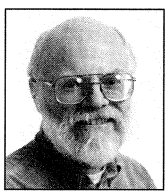
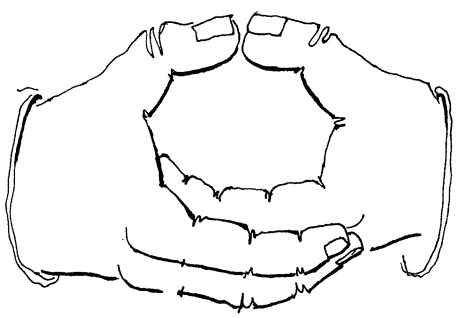
A Visual Essay on INVENTION *and* INNOVATION

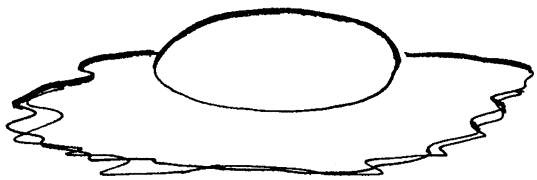
WISDOM COMES FROM many sources, and it is a mistake to shoehorn it into preconceived packages. Such reworking may make ideas fit more easily into the shelves of our minds or the niches of a journal format. But we risk losing the opportunity for new ideas precisely because we make them fit the old mold. Here, Rolf Faste digresses from the rigidities of our traditional layout to share his insights and sketches related to innovation. It is exactly the right way to keynote this issue and begin our discussion of this critical topic.

by Rolf Faste

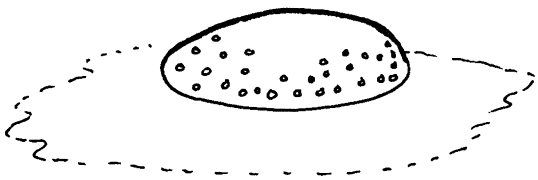


ROLF FASTE IS ASSOCIATE PROFESSOR OF MECHANICAL ENGINEERING AND DIRECTOR OF THE PRODUCT DESIGN PROGRAM AT STANFORD UNIVERSITY. IN THIS ROLE, HE IS RESPONSIBLE FOR THE UNDERGRADUATE VISUAL THINKING COURSES AND GRADUATE AMBIDEXTROUS THINKING COURSES, WHICH DEVELOP STUDENTS' VISUAL AND CREATIVE SKILLS.





1
A poached egg may be used as a metaphor for the ideas available to a person, organization, culture, or mankind as a whole.



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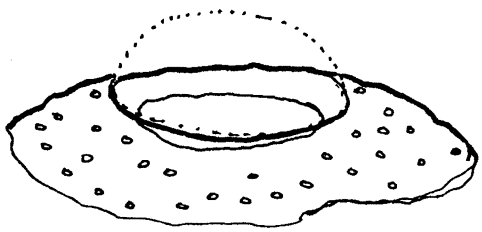
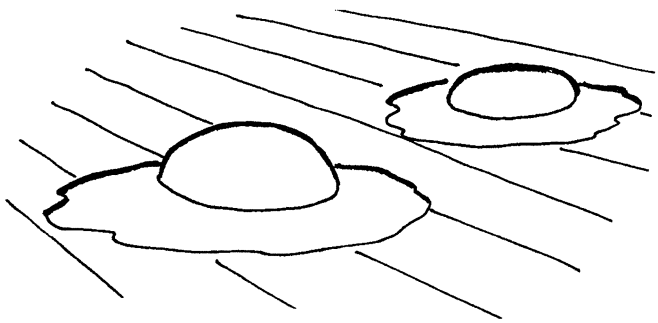
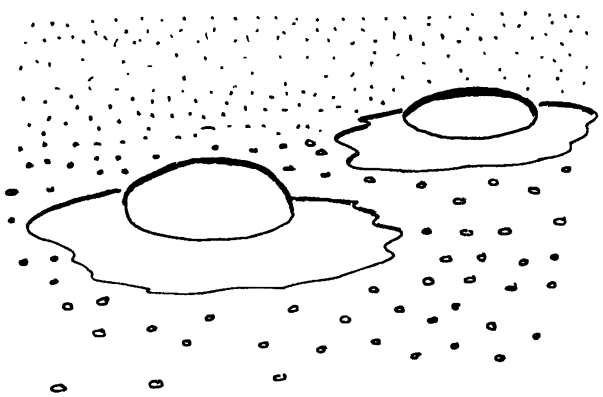
The ideas in the yolk of the poached egg are conventional ideas. The yolk is relatively well defined. Conventional ideas are those to which everyone has agreed. They are ideas that work and are useful.



3
The white of the poached egg is squishy and ill-defined. It contains ideas that are unconventional. Whether their source is old or new, they are not normal, not everyday ideas. They strike us as being original: we call them creative ideas.

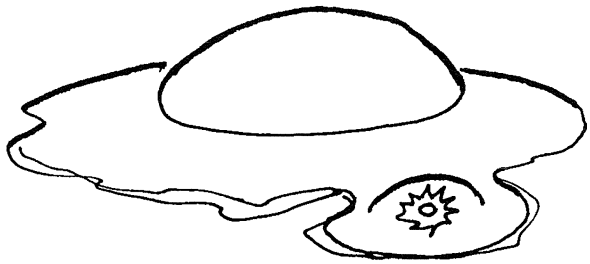


4
The poached egg may be seen to exist on a large field. Other poached eggs also occupy this field.

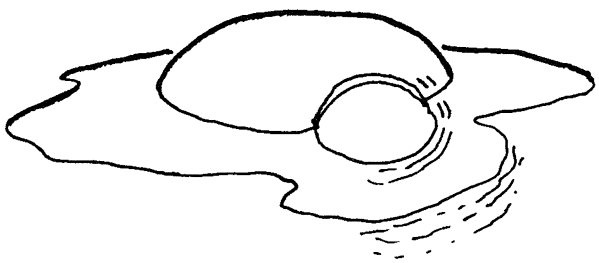


5
In between, and beyond, these eggs are an infinite number of undreamed ideas. These are ideas outside of current human consciousness. Actually, we have no way of telling whether this assertion is true. It is equally likely that ideas don't exist until we actually think of them.

6
Invention involves the conception and nurturing the growth of an unconventional idea in the white of the egg.

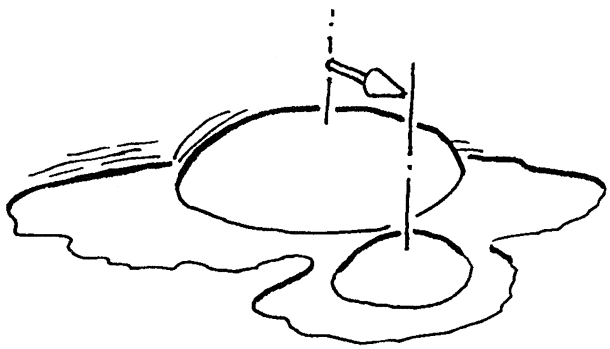


7
In order for an invention to become useful, it must be adopted. One way to visualize this is to imagine the invention being absorbed into the yolk, becoming acceptable, normal, and conventional.



8
The incorporation of an invention into the yolk may also be viewed as convention moving in the direction of the invention. That is, the new idea stays more or less in one location, while convention catches up with it.

Today's conventional idea is yesterday's unconventional idea.

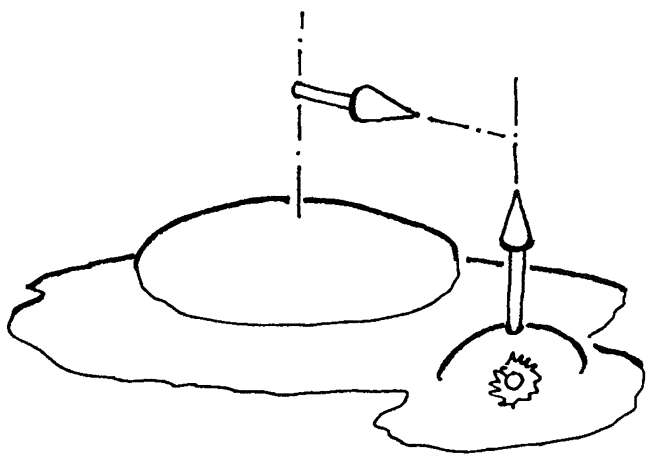


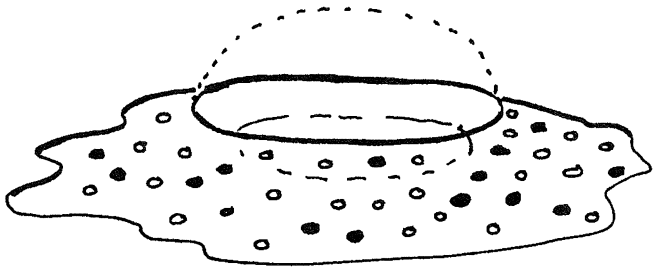
9
Innovation involves the implementation and adoption of an invention.

Invention involves conception and nurturing—it is about growth.

Innovation involves acceptance and adoption—it is about movement.

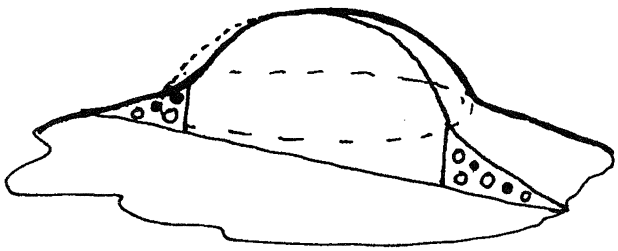
While invention and innovation are closely related, they are also different kinds of activities.



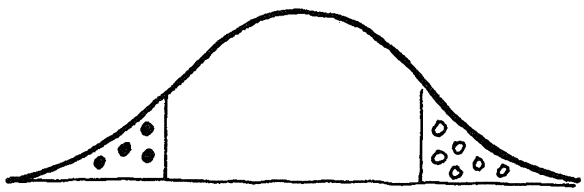


10
Inside the creative white of the egg there are two sorts of ideas: ones which may prove to be useful, and ones which will not.

The challenge is that it is impossible to tell which is which. This unpredictability is the reason creative ideas are risky.

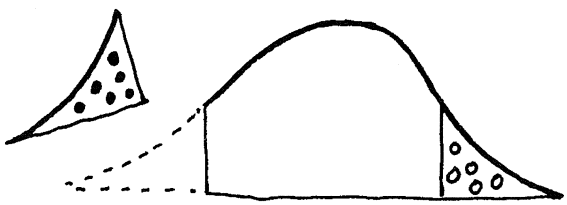


11
It is possible to view the poached egg two-dimensionally, as a section cut through the center.

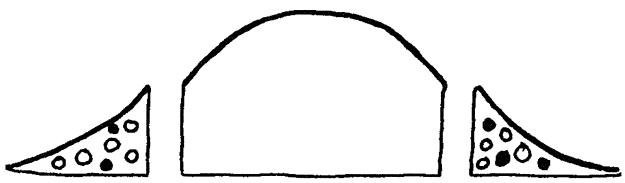


12
The resulting shape is called a normal curve.

Unfortunately, when the egg is viewed in this way, there is a strong temptation to apply notions of good and bad to the tails of the distribution.



13
Which translates into the common-sense attempt to improve overall idea quality by discouraging "bad" idea production, i.e., by cutting off the lower part of the curve.



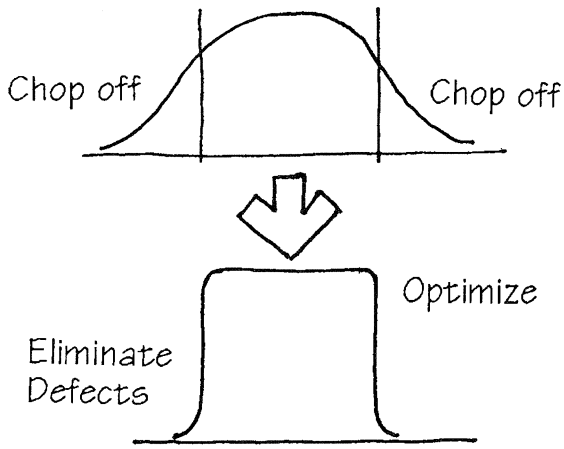
14
This can lead to disaster. Creativity is in the tails—both tails. Efforts made to eliminate one tail will eliminate both tails.

Exercises in "quality control" often eliminate the possibility of quality.

15
It is not surprising that the Japanese should have taken so readily to quality control. This is the way in which their population is shaped during the schooling process.

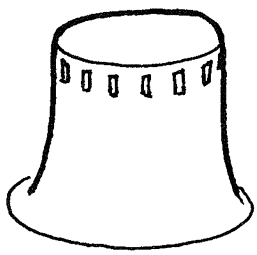
"The nail that sticks up gets pounded down."

Uniformity is achieved by eliminating any behavior that is unconventional. The result is the perception that the Japanese are uncreative.



16
When all creative ideas are systematically eliminated, the egg will take on the shape of a fortress.

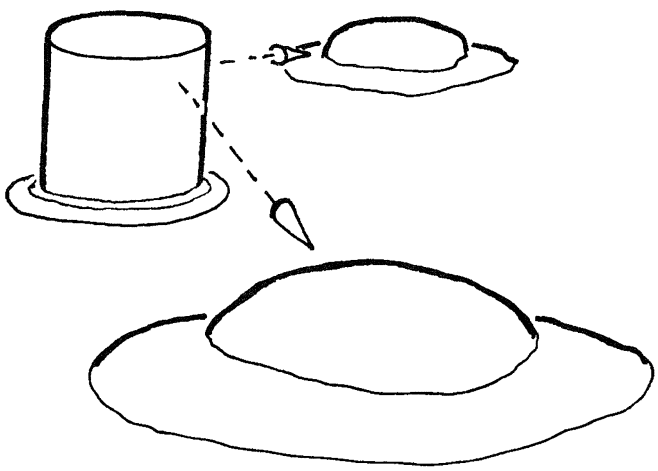
This is the shape of a typical Japanese firm.



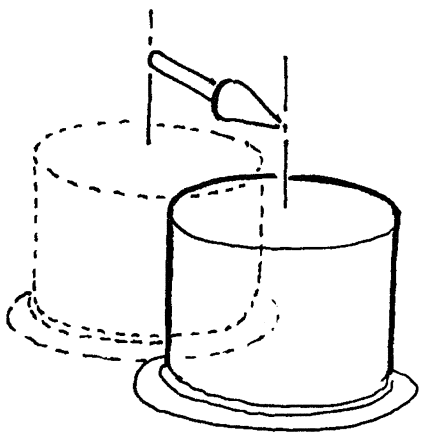
17
The seeming lack of Japanese creativity ignores the fact that the yolks of different cultures do not contain the same ideas.

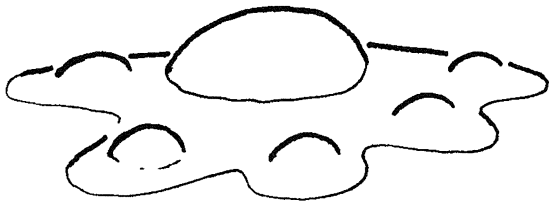
For two thousand years it has been conventional wisdom for the Japanese to look outside their own situation for new ideas to borrow and make their own.

Sushi is one of the exceptions.

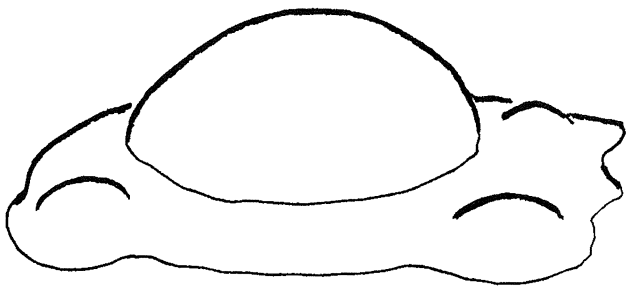


18
Innovation is relatively easy for Japanese firms. With homogeneous memberships and respect for consensus, they can innovate seemingly overnight. Outsiders can't see the lengthy time taken building consensus.



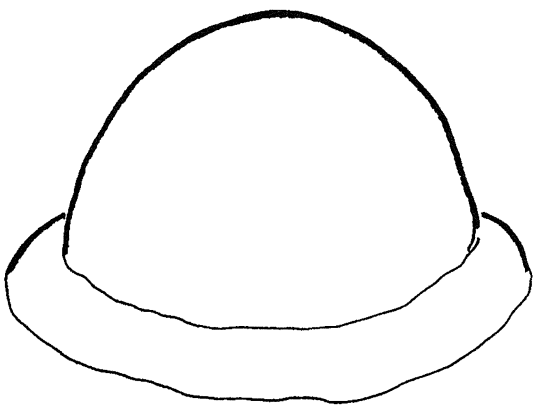


19
This profile typifies a U.S. high-tech start-up. When an organization is young, it is full of new ideas. It has no "yolk" putting limits on possible directions of growth.



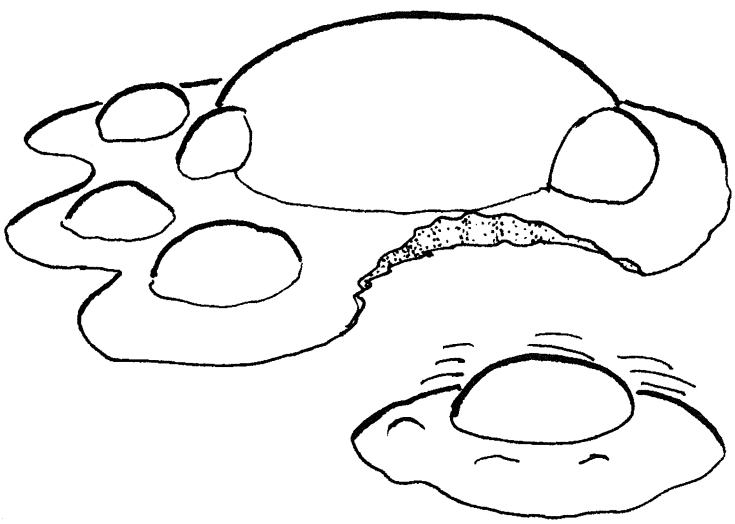
20
As companies grow, conventions are formed regarding both their intellectual focus of effort and their organizational structure.

Rules are made which reduce confusion, require accountability, increase efficiency, promote fairness, and maintain consistency.



21
As organizations grow larger, they can easily become hard-boiled and rigid. Fearful of losing their security, they spend increasing amounts of energy maintaining convention. They become yellow—they avoid risk.

In times of rapid change, playing safe risks being left behind. What would normally be safe behavior becomes risky.



22
Big companies can more easily afford to incubate ideas at the fringe. Resources generated by the success of other products and services can be channelled into these research activities.

23
Paradoxically, the same big companies are the least likely places to innovate. New ideas are seen as cutting into the continued profitability of major existing programs.

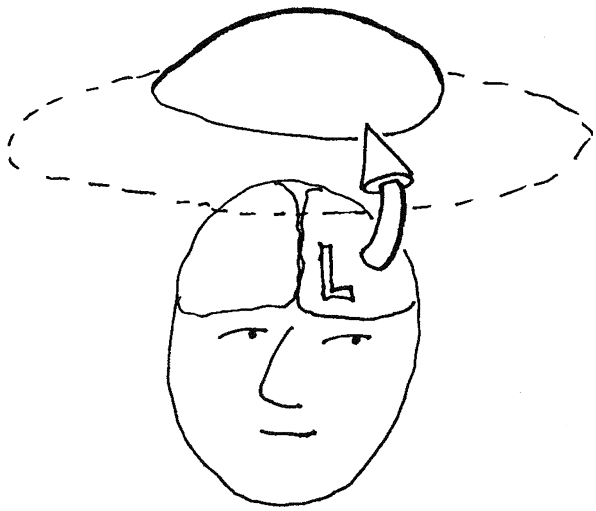
Individuals associated with nurturing these new ideas will move on to other projects, or spin-off and grow their idea into a new firm.

24
What is the nature of conventional thinking?

In our Western culture it is logical, linear thinking using words and symbols with socially agreed-to meanings.

In terms of brain functioning, it is "left mode." In terms of developmental stages, Piaget would describe it as being Symbolic.

In computer terms we would say it is digitized: on or off. It is yes or no and black or white. It is detached and objective.



25
What is the nature of creative thinking?

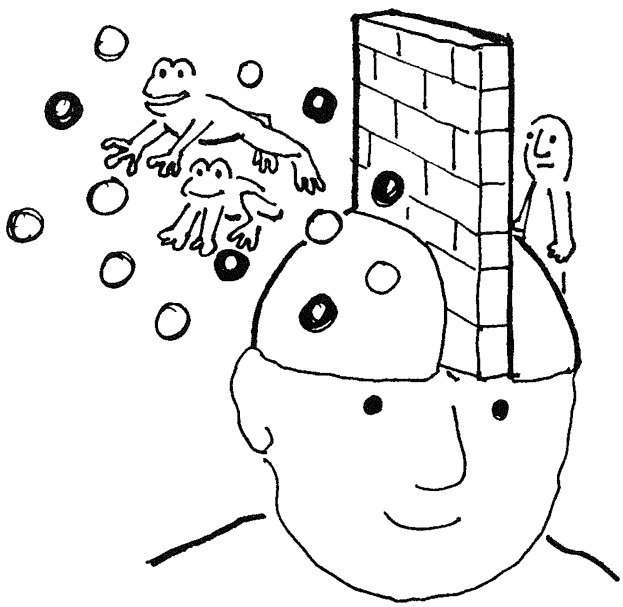
It is nonlinear and intuitive, leaping to make connections between seemingly unconnected things.

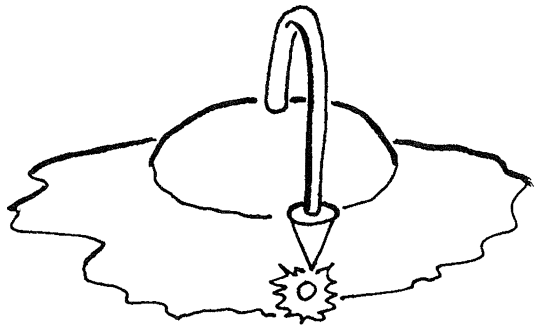
In terms of brain functioning, it is "right mode." In terms of developmental stages, Piaget would say it is kinesthetic and visual.

In computer terms we would say it is analog, real-time, and full-color.

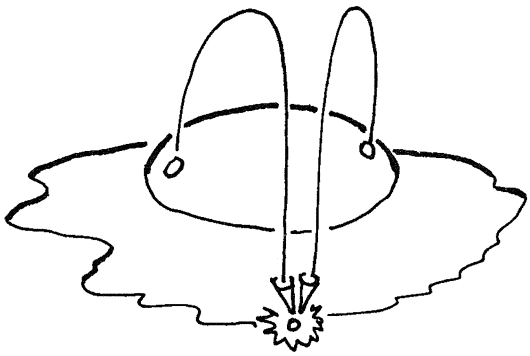
26
Encouraging creativity requires encouraging unconventional right-mode activities.

In Brainstorming, for example, the rules are:
1. Gleefully suspend judgment.
   (Don't apply conventional wisdom.)
   (Being in a state of simply "deferring judgment" is already too judgmental.)
2. Leapfrog off the ideas of others.
   (Don't make logical connections.)
3. Go for quantity and variety.
   (Don't focus.)

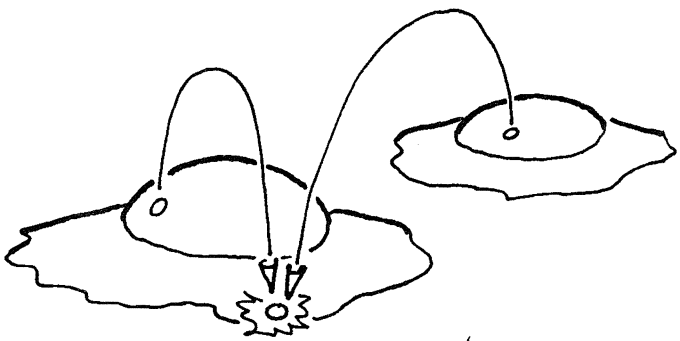




27
Synectic's description for invention is "Make the Familiar, Strange." That is, to invent something, one must look at the familiar, the conventional, in a new way.

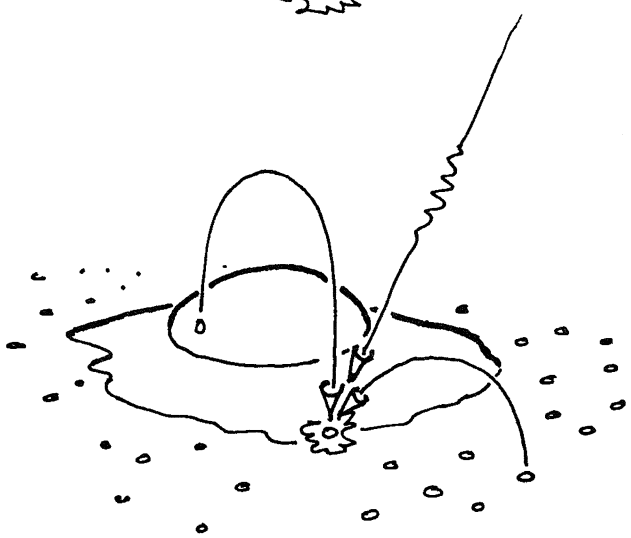


28
The mechanism for "Making the Familiar, Strange" involves the use of analogy and metaphor. Take one existing idea (the problem that you are familiar with), combine it with another from some other source, get a "strange" idea.



29
Strangeness is often enhanced when the idea comes from a totally different location, or culture.

The analogy shouldn't be obvious or fit perfectly. It should have "constructive strain."



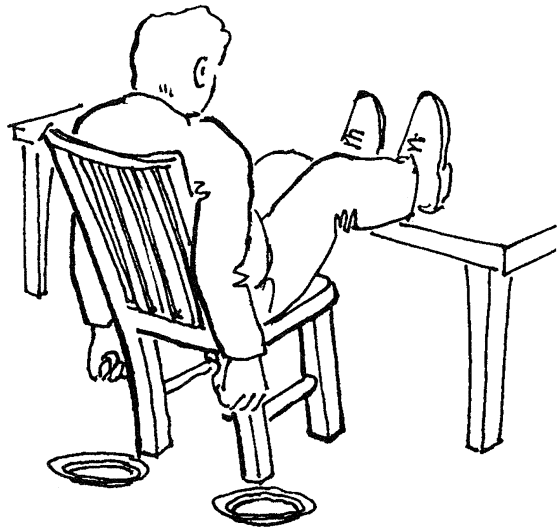
30
Or, the idea may come from out there.

Or really "out there."

31
Making such disparate connections is best done in the theta brain state (4-12 hertz) rather than the fully alert beta state.

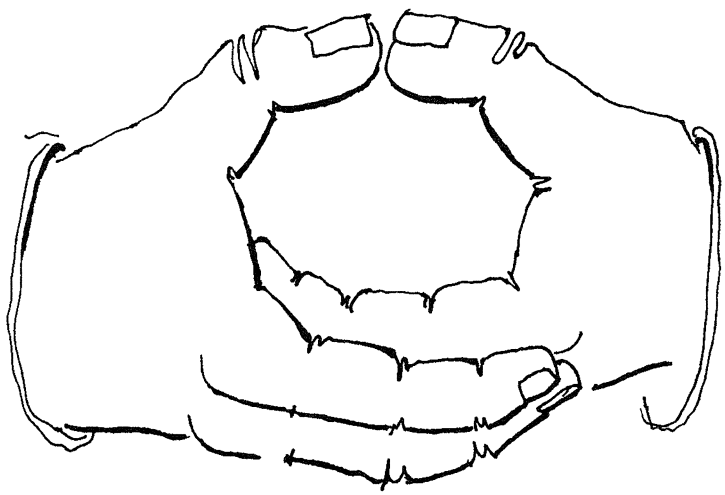
When a person is in theta and slips below about 8 hz, he/she falls asleep. Hypnogogic imagery occurs while falling asleep and hypnopompic imagery occurs while waking.

Edison is famous for his catnaps, feet up on the table and leaning back in his chair. What is little known is that he often held ball bearings in his hands at his sides over pie plates. If he actually fell asleep he would drop the balls and wake up. Primitive, but effective, theta-wave bio-feedback.

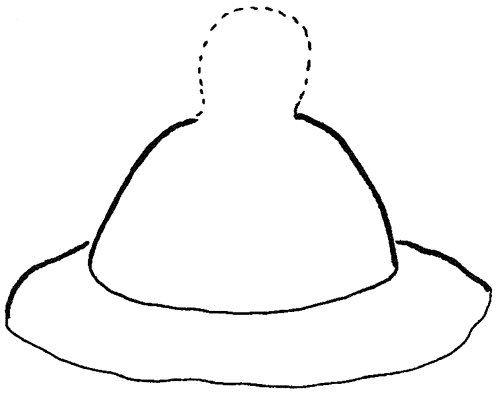


32
Likewise, successful meditation reaches the same state. Zen masters can stay in Theta for hours.

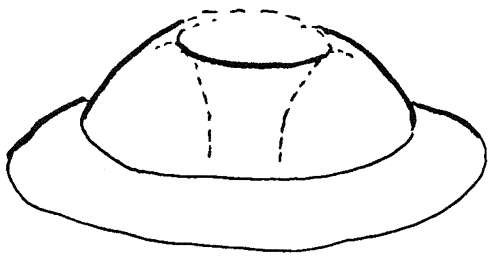
In meditation the hands are held with thumbs lightly touching. They will touch if the meditator falls asleep. This has the same effect as the crash of ball bearings.



33
Words are the pure embodiment of convention. Meditation involves turning off the chatter of the mind. Attention is instead focused on breathing, in and out.

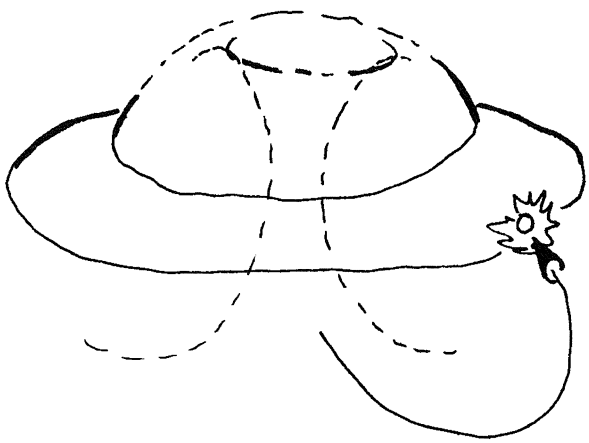


34
The successful meditator eliminates thoughts... words... conventions...



35
...and goes back to his or her pre-conventional awareness.

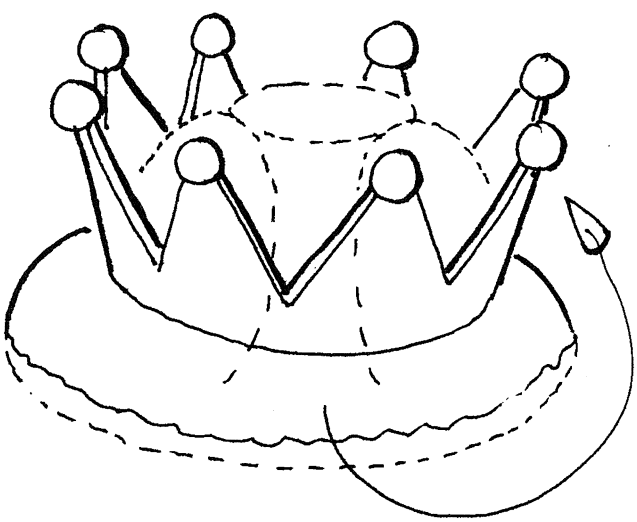
Being origin-al requires going back to one's origins.



36
In this state a person becomes one with the environment. Breathing in and out—"in here" becomes "out there," and visa versa.

The invisible center gains access to all possible ideas.

Inspire-ation.



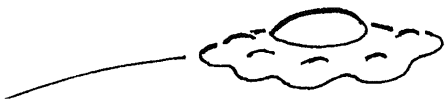
37
As Archimedes put aside his problem and lowered his body into the relaxing bath...

His body merged with the problem...

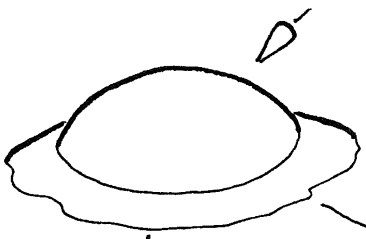
He became the crown.

"Eureka!"

38
Both humans and organizations begin life living in the moment with reckless abandon, full of excitement and possibility.

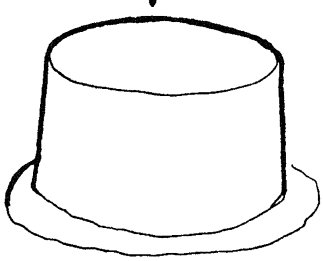


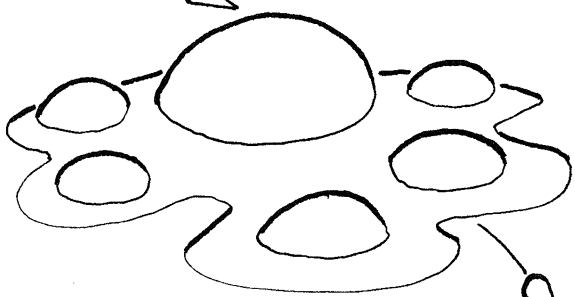
39
Encountering daily lessons, not all pleasant, our knowledge of the environment grows daily. We learn the rules and conventions that make life less painful.



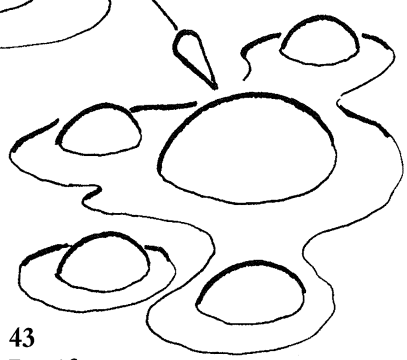
42
If we are fortunate, we continue to grow in understanding. Pushing boundaries, questioning conventions, we can contribute new ideas to the center.

40
If the lessons are too painful we become unadventurous and "fixed in our ways."





41
Scientists become technicians, artists go commercial, writers become hacks, each surviving by churning out a formula.



43
But if we go too far, it is possible to lose touch with the center… to lose control entirely and "break up."

44
With their questioning behavior and joy of living, creative men and women are often described as being child-like (not child-ish).

45
Life is a continual working out of the tension between security and growth.

46
It is obvious now that there is a better metaphor for creativity than the poached egg, namely the Middle Way… the TAO.

YANG, LEFT-MODE LINEAR THINKING: DETACHED, MASCULINE, ANESTHETIC

YIN, RIGHT-MODE INTUITIVE THINKING: INVOLVED, FEMININE, AESTHETIC

Postscript

Three years ago my family spent a five-month tour of duty at Stanford's Center for Technology and Innovation in Kyoto. While there, I investigated the nature of Japanese creativity. Being a visual thinker, I find it helpful to create images for concepts I am trying to understand. The creativity model I developed is described above as having the shape of a poached egg. It could have had the shape of Mount Fuji, except that I needed a metaphor which was far less permanent. Something squashy that can slip and slide around the plate. A poached egg also is appropriate because it has a clearly defined center, the yolk, and an ill-defined edge. In addition, eggs have always been wonderful metaphors for fertility.

There is much more to be said about Japanese creativity than is alluded to above. Professor Kowai, widely regarded as Japan's first Jungian psychologist, suggested that I look at Japanese myths and fairy tales if I wished to understand attitudes about creativity, whether in Japan or elsewhere. Western myths, be they older tales like Andersen's Ugly Duckling or newer ones like Segal's Jonathan Livingston Seagull, all involve heroic and macho images of individual separation and triumphant return. In comparison, Japanese stories are striking for their images of feminine and nurturing self-sacrifice. There is much to learn here.

The relevance of these images to design managers should be clear. The task of leadership involves finding the proper balance between security and growth.

Design managers are perhaps uniquely involved in both invention and innovation. To foster creativity, they must make their staff comfortable operating in the uncertain white of the egg. To foster innovation, they must be able to relate the importance of this work to the survival of the organization.

I have suggested that innovation is a different form of creativity. Rather than involving the skills of invention that most design managers are comfortable with, innovation requires social skills not often included in a design education. Depending on how eager or reluctant the organization is to adopt new ideas, the required skills are those of an educator or a negotiator. Again, the Japanese example is instructive, and Japanese negotiation is one of the arenas I am currently trying to learn about.

Readers interested in the genesis of the poached egg model for creativity may read "An Improved Model for Understanding Creativity and Convention," *ASME Resource Guide to Innovation in Engineering Design,* Cary A. Fisher, Ed., American Society of Mechanical Engineers, New York, 1993. Two other related articles in the same journal may be of interest: "The Use of Improvisational Drama Exercises in Engineering Design Education," and "Incorporating Creativity into the Mechanical Engineering Curriculum," the latter co-authored with Bernard Roth and Douglass Wilde, two Design Division colleagues of mine at Stanford. The description of a course intended to introduce engineers to these concepts, and to the tools of creativity, may be found in "Ambidextrous Thinking", *Innovations in Mechanical Engineering Curricula for the 1990's*, American Society of Mechanical Engineers, New York, November, 1994.

There are three classic books with the word Zen in the title that I would recommend as well: *Zen in the Art of Archery* by Eugen Herrigel; *The Way of Zen* by Alan Watts, which has a superb first chapter on the nature of convention; and *Zen and the Art of Motorcycle Maintenance* by Robert Pirsig, which has little to say about Zen, but a lot to say about quality.

One final note. The life of an individual organization isn't like a poached egg—just as "the map isn't the territory." It is, however, more like a poached egg than a box of chocolates. Life isn't pot luck; it is much more interconnected. The Tao is a much more useful image. As I get older, I find myself less excited about acquiring yet more facts, and more interested in paring away the irrelevant in the hope of finding a few kernels of wisdom. I hope that, in this spirit, you may have found something useful in these visual musings. ◆

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