Leadership: Creativity and Innovation

William R. Klemm

Leaders know in their gut that creativity and innovation are the lifeblood of their organization. New ideas can lead to programs that are superior to those that are already going on or planned in the organization and which would have been divested or never initiated had a better idea or program come along. So, the mission of every leader should be to search continually for ideas and programs that are superior to the ones the organization is currently committed to. In a word, it's called PROGRESS.

But what can the leaders do to promote creativity and innovation? The most obvious answer, short of hiring a new workforce, is to use management initiatives that create a work environment that stimulates the existing staff to be more creative and innovative.

Creativity CAN Be Stimulated by Leaders

There are many who would challenge the implicit assumption that leaders can do anything to foster creativity. They would argue that creative people, like baseball hitters, are born, not made. Indeed, much of the anecdotal literature about creativity would suggest that creativity is some mystical power that only a chosen few possess. But, then, why are all children creative?

Common Anecdotes about Creativity Are Wrong

People who have looked carefully at the creative process have learned that everyone of ordinary intelligence has latent creative abilities that can be enhanced by training and by a favorable environment. One recent book that is dedicated to defending this proposition is by D. N. Perkins, *The Mind's Best Work.*[1] He finds that after-the-fact anecdotes about well-known examples of great leaps of creative thought have generally received little or no close scrutiny of the mental processes that led to them. There are too many opportunities for the real mental correlates of creativity to be lost through excitement and distraction (as part of the "eureka" phenomenon), lack of need or desire to reconstruct the thought processes, and faulty skill and memory in reconstructing the process. Experiments where people have been asked to think aloud or report their thoughts during an episode of invention led Perkins to conclude that creativity arises naturally and comprehensibly from certain everyday abilities of perception, understanding, logic, memory, and thinking style.

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The Unconscious Is Not Magic

Some people believe that creativity emerges from unconscious thinking (fig. 27). Even if that were true, it would not necessarily impart any special mystery to creativity, compared to other aspects of thought and behavior. Unconscious thought appears to contribute to creativity no more or no less than to mundane activities. Most all thinking operates in the unconscious, including everything we do from taking out the garbage, to tying our shoestrings, to driving our car, to hundreds of other covert mental processes.

Why Leaders Hesitate to Foster Creativity

Listen to a typical commander as he thinks through the problems:

> I Need My People to Be More Creative. I wish our people would come up with ideas to cut our costs, ideas to make us more effective. What would really be great is to get some ideas for hot new plans, products, and services! Then if we got creative ideas, I wish we had a management structure in place that could get these new ideas out into the field.
>
> But My Boss Might Say: We Can't Afford Any More Creativity! "What would I do with new ideas?" he could say. "I don't have the time or resources to complete work on the old ideas." "Good point," I'll reply; but I will also remind him about the innovations of our competitors in the bureaucracy—not to mention those of the enemy! I'll remind him that the cheapest place we are going to get better ideas is to stimulate the creativity and innovation processes right here in our own organization.

Why Leaders Should Stimulate Creativity

Leaders should stimulate creativity for two very important reasons: to prevent obsolescence and to increase productivity. Let's consider both in turn.

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Figure 27. A Common Misconception about the "Magic" of Creativity–– Somehow "Stuff" Is Put into the Mind and Wondrous Creations Come Out.

In-House Obsolescence

If the organization is not getting a steady stream of new ideas, a focus on the old ideas runs the risk of current work being obsolete before it is even finished. Moreover, just how sure can you be that the old ideas are the best ideas? You say you can't afford to do new things. Maybe you can't afford NOT to do new things. Managing programs should be done with an "eye open" to incorporating changes that will make the work of higher quality, lower cost, or faster completion.

Worker Output Can Always Be Increased

Professionals tend to have the same capabilities in all organizations, and there is certainly room for improved productivity. The survey of 1,300 research and development (R&D) scientists and engineers by Pelz and Andrews,[2] for example, revealed that half of the engineers surveyed had no patents in the last five years; two of five junior scientists had not published anything, not even a report, in the previous three years. The noted science historian Derek de Solla Price has shown that scientific research papers come from a small elite, whose number is calculated to be about the square root of the total population of scientists; in a population of 10,000 scientists, for example, over 50 percent of the papers are written by only 100 people.

The payroll is going to be about the same, whether workers become more innovative or not. Wouldn't it be nice to get more for your money?

What Do We Know about the Creative Process?

The literature on the creative process is vast,[3] and we can only summarize it here.

Have you seen the ad from IBM Corporation, in which there was a long, alphabetized list of "old English" words? The ad's caption read, "Anyone could have used these 4,178 words. In the hands of William Shakespeare, they became *King Lear*." *King Lear* epitomizes the essence of creativity: to take commonly used and understood ideas and recombine them in elegant new ways; clearly the combinations have to have value.[4]

The basic condition for a creative act is to combine known elements into new combinations or perspectives that have never before been considered.[5] Perkins writes of the utility of deliberately searching for many alternatives so that many combinations and perspectives can be considered. He stresses that superior creative effort involves deliberately searching for many alternatives. Creativity is much more likely to emerge when a person considers many options and invests the time and effort to keep searching rather than settling for mediocre solutions.

Scratch Pad of the Mind

The first and fundamental step in the creative process is to have a clear notion of what the problem is and to be able to state it clearly. The effective thinker begins by first focusing

on the structure of the problem, rather than its technical detail. I symbolize putting the problem statement onto a scratch pad because the next series of mental operations occurs in the "scratch pad" of the mind, the so-called working memory (which is like the memory involved while you are remembering the phone number you are dialing) (fig. 28).

Also brought into working memory from creative operations are the potential solutions. These come from each person's permanent memory store, his or her lifetime database of knowledge and experience. Other potential alternatives are brought in from such external sources of input as reading, ideas from colleagues, databases, and other sources. Next, these alternatives can be processed logically (by associating, sorting, and aligning into new or unusual categories and contexts) or more "illogically" by the use of images, abstractions, models, metaphors, and analogies. The next stages involve noticing clues and potential leads, realizing permutations of alternatives that are significant, and finally selecting those thoughts that lead to a new idea. The process of considering and choosing among alternative approaches involves a progressive narrowing of options in the early stages of creation and a readiness to revise and reconsider earlier decisions in the later stages. This narrowing process requires the creator to break down and reformulate the categories and relationships of thoughts and facts that are commonly applied to the problems and their usual solutions. The creative thinker examines all reasonable alternatives, including many which may not seem "reasonable." Each alternative needs to be examined, not only in isolation, but in relation to other alternatives—and in relation to the initial problem expressed in different ways. The practical problem then becomes one of reducing the size of the problem and alternative solution space to workable dimensions. That may well be why one has to be immersed in the problem for long periods, with subconscious "incubation" operating to help sort through various alternatives and combinations thereof.

Note that all of these operations must occur in the working memory, which unfortunately has very limited capacity. That is probably the reason why insight and creativity are so hard to come by. Researchers of the subject of creativity would do well to look for ways to create more capacity for our working memory and to make it more efficient. The most manipulable factor would seem to be the mechanics of supplying information input from external sources. One example of a way that we already use to increase the efficiency of external source input is the use of brainstorming.

The final stages of creativity are more straightforward. They involve critical, logical analysis, which typically forces

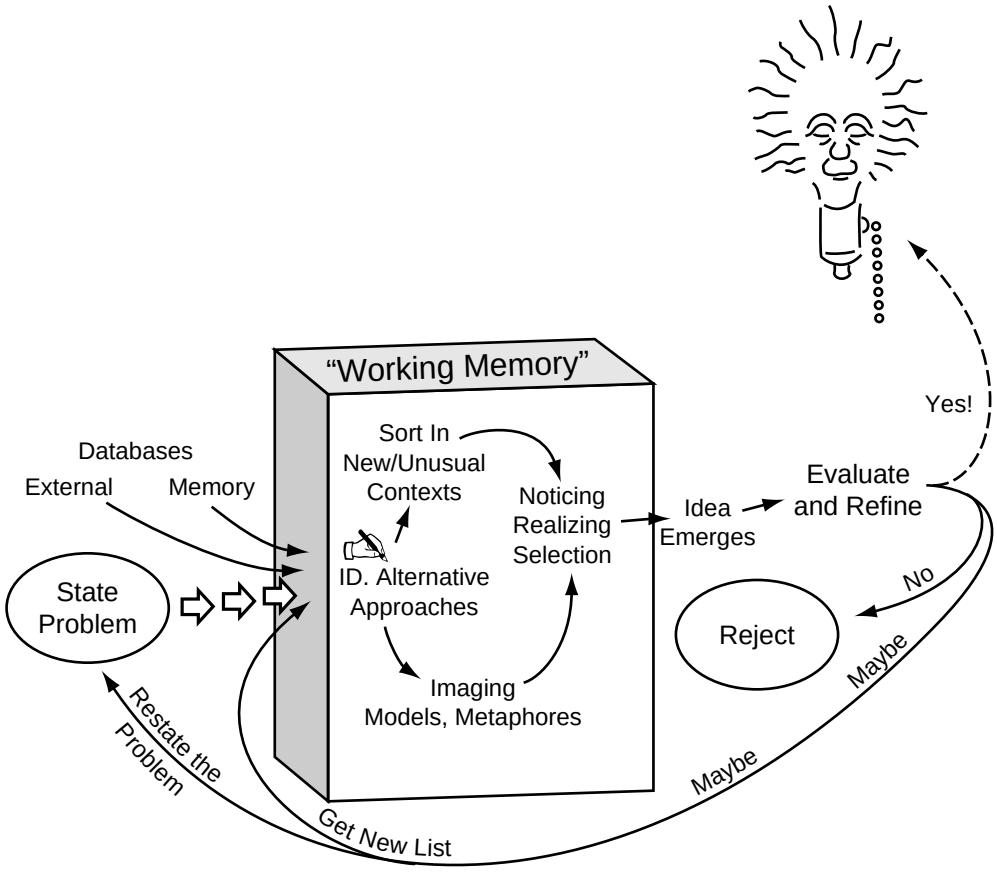

Figure 28. The Creative Process Is a Systematic Organization of Distinct Mental Events.

a refinement of the emerging ideas. Analysis should force the rejection of premature ideas and reinitiation of the search and selection processes. Sometimes, analysis will force the realization that the wrong problem is being worked or that it needs to be reformulated. Eventually, out of these iterative processes will emerge the bright idea.

Creativity Can't Be Planned—Directly

We know that discovery and creative thought cannot be planned by a leader; such thought just happens, emerging often during the course of ongoing activity that may have nothing to do with the new ideas.

In reviewing the literature on the creative process, Arieti[6] concluded that there are three stages in creative work: (1) an initial analysis that terminates when a "dead end" is reached, (2) a period of rest, recovery, and relative inattention to the problem, and (3) a sudden and unexpected burst of insight and solution. Perkins would argue that this last stage only seems to be sudden; the actual processes described earlier on our mental scratch pad have probably been going on consciously and unconsciously for quite some time.

The Way We Classify Things Creates a Logjam to New Ideas

Something in Newton's sensory or cognitive world caused him to see the similarity between an apple and the moon in a new way; of course they were both round, solid bodies. But it is not clear what caused him to perceive what is now obvious, namely that both are subject to the effect of gravity. Even seeing the apple fall from a tree would not be a meaningful mental stimulus to most people because they are not used to thinking of the moon as "falling." Creative thought is affected by the ways in which we classify things. We put apples and moons into categories, but by insisting on describing and naming them, we restrict the categories to which they belong. Apples are supposed to be round, red, and sweet, while moons are large, yellow, rocky, and far away. The names themselves get in the way of thinking of either as a classless object that is subject to gravity. A lesser order of creativity is commonly seen in the simple realization of the significance of obvious associations. The associations may even be negative (i.e., if penicillin is present on a bacteriological plate, the organisms will NOT grow).

Imagery Is More Likely to Stimulate New Thought than Language

Great discoveries may emerge from primitive imagery. Words and language, according to Einstein, had no role in his creative thought. Some famous scientists claim that their best thinking occurs in the form of visual images, even at the level of fantasy. Einstein, for example, in one of his fantasies visualized himself riding on a beam of light, holding a mirror in front of him. Since the light and the mirror were traveling at the same speed in the same direction, and since the mirror was a little ahead of the light's front, the light could never catch up to the mirror to reflect an image. Thus Einstein could not see himself. Although fantasy, such thinking is not the product of a hallucinating mind; there is clear logic and order imbedded in the fantasy.

Neuroscientists know that humans have a "split brain" wherein the left half controls analytical thought involved in speech and mathematics, while the right brain deals more holistically with imagery, music, art, and assorted nonverbal thought. The creative process seems to depend on freeing our right brain from the domineering control of our left brain. Managers tend to reward people for left-brain thinking, which is rigorous and precise. Are we thereby stifling creativity?

What Do We Know about Creative Leaders?

We do know some facts about creative leaders. They can be summed up as follows:

Creative Leaders Have Modest Intelligence

In summarizing the personal characteristics of creative thinkers, Arieti[7] concluded that they must be intelligent. The paradox is that they generally are not TOO intelligent. Excessive intelligence cripples creativity by imposing an examination of self and ideas that is too strict, too "logical."

Creative Leaders Are Well Informed

A profound knowledge of a problem area is needed in order to understand the limits of current dogma and to identify those areas where creative thought will be most fruitful. However, too much knowledge impedes the creative process, producing that thinking-process disease known as "hardening of the categories." This becomes a special problem when the knowledge is focused in a small specialty area because the breadth of alternative information that could be used in creative synthesis is missing.

Creative Leaders Are Original Thinkers

Original thinking is not the same as creativity but is obviously prerequisite for creative thought. Originality requires an active search for the different. This may involve deliberate attempts to conjure contrasts, opposites, bizarre associations, and symbolic thinking. Original thinking is sometimes no more than mere recognition that what is accepted by everybody else has flaws, is not adequate, or needs to be done differently. To complete the creative process, however, requires more than originality. Original thoughts that are not examined critically cannot be refined into useful and correct concepts; less creative people tend to be too quick to judge or reject ideas. Creative people think out carefully what they are looking for, and they clarify the reasons for their reactions to emerging ideas. They tend to search longer for original

Figure 29. Creative People See Things in More Than One Way.

thoughts that can improve upon or even replace the emerging ideas.

Creative Leaders Ask (the Right) Questions

A question calls forth an answer; a problem, its solution. The trick is not only to ask questions, but to ask questions or pose problems in the most effective ways. A question can easily limit creative thinking if it restricts the space of potential answers. It therefore is important to pose questions in open-ended ways and ways that do not make too many assumptions about an acceptable answer (fig. 29). A major part of the creativity task is proper formulation of the problem itself.

Creative Leaders Are Prepared to Be Creative

What this means is that creative people have a mind-set that enables creativity to happen, as if by chance. We have all heard the famous axiom

> Chance favors the prepared mind.
>
> —Pasteur

But the more complete explanation is

> Accident arises out of purpose. . . . The essence of invention isn't process, but purpose.
>
> —Perkins

In other words, creative people

1. desire to be creative,
2. believe that there is a creative solution, and
3. expect that they will be the ones to find it.

Some Characteristics of the Creative Person Are Innate

We know that creative people are self-directed, self-starting. Creativeness of scientists and engineers, as explicitly examined in the study by Pelz and Andrews, was found in those workers who maintained distinctive work styles and strategies.

To some extent, the attributes that foster creativity are innate, and cannot be "trained." For example, one evaluation of several studies of highly creative physical scientists revealed the following common denominators, indicating that creative scientists were most likely to be

1. men,
2. intensely masculine in interests and outlook,
3. from a background of radical Protestantism,
4. not very religious themselves,
5. reticent about interpersonal contact,
6. disturbed by complex human emotions, especially aggression,

7. hardworking, to the point of obsession,
8. music lovers, while disliking art and poetry, and
9. interested in analysis and structure of things.[8]

Can We Expect Leaders to Make a Difference

The creative ability of any given individual ranges from little to great. All professionals have some creative ability, but creative acts cannot occur in a vacuum. Creators must identify a problem, must be motivated to solve it, and must know at least some "facts" (but not too many) about the problem. They must criticize and refine their ideas to make them amenable to developing an innovative concept, process, or product.

In one study of the creative, innovative process, 115 senior scientists were evaluated for their native creative ability by a special psychological test for creativeness (the "RAT" test).[9] Some personal characteristics, such as innate creative capability and verbal intelligence quotients (IQ), were clearly NOT related to innovativeness. The analyst thus concluded that what really counted was the environment in which innovation is supposed to occur.

Taking the Plunge—How Do We Get Started?

"O.K." the boss says, "I am convinced we need to change our leadership style to foster creativity, but where do we start?"

For starters, look around to see how other organizations have been successful in generating new ideas.

Scientists in Organizations[10]

Pelz and Andrews summarize their findings on the effect of management practices on the productivity of over 1,300 scientists and engineers in 11 government and industrial laboratories. A composite productivity score for each scientist and engineer was determined by taking into account the number of publications and patents and the ratings assigned by a panel of colleagues on their contribution to the organization, as well as their more general contribution to science and technology. These scores were then used to compute correlation coefficients for the relationship of productivity score to various managerial practices. The analysis allowed them to identify many management practices that foster creativity and innovation, as well as interfering practices.

In Search of Excellence[11]

This best-seller was published in 1982 by T. J. Peters and R. H. Waterman Jr. This book was based on the authors' analysis of management in dozens of high-tech Fortune 500 companies that were especially well known for their ability to develop many new and widely accepted products. Such companies included IBM, 3M, GE, Boeing, and Hewlett-Packard. Peters and Waterman started with the premise that these companies "must be doing something right," and they wanted to find out what it was. They found some common denominators that these companies use to foster creativity and innovation. All these companies have built-in management mechanisms to stimulate individual entrepreneurs to take the lead in generating new ideas and pursuing them to the new product or service stage. The entrepreneurs "champion" their own cause and recruit fellow enthusiasts to a development team. Often the team is assigned an expediter whose function it is to cut red tape and provide needed logistical and other support. Typically there is an "executive champion" of the development team who has enough clout in the hierarchy to shield the team from administrative harassment or disruption.

Both of the above-mentioned studies make it clear that creativity and innovation are not beyond the control of enlightened leaders. Although leaders cannot create genius where it does not exist, there are many practices that influence creativity and innovation, for better or for worse.

Greasing the Wheels of This Creative Machinery

> The self is a growing thing, battered into shape by all sorts of forces.
>
> —R. B. McCloud

The creative self is also a growing thing, amenable to influence of the environment and self-education.[12] Leaders have more control over the creative process than they think. First, if they know what kinds of people are more creative, they can make it a point to hire such people. With people already on board, leaders can educate them as to what creativity entails and show them that some degree of creativity is within the grasp of everybody. Finally, there is a host of management practices that create the work environment that enables creativity.

Create the Right Environment—Creativity Is Contagious

Although we may not fully understand the processes of creativity, we know that they are "contagious." Certain environments contain something that enhances the creativity process. Hans Krebs,[13] the Nobel prize-winning biochemist, has worked out the "scientific genealogies" of certain famous scientists. Krebs himself had a Nobel Laureate teacher, Otto Warburg, who in turn was taught by Emil Fischer, who won a Nobel for his work on the chemistry of sugars. Fischer in turn was a pupil of another Laureate, Adolph von Baeyer, who won the prize for work on chemistry of dyes. Adolph von Baeyer's mentor was Reinhard Kekule von Stradonitz, famous for studies on organic compounds with ring structures. Kekule was a pupil of Justus von Liebig, who is the acknowledged "father" of organic chemistry. Liebig's teacher was a giant in the field of in-

organic chemistry, Joseph-Louis Gay-Lussac, who discovered many of the gas laws. Gay-Lussac was a pupil of Claude Louis Berthollet, who helped to introduce the concept of combustion and elucidated the chemistry of such compounds as chlorine, ammonia, and cyanide. Berthollet's mentor was the famous Antoine Laurent Lavoisier. Thus, this family tree of teacher and pupil extended in an unbroken chain over 200 years.

The contagion of creative fever can also be seen in industrial laboratories; the famous Bell Labs are a good example. Bell has had seven of its scientists to receive the Nobel prize. There are not many single work environments that have spawned such fundamental innovations as the transistor, the laser, and fiber optics. But the creative atmosphere at Bell is not limited to spectacular innovation. The staff at Bell has acquired over 31,800 patents since the lab was formed in 1925, and the current rate is about one patent every day![14]

Expect Creativity

Innovation correlates strongly with a person's perception of whether or not he is *expected* to be innovative.[15] When leaders shoulder the burden of responsibility for innovation, the workers shirk it. In part this may be because such environments may actually discourage or penalize workers for innovation.

Challenge People

Without challenge, there is not enough stimulus to elicit creative responses. But too much challenge burdens and overwhelms the emotions and the mind, shutting off the capacity for creative thought. Ever notice how some of your best ideas occur when you are NOT working, even when you are on vacation? Most creativity theorists believe that it is important, even essential, to have an intense and sustained grappling with a problem if creative solutions are to emerge, but often the flash of insight will only occur when you stop thinking about the problem.

In terms of leadership practices, Pelz and Andrews concluded from their study that a certain amount of "creative tension" had to exist between the conflicting states of worker security and challenge. They noted particularly that scientists' and engineers' productivity increased when the laboratory changed established patterns or when technical disputes arose. Productivity also increased when the scientists and engineers were given positive reinforcement and were encouraged to participate in policy making. Peters and Waterman found that the best high-tech companies instituted management practices that were deliberately designed to stimulate competition, sometimes even to the extent of assigning the same problem to two different teams and creating a contest atmosphere to see who would come up with the best solution.

Get Some Kind of Peer Review

The ultimate goal of the true professional is to be respected by his peers. If there is no way for professionals to know how they stand in the opinion of their peers, an important incentive for doing their best work is also absent. Where peer-review programs do exist, they often are administered in very negative ways, where the emphasis is judgmental and punitive. The real purposes should be to specify what is considered high achievement and who is doing it, to reassure workers that they will be judged on merit and technical productivity rather than on ancillary or political grounds, and to stimulate all workers to "keep up the pace."

Get a System of Rewards for Creativity

When workers know that management rewards new ideas, they will try to generate them. The best way that management can make its wants known, and believable, is to provide tangible rewards for new ideas. Rewards can take the usual forms, ranging from more money (bonuses or salary increments) to a wide variety of "perks." More subtle, and less expensive, devices include arranging for professionals to present their ideas in semiformal gatherings of peers and superiors. It is particularly important to give direct access to policy makers, not only for the ego-gratifying effect on the workers, but also because this is the one way to ensure that policy makers keep informed and stimulated.

Professionals may need frequent prodding to produce reports or papers that bear their name. Nonetheless, such efforts produce a positive feedback that will stimulate the worker to future creative activity.

Pelz and Andrews found that scientist and engineer productivity was stimulated when the workers knew that their ideas and work were evaluated by people other than their immediate supervisor, particularly people outside the hierarchy or high in it. Evaluations by peers and end users had great impact on motivating scientists and engineers when they knew that higher management sought and listened to such evaluations.

Get People Involved, Immersed, in Problems

Numerous anecdotes concerning great creative achievements have in common the feature that the discoverer was deeply immersed in the problem area.[16] Even Einstein had grappled for several years trying to clarify the relation of movement to electromagnetism. Not surprisingly, the best ideas have usually come in the fields that the discoverer knew a great deal about. There is a paradox here: knowledge often gets in the way of creativity. Professionals who are overly specialized as a group are less productive than are their more broadly based colleagues.[17] I suspect that the paradox exists because the creative person takes a different, more detached, and uncommitted attitude toward his or her

knowledge, whereas the noncreative person is more inclined to believe what he or she "knows."

Without direction and specific goals, research programs tend to flail and flounder. In the recent critique of American industry's R&D efforts,[18] Deborah Shapley and Rustum Roy levy the charge that R&D managers have largely failed to provide direction to their workers. They charge that we devote too much time, effort, and money to basic research that does not go anywhere. What we need, they argue, is more "purposive" basic research, where workers are given purpose and guidance, even for their basic research. Some practical objective should always be kept in mind, even for the most basic of research. This need not diminish the pure science value of the basic research; the work of Louis Pasteur should serve as ample proof.

Get Rid of the Disincentives

The most common disincentives for creativity and innovation arise in an atmosphere of fear—fear of being penalized for failure, fear of not getting adequate administrative support, or fear of not having enough time. That is one reason the new venture-team programs in the Fortune 500 companies surveyed by Peters and Waterman are usually specifically designed to relieve team members from all other duties during the project. The team is protected by the "executive champion" from external forces, disruptions, and punitive actions for failure. The team is protected from the red tape of their company's bureaucracy by the ombudsman/expediter. The "champion" programs in the Fortune 500 companies that were evaluated by Peters and Waterman exemplify just the opposite of micromanagement—at least once a champion and his or her development team are established. There is a good bit of management imposed during the initial stages of project approval, setting of goals, allocation of resources, and establishing the ground rules for the team. But once the team is formed and under way, successful management seems to require that they be left alone. The team does its own managing, at least to the extent they are able.

Avoidance of micromanagement is equivalent to providing more autonomy for professionals and their teams. But excessive autonomy is probably not desirable. Pelz and Andrews found that the most autonomous of their scientists and engineers did poorly, presumably because they were isolated from stimulation; some central coordination and direction are necessary for best productivity. The self-reliant and autonomous individuals should be able to produce more; in fact, if their superiors do not provide direction, they must be self-reliant in order to achieve. In a climate of complete freedom, autonomous individuals must have exceptional drive and motivation in order to keep achieving. On the other hand, under tight, micromanaged situations, the productivity of self-reliant individuals is not enhanced.

Give Your People Some Slack, Freedom, and Time for Meditation

Here we refer to mental freedom, as well as freedom from external constraints, to let emerging ideas take one where they will, even if they violate common wisdom or the constraints of time, money, and facilities.

Arieti also makes the point that the creative person must have time where he or she does nothing, as viewed in conventional terms by superiors in an organization, for example. If the workers must always be "doing" something (running an experiment, shuffling paperwork), they do not have the opportunity for uninterrupted reflection on their work. A case can be made for being too productive in the usual sense. One junior scientist I know was given some wise advice by his more experienced mentor: "Young man, you would do well to publish less so that you can publish better."

Arieti asserts that creative thought usually involves a period of meditation and aloneness. Aloneness is akin to sensory deprivation, a state in which the subject is less distracted by conventional stimuli, clichés, modes of thinking, and is free to tap his or her inner basic resources.

The common emphasis on teamwork is justified, as seen in the Pelz and Andrews study. Yet each team member must have time alone, free of distractions and interruptions, to reflect creatively on the team's problems.

Continued pursuit of a problem is often required before the creative solution emerges.[19] Leaders should give people time to pursue unresolved problems and not punish them as long as they are earnestly trying. Jung is quoted as saying that to get creative thought to emerge from its incubation stage, one must have a "special training for switching off consciousness, at least to a relative extent, thus giving the unconscious contents a chance to develop."

Be Quick to Recognize—and Use—Error

A rat uses its errors to help find the way through a maze, and in a similar but more sophisticated way creative thinkers must be assisted by their leaders and colleagues to recognize and use their thinking errors as they grope with the creative solution to a problem. In scientific and technical arenas of thought, mistakes can be quite useful in posing issues in a new way and in inviting unique approaches to a problem.

Be Quick to Recognize—and Use—Good Ideas

Although leaders can't force creative thought, they certainly can be receptive to it and recognize and value it when it happens. The best way to express value for an idea is to implement it.

Make Your People Secure, Not Threatened

The companies surveyed by Pelz and Andrews have found that it is important to provide opportunities for scientists and engineers to have their names associated with a product, a report, or a process.

The companies also favored practices that promoted the status of individuals, such as

1. letting professionals present their own work (briefings, reports, and so on),
2. giving them some autonomy,
3. minimizing the management from above, and
4. letting them help set goals and priorities.

The Pelz and Andrews study showed a clear increase in productivity in those workers whose managers let them set their own goals and priorities and influence policy making. This principle is explicitly embodied in the "champion" programs of the Fortune 500 high-tech companies that Peters and Waterman studied.

Change Attitudes about Yes-Men and Conformity

Conformity is the enemy of creative thought. As might be expected, people differ greatly in their conformist tendencies. Some conformity is probably imposed by cultural and educational conditions. For example, in one formal test which quantified conformist tendencies in terms of percentage of responses to questions that were influenced by group pressure, *military officers had the highest conformity score of 33 percent;* by comparison, college sophomores had a conformity score of 26 percent, while scientists in industry had a score of only 14 percent.[20] Notably, the range of individual scores in each group was from 0 to 100 percent, which means that each group does contain potentially creative people, even though in some groups conformity may be very conspicuous.

In examining common practices that get in the way of creativity and innovation, Hickman and Silvan[21] have developed a list of six common blinders that keep leaders from creativeness and innovation. They are

1. resistance to change,
2. reliance on rules and conformance,
3. fear and self-doubt,
4. overreliance on logic and precision,
5. black and white thinking, and
6. overreliance on practicality and efficiency.

As practical remedies to such blinder problems, Hickman and Silva suggest several exercises that will help both leaders and workers: (1) set a personal quota of one new idea a day, (2) pick an organizational rule that gets in the way and break it (in a benign way that won't harm you or the organization), (3) read literature on creativity, (4) indulge in fantasy and wild thinking, particularly when you are swamped with technical detail, (5) for any problem, force yourself to consider many solutions, and (6) defer evaluation of an idea (toy with it, explore its ramifications).

Show the Mavericks You Tolerate—Even Value—Them

By definition, creative people are more likely to be nonconformist, not only in their thinking but sometimes in their attitudes and behavior. If such people are valued in an organization for what their ideas can do for the group, then a certain amount of tolerance for unconventional behavior is the price that has to be paid.

Sometimes creative, innovative people are uncomfortably aggressive. They may be driven by ambition and are not very tolerant of obstacles, be they material or managerial. "Best workers gripe the most" was the conclusion drawn by one analyst of a survey of industrial productivity. Clearly, malcontents and chronic complainers are not much of an asset to an organization. But it is axiomatic that the best producers and self-starters are assertive, sometimes "pushy," and even obnoxious. In the Pelz and Andrews survey, there was a striking correlation between productivity and the fact that the scientists and engineers did NOT fully share the goals and interests of higher management. However, they were responsive to input and direction, both from management and from colleagues.

Provide Formal Means for Idea Generation

Among the various tactics that can be used are frequent use of seminars and symposia, where the "in-house" people are expected to make presentations. Debate should be encouraged, but it needs to be conducted in a positive, nonthreatening way.

Brainstorming sessions can be especially useful, provided they are well structured and controlled. The proper environment for effective brainstorming has been described by Osborn.[22] The basic premise is that creativity requires free and uninhibited thought, coupled with critical analysis and synthesis. However, the typical human cannot think imaginatively and critically at the same time. Thus, Osborn advocates a brainstorming session in which (1) criticism is ruled out, (2) freewheeling is welcomed (the wilder the idea, the better), (3) many ideas are better than a few, and (4) combining of ideas into new ways is encouraged. To make sure that "imagineering" is fully stimulated, an atmosphere of excitement and enthusiasm is needed, along with a tolerant, noncritical attitude toward "off the wall" ideas. But, if a brainstorming session ends at this point, then all one has is a collection of imaginative ideas, none of which may have real value. Subsequent critical analysis is required to winnow out those ideas that can be criticized, reformulated, and recombined into useful concepts that can lead to true innovation.

How about computerized Delphi conferences? I don't think anybody does that, but the technology is available. One popular technique to make such problem-solving communication more systematic could employ a modification of the so-called Delphi method.[23] This is a structured communication approach to problem solving, planning,

forecasting, and decision making that involves individual contributions of information and insight, followed by some critique of all the individual contributions, followed by responses of the individuals and revisions of their original ideas. To modify the approach for brainstorming functions, it would be ideal to have a computerized conference approach, wherein a computer tallies all the input and makes it available in real time.

Create a Climate for Discussion and Disagreement

In their analysis of successful executives, Hickman and Silva concluded that they never ceased their curious probing. "They are imaginative and innovative developers who can transcend old habits. . . . They make an abiding commitment to creativity, always setting aside the time and resources to nurture it."[24] Such a climate stimulates workers to come forth with their ideas, giving management a chance to use those inputs to generate even better, more workable ideas. Creativity feeds upon itself, producing more and more creative ideas.

The creativeness of professionals is directly proportional to the extent to which they can communicate with both supervisors and with peers. Leaders should openly solicit the ideas of workers—and then LISTEN to what they say. This serves not only the positive motivational. purpose of making workers feel like they are important, but it also gives the leadership access to information and ideas they might otherwise not obtain. This principle lies at the heart of Deming's quality control philosophy, which has been so successfully employed by Japanese industry.

Workers need good, clear channels of communications with superiors, particularly the leaders who operate at the policy-making levels. Among the reasons this is important is that in this climate workers have some hope that they have access to policy makers when they get a good idea. They need not fear that somebody else will "steal their thunder" and get the credit for their idea. The leadership, in turn, encourages the surfacing of new ideas only if they openly value it and provides positive reinforcement to those who advance new ideas, even ideas that are not feasible.

In the case of peer communication, Pelz and Andrews found that increased productivity was directly correlated with the number of peers whom a given worker contacted as well as the total number of contacts.

Give Your People Influence on Policy Making

Another factor that correlates positively with innovation is the degree to which the workers exert influence upon decision making.[25] Not surprisingly, if workers know they have no clout with the leaders, they have little confidence that their ideas can get accepted and implemented. So why risk exposing one's ideas to possible criticism? Thus, it is in the best interests of leaders and their organizations to make all workers feel important and to solicit their ideas in nonthreatening ways.

In any hierarchy, one of the hurdles that a new idea must overcome is the worker's immediate administrative superior. The superior sets the psychological tone of his or her unit, and that tone may encourage creativity or may actively discourage it. Junior-level professionals are easily intimidated or disheartened in attempts to sell their ideas. The senior scientists studied by Pelz and Andrews who were the most effective in implementing ideas were those whose superiors "stayed out of the way," with respect to the actual conduct of the research. For this level of employee, the proper role of leaders would seem to be limited to encouragement, friendly criticism, and making resources available.

It is one thing for workers to have a good idea. It is another to get them to "surface it." Some work environments discourage innovation, if not actively, at least unwittingly. Leaders of the 3M company, noted for the large number of diverse product innovations, have a slogan: "Thou Shalt Not Kill a New Product Idea."[26] Of course they do not implement all of the employees' ideas, but they make it company policy to encourage all the ideas they can get. They don't intimidate their employees with criticism, but rather encourage and help them to develop their ideas into marketable products.

To sell an idea, it must be communicated comprehensibly. Although the illusion of success can be obtained by "snowing" superiors with complex ideas they do not really understand, their sustained support will ultimately require that they do in fact understand what they are supporting. In most cases, support is not given in the first place if the idea is not clear and understandable. The advocate of ideas must also have sufficient status and credibility for the ideas to be taken seriously.

Optimize Interpersonal Interactions

Progressive leaders actively seek ways to increase communication and break down interdepartmental barriers among their workers. Specific actions range from the physical design of work and recreation space to open forums where workers make presentations in front of their peers and superiors. Such devices not only improve technical communication per se, but they also make workers more aware of the skills and achievements of their peer competitors. This environment instills a desire to run faster just to keep up.

Get the Right People Together

The principle of critical mass in personnel management is well known. Bright people stimulate each other, particularly if each person has a different background and set of technical skills that he or she brings to a common problem. This team concept is explicitly fostered in many R&D companies.

In many organizations, it is not feasible to create critical mass; there just is not enough money to hire necessary new talent. Sometimes, however, the problem can be overcome

by tearing down the barriers that separate the boxes on an organization chart and building dashed-line connections between the boxes so that close interaction can occur among the people with common interests but who are assigned to different organizations. Administrators who are real leaders rise to the top and impose massive reorganization where necessary to reassign people to create critical mass and optimize effectiveness. There must be clear lines of authority and responsibility, however. Cavalier use of dashed lines on an organizational chart leads to situations where nobody is responsible to anybody for anything.

Create Study Teams, Evaluation Groups

Many traditionally managed R&D operations have historically seen the value of creating interdisciplinary teams to solve problems. A recent workshop review of this management practice by the National Aeronautics and Space Administration has confirmed its utility.[27] Where management often falls short is in implementing the good ideas that emerge from such study and evaluation groups.

Periodically Regroup the Organizational Teams

Research teams grow stale with age, and their productivity generally falls off after four or five years, as the Pelz and Andrews study clearly showed. They also learned, however, that shuffling people around to new research teams was not effective if it was done against their will.

Give the Teams Autonomy

The success of new-venture teams derives not only from the positive motivation that comes from championing a cause but also from the fact that the team is autonomous. Each member knows that he or she is responsible to the team and that the team is responsible for its own success or failure. If teams are allowed to operate in an environment where nobody can get the credit and nobody can take the blame for foul-ups, there is little incentive to do one's best.

Keep People from Getting Too Specialized

Overspecialization gets in the way of creative thought. A research team with people of diverse backgrounds creates a stimulating intellectual environment that can promote the evaluation of problems from a broader perspective and lead to new ways of seeing problems and solutions. Moreover, many projects require a diversity of technical skills, which is obviously provided in a diversely structured team.

Many of us have habitually considered technical expertise as a critical component for productivity. Thus, workers who specialize are considered experts. But Pelz and Andrews found that the most productive workers were those who specialized in more than one technical area. Presumably, this served as a stimulus for creativeness. A related observation was that research teams that have worked a long time in a certain area and acquired status as the in-house experts gradually declined in their productivity. Better results are sometimes achieved when management deliberately assigns a project to a team other than the one with the most expertise.

Pelz and Andrews also found, to their surprise, that productivity was greater in those scientists and engineers who worked at several levels, including both basic and applied research. Those who focused only on either basic research or applied research were usually much less productive. This may indicate that the more productive scientists and engineers are more productive because they are capable enough to work at several different levels. However, it is also possible that efforts to make them work at different levels actually can stimulate their creativity and productivity.

Unexpectedly, it was the younger workers whose productivity was most impaired by being required to focus in depth on a subject. Leaders are advised not to assign young workers to a narrow piece of the problem, but rather to see that they read and talk about it from many angles.

Recognize and Exploit the Age Effects

Conventional wisdom holds that young people are the most creative. In physics, for example, it is commonly believed that great discoveries must be made before the age of 35, or they will not happen at all. When this issue was examined by Pelz and Andrews, they found a biphasic curve, with a peak in the 30s, followed by a decline, especially in the late 40s. However, there was another spurt of creative productivity after 50. The late 40s decline was quite distinct and was most marked with government workers, compared with those in industry or the universities. At all ages and in all work environments, productivity was greatest in those scientists who were motivated by their own ideas rather than the ideas of management.

Newly formed research groups are the most creative and productive. For example, when research directors of 21 industrial labs were asked to rank their teams or sections on such criteria as "creativity," they found that the most creative groups were less than 16 months old. According to the survey by Pelz and Andrews, the height of a group's creative powers lasts about five years, after which they generally decline. They explain this phenomenon on the basis of their idea that a certain amount of creative tension is needed; in this case, the tension and stimulation are achieved by placing staff on a new team in which the insecurity of proving oneself to new peers brings out the best in each worker.

The typical decline with age of the group can be partially offset if the group becomes especially cohesive, while at the same time becoming intellectually competitive. The cohesiveness is illustrated by the frequency of communication among team members, which under normal circumstances is quite high during the first year but falls off drastically as the group ages. Competitiveness included competition among

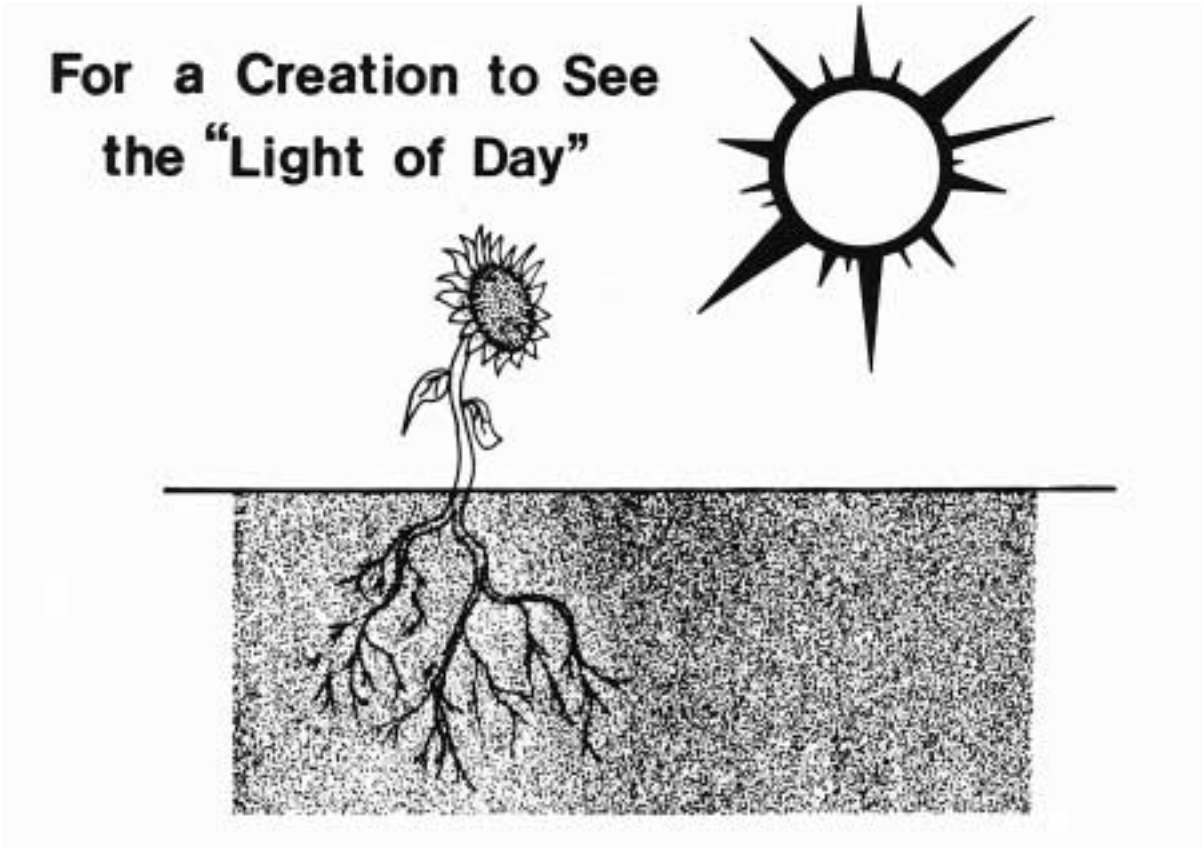

Figure 30. Good Ideas Have to Be Nurtured to Yield Their Fruit.

individuals in the team as well as competition between a given team and other teams.

Stagnation also sets in because an older group tends to get specialized, and the members' approaches to problems become more stable and stereotyped. The loss of a broader perspective and the creativity that goes with it are best offset when management challenges an older group with problems outside its expertise. Leaders are advised to avoid letting a group come to believe that they are the in-house experts in a special area; in fact, some leaders will deliberately assign a problem within an older group's specialty to *another* group which has no such expertise.

Reorganize

The more productive professionals in the Pelz and Andrews study were those in organizations that had a relatively "flat" organization tree, with few levels at which veto or interference can occur. Pelz and Andrews also found that conventional management schemes that were designed to make workers dependent on their supervisors were counterproductive.

Specifically, real productivity declined when the primary source of evaluation was the immediate supervisor. As Pelz and Andrews put it, "If you deliberately wanted to stamp out independent thought in the subordinates, could you design a better system?"

Transitioning Creativity to Innovation

To get a creative idea is one thing, but to get it transitioned into the innovation of a new product or service requires other personal characteristics. Innovative people need the kind of mind-set that can produce the succession of processes that lead to successful innovation, such as

1. generating the idea,
2. informing "significant others,"
3. "selling" the idea effectively,
4. planning the development process, and
5. overcoming constraints (time, money, relevance).

Even though an organization may have plenty of such people, management practices will determine the extent to which these personal characteristics can be expressed. Technology transition is the theme of a growing body of business literature, which we need not dwell on here.

The Bottom Line

Creativity and innovation are not mysterious forces over which leaders have no control. Progressive leadership can and does create a climate that encourages creativity and innovation. As we have reviewed here, there are many specific leadership initiatives, validated by the success of certain high-tech companies, that enlightened leaders can take to stimulate creativity and innovation in any work setting.

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