need to focus business on innovation has taken place more or less as a next step in the evolution of management (knowledge and practice). But with this development, we run the risk of missing a much more fundamental and disruptive change in the way we organize and manage businesses. Innovation is not primarily a business — it is creation/imagination/fabling. This is a human activity that corresponds not to *homo oeconomicus* (economic human) but to *homo ludens* (playing human). In their article, William Seidman and Michael McCauley address a consequence of thinking differently about innovation as they discuss the concept of the “positive deviant,” as identified in an organizational context. My reading of this suggests that the “playing human” provides a much better explanatory model for such individuals than the dominant model of thinking of people in business as “economic humans.”

The established order of economy and aesthetics — assigned to different spheres of human activity (business and art), corresponding to two different times in human lives (work and leisure) and two different behavioral archetypes (Lent and Carnival) — is breaking down. Alfred Chandler, Jr., the late Harvard Business School historian, rightfully identified the central role of management in the establishment of the competitiveness of American businesses during the era of the industrial economy.¹ This centrality might even have peaked in 1977 when he published his landmark book, whose title — *The Visible Hand* — poetically captured the function of management (in an obvious play on Adam Smith’s characterization of the market as the “invisible hand”).

What I propose here, though, is that the industrial economy was the basis for a certain order of running businesses, an order that included management primarily focused on efficiency, predictability, and control. The postindustrial economy is the basis for a new order. Not only is the domain of management limited, but also the business organization as such is opened to practices beyond the scope of “scientific knowledge.” In Kas Kasravi’s discussion of the TRIZ methodology, we find an example of this struggle to reconcile the two sides of systematicity and artistry. As Kasravi writes, “Although

TRIZ can methodically provide a direction for innovation, the effective interpretation and application of that direction is very much an art." The creative business's competitiveness is based on the capacity to synthesize aesthetics and economy, art and science, senses and reason, passion and algorithm. We have left the time of "either or"; this is the era of "both and." We have more artists-in-residence than ever before. Companies employ philosophers and anthropologists. Humanities are experiencing a new growth market in the business schools (in Europe, at least). Maybe we are experiencing the dawn of the Art Firm, as Pierre Guillet de Monthoux claims.² Kalpana Sampath's contribution is written in this spirit. Her article inquires into how we can learn from the performing arts as we develop agile work environments that can act as fertile soils for innovation in organizations.

IN NEXT MONTH'S ISSUE

IT Usability: Bridging the Gap Between Machines and People

Guest Editor: Carolyn Snyder

For decades the field of human-computer interaction (HCI) has studied the relationships between computers and the people who use them. But HCI isn't limited to just ivory tower researchers. The real-world decisions made by IT professionals have an impact on the effectiveness, efficiency, and satisfaction of users across the organization. Yet while it's easy enough to understand what usability might mean for a task like creating a spreadsheet, changes in the IT landscape (the advent of Web 2.0, the proliferation of data on corporate intranets, growing security threats, even the aging of the user population) pose new challenges and thrust usability issues once again to the forefront in IT.

In the August issue of *Cutter IT Journal*, we'll investigate these new usability challenges. You'll hear how Web 2.0 is raising expectations for corporate intranets — and what you can do to meet those expectations. You'll discover a three-part strategy for ending the security versus usability "standoff." And you'll learn how designing solutions with an aging population in mind can make your applications more user-friendly for everyone.

Don't leave your users gnashing their teeth and rending their garments. Join us next month and become part of the usability solution!

We have seen this phenomenon before, but without noticing its revolutionary potential. The 1990s was the decade of entrepreneurship, but in most cases the business organization was open to the entrepreneur only in its tamed, managed version. A century of management's preferential right of interpretation is not broken that quickly. We invented management to secure social control and economic efficiency. In the innovation-intense experience/knowledge economy of today, however, the time and place for prioritizing control is limited. Efficiency is not the winning card. The competitive game is won by businesses that know how to balance entrepreneurial and managerial modes of organizing in the innovation process. The managerial revolution in business, well described by Chandler, is over. The entrepreneurial revolution has barely started.

Understanding the art of innovation, I suggest, is a way to grasp the new business as characterized less by the behavioral genre of the industrious, and more by the genre of the assiduously imaginative. This is an "artful making," as Cutter Fellow Rob Austin and Cutter Senior Consultant Lee Devin have argued,³ where the authority is to be found in those who have learned how to master such processes. We (i.e., business) need to learn, and we need to unlearn. David Rasmussen's interesting elaboration on the jazz method of creating provides another example of artful making that is sensitive to the potential of collective creation processes. The listening is as important as the "speaking" in improvised jazz performances, and this, I believe, holds a great secret for how innovation is successfully organized.

The message of this issue is not that "work is now theatre and everyday business a stage," as Joseph Pine and James Gilmore claim in *The Experience Economy*.⁴ Rather, this special issue is an indication of a fundamental change in the order of economy and aesthetics as we know it historically. It radically renews the way we think of business and the role of economic rationales as guiding practices. It is a change in the relative importance of management and entrepreneurship — in favor of the latter. It is, as Jon Marshall articulates convincingly, a challenge to the ways we think about and practice innovation. Marshall's article addresses the stalemate that results from the malign "art vs. science" dichotomy I touched on above and provides a perspective on how to breach it. In Marshall's discussion, we are moving toward the art of innovation. This is "a minor science," guided by weak rather than strong theory, running by an operative reason "inseparable from a process of trial and error, with occasional shots in the dark, guided in every case by a pragmatic sense of the situation's *responsivity*,"⁵ as Brian Massumi has put it. It follows that innovation is not stimulated by managerial attempts to bring it under

control. For sure, there is a time for that, but we cannot *start* with that. Rather, as in rehearsals before a play, control needs to defer to creative processes, and entrepreneurial imagination needs instead to get to work. We now need a sense of timing to know exactly when, later in the process, management is needed. This is a new order, a new world of business. This is the art of innovation. Nancy Van Schooenderwoert rightfully invokes the metaphor of a journey when she talks about innovation processes. She also indicates that spontaneity rather than control is crucial to turning such journeys into discoveries of novelty rather than instruments for getting from point A to point B.

Improvisation, iteration, experimentation, aesthetic management, metaphysical marketing, and space for play are all prerequisites for innovative businesses. Design-intensive companies have taken the lead in integrating aesthetics as core knowledge in the way they “make business.” Innovation-oriented high-tech companies develop models that secure free time for employees to do “*not* what they were hired to do.” In what Volkswagen has described as the “century of design,” the car producer is committed to selling by *emotion*, understanding technology and quality to be givens. Aesthetics is not only central to how a winning car is manufactured, it is also central to how it gets sold. Nokia sponsors “fashion weeks” all over the globe to emphasize its design profile. Ericsson recently opened a new Experience Center in Plano, Texas, USA, that demonstrates how the “world of wireless” holds new revenue-generating capabilities for companies and dazzling experiences for consumers. The examples are many, but the message is similar: as we are heading for a time when the so-called digital natives (i.e., those born into a digitalized world) need to be attracted to join the corporate workforce, work needs to be organized differently so as to provide space for innovation, play, improvisation, and passion.

I am happy to invite you to a reading of the interesting articles that make up this special issue. You will find that they primarily focus on new ways of approaching, thinking about, and organizing creative work. They will provide useful insight into how to facilitate innovation, including establishing agile work environments, framing the challenge of systematizing innovation, and making space for those that deviate from the norm. Together they represent a much-needed contribution to a rethinking of organized work in the postindustrial economy.

ENDNOTES

¹Chandler, Alfred D., Jr. *The Visible Hand: The Managerial Revolution in American Business*. Belknap Press, 1977.

²Guillet de Monthoux, Pierre. *The Art Firm: Aesthetic Management and Metaphysical Marketing*. Stanford Business Books, 2004.

³Austin, Rob, and Lee Devin. *Artful Making: What Managers Need to Know About How Artists Work*. Financial Times/Prentice-Hall, 2003.

⁴Pine, B. Joseph, and James H. Gilmore. *The Experience Economy: Work Is Theater & Every Business a Stage*. Harvard Business School Press, 1999.

⁵Massumi, Brian. *Parables for the Virtual: Movement, Affect, Sensation*. Duke University Press, 2002.

RECOMMENDED READING

Hjorth, Daniel, and Peter Pelzer. “The Fate of Phaeton: Baroque Art for Management’s Sake?” *Organization*, Vol. 14, No. 6, 2007, pp. 869-886.

Hjorth, Daniel. *Rewriting Entrepreneurship: For a New Perspective on Organisational Creativity*. Liber/Abstrakt/Copenhagen Business School Press, 2003.

Daniel Hjorth, a Senior Consultant with Cutter Consortium’s Business-IT Strategies and Innovation & Enterprise Agility practices, is the Entrepreneurship and Innovation Management Professor at the Copenhagen Business School (CBS) Department of Management, Politics, and Philosophy. Prior to this position, he was Acting Professor at Växjö University, a driving force of entrepreneurship research in Scandinavia.

At CBS, Dr. Hjorth is the Research Director of the LIKE (Leadership, Innovation, Knowledge, Entrepreneurship) group. He teaches “organizational creativity,” general management, innovation management, and entrepreneurship courses for graduate students and is the creator of courses and programs in entrepreneurship. As part of Dr. Hjorth’s recent focus on the so-called experience economy, one of his research projects explores the relationship between aesthetics and economy in processes of product development and innovation.

Dr. Hjorth’s research is widely published in academic journals. He is coeditor (with Chris Steyaert) of the book series New Movements in Entrepreneurship and has served as Guest Editor of special issues of academic journals. He is the author of Rewriting Entrepreneurship and coauthor (with Monika Kostera) of Entrepreneurship and the Experience Economy and the forthcoming Organization and Entrepreneurship.

Dr. Hjorth did his PhD studies at Lund University, Universitat Autònoma de Barcelona, and University of Massachusetts and earned his doctorate at Växjö University. He can be reached at dhjorth@cutter.com.



Innovation Is an Art — Here's Why

by Jon Marshall

Many people misunderstand the word “art.” You can detect this misunderstanding when you hear people imply that art is a subordinate discipline to science and technology. Images of undisciplined “artist types” and hard-to-understand works of modern art come to mind versus highly educated and disciplined scientists in their laboratories and all-business MBAs with the seeming precision of their quantitative analyses.

Unfortunately, this view does not deeply understand art. A true art requires its practitioners to understand the supporting sciences and to master excellent technique. But art transcends science and technique because art creates new human value. Art requires additional ingredients beyond the understanding and mastery of the component parts. It requires creative and critical judgment, a vision of potential, and a practical sense of balance in the application of its component parts. In this sense, art and artistry are senior to science and technology.

Art understands that the world is not completely deterministic. Science and technology seek to develop improved determinism in our attempts to create and control things. Technology makes life easier by converting certain knowledge into repeatable processes. That adds some certainty to the process of producing something. But creative life is filled with emergent factors, emergent conditions, and emergent laws. It is a never-ending process of the creative emergence of new things. Duplication of well-understood things is not the same as the creation of new value.

Art taps into the powerful human ability to solve difficult problems — not just by the procedural application of technique, but by the creative combination of mastered technique with inspired visions, unexpected combinations, and sudden, brilliant insights. Art involves judgment in application and with that, the well-chosen use of proportion. But art is also willing to take chances, to be inspired by possibility, and to bring forth in real time.

Let's consider some examples of familiar art forms, such as the martial arts, ballet, and music. For any practitioner of these arts, the first 10 to 15 years of

development are spent learning technique and theory. Theory is based on science: codified discoveries about what works, how it works, and why it works. Technique comes from years of rigorous practice, experimentation, and attempts in the context of training, coaching, and individual determination to succeed. In time, one becomes a master of technique. But mastery of technique is not the same as mastery of the art. One becomes a master of the art only when one moves beyond the mastery of method to become a source, not just a duplicator, of inspired creative works.

One emerges as an artist from the crucible of creative application. True art is backed by years of learning, trying, failing, recovering, analyzing, and making new attempts. And true art emerges as one integrates oneself into one's team, troupe, or symphony the combined lessons from the rigors of one's science and technique coupled with the new and creative ideas, expressions, and deeply felt messages that reflect what is important. It comes not just from learning, but from the attempts.

INNOVATION AS AN EMERGING ART

Today, human innovation is emerging in the context of high tech, the World Wide Web, and changes in the social collaboration processes of mankind. But innovation has been emerging since the Big Bang. If we agree that innovation is the creation and diffusion of something new, then we can say that innovation is, in a very deep sense, what this universe is about: the constant emergence and diffusion of new things.

In our human world, we wish to put innovation to practical use, to create an effect and solve problems. If we bumble through it — and succeed — we call ourselves lucky, and possibly in retrospect, clever. If we study innovation as a process, as a phenomenon, and ultimately as a skillful capability, we can develop innovation into an art — provided we address not only the development of our technique, but also the development of our creativity and our responsiveness to the needs and conditions of the world receiving our innovations. We can envision a sort of scale of competence with “bumble through” at one end and “artfully

obtain” at the other end (with all points between). If we artfully obtain our result, this could be the consequence of our mastery of the *art of innovation*.

For the purposes of this article, I will define (or at least describe) an art as an accomplished body of work and an accompanying body of developed knowledge and skills that can be acquired and developed. When a person or a group acquires and develops an art, they become capable of producing new works of that art form to high standards of both function and beauty. For example, the art of ballet includes the great ballets that have been created and performed and the body of knowledge and skills that are known and can be learned by others. When perfected and unified, a body of work naturally emerges with a sense of unity and beauty of its own. It becomes recognizable as an entity and is generally appreciated by others for its own unique qualities and human values.

If an art form has a purpose beyond doing it for its own sake, if it has a function it performs, then we must begin to think about the topic of control. A purposeful art has to achieve its purpose, even if only to entertain or delight. The art of innovation falls in this category.

Innovation, at least in business and industry, must generally be a purposeful art. Since life contains so many random forces acting on things, we need to guide the processes of innovation to generally produce the desired results, despite the forces of resistance and distraction. It is precisely here that we enter into a conflict of approaches. The problem centers on the concept of guidance and control.

The key problem we encounter is that when we want repeatability and the ability to get a certain result, managers react with a “control” response. But in art and also in innovation, control is not the only answer. You also need, in fact, the opposite of control: certain freedoms and an openness that encourages play, emergence, creativity, and natural, not contrived, solutions.

Because innovation is the generation of something new to the world and because creativity must be involved, *we cannot generally achieve planned and predicted results with control alone*. In fact, the notion of control becomes an illusion. It’s hard to control something you don’t know much about.

One of the best illustrations of this phenomenon is the idea of “customer requirements” in the development of a system design. The illusion is that “if only we know all the customer requirements before we start a design project, then we can deterministically and in a controllable fashion turn the crank. Innovations will

magically occur, and out will pop a perfect product that delights both the customer and our CFO.” Anyone in business knows how seldom this actually occurs. There is a lot more to creating a successful outcome than a “controllable process of development.” It is those things, over and above the mechanistic and pseudo-deterministic process steps, that fall squarely into the category of the art of innovation.

In art and also in innovation, control is not the only answer.

It is in this sense that *the art of innovation is senior to its supporting sciences and technologies*. Art must include science (why and how things work) and technique (repeatable processes to create specific results). A painter must know something of the properties and techniques of the paints themselves and the techniques of converting mental and physical visions to wet paint on the canvas. But art goes beyond this to produce an artifact of intrinsic beauty and (perhaps) useful function that transcends the materials and the technique. It is not the paint that makes a Mona Lisa — it is the soul and mastery of the painter coupled with the ability to play, to adapt, and to experiment, but all within a gradient force field pulling to the vision within the mind of the artist.

It is doubtful that Leonardo da Vinci could have been managed into creating the Mona Lisa. It is doubtful that any great work of art was managed into existence. The same is true of innovation. Management may be one of the useful tools, helpful (one hopes) and not destructive. But more is involved. More must be understood. To understand an art of innovation and to develop that art, we must understand the nature of innovation itself: the forces that promote it and the forces that work against it.

THE PROBLEM OF PRODUCTIVITY

There is always a villain in every story. In many great stories, the villain is a good guy who, through his excessive zeal, has become bad. Too much of anything becomes a bad thing.

In today’s corporate world, that good-guy-gone-bad is what you might call an extreme and unbalanced emphasis on productivity. For example, the lean practices originally developed in the Toyota Production System (TPS) have often been mistakenly applied with a fanatical focus on cost-cutting and headcount reduction rather

than the development of human value, constant improvement (including innovation), and the smooth and rhythmic flow of value creation in a company. The price of this mistaken interpretation of lean principles, this prison of pure productivity, is the squashing of any environment conducive to innovation.¹

To survive, you need both profitability and constant new growth. A search for profitability alone leads to a downward spiral. Old generations of products and services are becoming obsolete, and competitors offer new value every day. A total focus on “leaning out” an organization without also providing for the freedom and experimentation that foster innovation will lead a company eventually to mediocrity and then death. This is where “art” comes into the picture.

The price of this mistaken interpretation of lean principles, this prison of pure productivity, is the squashing of any environment conducive to innovation.

Art is all about the skillful and sensitive adjustment of proportions so that the value of the whole is maximized. The art of business includes the successful balancing of freedoms and constraints. While highly documented and tuned processes are essential for efficient operations, those same processes, when taken to an extreme, can destroy any chance of real innovation and real breakthroughs. This again becomes a case where the artful proportioning of contrasting values produces the best overall result. The art of innovation requires the organization to balance the forces of productivity and the needs of creative innovation.

Because of economic pressures, and because of the sort of “moral high ground” that things like productivity, quantitative metrics, and a total focus on processes for everything seem to possess, the more free-form, less preplanned, and more playful activities surrounding innovation can easily take a back seat or be forced out of an organization altogether. This seems to have happened to many companies today.

As a compromise, many organizations seek to keep the freedom of innovation bounded by putting it — literally — in a “bounding box.” That is the current term used by many companies to say, “Here are your boundaries, and if you go outside of them, you must get permission from corporate Mom or Dad or face the consequences.” It is difficult to be truly innovative when living under this sword.

So like it or not, the “manifest productivity doctrine” acts to severely limit or constrain innovations, at least in many companies. This phenomenon is only amplified by the view that innovation is just a process, not an art. It has the effect of validating the suppression of the kinds of activities and the more free-thinking, experimental, and risk-taking environment that would give rise to innovation.

THE NEED IS FOR BALANCE, NOT A PENDULUM SWING

What organizations need is to integrate both an innovative and a productive view into one. A pendulum swing to the polar opposite in a highly controlled environment would surely lead to chaos. Part of the reason for this is the *lack of real responsibility in a highly controlled environment*. After all, one of the “benefits” of a highly proceduralized environment is that people don’t have to think too much. If everything is worked out for them, they can just crunch away at their tasks and the machinery moves forward. People are not challenged with perhaps the most difficult task at all: remaining responsible when the chains are suddenly released. If they are, chaos ensues because there is no personal discipline. Fear of consequences is not real self-discipline; instead it is forced self-interest.

Toyota’s development system is among the most innovative and least bureaucratic in the world. Its development cycles have few mileposts, and the chief engineer and the team have great latitude in defining the development cycle used. But the TPS works because the engineers and designers have achieved a high level of personal responsibility for the success of the cars and the company. And they are supported with a world-class learning model that guides their decisions and work in a way no bureaucratic process could. Toyota still has plenty of processes, of course. But the processes are tools, not taskmasters of the individuals and teams who design and innovate.

This state of operations can be described as a sort of cultural art. It is an ongoing and dynamic balance informed not so much by rules but by specific knowledge of design tradeoffs. Toyota is famous for the tradeoff graphs it uses as a way to capture knowledge and make that knowledge universally accessible. It is interesting that so much valuable engineering knowledge is packaged as tradeoffs rather than as absolutes. Yet this fits the model of innovation as art. It grants engineers the ability to vary parameters in the quest for the best proportions, whether it’s horsepower versus muffler pressure or legroom versus seat size. It creates

a culture of optimizing tradeoffs rather than cleaving to absolute principles.

Toyota's innovative culture did not happen overnight. It was developed and evolved. But it is living proof, and an exemplar for the rest of the world, that a dynamic and ever-changing balance between process and innovation is possible and effective.

TRULY ARTFUL INNOVATION

To create this sort of dynamic balance in your own organization, there are steps you can take. First of all, treat people as artists with creative potential, not just as obedient functionaries carrying out preassigned tasks within predefined programs. Help them to become responsible for making decisions that optimize the whole not the parts, and think of them as *sources*, not just resources. This means developing an environment of creative responsibility. Cultivate people to self-manage more and be directed less, knowing they will make well-balanced decisions and apply both creativity and responsibility to their company contributions.

For each separate situation, find an appropriate balance between following processes and creating new ways: it is actually the proportioning of these things that is of the highest value. Swinging the pendulum to extremes is easier than moving to a balanced state, but it is almost always the wrong solution. Seek a place that is truly synergistic between both ends and not a dull compromise of both. In biological systems, this is called homeostasis. It is the ongoing balancing act between opposing forces. One way to do this is to avoid the "associative barrier,"² which is the phenomenon of jumping to the first idea (association) that comes to mind when confronting a new challenge. The TPS solves this problem with set-based design.³

Changes in attitude are a good start, but they are not enough. There must be behavioral change, and, taken across a whole organization, this converts to cultural change. Accomplishing cultural change of this magnitude requires a steady force over a long period of time. To invoke this level of change, it must come from the top and be steadfastly maintained, especially during the inevitable setbacks.

Managers should work to become more facilitative and less directive in their leadership. Of course, there are times when you must be very directive. Generally, however, a management style that lets people discover things for themselves and take more responsibility for the whole eventually wins.

This is often very hard for people who have risen to management positions in IT. They may be very left-brained technology types who like lists and algorithms and hate loose concepts and fuzzy goals. They may want to organize and "processize" everything. Because they are smart, they may jump to conclusions quickly. But premature convergence is the enemy of creative development.

IT organizations have it especially hard because they are generally regarded more as subservient service providers ("cost centers") and less as strategic partners ("innovation centers"). Thus, for IT, transforming to a creative, originitive role within the company is very challenging and will require great leadership from IT directors and managers. It will also require others outside of IT to have a significant change of attitude so as to accept IT as a co-innovator in the company.

An unbalanced, cost-cutting focus on productivity and a tight economy further conspire to kill the kind of free initiative and creative innovation that might arise from the IT ranks. Thus, it is critical for IT leadership to believe that, despite the odds, it is still possible to be innovative and make a difference. You must learn how to inspire not only your own people, but the rest of the company with the idea that innovation-as-art is possible, valuable, and can be done by IT.

Treat people as artists with creative potential, not just as obedient functionaries carrying out preassigned tasks within predefined programs.

CLOSING THOUGHTS

Treating innovation as an art, combined with a respect and understanding of art itself, can lead to much better practice of innovation in your company.

Seeing innovation as a combination of science and technology *plus* the masterful application of skill, experience, and judgment will produce superior results. Innovations will have value and relevance, and their development will be more efficient and happen more smoothly. This attitude will help us encourage budding innovators to take risks, to think boldly, to dream, to experiment, and to develop their ideas and not let them die. It will also give more respect to the innovator and grant that person the space and time needed to go through the processes and discoveries, the agonies and joys, required to make an innovation real.

Furthermore, treating innovation as an art will grant respect to the parts of innovation that truly give it life: the creative moment, the concern for the experience of the user, and the value your innovation brings to the world. It will help change the focus from the technical ideas themselves to a broader view: the prospective innovation in valuable interaction with your customer. This perspective maximizes the value of the relationship between your customers and your company.

In this day and age, we take our innovations for granted. Few people have any idea what it took to create the cell phone and its supporting radio and computer networks, or the data processing and economic systems behind the seemingly simple credit card. Yet these innovations changed our world, and the innovations of the future will change it more than any of us can today imagine.

Thus, just as artists deserve respect for their work, so do innovators. And we can grant that respect by acknowledging them, the innovators of this world, as true artists and their work as true art.

ENDNOTES

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The Business of Jazz: The Role of Improvisation in Fueling Creative Innovation

by David N. Rasmussen

Of all the musical forms that exist, only jazz requires the creative skills to invent new musical themes in real time. Once such a theme is invented, a repeat performance is never exactly the same (although occasionally a great improvised solo may become so popular that it is copied, memorized, or notated for others to perform).

How do musicians go about achieving such instant innovation? What are the skills, disciplines, and “business rules” that support such creativity? And, more importantly for our purposes, how can they be applied to the workplace in order to support improved innovation for the business unit? In this article, I examine the process of real-time music creation and suggest some steps a business might take to improve its own creative abilities.

THE STRUCTURE OF JAZZ

All forms of music are based on an underlying harmonic structure that supports the melodic theme. This structure is based on chords — groups of notes played simultaneously. Sometimes the chords can be heard, as in the various notes played by a trombone section or a section of violins. Sometimes they are implied, or felt, as when the melody or theme moves through a sequence of various notes. The movement of those note groups, one after the other, is referred to as “chord changes.” All popular songs, whether show tunes, country music, blues, or even some more popular classical themes, are accompanied by their respective chord changes or progression.

Other components of musical structure include melody, rhythm, and tempo. The melody, of course, is what we normally think of when we recall a tune that we enjoy — that sequence of musical notes that makes for a pleasing and memorable listening experience. Tempo refers to the relative speed of the beats against which the notes are played, while rhythm tells us about the grouping of the beats into logical patterns (three beats

in a waltz, four beats for a foxtrot, etc.) as well as the type of syncopation (swing, samba, mambo, etc.). Without going into a more technical discussion of these musical components, suffice it to say they all must be present to support the improvisation process.

So how is it that a skilled musician is able to rely on this structure to produce new groups of notes (melodies) that have rarely, if ever, been heard before? First of all, we must understand that there is a vast number of notes the musician can choose to play next. The standard piano keyboard has 88 keys, each of which creates a unique note (high, low, somewhere in between); a saxophone has 33 standard keys, while other instruments each have different sets of keys or strings. In a jazz solo performance, the next note to be played must have a logical and musical relationship to the previous note. Therefore, on the piano, not all of the 88 piano keys are candidates to be played next. That’s where the chord structure comes in — it indicates to the soloist the next note group from which the note can be selected. With rhythm, tempo, and melody included, the jazz musician has the necessary guidelines for constructing a unique new melody.

The ability to implement the above process in real time requires a technical skill that is challenging to master. The musician cannot consciously “think” about what note(s) to play next; he or she must feel, or sense, all of these musical components in order to somewhat automatically pick the desired next note on which to build the note sequence of the new melody. It takes years of training, practice, performance, and feedback to learn and become competent in this skill. This is not unlike the years of training, practice, implementation, and feedback that engineers, accountants, salespeople, lawyers, astronauts, pilots, and the myriad of other professions undertake in order to excel, although musicians use different tools, techniques, procedures, and business rules.

MAKING THE ANALOGY

What, then, are some of the common traits that apply both to the jazz musician and the business professional? They are:

- Well-defined infrastructure
- Flexible business rules
- Process discipline
- Project plan
- Provision for creativity and innovation
- Technical (core) competencies
- Shared intellectual property
- Teamwork

Well-Defined Infrastructure

First of all, there is a structure — the manner in which musical notes, financial numbers, engineering designs, contracts, and so on, are represented such that they may be understood and valued. One of the common attributes of these structures is that they can be represented on paper (physically) or media (electronically). Furthermore, the rules that govern those representations and guide our understanding of them are reasonably well defined and can be followed. Every business has some form of infrastructure (organization charts, workflow, cultural attributes, etc.) that guides how the participants behave. The same applies to jazz, for without such a structure, the musicians would be free to play any note that comes to mind, independently of what other members of the ensemble might be playing. When that happens, it can lead to musical chaos. Even “free jazz,” in which many of the infrastructure rules are discarded, maintains some basic elements of structure in order for

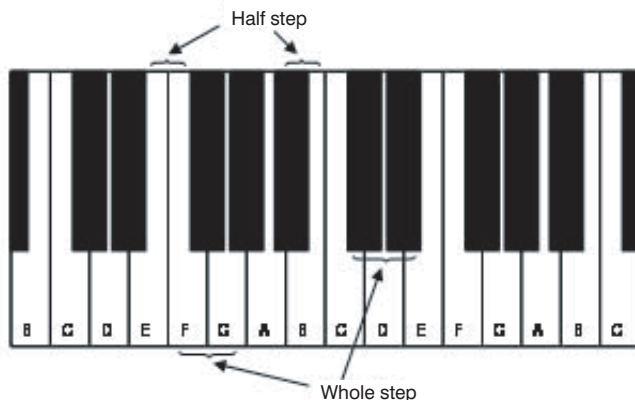


Figure 1 — Most jazz chords are made up of four notes played simultaneously.

musicians to know when to begin, end, and adjust their performance while in process.

Yet even with a solid infrastructure in place, there needs to be an acceptance of the role improvisation plays in creating new musical ideas, a willingness to tolerate and fix mistakes, a desire to continuously learn from previous attempts to generate new musical ideas, and an understanding of the importance of striving for improvement. Great jazz solos don't occur every time, nor do exciting new product ideas come out of the R&D function every time. It takes a combination of many factors, all coming together at the same time, and supported by a firm infrastructure, to produce a memorable Carnegie Hall jazz concert (Benny Goodman), an award-winning movie (*Gone With the Wind*), or an industry-setting new product (minicomputer, cell phone, portable music player).

Flexible Business Rules

Without a set of rules to guide the behavior of musicians in a jazz combo or orchestra, the sounds produced might be little more than a din. The rules may or may not be written, but they all are known and adhered to by the group's members. Let's look at the aforementioned progression of chords for any song. Most chords that support a jazz performance are composed of four notes played simultaneously (see Figure 1). There are two basic types of chords — major and minor. They differ from each other primarily by a single note. The easiest way to visualize this is by looking at the piano keyboard, which has 88 keys, white and black. A black key is one half-step removed from its adjacent white keys. A D-minor seventh chord is composed of all white keys; a D-major seventh chord consists of three white keys and one black key. We don't need to go into more detail for our purposes here. What's important to understand is that the progression of chords from a D-minor seventh to a G-seventh to a C-major is a standard one in most popular songs. The musicians in the jazz band know this, understand it, and use it as one of their rules during a performance. They can, however, change this sequence by substituting a different chord, Db-seventh, in place of the G-seventh. The rule remains the same but can be adjusted anytime. However, if a different chord were substituted, the meaning of the progression would change more dramatically and could sound strange.

There are many other business rules that guide a jazz performance. While I won't go into them here, the point is that they exist, are well known by musicians, and collectively form the plan that the band follows when performing. Unlike many project or business plans that,

once approved, are never updated, the musical plan¹ for a jazz group can be revised and updated in real time during a performance. This can be successfully accomplished because all of the musicians know, understand, and are technically proficient in the underlying infrastructure and business rules. If, however, they were to attempt such revisions without knowing the song's chord progression, melody, and which musical rules are appropriate in what situations, the result could be very unpleasant for the audience.

Process Discipline

As important and fundamental as is the need for supportive infrastructure, there is also the need for discipline, "stick-to-itiveness," and continual striving for improvement and a nurturing environment. Creativity cannot be turned on and off like a light switch. However, if one desires to gain the benefits from creative and innovative activities, such an environment is essential — whether in the concert hall, research lab, or business office. Innovative thinkers have given the world many wonderful products over the decades, some of which (light bulb, automobile, aircraft, computer, etc.) have spawned entirely new industries. However, the creative minds that generated these new innovations did so after many failed attempts to come up with the correct solution. Without the discipline of trying again and again and again, failure after failure after failure, we would not be the beneficiaries of so many products and services that make our lives more prosperous and enjoyable.

Jazz is a musical idiom based on the creativity, spontaneity, and innovation of skilled musicians, yet it too requires discipline. The jazz musician achieves the appropriate level of discipline over many years. The notion of continuous improvement found in TQM has nothing on the discipline of legendary jazz saxophonist Sonny Rollins, famous for his solitary practicing on New York City's Williamsburg Bridge to perfect his craft.

Project Plan

The project plan for a jazz performance can be written in the form of a musical score (see Figure 2), or it can be "known" by the musicians who, for example, all understand the chord progression for a standard blues-type song (or many other song-forms that are well known). For any given performance, the melody may vary, the tempo may be different, the rhythm may be swing, Latin, or some other form — but the chord progression remains the same. An unwritten plan generally starts with one or more musicians stating the melody,

followed by a series of improvised solos, with a final restatement of the melody. Variations may include an introduction and/or a repeating "tag line" at the end, any of which can be determined in real time.

For a small jazz combo, this plan may be unwritten, may be a brief musical sketch on paper, or may be fully orchestrated for all the musical instruments. For a larger jazz orchestra, the plan is mostly (but not always) written in the form of a musical arrangement with individual musical parts printed for each instrument. In any case, rehearsals prior to public performances most always result in alterations to the plan as the musicians determine where and how to improve it. Regardless of the form of the plan, there is *always* a musical plan in place to guide the tasks, behavior, and interaction of the musicians.

Provision for Creativity and Innovation

Unlike other musical styles, the jazz plan includes provision for individual musicians to innovate new musical ideas in real time. In addition to the need for infrastructure support, there needs to be the opportunity for the performers to express themselves individually within a disciplined environment. The rules for doing this are not always written, but they are always understood. The interaction between members of the team is supportive, but not intrusive, for the soloist.

One could argue that these comments also apply to other musical styles where a soloist is performing with other musicians. True; however, the differences are found in the musical infrastructure and plan that present the opportunity to invent new melodies, of almost infinite variety, in real time during the performance.

Technical (Core) Competencies

In order to create a new melody line for any song, jazz musicians must have a high level of technical ability on their instruments. They must be able to intuitively



Figure 2 — A jazz ensemble's musical plan.

know what notes to play, when, and in what order, but also when not to play (space). They must be able to do this instantaneously based on the chord changes they know, hear, or read. The great jazz soloists can play any musical idea they can think of instantaneously. Others, with more limited technical proficiency, can create exciting and interesting musical statements but with less complexity. Those starting their journey on this musical path spend long periods of time achieving technical mastery on their instrument as well as learning the rules of improvisation.

Improvisation is a competency that is unique to jazz. In addition, however, the jazz musician must be proficient in reading and interpreting written music, replicating musical phrases by ear, blending with other members of an ensemble, and playing in synergy with a pulsating rhythm section. And jazz improvisers must know how to get out of musical trouble if they play an incorrect note with a correct chord. (There is a business rule for doing this, also.)

Shared Intellectual Property

The knowledge that is required for effective improvisation includes the chord changes of the song being performed, the original melody written by the composer, the form of the song, and a sense of the musical style (funk, swing, ballad, bossa nova, etc.) as determined by the integration of the individual skills into a collective performance. Many jazz musicians can recall thousands of songs from memory.

A key attribute of this sort of ensemble integration is good listening. This includes hearing what other musicians are doing and adjusting one's own playing — volume, phrasing, and so on — accordingly. Two of the more exciting aspects of good jazz improvisation are:

1. Call-and-response
2. Phrase quotation

The former occurs when one soloist plays a musical phrase and another plays an alternative version of that same phrase. The latter is when a soloist takes a phrase from another song's melody and incorporates a modified version of it into the solo. The ability to share such intellectual property can differentiate the creative abilities of one musician from another.

Teamwork

In order for the jazz ensemble to give an exciting, audience-pleasing performance, all of the variables described above must be effectively integrated in real

time. There is no opportunity for performing a composition a second time in a concert. Not only must the members of the jazz ensemble be proficient with their own roles in the performance, they also must be knowledgeable and aware of what everyone else in the group is doing. They must be able to instantly adjust their own playing to create balance and synergy with the others. In some ways, they subvert themselves for the benefit of the collective whole. Yet at the appropriate time, they still add their own individuality of expression into the mix during their improvised solos.

Musical communication is a balance of speaking, listening, reading, understanding, anticipating, interpreting, and keeping quiet. Is that really any different from a business environment?

THE BUSINESS DILEMMA

The dilemma for the executive who may want to improve innovation in the business unit is finding the resources (people, money, time) and making them available for a disciplined innovation practice. With all of the economic pressures in the market, it is difficult to meet the current business demands and commitments, let alone allow a few people to "go innovate." One approach can be found in the following case study.

CASE STUDY: THE DIGITAL SANDBOX

Some years ago, there was a division in Digital Equipment Corporation that was responsible for delivering custom solutions for unique client business needs and for developing new low-volume standard products to complement the high-volume product portfolio.

Many of the new products came from customer needs and ideas. However, others came from a disciplined process that enabled design engineers to devote a limited amount of time to investigating new technologies from other sources. Employees who had an idea for a new product could request a small amount of funding from a pool of discretionary funds that could be used for investigative purposes (in those days, it was about \$5,000 per idea). These funds were formally included in the budget, and there was a defined process for review and approval at the business unit level as well as guidelines for selection or rejection. We called this the "engineer's sandbox," as it enabled hardware and software engineers to go "play" for several weeks to see what they could come up with regarding their particular product idea. Among the guidelines was an expectation that not every idea would result in a new product; in

fact, our measure of success was that one out of 10 ideas would lead to an eventual product for sale.

The concept of the engineer's sandbox incorporated all of the essential components described above. It was a formal part of the planning and operating procedures for the business units. In addition, the level of funding available (usually representing less than 1% of budgeted revenues) was adjusted to remain in balance with the ebbs and flows of the business. The key that made the program work was that it presented a win-win outcome for the participants. The business unit would gain when a new technology was used to produce a new product that satisfied a clear market need. The engineers enjoyed the opportunity to come out of the "pressure cooker" of customer or R&D project work and have a few weeks to experiment. And the risk of failure was tolerable because the efforts were bounded in size and scope.

Did this really work? Well, one of the new products that came from this process became Digital's first successful removable disk drive. (This was in the days of the Winchester drives, which some older readers may remember.) The product satisfied an emerging market need for flexible storage, achieved an acceptable level of sales volume, was profitable, and led to the evolutionary development of more efficient and functional high-volume products from other parts of the corporation.

The major point of this story is that this success, and others like it, would not have occurred without a planned, disciplined process to enable creativity. New product ideas don't just happen; they occur because of some level of dedicated effort. In reality, our experience was very much the same as what occurs in large R&D departments all the time. The difference was that our business was smaller in comparison, our innovation was driven by custom solutions, and the process was formally planned and structured.

CONCLUSION

The objective of this article was to illustrate some of the similarities between jazz music and business innovation. I hope I have presented some new ideas and concepts that you can consider for your own business. I also hope that I've dispelled the myths that creativity "just happens" and that innovation only occurs in large corporations. A formal innovation practice is not only

possible, but necessary, for small and medium-sized businesses. For without it, the smaller company will be at a competitive disadvantage when the competition is first to the market with new products.

It takes a lot of work to create an environment in which technical creativity can lead to innovative products and, possibly, new business endeavors. And the person in charge, whether the musical director or the IT executive, is responsible for creating such an environment. With so much focus on short-term business performance, this notion can get lost. A supportive environment for innovation doesn't just happen; it requires conscious effort on the part of senior executives to establish a workplace in which people can explore and innovate.

ENDNOTE

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A Sea Breeze Jazz recording artist, Mr. Rasmussen is also the founder and leader of the Jazz Factory, an organization composed of several jazz ensembles, from small combo to big band. From 1999 to 2005, he performed with the Altamonte Jazz Ensemble in the Orlando, Florida, area, appearing in concerts that featured such nationally known jazz musicians as Bobby Shew, The Four Freshman, John Von Ohlen, Bob McChesney, Rich Walker, and Jamie Davis. He has also performed with the Les Brown Orchestra. Mr. Rasmussen is active as a composer/arranger, contributing new music for the Jazz Factory ensembles. His arrangements are included on Not So Tenderly, recorded and released on the Sea Breeze label. Mr. Rasmussen can be reached at drasmussen@cutter.com.



Positive Deviants Rule!

by William Seidman and Michael McCauley

Is continuous innovation important to your organization?

This article presents a methodology for identifying and leveraging “positive deviants” as a simple, readily available means of continuous, effective innovation that can be used by virtually any organization. In fact, it has already created great success in organizations as diverse as high-tech manufacturers, quick-service food chains, construction companies, and many other environments. So what are you waiting for? Read on and increase your organization’s innovation capabilities today!

WHAT IS A POSITIVE DEVIANT?

No doubt you are familiar with the term “deviant.” *Merriam-Webster* defines it as someone who “departs from an established course or norm.” Most people think of a deviant as someone who does bad things — someone who disrupts the natural flow of society. However, there are also *positive* deviants. These people are at the other end of the performance spectrum; they are the very top performers (see Figure 1).

The term “positive deviant” was first used by Richard Pascale and Jerry Sternin¹ to describe people who, with exactly the same resources and circumstances as everyone else, are consistently and significantly more

successful than the norm. In any population in any organization, whether it be IT project managers, quick-service restaurant managers, or insurance agents, some people consistently and systematically outperform others. These are the positive deviants. Positive deviants are a great source of innovation.

What makes positive deviants such an extraordinary source of innovation? Unlike most people, positive deviants transcend the conventional wisdoms, discovering new and innovative ways to function *without* creating conflict. By identifying your positive deviants and discovering their unique capabilities, you can quickly and efficiently transform your organization.

WHAT DRIVES POSITIVE DEVIANTS TO BE INNOVATORS?

Positive deviants can routinely violate conventional wisdoms without disrupting the organization because they love what they are doing. They bring passion, energy, and commitment to their work. Because they work at significantly higher levels of intensity than most other personnel, they are, in effect, given permission to go beyond conventional boundaries.

In fact, they are so passionate and committed to their work that they focus much more on finding a way to succeed than on the barriers that might limit their effectiveness. In a sense, they are the ultimate “glass is half full” people, always emphasizing and thinking about what is possible. Not surprisingly, if someone spends a lot of time and energy thinking about what is possible, they tend to find innovative ways to make the possible occur.

Our work has shown that the source of this passion and energy is the positive deviant’s commitment to a powerful, underlying social or moral purpose. While most people are merely surviving their jobs, positive deviants are trying to create greater good for society. For example, we had a recent opportunity to work with pharmacy managers at a large drug store chain. We found that positive deviant pharmacy managers thought of themselves as “a critical part of the family emergency response system,” which is in sharp contrast to the

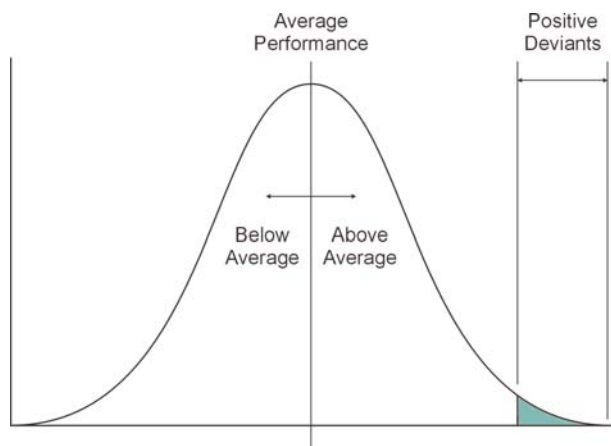


Figure 1 — Positive deviants defined.

less effective pharmacy managers who thought of themselves as “providing 120 prescriptions a day.” Which perspective would drive greater innovation for you: helping families in distress or filling out insurance paperwork?

To be clear, positive deviants are not rebels and they do not disrupt their organizations. Instead, they consider achieving the social goal more valuable and important than conforming to organizational limitations and conventional wisdoms. However, when they consider the possible, they are acutely aware of the limits and boundaries of the organization, so they factor in such things as political concerns and resource constraints without feeling restricted.

Consequently, one key element that makes a positive deviant more successful is a more holistic approach to thinking. For instance, we often hear the comment that an organization is “too politically motivated to encourage innovation.” We respond to that comment with a simple question: “Are there some people in the organization who are more successful than others in managing both the politics and their work?” The answer is always, “Of course.” Naturally, these are the positive deviants, and wherever there are positive deviants, there is innovation.

Not surprisingly, once positive deviants have proven themselves, they are given more latitude within the organization because their positive views are infectious. Organizations want to follow and listen to their positive deviants because they bring so much more energy, excitement, and innovation. They are often the real leaders of an organization.

HOW DO POSITIVE DEVIANTS GET THINGS DONE?

Do you know someone who has great ideas but can never get anything done? Most of us know people like that. In order to be truly innovative, the innovator must also understand and factor in the practical realities of implementation.

While positive deviants’ social commitment is the driving force of their innovation, they are also extremely practical. They know what actions to take, how to manage risks, and which resources will produce the maximum impact, all in support of implementing their innovations (see Figure 2). In fact, positive deviants are generally more efficient than anyone else at driving change.

This efficiency derives, in part, from positive deviants’ alignment of their specific actions with their social passion. They do the work that promotes the desired

innovation but rigorously reject work that is off target. Everything they do is aligned with their passion. For example, the positive deviant pharmacists described above hired differently, choosing technicians more for their ability to connect with patients than their ability to just fill prescriptions efficiently. They also laid out their pharmacies differently, organizing the pharmacy shelves for particularly easy and quick access to the drugs most frequently used by their patients. Most importantly, they interacted with their patients differently — taking more time with each patient, listening to the patient’s issues, and providing additional solutions, such as pressure bandages for diabetics. Similarly, positive deviant customer service personnel at a large service company used support tools differently and worked more as a team.

A positive deviant’s efficiency at implementing innovation also comes from an ability to identify and manage the risks associated with innovation far more rapidly and completely than others. While thinking holistically mitigates some risks, positive deviants are quite skilled at managing the “devil in the details.” For instance, positive deviant process engineers at a manufacturing company were able to identify the risks associated with shop floor changes by using odors as an early warning sign of imminent machine breakdowns. Within five seconds of entering a fabrication building, they could detect an emerging equipment breakdown from the odor emitted by the failing machine. They could quickly identify the risk and execute an effective mitigation strategy. In fact, positive deviant risk management is so fast that it is not often apparent to most people. In most cases, positive deviants can’t even clearly articulate their own risk management process. When questioned, they often say that it is just an “innate ability they have” or that they “just sensed something.”

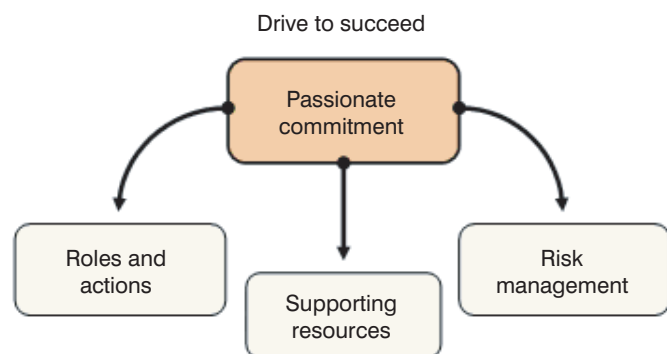


Figure 2 — Positive deviant wisdom.

Finally, positive deviants are intense users of supporting resources because they are open to the idea that, in specific areas, other people and other sources are actually better than they are. “Not invented here” syndrome is rarely an issue for positive deviants. Instead, because they have typically worked with many people and scrutinized a lot of available resources, they are intensely focused on bringing the best resources to bear to achieve their social purpose. Furthermore, positive deviants are better at separating the informational wheat from the chaff. For example, positive deviant product managers at a medical products company were able to point to just three specific sections in three particular reports (out of more than 100 available) as the critical information needed for effective product management. In contrast, less effective product managers scanned through as many as 50 of the reports to find the required data. In another situation, positive deviant restaurant managers used a single number found buried in a thick stock printout to manage their inventory. Other managers pored over the entire printout for hours trying to manage every aspect of their stock.

Finding the positive deviants in your organization doesn't require a lot of time or money. In fact, you already know who they are.

How is it that positive deviants' use of supporting resources is so focused and efficient? Because positive deviants are intensely committed to their goal, they are more rigorous in evaluating an experience for its impact on achieving the goal. So while others have experiences, positive deviants have experiences that are examined for the extent to which they promote the goal. Over time, sources/resources that add value are more explicitly identified and those that don't are ignored. This ability to hone in on critical resources is also related to both the positive deviants' impatience with bureaucracy and their desire for success. They don't just follow orders, but instead look for ways to be efficient, often transcending standard practice in order to achieve success. When positive deviants look at a voluminous report, for example, they look for what is really important and useful in it. Once they've found what they want, they will avoid everything else in future reports and focus in on the key information — regardless of what the standard practice says to do.

In short, positive deviants really know what they are doing and are often leaders because of their powerful combination of passion and practicality.

WHO ARE YOUR POSITIVE DEVIANTS?

Finding the positive deviants in your organization doesn't require a lot of time or money. In fact, you already know who they are.

Positive deviants are those highly respected personnel who lead by example without demanding recognition or mindless adherence to their ideas. Instead, they are flexible and thoughtful, quietly ignoring various social norms.

Here is a quick-and-effective means of identifying your positive deviants. First, identify a specific function (office manager, shift supervisor, pharmacist, software architect, etc.) within your organization. Then, ask yourself, “Who are the people I most respect for their ability to perform this function?”

Can you visualize these people? Most executives and managers can immediately visualize their positive deviants. Ask your peers the same question. Can they visualize these people? Are they the same people you thought of?

Now let's test it some more. Ask yourself:

- If I have a problem in this area, are these the people I go to for a solution?
- When these people tell me how to solve the problem, do I both believe them and act on their ideas?

If your answer is “yes” to these questions, you have identified your positive deviants.

As you may already have figured out, “respect” is a very powerful concept. Respect is much more than an ability to drive numbers or be friendly with people. After all, it is possible to drive numbers and make friends in ways that do not support the long-term organizational goals or promote social commitment. While positive deviants have, at some time, driven metrics and are invariably friendly and gracious people, these factors are not the foundation of positive deviance. Positive deviants gain respect by achieving results in ways that are positive, efficient, and energizing for those around them.

The method we've just described for identifying positive deviants may seem simplistic, but it works! It is the result of our extensive experience plus exhaustive,

structured testing. Just to be sure this approach really worked, we conducted several formal statistical analyses of groups to identify their positive deviants. The statistical work took a minimum of three weeks for each organization. The statistical analyses came up with the exact same list of positive deviants as was identified in two minutes using the visualization process above.

During our testing, we also discovered that this visualization process transcends organizational and geographic boundaries. For example, when asked to identify their positive deviants, the 12 regional managers of a quick-service food chain identified the same eight people, even though they were most often in other regions. Similarly, in a worldwide manufacturing company, the executive team identified the same positive deviant engineers even though the engineering function was scattered around the world. Positive deviants have almost mystical qualities that are recognized throughout organizations. Consequently, once you have visualized your positive deviants, you can be confident that you have, in fact, identified them.

DO POSITIVE DEVIANTS KNOW WHAT THEY KNOW?

Unfortunately, positive deviants are unconsciously competent. In other words, they don't know what they know, and they can't answer the question, "What do you do that makes you so innovative?" They just innovate, which is good, but this does not create systematic innovation in an organization.

Fortunately, what they know isn't deeply hidden. You just need to know what questions to ask and how to ask them in order to open up the positive deviant's treasure trove of innovation and "wisdom." Through nearly 11 years of work, we have developed a technique called "Wisdom Discovery" that is designed specifically to access the best of the positive deviants. Here is how Wisdom Discovery works:

- Identify six to eight positive deviants in a particular function. (This is all that is needed, even if there are thousands of people actually performing that function.) We described this process above.
- Bring them together in a workshop-like setting for three days. (It only takes three days to gather all of their expertise.)
- Interview them from the perspective of a "naive new person" about their passion, organization, work, risk management, and resource utilization. (Taking on the naive new person role enables you to ask the "stupid

questions" that bring out the complete positive deviant response.)

- Record their responses to your questions in real time and display them by projecting them in large format. (This enables the positive deviants to see what they have said and self-correct instantly, producing still more profound content.)

At the end of Wisdom Discovery, a wide range of innovative ideas will have emerged, as well as specific action plans to implement the innovations.²

WHAT IS THE VALUE OF INNOVATION THAT NOBODY USES?

Of course, if nobody uses the innovation provided by the positive deviants, then its value is zero. While this may seem obvious, many organizations have difficulty with implementation.

A few years ago, we worked with a group of aerospace engineers to discover their positive deviants' wisdom. The discovery process worked like a charm — the organization's management was amazed at the innovations that had been "discovered" in just three days. When we asked them what they were going to do with these new innovations, they looked at us and said, "Interesting question — we never thought about that!" This organization was disbanded a few months later, primarily because the organization as a whole was not generating and implementing sufficient numbers of innovations. Discovering wisdom isn't enough to ensure that an organization becomes innovative. Here, too, positive deviants can help.

Recall the importance of respect in the process used to initially identify the positive deviants. When an innovation is presented to the organization as coming from one of its positive deviants, it is always treated with greater seriousness than if it came from other sources. For example, when an insurance company recently implemented a highly innovative agency management program — the brainchild of a number of the company's positive deviants — the program was presented to the organization as coming from those deviants, not from "corporate." The agents who were asked to implement this new program reacted by saying (and we quote): "This came from Larry? I can't wait to see what he has to say" and "This is how Mary does it? Then I'm in. Just tell me what to do." The respect given positive deviants is a powerful force for driving the adoption of innovation.

Does the initial motivation to try an innovation produce sustained use of the innovation? Unfortunately, no. While innovations do not get adopted without some positive motivation, positive motivation alone is not sufficient to sustain their use. Here again, the positive deviants provide guidance on how to produce a sustained impact. Research on brain function indicates that repetition of the innovation is essential for creating a long-term impact.³ As part of Wisdom Discovery, the positive deviants identify the practices required to produce long-term impact and the frequency of repetition of these practices to ensure complete integration with each individual's attitudes, behaviors, and skills. As one initially less effective customer service person said, "I used to think of the positive deviant ideas as just more work. But then I realized they were actually teaching me how to think differently. Now I realize that the positive deviant ideas and actions are my real job, and I do it this way everyday."

INNOVATION FROM THE BOTTOM UP OR THE TOP DOWN?

Which is more effective: a bottom-up, grassroots pull for innovation or a top-down, forced push for innovation? You may say that the answer is obvious — grassroots pull is better. So why do so many companies try to force innovation from the top down? It's probably because most organizations don't know how to utilize their positive deviants.

As may be apparent, when organizations combine all of the elements of positive deviant innovation, they feel as though innovation is grassroots — pulled by each person's requests for improvement and not driven by executive pressure. Not surprisingly, when innovation is pulled by the organization, it is adopted much more rapidly, completely, and without the disruption usually associated with radical change.

IS POSITIVE DEVIANT-LED INNOVATION FOR YOU?

The question really is "How can it not be?" Over the past 11 years, we have implemented this process throughout numerous organizations across diverse industries. The results have always been the same. For those organizations that truly adopt this new paradigm and follow through, the change is rapid and transformational. In just 12 weeks, one company saw a 5% increase in sales at their stores that utilized this process. Another company saw one of their development cycles shrink

from 24 months to just eight months when they used their positive deviants' wisdom to drive innovation.

These results are typical. Similar results can be seen in your organization. So what are you waiting for? Go out and find your positive deviants today, and begin reaping the rewards of transformational innovation!

ENDNOTES

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²If the discovery process interests you, there is a more complete description of it in a white paper entitled "Harvesting the Experts' Secret Sauce" at www.cerebyte.com (in the Articles Library).

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Creating an Agile Work Environment to Nurture Innovation: Lessons from the Performing Arts

by Kalpana Sampath

Agile work environments are highly sought after as a means of developing high-performance teams. In this article, I will elaborate on the factors that promote the creation of an agile work environment and a culture that supports innovation as a way of life. An agile work culture is expected to enable a high level of change sensitivity, coupled with team synergy. Such cultures seek to bring out the best in each individual, while at the same time drawing out the best performance when those individuals become a team.

Given these expectations, there's much that would-be agilists can learn from the performing arts, which call for the highest level of individual performance along with group synergy. Every art production has its own uniqueness. To present a theme in one's own way and to present a point of view through an art form requires large doses of creativity and innovation. Innovation cannot be a onetime activity. It has to be embedded in the work culture.

In the discussion that follows, I will explore — based on my two decades of career experience in both the performing arts and building high-performance work cultures — the lessons the performing arts offer to those seeking to build an agile work environment. This discussion is based on the assumption that agile work environments help to create organizations that work toward excellence in every aspect of their existence.

Usually a major part of any exploration of innovation centers on techniques and attitudes that aid innovation within the individual and/or the organization. Equally important, however, is a culture that is conducive to stimulating, sustaining, and enhancing innovation in those individuals and organizations. Innovation requires a culture where people feel they *belong*, where they can be themselves and bring forth what they have in their mind to the team and add value to the existing products and processes. In my doctoral research on “belongingness” in an organizational context, I identified eight dimensions that are critical to building an agile work environment:¹

1. Clarity of vision and purpose
2. Sense of ownership
3. Exploration and development of potential
4. Recognition of contributions
5. Professionalism
6. Alignment of personal and organizational values
7. Emotional satisfaction
8. Material comforts

Together these eight dimensions form the foundation on which innovation can thrive and become a way of life in an organization. In the remainder of the article, I will show how these dimensions find expression in the performing arts, how they apply in the agile work environment, and how they contribute to innovation.

1. CLARITY OF VISION AND PURPOSE

In Art

To conceive and develop an art production — be it a theatrical, musical, or dance performance — one requires clarity of purpose. The broader vision serves as the foundation on which the performance is based. What is it that the entire program wants to convey? If this question is not answered, there will be several gaps that the audience will experience in the show:

- There will be a disconnected selection of pieces for the presentation.
- People and their capacities will not match the presentation.
- There will be no flow in the tempo of the performance. This will make the audience uncomfortable in their journey through the show.
- The artists will leave behind no lasting effect on the audience.

- There will be no specialty or uniqueness that would cause the audience to identify with the artists. Therefore, in the long run, the group will fail to earn a constant group of people who will be loyal to experiencing their different productions and appreciating the variables in their performance.
- The target audience itself will not be clear, thus hindering the production's ability to draw people to watch the performance.

While the vision is the desired end state, purpose provides clarity to the vision. Why is the performance being presented? Is it for entertainment, for sending a message, for reflection, to preserve the art, to display the artists' prowess, to show the synergy in the group, to experiment with new presentations, to awaken society, or what exactly? A clear understanding of the vision and purpose will carve out a niche for the production, including the group and the individual artists.

Innovation is not the responsibility of R&D or management or the "genius" members of the organization alone.

In the Agile Work Environment

Clarity of vision and purpose is critical at the organizational level as well as at the team level. It is the base on which every decision anchors. Since there are many people involved in the functioning of the organization, it is important that the vision be well articulated and disseminated throughout. The vision is the desired future state toward which the organization intends to move. It is different from goals and objectives.² For instance, an objective is a part of a goal, and every goal comprises many objectives. A few selected goals knitted together with a purpose form a mission, and several missions aligned to move in a single direction form a vision. When one talks of a vision, there is an "ultimate-ness" to it. This acts as an anchor every time there is a need to bring focus to the teams.

Innovation and Vision

Innovation cannot be for its own sake. It must occur in the context of the organization's vision; otherwise, it cannot be translated into the reality of a new product or service. When members of the organization are clear on the organizational vision and the impact an innovation will have on that vision, they will come up with

innovations that can be translated into reality, thus wasting less time and energy.

2. SENSE OF OWNERSHIP

In Art

Unless every single artist owns the project, the performance cannot achieve excellence. It may be just one dialogue, a scene, or a few steps, but each is a critical link in a performance. If each artist does not feel he is important and that his role is a showcase of his talent and identity, the sense of ownership will not be present and the performance will not achieve its greatness. This applies equally to behind-the-scenes individuals who support the performers. Sometimes everything else about a performance is outstanding, but an ill-chosen lighting effect or flawed makeup brings down the effect of the entire performance. Until every individual involved is aware of the difference she can make to the final output, excellence is not possible. A sense of ownership makes people feel responsible for the entire project and not just their particular role.

In the Agile Work Environment

One of the key requirements of agile teams is for individuals to own the entire task and not just their specific job. This shrinks response time, because they are able to place their job in the perspective of the whole task. As with the performing arts, it is not possible to achieve this until the individual team members have a sense of ownership. Agile work environments have individuals who may be in support roles, but they are well aware that their actions influence the final output. They go beyond self and help each other to ensure the customer demands are met and response time is minimized. Individual team members take pride in their collective achievements and stretch themselves in response to the content of the task.

Innovation and Ownership

Innovation is not the responsibility of R&D or management or the "genius" members of the organization alone. Every member of the team should have the mantra "How can I add value and make this better?" Many an innovation fails not due to its content but to lack of support within the organization for implementing it. When there is a high sense of ownership, the members have a holistic perspective toward the growth of the organization. They take pride in the new dimensions added by the innovation and will support its implementation in the interest of the greater good.

3. EXPLORATION AND DEVELOPMENT OF POTENTIAL

In Art

For every artist, exploration in art has a high internal satisfaction factor. If artists feel that a performance is merely a repetitive exercise and there is no scope for exploration and development of their potential, their level of internal engagement with the show is reduced. When this happens, passion and intensity are lost, and this brings down the artists' ability to reach out to the audience. It can even affect the group's reputation and the trust people have in their ability to communicate the intended message. Therefore, there must be scope for developing an artist's potential. Artists who care about excellence will choose different, challenging pieces/roles to perform. They will explore and extract the hidden talent within themselves to give freshness to their performance. Even if the same piece has been presented by several other artists, an audience will still make an effort to experience a presentation by an artist who is willing to explore his own potential.

In the Agile Work Environment

It is no overstatement to say that knowledge workers leave if they cannot learn and develop in their job. Monotonous, stagnant working environments are a major factor in attrition. In agile work environments, the need to offer new challenges becomes even more critical. Organizations have to strike a balance between allowing people to explore and enabling them to complete and deliver projects. The ability to risk, experiment, and allow creativity to blossom is essential to retaining the organization's human capital.

That said, many organizations grow and move ahead because of the particular people who are making the decisions rather than efforts to build a learning culture. Customers may become attached to certain people on the team rather than the ability of the team to provide the best solutions. This makes the organization person-driven. But agile organizations, which are dynamic in their functioning, need to build a learning culture in which "the purpose is beyond self." The ability to learn and provide the best solutions is a way of life in such organizations, regardless of which team members are involved.

Innovation and Development of Potential

A child is a good example of developing potential. The world looks so new and inviting that a child experiences innovation everyday. A learner, too, is a child

at heart. When the agile work environment supports learning and exploration, it nurtures the child in each member of the organization. This makes out-of-the-box solutions a way of life. For a learner, every problem is an opportunity and therefore a space for innovation. A learning culture will promote openness, initiative, and curiosity, which are the prerequisites of innovation.

4. RECOGNITION OF CONTRIBUTIONS

In Art

Exploration and development will happen at the group level only when artists feel their contribution is valued. They may be compensated in monetary terms for their efforts, but that pales in significance if their artistic contribution is not valued and publicly recognized. Furthermore, those who acknowledge even the backstage artists have seen higher levels of performance than those who take these people for granted. The recognition that artists get for their contribution to art further serves as a motivation to scale newer perspectives in art. Innovations occur when artists stretch the boundaries in moving from known to unknown.

In the Agile Work Environment

When the team performs badly, there are any number of review meetings, but when they do well, there is only a group celebration or collective acknowledgment. In some organizations, success is even taken for granted. But agile work environments cannot afford to do so. Since there is constant change, great work mobility, and high expectations for deliverables, the efforts of individuals need to be visibly acknowledged and valued. Not only does this communicate to the individual team member that she makes a difference through her contribution to the group's work, it also makes the team confident of the competencies and talent available to them. This recognition can also indirectly motivate others in the team to make their own contributions.

Innovation and Recognition of Contributions

Innovations happen when an individual believes in himself. When innovations do not see light of day, it is not because they don't occur in the minds of individual team members, but because they think organizational processes will not value the suggestions. When an organization values the contributions of its members, it sends the needed message that any innovation big or small is valuable and will be part of the organization's evolution.

5. PROFESSIONALISM

In Art

Many do not believe “artists” and “professionalism” go together. That is because the word “professionalism” has been corrupted by the actions and myths that have emerged from the corporate world over time. For an artist and the group, professionalism would mean: fitting the role to the person’s best capacity; respecting every individual and every role in the group; doing what one says one will do; putting the team’s interest before self-interest in every decision; responding to what is required rather than what one wants; and having an internal sense of discipline. The artist is respected for being the person she can be while working in a group rather than merely for her expertise. A true professional not only respects herself but also others in all her interactions.

In the Agile Work Environment

The agile team, too, requires a high level of commitment, respect, and expertise to deliver results. The experts have to understand that their expertise is for a purpose and that they must therefore put the project vision before their own. Professionalism manifests itself in the way a team is able to handle its role and the power that comes along with it. Agile teams require consciousness rather than ego to prevail all their actions and decisions. This, in effect, defines professionalism in an agile work environment.

Innovation and Professionalism

Innovation is not complete merely at the thought level. It is complete only when it is translated into a usable product or service in an organization. Most innovations involve changes at several levels within the organization. Where there is a high level of professionalism, the processes automatically shift to implement the innovation. Consciousness prevails. But if professionalism is lacking, ego clashes can become a hindrance, thereby hampering the organization’s progress.

6. ALIGNMENT OF PERSONAL AND ORGANIZATIONAL VALUES

Synergy cannot be achieved unless values are aligned. Values give meaning to the vision and determine the process by which the vision will be achieved. Values can be defined as “the beliefs I hold within myself which govern my behavior in any given context.”³ Values may also be defined as a person’s internalized

beliefs about how he ought to behave.^{4,5} When there are varied set of beliefs governing people in a team, there is disharmony within the team. The misalignment can exist at two levels: first, within the person with regard to what he believes and the behavior he thinks he has to express to be accepted in the organization; and second, the varied beliefs that govern the behavior of the individuals within the team.

In Art

Passion and identification make for the best performance. Therefore, all the artists who work on a production should be governed by similar beliefs about what they are doing. Unless there is a synergy among the members of the group on what they value, they will not be able to understand each other and will lack common ways of functioning. If the group values are different from the artist’s personal values, there is an internal conflict within the individual artist as well as between the members of the group. This can suck energy out of the group and cause them to be fragmented.

In the Agile Work Environment

In an organizational context, every individual experiences three kinds of gaps:⁶

1. What one wants to be versus what one is (Intention-Action Gap)
2. What one is versus how one is perceived (Action-Perception Gap)
3. How one is perceived versus what is expected by the organization one belongs to (Perception-Expectation Gap)

Efforts are required to help individuals align themselves and work toward reducing these gaps. This will in turn improve the response time of the individuals, projects, and the organization, which is a major contributor to agility. Reducing the gaps requires a thorough process of values clarification — not through a prescriptive process, but through a realization and change process. To bring about the realization and change that lead to transformation, the changes have to be deep and foundational. Working with the beliefs of the individuals brings about deep change.⁷ Beliefs lie at the cause level, while behavior is only at the effect level. The organization should help the individual to align within herself as well as assist the team in formulating a clear set of governing beliefs. Such efforts would ensure a common language amongst the team members, which in turn would enhance team synergy and commitment.

Innovation and Alignment of Values

Every innovation brings a shift in the organizational paradigm. Erosion of values occurs when the values ushered in by innovation are not aligned to the core values of the organization. Some paradigm shifts can also create attrition because of value conflicts. In an agile work environment, when the beliefs are aligned at a personal and organizational level, innovations will be value adding and not value depleting. If a paradigm shift is necessary, change management processes will be initiated at the beliefs level and not at the behavioral level. Therefore, the effects of the innovations will be long lasting and accepted by the members of the organization.

7. EMOTIONAL SATISFACTION

For the vision and values to be aligned, one of the critical components is the alignment of emotions. For this reason, the members of the team must have a high level of emotional consciousness. Emotional consciousness can be defined as “Our ability to align with the larger consciousness and allow it to flow through us to be able to respond with the emotions that are needed in a given context; that what we think is appropriate to that context.”⁸

In Art

In Indian classical dance (Bharatanatyam), the emotions expressed have two dimensions: the “Staayibhava” and “Sancharibhava.” Staayibhava represents the core, foundational mood of the artist in the piece being performed. It is related to the nine emotional states, or “Rasas,” such as love, humor, anger, compassion, and so on. The Sancharibhava represents the different emotions that can be expressed to communicate the Staayibhava. For example, anger, rejection, remorse, happiness, and possessiveness can all be expressions of love. An exquisite performance results when the artists have developed bonding within the group. This bonding happens when they both understand the core emotional space in which they are all connected and have the freedom to express their emotions in several ways.

In the Agile Work Environment

With time pressure and expectations on the team members mounting, there is very little time that individuals have to interact with each other. Furthermore, members of virtual teams hardly have the chance to know and express themselves. This limits the extent of bonding within the team. Organizations today try to address this issue with picnics, outings, club memberships, get-aways, celebrations in the office, and so on. But these

work only on the surface; the effect lasts for the day and leaves little behind compared to the efforts that go into it.

There is a better way. First, individual team members have to work on being emotionally aware. Then they have to relate to a clear purpose (vision) and set of beliefs (values). This process pegs them to a core emotional space in which they can interact with each other. This space cannot but have love, trust, and acceptance in it, all of which are very critical. Then, when the team members are emotionally conscious, there is a natural appropriateness that emerges in every situation. This helps them sustain their connectedness whether they work in one location or in virtual teams in different locations.

Innovation and Emotional Satisfaction

No innovation is purely a thought process; there is always an emotional dimension involved. Innovations happen easily when the individuals feel secure in the space in which they perform. Moreover, no organizational innovation can be purely an individual effort — there is a lot of interdependence involved. In an agile work environment where there is a high level of emotional satisfaction, the mutual support of the team will enable out-of-the-box thinking to be expressed. During the implementation stage, when experimentation has to be done and fear of failure can grip a team, emotionally conscious teams will understand and support each other to see the completion of the thought. Sometimes indifference can be more detrimental than negative comments. A team with high sense of belongingness will understand the needs of its members even without verbal articulation and will give what is required.

8. MATERIAL COMFORTS

Finally, infrastructure, comforts, and compensation play a significant role in ensuring the team can move toward excellence.⁹

In Art

The comforts in an art performance are mainly related to the infrastructure needed to make the production the best possible. Compromises may hamper the quality, but if the team is aligned in all other dimensions discussed above, they will come up with alternatives to ensure they get what they require to complete the production. Compensation does become important when they need senior artists. But history has proved that if the production has substance and depth, artists will more likely participate because it is aligned to their vision than for the money alone.

In the Agile Work Environment

In my study of what makes employees feel belongingness to an organization,¹⁰ I found that material comforts are a significant dimension but not a deciding factor. Belongingness can be defined as a “state of being born out of a relationship, in which one experiences value for oneself, being cared for with a space for continuous evolution leading to the need to fulfill the expectations of the relationship and beyond.”¹¹ It is internal, tacit, and grounded in what the individual human being is seeking for himself. This makes belongingness not a destination, but a continuously evolving process. Innovation, then, will not be an attitude that has to be instilled into the organization, but rather an outgrowth of the natural evolution of the organization and its members.

Innovation and Material Comforts

One dangerous thought that can inhibit innovation is “What’s in it for me?” People who come upon innovations are those who are more focused on the process than what they will get at the end of it. When the basic material comforts are taken care of in the agile work environment, monetary considerations do not hinder the emergence of innovations or implementation of the same.

FINAL THOUGHTS

To go to a new place, I need to take a path I have not taken so far. If I try to go in the path I know, it is unlikely that I will reach the new place.¹²

Innovation is an outcome of an environment that nurtures the growth of individuals and teams as holistic beings. It accepts the core need of all individuals to belong and give their best of themselves and to the environment that surrounds them. Techniques and processes of innovation thrive better in an agile work environment that nourishes these eight dimensions on an ongoing basis. If innovation needs to be enhanced in the organization, the foundational elements of the environment require equal attention.

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Apart from a PhD in social science, Dr. Sampath holds a master’s (VIDVAT) degree in Indian Classical Dance from the government of Karnataka, India. Her experiments with art forms include women in their middle age using dance as self-expression; “Ganabodhini,” a series that combines values with music to bring to the fore the lyrical element of music; folk dance workshops with children; contemporary dance with youth groups to facilitate addressing identity issues; and work as a theatre artist and director of plays. Dr. Sampath can be reached at kalpana@arpitha.com.



Sparking Innovation: The Art of Software Process

by Nancy Van Schooenderwoert

To many people, the process of creating great art or new innovations is a bit of a mystery. At the same time, the development of IT systems is viewed as drudgery. Yet from my experience in both the art and IT fields, artistic and innovative processes can and should be linked. How can we apply the creative skills that artists possess in abundance to develop innovation-friendly IT teams? I see three key patterns:

1. Mindset (or process)
 - Every part supports the whole
 - Form follows substance
 - Aesthetics
2. Distributed control
 - Express a clear vision
 - Focus
 - Inspired, not appointed
3. Personal commitment
 - Planning determined by medium
 - Control and spontaneity

I have always approached my engineering work in the same manner that I do artwork — with passion and creativity. By the end of my college years, I majored in software engineering, but from preschool through high school, my focus and talent had always been in the visual arts — drawing, clay sculpture, a little painting. Along the way, I discovered that physics and engineering were just as creative endeavors. As my career progressed, my interest in finding practical ways to develop bug-free software ultimately led me to agile methods. Agile practices have elevated my thinking in two crucial ways: I learned that innovative software work can be done as a team, and it can be delivered within time and scope bounds set by another group — the business.

My purpose in this article is to examine the aforementioned three patterns — a proper mindset for creative thinking, the right control framework, and a personal

commitment to excellence — which I believe can improve the delivery of IT innovation. These elements of the artist's methodology speak most compellingly to IT.

ARTIST PATTERNS THAT CONTRIBUTE TO INNOVATION

Every Part Supports the Whole

For an artist, the very definition of a well-executed piece is that each part supports the whole. In art, suboptimizations are readily apparent. They spoil the visual sense the artist is seeking. Sadly, in business, the individual units often work against the best interests of the overall organization, and suboptimization is rampant. For example, an insurance company's IT department created a startup script that runs for a few seconds on each employee's PC to check for prohibited software installations. It seemed like such a good idea that the list of things it monitors quickly grew like kudzu. Boot-up time now averages over 10 minutes, so most of the 3,000 employees leave their machines on, defeating the original purpose and wasting electricity.

Because each such problem is small enough to be ignored, a company will accumulate more suboptimizations over time, eventually creating a significant drag on efficiency. The best way to combat this sort of "death by a thousand cuts" is to enlist the personal commitment of ordinary employees in eliminating it. In business it takes a serious cultural shift to truly address suboptimizations. It requires cooperation and understanding across organizational boundaries — something that is seldom rewarded when people are juggling multiple commitments within their own area of specialization. Success in optimizing practices throughout an organization is not unprecedented, but is in my view a kind of undervalued innovation in its own right that sets the stage for more.

Form Follows Substance

Many artworks use the nature of a medium to advantage; for example, a mass of suspended folded paper can evoke a flock of birds. Others simply draw the eye

to an existing pattern, such as a wood sculpture that highlights an unusual grain. The artist controls the output through intimate knowledge of the medium — oil paint, glass, wood — that he works in. Many unseen iterations have taught the artist to mix the paints correctly to achieve the desired effect.

In software, the inner structure and composition are hidden from casual view. Quality is hard to test, so it has to be embedded in the very fabric of the code. Product is the outcome of process, both for software and art. Like the artist, a master developer has gone through untold iterations in learning to handle situations such as interprocess communications, or asynchronous communications. While details are different, there are commonalities across every language and platform. The software patterns community has emerged for this very reason — to leverage what is unchanging in a constantly changing profession.

Rules can be a support for personal commitment, but they are never a replacement for it.

Both in art and IT, practitioners must attain a deep knowledge of their tools and medium in order to consistently produce quality work. But what *is* quality work? In art, the artwork sells (or pleases the critics) or it does not — although tastes do change over time. However, software quality is far more difficult to measure. Unlike art, where quality is in the eye of the beholder, we judge software quality by the number of defects found. Agile software development is an example of a process that has produced truly innovative results: agile software teams consistently achieve bug rates of roughly one to three bugs per month for the entire team.¹ Replicating this level of performance is possible if two key ingredients are present:

1. An iterative coding and testing practice to effectively address software complexity
2. Deep knowledge of the medium — the software tools and business problem domain

The payoff for achieving these quality levels is virtually no debugging time. High quality is achieved while completing the work in significantly less time (often 30%-50% less), due to the leveraging of agile processes. This level of quality and productivity is an innovation

in software development that is directly attributable to use of an appropriate process and deep knowledge.

Aesthetics (or, Good Code Looks Good)

Over the years, I have had the privilege of working with quite a few outstanding software developers. I cannot think of a single person in that category who didn't go out of his or her way to keep source code indented and variables well named. It's not just the code — the call tree diagrams look orderly, too. This is not merely aesthetics for its own sake. This orderliness helps us to reason about the software, communicate about it, and envision the plan for the next set of changes.

The reverse is also true: ugly code can easily hide bugs. The agile community has even tabulated categories of software "smells" that indicate a need for a code cleanup. One example is duplicated functionality, with the resulting difficulty of keeping changes in sync.²

Far too many companies assume that if they enforce coding standards, that action alone will ensure good software. Rules can be a support for personal commitment, but they are never a replacement for it. Developers who use good aesthetics are exhibiting a seriousness that goes beyond the minimum necessary to stay employed. They are taking full responsibility for their work. Building a deep knowledge of the tools and media (languages, operating systems, etc.) of software development requires study and mentorship, and this personal commitment is usually not strongly tied to extrinsic motivators like pay increases. A good example is the commitment shown by open source developers, who build their reputation as well as learn and teach software skills without such incentives. There must be a personal commitment to the aesthetics of good art or of good software as a starting point for new ideas. Personal commitment is a foundation, a prerequisite, for innovation.

Express a Clear Vision

Art expresses a vision, whether it comes from an individual or a group. A painter working from her own ideas acts as both the sponsor and the creator of the artwork. In contrast, a typical software development project requires inputs from those commissioning the work (end customers, internal stakeholders, partners), not just those creating it. All the communication that happens internally in a flash for the artist needs to be expanded to encompass two distinct groups of people — sponsors and implementers — who must develop a clear business vision and a clear technical vision, respectively. Each group needs sufficiently robust internal communications to make ongoing tradeoff decisions about their

vision. Clearly, there has to be robust communication *between* these groups as well.

How does a team do the equivalent of thinking with one brain? We need to create explicit mechanisms to combine the business and technical thinking processes. To achieve this goal, agile teams sit together with the product owner and use other high-touch communication techniques to replicate the instantaneous feedback loop that occurs between the artist's eye, brain, and hand. Explicit communication mechanisms agile teams typically use include:

- Testers creating acceptance tests to verify that features behave as the product owner desires
- Developers writing unit tests to ensure the software behaves as they intend
- The whole team, stakeholders, and managers holding retrospectives (or kaizen sessions) to implement continuous improvement
- Regular updating and posting of key progress indicators, such as burndown charts, quality metrics, number of features accepted into production, and so on ("information radiators")
- Daily standup meetings to coordinate team activities and to flag impediments

Well-executed IT software projects implement a clear business vision *through* a clear technical vision, and these don't come about by accident. In agile teams, the businesspeople stay in control of the "what to build" decisions while the technical folks decide "how to build it." Technical teams can then give honest estimates, and the businesspeople can change or reduce scope if those estimates don't fit their business goals. This separation of responsibilities is key to establishing a clear vision for both the business goal and the technical pathway supporting it. Such a vision is necessary to allow innovation ideas to more easily come through.

Focus

Being able to focus on a piece of work to completion is essential to doing it efficiently. Whether it's artwork or anything else, you're not likely to hear anyone arguing against this. Yet often on IT projects, people are time-sliced across multiple projects. The time spent on context switching can never be recovered — it's pure waste. People with narrowly specialized skills are particularly prone to time-slicing. Ironically, it is the drive for 100% utilization that forces the loss of focus so crucial to getting the job done right.

Prior to joining an agile team that I launched, one software architect told me, "I only get to spend a week or two on each waterfall project because I just do the high-level design. I don't get to make it work. This siloing is de-skilling us!" The best way to limit this effect is through cross-skilling. While it's good for each team member to have deep knowledge in some area, it is also good for the team and the member's career to add some familiarity with a related skill. This allows quick planning at the start of an iteration because the team members are able to work more flexibly. Everyone enjoys having a broader understanding of the product, and that leads to better brainstorming when problems arise. The software architect just mentioned should be contributing to the implementation of his designs, not just sketching UML diagrams.

How does this link to innovation? In every business activity, managers must contend with uneven work-flows. If your workload fluctuates, you must keep enough staff for the "peaks," but these individuals are idle during the "valleys." By having a "shadow backlog" of investment work that is valuable but *has no hard deadlines*, you can fill those valleys in a way that will pay off. Queuing theory tells us that the patches where individuals are idle are *not* actually wasted time.³ It says that when you increase utilization beyond 80%, you actually *slow* the system down. Less is produced. This cannot be solved by cutting everyone's hours by 20%. The whole point is that roughly 20% of everyone's time is unavailable for deadlined work. It is this buffer that allows the system to run optimally, an idea that Cutter Fellow Tom DeMarco elaborated on in his book *Slack*.⁴

Does this mean we pay people to do nothing for 20% of the time? Not if there is valuable work that can be done without switching to another project. Agile teams have plenty of flexible investment work such as refactorings and test automation that will boost the team's productivity. The point is to not have everyone on a frantic treadmill but to allow them to focus deeply. If the team can stay focused on the project, they are more likely to come up with innovative solutions to difficult problems.

Inspired, Not Appointed

Artists are inspired to create their works, but project team members are usually appointed by managers. There isn't necessarily anything wrong with this; what matters is that team members work willingly together. Nevertheless, the level of commitment to the effort and the teamwork might not be optimal.

One company, ICU Medical, Inc. in San Clemente, California, USA, tried an idea to move more decision

making to its employees.⁵ The CEO, George Lopez, was overwhelmed with work as the company grew past 100 employees. He decided to let employees form teams (in addition to their regular jobs) to boost production through innovation. It didn't work — with no leaders and no rules, there was lots of talk but no definitive action.

So Lopez decided that teams should elect leaders, and he followed through by hiring an HR director to create a low-bureaucracy structure to facilitate the teams. The director devised “core values” guidelines for team decision making and team bonuses for successful ideas. This created just enough structure so that the teams could work optimally.

Even when the medium does not allow fast iterations, “big design up front” is still not the best answer for innovative companies.

When advising managers in how to assemble a good agile team, I recommend training so that team members get an understanding of the agile basics, and then I ask for volunteers. Provided the team gets the necessary skill mix, having people volunteer helps to create the same sense of ownership that artists feel in their work. The only other crucial ingredient is techniques for effective group decision making. I recommend the time-limited consensus mechanism described by Ellen Gottesdiener.⁶ For this to work, you need to outline the bounds within which the team can make decisions, and you'll need to understand the decision-making mechanisms in advance.

In my coaching experience, the teams that took the strongest ownership over their work have been those who elected their team leaders. By “ownership” I mean that these teams would do just about anything to bring their projects in on the promised date because it was *their* promise, and everyone individually felt accountable for it. It is important to respect the team's choice in leadership — after all, teams might not elect the person you would have appointed. Elections can be problematic in teams that are part employees and part contractors. Should they all have equal say? If that is not the case, or if you are unwilling to accept certain people being elected, then avoid using elections. Personal commitment is what matters here, and there is more than one way to inspire it.

Planning Determined by Medium

There has been a lot of debate concerning whether — and how much — up-front planning is really required for software projects. There is no blanket answer. In my work with embedded systems, clearly the hardware requires significant advance planning and the software not as much. Generally for agile teams, I coach them to plan the first couple of iterations in detail and then leave some room for learning and the flexibility to act on what they find.

The key is the medium in which the work will be done; thoroughly understanding your medium is a measure of your skill in both art and IT. A watercolor painting may require more planning than an oil painting because you cannot just paint over watercolors when you've made a mistake. On the other hand, a friend of mine (who has done many more watercolors than I) commented, “It's my experience that watercolor artists do almost no planning and oil painters do a lot. Watercolorists work really fast, and if there's a mistake or a spill, they simply throw it away and start another.” That makes sense to me. I might plan the watercolor painting carefully before starting, or I might get good at turning mistakes into features, or I might get so fast at it that I just keep starting over any time I make a mistake that I can't salvage.

As Cutter Fellow Rob Austin and Cutter Senior Consultant Lee Devin observe in their book *Artful Making*:

The cost of *iteration* — the cost of reconfiguring a process and then rerunning it — significantly impacts the way we work. Reconfiguring an auto assembly process would involve purchasing and installing millions of dollars worth of new equipment. So, typically automakers usually do lots of planning before they commit to a configuration. They don't want to have to reconfigure very often. They try to “Get it right the first time.”

On the other hand, some software development processes are designed so that they can be reconfigured cheaply and quickly.... Because it doesn't cost much to iterate, the value of doing so is greater than the value of thinking about how to do. Cheap and rapid iteration allows us to substitute experience for planning.⁷

These quotes nicely sum up my experience with agile hardware and software projects. Since your medium determines how fast you can iterate, balance the medium's constraints with the axiom “The faster you can iterate, the faster you can innovate.” But even when the medium does not allow fast iterations, “big design up front” is still not the best answer for innovative companies. When the stakes are high, time to market is important, and understanding of the problem is still evolving, lean companies use concurrent development.

They explore multiple designs to a point where they can select one knowledgeably.⁸ This has been characterized as “Make it great before the deadline,” and it is a good counterstrategy to trying to get it right the first time.

Control and Spontaneity

Agile teams have much in common with artists when blending control and spontaneity. In art, things are much more under control than they appear. When work proceeds in an orderly, *controlled* way but without anyone needing to give explicit orders, managers often find it baffling. I’ve found that this ability is something people simply do not believe until they experience it.

I once held kickoff training and workshops for a new agile team of six, including Andrea, a very able traditional-style project manager. This was a team that couldn’t have created a detailed plan at the start. They didn’t know the code base — it was outsourced software that needed an upgrade. They knew what capabilities had to be added, but not the best approach to complete the upgrade.

During the kickoff training, the team had set up their storyboard with cards for each story and task. They’d completed estimates for all the tasks as part of that last workshop. They were ready to start working the tasks of their first iteration the next morning. Later the next day, I saw Andrea and asked how it was going. She was nearly speechless. Hoping this was a sign of good news, I listened intently.

“I just can’t believe it!” she exclaimed. “They’re picking up the cards and doing the work.” Puzzled, I asked, “What did you expect?” “That I’d have to assign them their work and keep pushing them to get it done,” she replied. “After all we talked about in the training?” I asked, even more puzzled. “I didn’t believe it” came the reply.

Over the next few weeks, the most experienced team member held several short tutorials to help the others come up to speed on the software, and they fleshed out a technical approach to the project as they uncovered more details of the legacy code base they were working with. This was an exploratory iteration. Andrea’s trust in her team members grew steadily. With the team guiding the technical aspects, she was free to use her time to get them the information and other resources they needed. They finished that project in just over half the originally estimated time.

The team responded to the agile training by stepping up and making a personal commitment to the project goals, and at the same time, the agile mechanisms for

distributed control freed Andrea from having to prod team members to do their work. In a company where IT performance was far below what the business needed, this team’s turnaround was an innovation that everyone wanted to copy.

Creative control is vital for both artists and software developers. When an artist must rely on others, she needs to maintain creative control. For example, a graphic artist will want to be sure the printer reproduces the colors to the correct hue and shade. Likewise, developers and testers need good tools to “see” the software’s structure and make changes accurately. They *want* to be responsible for the software but are often hindered by company policies.

I’ll never forget the time a senior technical manager suggested that I have my software team just use Notepad as a source code editor. This manager had been a developer many years back and couldn’t see why we should pay for a language-sensitive editor (they were not invented at the time he coded). Yet a good language-sensitive editor can point out mistakes before you even compile the code, thus saving lots of time.

Very often companies unintentionally hobble their technical people through tooling decisions. Such decisions should be made by development teams. Organizational guidelines or bounds are fine, so long as the teams have a meaningful voice in the tool selection. Decentralized control aligns the responsibility with the expertise. This is surely a prerequisite for success, if not necessarily innovation.

In a company where IT performance was far below what the business needed, this team’s turnaround was an innovation that everyone wanted to copy.

IS PROCESS MORE IMPORTANT THAN GOALS?

Clearly IT practitioners can learn from artists’ ways of working, but IT development often involves “process” and project management. How do those aspects fit in the concept of software development as art? They could be seen as means to an end, or we might just focus on the development journey and never mind the destination. Unlike the freelance artist, however, business cannot work without goals and reliable commitments.

It’s hard to express what I want to say using the word “process,” as it has become a pejorative term. It invites

Orwellian visions of tick-box-minded bureaucrats who prevent any useful practices from emerging. Do not make the mistake of dismissing process out of hand, though. The correct use of process is a valuable tool for reaching business goals.

In art, the process is what you do. The finished artwork cannot help but occur and be of good quality if the artist is devoted to the process. If you enjoy drawing, you will hone your skill at it effortlessly, constantly. No matter what subject you draw, you will be able to achieve your vision.

Artists cannot guarantee they'll have a great idea on a given day, but they know how to clear their minds and set the stage for inspiration to occur. Managers can similarly set the stage for themselves and their teams.

I prefer the term “mindset” rather than “process.” I’m not sure there can be too much focus on process if it is the correct process. Look at the difference if we instead say, “You cannot have too much of the right mindset.” How do you know if you’ve got the right mindset? Constant experimentation and unfiltered feedback: each iteration should be a well-designed experiment seeking the next step in continuous improvement. This has to be grounded in clear business goals (a feature set) for the iteration. Agile iteration planning is the art of setting clear pass/fail criteria for all the features being built. This is the proper balance of process (mindset) with goals.

BUT CAN WE MAKE MONEY DOING THAT?

Lastly, an observation about money. Artists are known for having a problematic relationship with money, for being too idealistic, and for counterintuitive solutions that somehow work. Corporations are notorious for their straight-line relentless drive for quarterly profits and a myopic focus on cost-cutting, yet few can match Toyota’s performance. As author Jeffrey Liker notes in *The Toyota Way*:

Can a modern corporation thrive in a capitalistic world and be profitable while doing the right thing, even if it means that short-term profits are not always the first goal? I believe that Toyota’s biggest contribution to the corporate world is that of providing a real-life example that this is possible.⁹

Toyota has defined the lean approach, but it is not the only company to successfully apply it. Agile software methods can be described as lean ideas applied to software development — the two philosophies are fully compatible. And yes, money is being made from the innovations generated by lean thinking. This year Toyota became the world’s largest car maker.

SUMMING UP

We’ve looked at how three patterns that serve artists can be mined for innovation in IT development:

1. Mindset (or process)
2. Distributed control
3. Personal commitment

Mindset is needed to create balance between form and substance where qualities like robust design cannot be readily seen. A balance between effort spent planning versus executing affects the length of the iteration (learning) cycles we use. A mindset of deep focus on the project work is vital for knowledge work because context switching is expensive.

Distributed control mechanisms prevent conflict and align expertise with control. The business stakeholders say what to build and the technical teams decide how to build. Proper support for distributed control will allow a clear business vision and technical vision to emerge and become platforms for innovative problem solving. Necessary supports for distributed control include techniques for group decision making and a mechanism for team-based estimating.¹⁰

Personal commitment engages everyone in combating suboptimization. Pride in the aesthetics of good code is the most reliable and inexpensive way of preventing defects. The essential ingredient in agile teams is a certain control through spontaneity, not unlike an acting troupe with great on-stage chemistry.

Professional artists, performers, and composers learn to be creative at a steady pace to deliver commissioned work. They cannot guarantee they’ll have a great idea on a given day, but they know how to clear their minds and set the stage for inspiration to occur. Managers can similarly set the stage for themselves and their teams. It’s not about trying to find a spot in the Gantt chart for the “innovate” task. It’s about finding an appropriate scope for trying out a little bit of the agile mindset and distributed control and persuading your team members to commit to making the ideas work.

ENDNOTES

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TRIZ: The Art of Systematic Innovation

by Kas Kasravi

Innovation is imperative to a thriving organization. Yet it is well known that innovation is a trial-and-error process — risky, ambiguous, and with uncertain ROI. These challenges can be mitigated by taking a more predictable approach to developing innovative solutions. One such approach is TRIZ, an engineering methodology for systematic problem solving that can be adapted to IT. The use of TRIZ involves resolving a critical dichotomy; although TRIZ can methodically provide a direction for innovation, the effective interpretation and application of that direction is very much an art.

The key postulate of TRIZ is that innovation is *not* a random process and in fact follows specific laws. Further, TRIZ suggests that innovation is generally required only where certain conflicts exist — and that certain principles can be used to solve those conflicts. Originally, TRIZ was developed as an engineering methodology for solving problems associated with physical systems. Recently, there has been growing interest in adapting TRIZ to other industries. One such industry is IT, where TRIZ has been used to solve non-physical information- and business-related problems.

TRIZ does not solve any problems by itself. Instead, it is a methodology that rapidly guides the innovator toward the area where innovation is needed and shows him or her how to develop it. Although TRIZ is systematic in nature, the application of TRIZ in IT is an art, in the sense that the practitioner must intuitively transform the elements of the problem and the solution through multiple levels of abstraction. The practitioner's experience and creativity are essential to producing useful results.

Based on analysis of numerous patents and discovery of inventive patterns, TRIZ dismisses the notion that innovation must inherently involve uncertainty and risk. In fact, creativity and innovation can be enhanced by focusing efforts on certain areas that can produce more effective results. Therefore, as part of an IT innovation strategy, TRIZ can be used to help rapidly discover the root cause of problems and develop innovative solutions with less trial and error. However,

would-be innovators must be ever mindful of the need for creativity and intuition within a framework that may otherwise appear to be highly systematic.

THE INNOVATION IMPERATIVE

Economist Joseph Schumpeter has suggested that economies reach an equilibrium state in the absence of innovation. In this equilibrium state, supply and demand are in concert, and no growth or new profits can be realized.¹ Innovation is the disruptive change that leads to new opportunities, growth, and new economic cycles. These economic cycles, in turn, will reach a new equilibrium state in the absence of new innovation waves. Therefore, thriving organizations need to innovate at an accelerating rate. The factors that lead to a more complex and demanding innovative environment include:

- Customer requirements
- Regulatory mandates
- Globalization
- Rapid changes in technology
- Shareholder expectations for more efficiency and productivity

As business history suggests, not only are innovation waves successive, but they are accelerating. The frequency of these waves is increasing, as the economic life of each innovation wave decreases.

The demand for faster innovation is hindered by innovation's own trial-and-error nature, which typically involves uncertainty, ambiguity, and a high level of risk. These challenges can slow down innovation waves, especially when businesses are under greater economic constraints, and faster and more certain ROI is being demanded. Therefore, there is a need to create new innovations in a more rapid and predictable manner. This is where the adaptation of TRIZ may be able to help businesses in general and IT companies in particular.

ABOUT TRIZ

TRIZ is a systematic innovation methodology that was initially developed in the 1940s in the former Soviet Union by Genrich Altshuller, a Russian dissident and patent clerk. (“TRIZ” is the Russian acronym for the Theory of Inventive Problem Solving [*Theoriya Resheniya Izobreatatelskikh Zadatch*].²) After analyzing hundreds of thousands of patents,³ Altshuller concluded that innovation follows a predictable path, that it solves certain types of conflicts, and that each type of conflict can be solved by certain types of innovative principles. Thus, by following a step-by-step process, an innovator can analyze a problem, identify the root cause, and apply the type of solution that is most likely to solve the problem.

Conventional innovation methods generally involve trial and error, consensus, and compromises, but the TRIZ approach is often directed toward a compromise-free solution. In compromise-free solutions, we typically see an out-of-the-box breakthrough that solves a problem without giving up anything — and usually cuts costs as well (see Figure 1).

For example, a complex transportation IT infrastructure was experiencing excessive outages and instability. The conventional solution involved adding more hardware and people, which in fact exacerbated the problem and cost more. TRIZ identified as the root cause of the problem the lack of constancy of IT purpose across multiple organizations. TRIZ offered a better solution that involved using cross-organizational IT teams, developing teamwork and trust, agreeing to share assets, and actually reducing infrastructure complexity and costs through the sharing of fewer computing resources. The TRIZ analysis for this application took only two hours.

The literature reports many examples of complex problems solved using TRIZ, including:

- **Boeing.** International customers preferred TRIZ-inspired designs of the Boeing 767 midair refueling systems.⁴
- **HP.** TRIZ was used to design the HP DeskJet 990C, one of the company’s best-selling ink-jet printers in 2001.⁵
- **Mars.** A UK division of Mars, Inc., is reported to have used TRIZ to develop the unique Flavia coffee-brewing system.⁶
- **Proctor & Gamble.** TRIZ was used to develop the Crest Whitestrips product, which generated US \$200 million in revenue and grabbed 90% of the market share in about one year.⁷

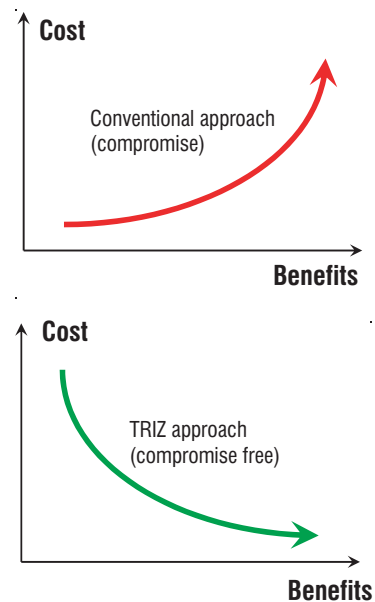


Figure 1 — Economy of compromise-free solutions offered by TRIZ.

- **Samsung.** A number of reports have been written about extensive applications of TRIZ at Samsung that contributed to the company’s dominance in the consumer electronics market.⁸

Although TRIZ is systematic, its use requires a substantial level of expertise by the practitioner. Also, TRIZ is not deterministic and infallible; TRIZ works most of the time, but not always. Occasionally, the inadequacies of the underlying technology, the advanced stage of current technology, or regulations and rigid preferences may prevent TRIZ from producing tangible results.

Conventional innovation methods generally involve trial and error, consensus, and compromises, but the TRIZ approach is often directed toward a compromise-free solution.

HOW TRIZ WORKS

A detailed explanation of how TRIZ works is beyond the scope of this article. However, a high-level review of TRIZ reveals a set of techniques for solving different types of problems. They are:

- The Technology Evolution Vector
- Laws of Technological System Evolution

- System Conflicts
- 40 Principles

I will briefly describe these techniques in the following sections.

The Technology Evolution Vector

Technological systems evolve along a predictable vector. This vector consists of four major phases:

1. **Rigid.** The initial solution is one-of-a-kind, generally unreliable, difficult to use, difficult to maintain, and expensive. The user typically must adapt to the rigid solution.
2. **Modular.** The solution offers a few configurations; it's more reliable and easier to use and maintain. The user can choose among several different implementations.
3. **Programmable.** The solution is offered in numerous configurations to best meet the user's needs. It's much more reliable, and extensive support is available. The solution is more affordable and is in common use.
4. **Autonomous.** The solution is commoditized and blends into the background. It is automated and inexpensive, and the user often doesn't even think about the solution.

A key postulate of TRIZ is that innovation is needed only where certain conflicts are present, which generally means that we are trying to do two opposite things at the same time.

To take an example, early computers (circa the 1950s and 1960s) were Rigid. They were characterized by unreliable hardware, were very difficult to use and maintain, required highly skilled operators, and were very expensive. The mainframes and minicomputers that followed (in the 1970s and 1980s) were Modular. The user could select among a few configurations, and the systems were more reliable, less complex, less expensive, and easier to use. In the PC revolution of the 1980s and 1990s, the computer entered the Programmable stage. Users required far less skill to operate the computer, numerous configurations and applications were available at very low cost, and the units have been generally much more usable and reliable. Today computers have reached the Autonomous

stage. Not only are they ubiquitous, but they are entering everyday devices, such as cars, toys, appliances, and so on. In many cases, the user may not even be aware of the computer's presence.

Would-be innovators can study the Technology Evolution Vector via historical market data and/or patent reviews. In this type of analysis, the development of technology is mapped over a timeline, the current stage is identified, and the future stages are extrapolated. To extrapolate the future stages, TRIZ uses the Laws of Technological System Evolution (see below).

TRIZ suggests that a product or service is most likely to succeed in a market if it follows the logical progression through the evolution vector. For example, advanced data mining techniques were available in the 1980s, but they didn't reach their full potential in business intelligence until after data warehouses and data marts were in common use in the late 1990s. Therefore, the Technological Evolution Vector is an especially valuable tool, not only for developing the next product that will succeed in the market, but also for protecting future markets by enabling innovators to develop and patent the subsequent ideas.

Laws of Technological System Evolution

TRIZ proposes nine laws that govern the development of most technological solutions. Altschuller discovered these laws by observing the common patterns among numerous patented inventions. These laws are generally stable, significant, and sufficiently abstract to apply to many industries. The Laws of Technological System Evolution are summarized in Table 1.

Experienced TRIZ practitioners apply these laws to various problem domains to determine the evolution of systems. These laws are what enable TRIZ to guide innovation in a directed and predictable manner. In fact, this is where the art of innovation enters TRIZ. While these laws provide a direction for innovation for a particular problem, the interpretation and application of these laws require much creativity, experience, and intuition on the part of the practitioner. However, by providing the direction to a potentially optimal solution, innovation is now guided and not random.

System Conflicts

The process of conducting a TRIZ analysis involves formulating a problem and identifying the inherent conflicts. A key postulate of TRIZ is that innovation is needed only where certain conflicts are present, which generally means that we are trying to do two opposite

Table 1 — TRIZ's Nine Laws of Technological System Evolution

TRIZ Law	Summary Description
1. Increasing degree of ideality	Systems evolve in the direction that increases the ratio of benefits to costs.
2. Nonuniform evolution of subsystems	The rate of evolution of subsystems is not uniform; the more complex the system, the more nonuniform the evolution of the subsystems.
3. Transition to a higher-level system	Systems evolve from a single implementation, to multiple implementations in series, then in parallel.
4. Increasing dynamism (flexibility)	Systems evolve in the direction of increased adaptation, flexibility, and multifunctionality.
5. Transition to micro level	Systems evolve toward an increasing use of microcomponents.
6. Completeness	An autonomous system consists of (1) working means, (2) engine, (3) transmission of power, and (4) control means.
7. Shortening of energy flow path	Systems evolve in the direction of shortening the energy flow passage through the system.
8. Increasing substance-field interactions	Systems evolve in the direction of increasing controllability via more complex or complete tool-object-energy interactions.
9. Harmonization of rhythms	Systems evolve in the direction of increasing coordination of the periodicity of the subsystems and components.

things at the same time. For example, in a soda can, the conflict is at the top, where we need to both seal the contents as tightly as possible and also allow those contents to be poured as easily as possible. So it's not surprising that most innovations in the design of soda cans have occurred at the very top, via better means of sealing and opening the can.

Identifying the system conflicts helps to minimize or eliminate the trial and error associated with conventional innovation. When solving a complex problem, trial and error is needed when we don't know what to do next — we just try different approaches until something works. This is often too expensive and time-consuming. By discovering and focusing on the system conflicts, the innovator is no longer experimenting in a shotgun manner. The individual can now focus exactly on the area where innovation is needed and will be most effective.

40 Principles

TRIZ offers a set of 40 inventive principles that appear to solve most system conflicts. The 40 Principles are concepts at a high level of abstraction and require careful interpretation and application. A few of the 40 Principles are listed here as examples:

- **Principle 1: Segmentation.** An object is divided into multiple parts.
- **Principle 2: Take Out.** Part of a system that produces undesirable effects is separated from other parts or removed altogether, usually by substituting another object or the environment.
- **Principle 4: Asymmetry.** An object's shape or configuration is changed from symmetrical to asymmetrical.
- **Principle 19: Periodic Action.** A continuous action is changed to a periodic or pulsating action.

- **Principle 25: Self-Service.** A system or object is changed to act on itself by performing a new useful function.

Collectively, TRIZ's 40 Principles offer a finite number of proven techniques for solving problems. Therefore, the innovator no longer needs to "guess" what to do next. When using the 40 Principles, the innovator starts with a specific problem, then generalizes the problem to discover the system conflicts, uses the relevant principle(s) to identify high-level solutions, and then specializes the high-level solutions proposed by the principle(s) to create an innovative solution for the original problem.

TRIZ FOR IT

Historically, the TRIZ methodology has been targeted at solving engineering problems more efficiently, and even brief market research reveals that most uses of TRIZ have been directed at physical and mechanical systems. Indeed, during the past 60 years, it's been a virtually unknown factor in business and IT. But although the terms used in most TRIZ literature suggest a strong engineering inclination, this doesn't have to be so. The underlying postulates of TRIZ are equally applicable to other industries and problem domains, including IT and business management. What is lacking is an awareness of the TRIZ methodology and adaptation of the terms and concepts.

TRIZ for IT is the application of TRIZ to complex IT and business management problems. Currently, experienced TRIZ practitioners who are sufficiently IT knowledgeable can perform TRIZ analysis and obtain good results. Upon further adaptation to IT, TRIZ should be easier to leverage. Adaptation of TRIZ to IT can involve any combination of the following activities:

1. Creating a clearer definition of how each stage in the Technology Evolution Vector applies to IT
2. Revising the Laws of Technological System Evolution by adding general laws that specifically apply to the evolution of IT systems (e.g., "IT systems evolve in a direction to automate tasks" and "IT systems evolve in a direction to increase information visibility")
3. Revising the 40 Principles to better match the language of IT (e.g., instead of Temperature, use Number of Users; instead of Power, use CPU Speed)
4. Better integrating TRIZ with existing practices and processes used in IT, such as Lean Six Sigma (LSS)⁹ and quality function deployment (QFD)¹⁰

APPLICATIONS OF TRIZ FOR IT

Although TRIZ may sound intriguing, it is not a silver bullet. As with any other methodology, TRIZ is best suited for certain classes of IT problems and not others. Some general guidelines for selecting the right application for TRIZ are:

- The problem doesn't have an obvious or conventional solution.
- If a conventional solution exists, it involves a compromise.
- The solution space is not artificially limited by rigid preferences, regulations, or policies.
- The problem has definable components.
- The underlying technology is adequately developed.
- The required solution involves prediction of technology evolution.
- The root cause of the problem is unknown.

Applications of TRIZ to IT may fall into three distinct clusters:

1. **Reactive.** A problem exists, and a tactical solution is required.
2. **Proactive.** The objective is creating a roadmap that will prevent future problems.
3. **Futuring.** Thought leadership is required for defining future opportunities and markets.

The nature of the problem to be solved will guide the TRIZ practitioner in determining how best to use TRIZ to solve the problem.

Using the approach described in this article, TRIZ has been used to address a number of IT problems, leading to innovative solutions:

- A banking client was experiencing significant IT cost overruns due to implementing a tool in an unintended but necessary fashion. Conventional solutions had failed to adequately reduce the IT charges. TRIZ analysis offered three technical ideas and four business solutions for this problem. One of the proposed ideas involved a radically different — and potentially patentable — way of processing ACH (automated clearing house) transactions. This exercise took about 15 hours.
- An inventor had developed a new solution in the area of IT application modernization. The invention disclosure was rejected by a review committee on the grounds that it lacked novelty. A one-hour

TRIZ exercise developed a novel and potentially patentable idea.

- An IT service delivery optimization exercise used TRIZ to develop several new ideas for resource alignment and integration with early sales data to better predict future resource requirements. This analysis took about two hours.

CONCLUSION

IT and business organizations require more innovation at an accelerating rate, but the randomness and trial and error associated with conventional innovation methods present challenges. TRIZ is a proven engineering methodology for innovatively solving engineering problems, but it can be adapted to IT and business management. Adaptation of TRIZ to IT can offer a method for compromise-free and more predictable innovation with less risk. However, the use of TRIZ in support of IT innovation is a significant undertaking that requires creativity and intuition. Specifically, the laws and principles used by TRIZ to direct innovation are highly abstract; lacking specificity, these elements are subject to the practitioner's experiential reasoning and intuition. Therefore, innovators using TRIZ can benefit from its nonrandom approach to innovation, but they must remain mindful of the dichotomy of artful creativity within a systematic framework.

ENDNOTES

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