John G. Young, M.D.

Evolutionary Creativity:
Selection in the Creative Process

John G. Young, M.D.

Adventures in Creativity Publications
1709 Hillside Road, Boulder, CO

Evolutionary Creativity:
Selection in the Creative Process

Printed in the United States of America

John G. Young, M.D.

Dedication

To Diane, Amy, Freddie and Toby, all my love.

Table of Contents

1

CREATIVE BEGINNINGS

GENESIS

When I think of origins, I recall my grandfather, a fundamentalist minister. He did not see the Genesis story as myth, but as literal truth. Though as a youngster I dared not argue with him, I often thought about his opposition to the theory of evolution and his insistence that the Biblical account was factual.

"In the beginning God . . .," he described the Old Testament writer's story of the creation. (1) This origin myth begins with a creator. For the Genesis poets and my grandfather this was the central truth: Everything proceeded from the word of God. St. John put it another way, "In the beginning was the Word." (2) The creation was cosmic wordplay. God inserts His "l" into the "word" and forms a "world." Everything was a separate act of the power of God. My grandfather did not see the Genesis story as a metaphor about creativity at the conceptual level. He didn't have much of a sense of humor either.

God, the creator, creates a universe according to His will. Creation in this view becomes a matter of will power. He decides a new world should come into being. It requires conscious intent and effort. This myth also suggests that creation requires a creator. Other origin myths don't. In this conception a creator has an idea that he carries out. This creation begins with a creator with an idea he wants to develop.

Let's play around with some thoughts advanced in this early story. It suggests some paradoxical ideas about the nature of the creative process and its beginnings, that is, the earliest recognizable stages in the development of any new idea. Creativity

at the conceptual level refers to the formation and development of new thoughts, concepts or images such as those found in poetry, paintings, scientific theories, mathematical formulas, inventions, technologies, production methods, even advertising schemes. Metaphor from the French meta: "beyond" and pherein: "to bring" suggests taking some ideas beyond their usual sense to some new meaning. "Carrying beyond" is basic to conceptual creativity: Creators get carried away with their new ideas.

Myths are stories man develops to explain his experiences to himself. The popular idea of a myth is that it is a false explanation; on the contrary, myths are metaphors containing hidden truths. They are written in symbolic, rather than literal language. They may be true on several different levels like a poem. As explanations they are as comprehensive as they can be when they are conceived. Though their origins are often forgotten, the psychological truths remain.

Myths are continuously being created, even in our scientific age. Theories, for example, are stories that have more or less usefulness in explaining phenomena. They are often good for a season. Psychologists, for example, once thought we had full conscious control over our destinies. Freud then challenged that idea with the mythology of the Unconscious. As our experience changes, we invent a new mythology or resurrect and improve upon old ones.

Certain myths, namely cosmogonic or origin myths, tell of the beginnings of the cosmos. By analogy they also suggest certain psychological truths about conceptual creativity.

LINEAR VS. WHOLISTIC PROCESSES

St. John says the word started it all. Even current understandings of creative evolution recognize that verbal communication caused great change from a purely biological world. Language supported evolution beyond pure genetic transformation. Now there could be cultural changes as information passed from generation to generation, first by word of

mouth, then in written form. Human cultures could go beyond animals.

But with every advance something tends to get lost. Because language usually is expressed in a linear way, it often distorts the reality it attempts to describe. Forcing an organic, interactive process such as creativity into a linear system is like flattening a cube into a square and still calling it a "cube." A dimension of reality gets lost--its wholistic and interactional nature. (cf. web sites)

SEQUENCES IN CREATION AND PRESENTATION OFTEN DIFFER

Let us return to the Genesis story. A few interesting paradoxes might shed some light on creative beginning.

God creates a world to reveal Himself to. He creates the earth, then light, then grass, then the sun. The sequence is confusing, if taken literally and linearly. If the sun was formed on the fourth day of the creation, what provided light on the second? If grass was formed on the third day, how did it receive photosynthetic energy to grow? (The sun was not created until the fourth day.) Yet most creative beginnings are as non-rational and nonlinear.

The sequential confusion in the myth suggests a paradoxical truth, namely, most creations do not occur in the order finally presented. The melody stirring the composer to write may turn up in the third movement. Some parts of the creative act are not even presented. "When I tackle the white canvas," says George Braque, "I never know how it will turn out. This is the risk you must take. I never visualize a picture in my mind before starting to paint. On the contrary, I believe a picture is finished only after one has completely effaced the idea that was there at the start."(3)

Howard Gruber says, "The growth of a creative thought process is complex, often slower than commonly recognized, many-streamed, and endlessly intriguing . . . From the thinker's own point of view, there are doubts, retreats, detours, and

impasses; there are also impulsive moments of decision, leaps into the dark from points of no return."(4) Scientific work is rarely done in the published order.

Rarely do workers define their terms before they begin. They are, on the contrary, the consequence of understanding the problem, not the cause. Researchers change materials and procedures often as results alter original hypotheses. Feedback from experiments determines subsequent directions. Researchers complete their review of the literature after concluding the experiments. Sigmund Freud, for example, put off his extensive review to his most famous work, **The Interpretation of Dreams**, to the very end. It was the last thing he wrote before sending it to the publisher. (5) Most creative people do not know ahead of time what will finally be relevant. Research is groping forward. Experiments do follow one another in time, but rigidly following a fixed order of procedure blocks the discovery process. True discovery always surprises.

THE CONCEPTUAL NETWORK

Not only is creativity nonlinear, we begin all over. Our starting point may be the ending point; the middle may go to the beginning. The scientific method of hypothesis forming, data collecting, and testing is a general outline, not a rigid way to empirical truth. Backing and filling is the nature of the creative process. Just because we write results in a linear fashion does not mean we find them that way. The method is a circumflex going forward, backward, inside, outside tangle of progressions and regressions. The process of thought is full of trials and errors, starts and restarts, blind alleys and occasional open byways. There is no one way to creative progress. There is no one way to begin.

Creators work in a similar fashion to their brain. Although some neuronal connections are serial (one after the other), most are parallel and cross-linked. Stages in the process can be recognized, but creators often use them simultaneously and/or out of sequence.

Scientists, in the end, write their results in terms of logic and reason, but they integrate information from many sources and different points of view along the way. From the framework of an individual experiment each part has to connect with the next in a logical sequence at the explanatory stage. Each line of thought also has to tie together with the strands of logic from other frameworks. Researchers, however, are not mathematicians linking deductions to prove a theorem, repeating experiments several times to "prove" their hypotheses. They go beyond single lines of reasoning. Ultimately they do not think linearly.

Because many overvalue the linear approach, there often is an overvaluation of particular ideas called "insights." It is not the concept, by itself, which has value: If you tie many strands of thought into knots (insights) forming a net, it is not the final knot that provides the "aha" to your theory that matters. You could have tied it together in a different order and another one could have been the final "insightful" one that pulled everything together. Instead, the whole process is necessary and all parts must fit together.

Creators tie several strands of evidence together into a trap to gather more fish than one could with a single hook and line. Gruber says that the general architecture of scientific thinking is like "a network of enterprises . . . which are mutually supportive, yet in some ways they have an existence independent of each other, very much as the strands of a net. And since it is a living network, new relationships are constantly appearing . . . The total process of constructing a novel point of view is so complex that it is impossible to identify the solution of some one problem as a step more crucial than any other."(6)

Jacob Bronowski, the philosopher, says about scientific evidence, "A concept is formed, a law is proposed, not because the repetition of an experiment makes it inevitable, but because a crisscross of evidence from many different kinds of experiments supports this hypothesis (and confounds others) as a plausible way of linking them all together."(7) What convinces us is that the

system as a whole works, not that the same thing is repeated in a linear fashion.

The painter's creative vision, like a scientific theory, holds together because of its wholistic approach. Artists also work in a nonlinear fashion. Although stages can be identified over time, artists also begin and work all over. They make many simple sketches to determine possible positions of the major masses in the picture. They initially avoid getting absorbed in details. They focus on the relationships between the shapes rather than on the beauty of the mark they are making. To become emotionally involved with partial aspects would cause them to lose proportion in the whole design.

Thus, for a work to hold together, we begin all over. We examine the problem from as many viewpoints as we can, integrating as we go along. The conceptual creator, like God in the Genesis myth, begins and works all over, that is, many starts in many places. All converge on the final goal. Conceptual creators develop ideas wholistically. New ideas are netted not hooked.

DOUBLE PARADOX

The Genesis myth suggests a creative double paradox: Poetic truth is sometimes truer than life, and stories about life sometimes have to be false to be true.

Let's take the latter first: In writing a story, at least, the facts sometimes suffer. They are sometimes less important than the presentation as a whole. In art, unlike science, empirical veracity is the least important part of the presentation. Jean Freeman says that a plausible story is more important than the way it actually happened. She says, "A serious writer soon discovers that part of his job is to impose order on life, which is so often full of coincidence, chance, and irrelevance. He must make coincidence seem fordained, turn chance into cause and effect, and rule out irrelevancies altogether."(8) Stories, the product of imagination, have to be sequential and reasonable, the writing of them is often neither. It is paradoxical, but true.

On the other hand, the Old Testament writers did not follow Freeman's advice. Their sense of causality was entirely out of whack. How can we understand this? While these writers described sequences as though they were giving a factual account, they really were depicting subjective experiences: the poetic experience of a God creating "all over." Rather than concern themselves as a novelist like Jean Freeman with plausibility, they expressed a particular understanding: For them the psychological and religious truth was that God created their world. He could do it anyway He wanted. The Creation was a division, expression and revelation of Himself to Himself and to man whom he created in His image.

The Genesis writers were poets. They described essences. They showed God creating. It was kind of messed up back then. Most start-ups are that way. Alfonso X said, "If I had been present at the creation of the world I would have proposed some improvements."(9) But hindsight is usually better than foresight.

A creator wills what he wants and sometimes it gets messed up. A factual presentation is one thing, a poetic presentation another. Sometimes art is "more truthful" than reality. Just as Rimskii-Korsakov's "Flight of the Bumble Bee" characterizes the feeling of bees in flight better than a recording at a hive, so the Genesis version conveys the essence of one idea of creating, that is, a creator bringing into being an idea according to his will. He does it as he wants to.

A TEST OF WILLS

After turning chaos into a world, God feels lonely so He becomes further inspired and breathes life into man. (The word "inspiration" comes from the French "in + spirare": to breathe into.) After creating Adam, He takes one of Adam's ribs close to his heart and shapes Eve. Her shape later creates chaos for Adam.

The story is familiar. God instructs them not to eat of the apples of the tree of knowledge for then they would lose innocence and have to leave the garden. But Eve meets a serpent who cons her into eating the restricted fruit. She, however, bids Adam to try

it first. After both eat, they discover their nakedness and cover up. Eating from the tree of knowledge leads to their "fall" upwards into consciousness of themselves. They then must grow up to struggle in a world outside the garden of infancy.

When we create something, we must give it freedom to grow. It needs to have a life of its own. Sometimes it goes against our conscious intentions, though at times it displays our unconscious desires. Do you really think God wanted man to remain a psychological infant? Would you do that to your child? No, God recognized Man's need to grow up--even if it is hard on both parent and child.

I was told that Adam said to Eve on their departure, "We're living in an age of transition." When we create, we must face change. Moreover, as times change, we must change with them. Do it with a sense of humor.

Creativity results in transitions, but with them there can be psychological growth. The irreverence in the above paragraph suggests that mocking the father (and the grandfather) is important to the separation process in any creative adventure.

Human consciousness requires the ability to say "No." The rebellion in this part of the myth suggests that man, to move from where he is, must say "No" to his father and others that represent the status quo. It also suggests that those who would attempt new beginnings may risk serious loss as well as potential gain, and that those who represent the past may not be completely happy that others want to move on.

Chaim Potuk says in his book In the Beginning, "All beginnings are hard."(10) They are not only hard; they are often unclear, arbitrary and uncertain. The conceptual creator faces many hard beginnings. To be innovative is to struggle with beginnings.

SUMMARY

- Myths are metaphors containing psychological truths. They are written in symbolic, rather than literal language. We are still creating myths to give meaning to our world.

- Cosmogonic or origin myths suggest multiple kinds of beginnings.
- There is no set starting procedure. Creativity is no linear process, but an organic wholistic process. One begins "all over."
- Different perspectives must converge together in an integrated fashion thus some viewpoints have to be altered to fit the theme as a whole.
- Rebellion is often part of the innovative process.
- Creative beginnings are hard, unclear, arbitrary and uncertain.

REFERENCES

1. "Genesis" *The Holy Bible*
2. "St. John" *ibid*.
3. Braque, George. in Sedgwick, John P. Jr. *Discovering Modern Art*, New York: Random House, 1966.
4. Gruber, Howard E. *Darwin on Man*. New York: E.P. Dutton & Co., Inc., 1974.
5. Freud, Sigmund. *The Interpretation of Dreams* (1900) in *The Complete Psychological Works of Sigmund Freud*, Standard Edition, London: Hogarth Press, 1953.
6. Gruber, *ibid.*
7. Bronowski, Jacob. *The Identity of Man*. Garden City, New York: Doubleday/Natural History Press, 1971.
8. Freedman, Jean Todd, "Writing the Commercial Short Story" in Engle, Paul ed. *On Creative Writing.* N.Y.: E.P. Dutton & Co., N.Y. 1964.
9. Alfonso X. Alfonso the Wise (1226-1284) quoted in *The Great Quotations* compiled by George Seldes. New York: Pocket Books, 1967.
10. Potuk, Chaim, *In The Beginning*. New York: Knopf, 1975

2

OTHER COSMIC BEGINNINGS

THE UNCREATED UNCREATIVE UNIVERSE

Other religious myths suggest that the universe was uncreated, that is, there was no outside "creator" who willed that a world come into being. The Jaines did not believe in true creation, i.e., developing something new. For them there is nothing new under the sun. Instead, their world was a cycle of no real change.

The uncreated universe of the Jaines. Unlike the linear Judeo-Christian view, that is, the creation, the fall, the incarnation and the redemption, the Jaines believed in a circular universe. This Indian religion and philosophy, dating from the sixth century B.C., tells of an uncreated universe. They conceive the cosmos as eternal and infinite. For them time is without beginning. Like a wheel spinning it is a cycle without progress. Time goes through twelve stages like the spokes in a wheel. Six spokes constitute the ascending progress of man and six spokes the descending deterioration. (1) Whatever is created is later destroyed. What can we learn from this origin myth?

Destruction and creation require one another. Though most think of the creative process as the building up of theories, paintings, poems and so on, the ability to break down the no longer useful is an important part of the creative process. Picasso says, "With me, a picture is a sum of destructions."(2) Because we cannot create *ex nihilo*, that is, out of nothing like the Old Testament God, we have to change what is. Creativity is

restructuring the old into something new and better. Paradoxically the courage to create is also the courage to destroy.

"Beginning points" are only arbitrary designations. The Jainesian myths suggest that not only is destruction part of creation, but also that beginning points in any creation can only be arbitrarily assigned. They point out that every beginning is an ending; every ending is a beginning. The designation "commencement" at the time of graduation from school points out this truth.

Poets, for example, often do not know the source of their poems. They may remember the stirrings--some scene, a sound, an image. A memory connects. But before they began to write, they were ready. Their life experiences up to that time, their cultural heritage, their participation in the "collective unconscious--all are beginnings.

Feelings stirring within poets may remain unarticulated until an outside stimulus activates them. Paradoxically when poets have intense feelings, they are usually unable to write. It is only after the affects modulate with time and distance that they can put them down on paper. The ending of the strong emotion sets. the stage for a quieter time. The poet writes in tranquility. The cycle goes on.

Poets, moreover, are different when they write about their emotional experience from when they had them. As Hericlitus said, "One cannot step twice into the same river."(3) Thus there are several beginnings: when one first has the feeling, when some outside stimulus brought the emotion back into consciousness, and when one feels free to combine them all into a poem. When did it all start? Beginning points are only arbitrary designations.

ORGANIC CREATIONS

The Hindus' sacred work, the ***Chandogya Upanishad***, uses a biological metaphor. "In the beginning this world was merely nonbeing. It was existent. It developed. It turned into an egg. It lay for a period of a year. It was split asunder. One of the two eggshell parts became silver, one gold. That which was of silver is the earth. That which of gold is the sky. What was the outer membrane is the

mountains. What was the inner membrane is cloud and mist. What were the veins are the rivers. What was the fluid within is the ocean. Now, what was born therefrom is yonder sun."(4)

New ideas like eggs develop as a whole. According to the metaphor of the emerging embryo, we cannot change the ultimate condition of the animal or plant or by implication, the creative product. We can nourish it or hinder its growth. We can kill it off. But we can't change its inherent nature. The genes determine its destiny. This view takes the "all or nothing" attitude about creativity.

Some psychologists take this viewpoint. They think that administrators, for example, must identify the creative people in their organization and give them different tasks from the others. They do not think that creativity can be enhanced in just anyone. According to this attitude either you have the ability or you don't.

While I like the biological metaphor of wholistic change, I don't take this all or nothing viewpoint. Everyone can change in someway. The genes themselves can and do change. *Creativity is an organic process involving the whole being of the creator which extends biological evolution to new levels of experience.*

SELF-ORGANIZING EMERGENT CREATION

The Navahoe and the Zuni interpret cosmic beginnings through myths of emergence.(5) Unlike the Old Testament God creating outside Himself, these American Indians saw the creation as a process emerging from within. The earth gradually expresses inherent possibilities. This continues the organic metaphor of the eastern Indians.

The system as a whole expresses its potential. Not only do poets often not know the "true beginning" of their poem. They frequently are not in as much control of the process as they would intend.

Feelings held in memory and an external stimulus often combine in unexpected ways. Hence the poem may reveal more than the poet consciously intended. The creation is sometimes

more than the creator wills. The new creation emerges out of the unconscious through a process the poet can not fully control.

There are some who would say that the poet is in full control like the God of the Old Testament. Edgar Allen Poe, for instance in writing about his poem, the *Raven*, says, "It is my design to render it manifest that no one point in its composition is referable either to accident or intuition--that the work proceeded, step by step, to its completion with the precision and rigid consequences of a mathematical problem."(6)

Though I cannot prove it, I think he "protests too much." Poe, whose ghost stories showed that he was in touch with his unconscious so much of the time, may have needed to emphasize the rational in his work. Maybe he scared himself. But that Poe used craft in his work is not doubted.

A poem may reveal more than the poet intends. I remember the surprise I felt when someone interpreted a poem I had written in a new way. Initially I thought their idea was a misinterpretation--it was not what I had meant. But on more sober reflection, I had to admit that the discovered meaning was there. The poem expressed more than I was consciously aware of. It communicated more about how I was feeling than I knew. Critics and therapists interpret an author's work and reveal many of the levels present, even those out of the writer's conscious awareness. The reader also has a part in the creation--not only re-creating what the poet consciously intended, but also discovering what the *poem* itself intended. The poet and the poem emerge as a new creation. The order emerges through its own power.

Monroe Beardsley in his article, "On the Creation of Art," says, "The real nature of the artist's control over the creative process will elude anyone who looks for a single guiding factor, whether a need or an end. It is internal to the process itself . . . the crucial controlling power at every point is the particular stage or condition of the unfinished work itself, the possibilities it presents, and the developments it permits."(7)

Like the egg embryo, the cosmos, for these Indians is *self-organizing*. How do systems self-organize? Inherent in the structure of the individual elements is the capacity to combine as slightly opened paper clips will link when jostled together.

Biological evolution, for example, proceeds along similar principles of self-organization. The genetic molecule DNA, deoxyribonucleic acid, makes necessity out of chance occurrences. When cosmic rays or other energy sources alter the structure of the neucleic acid sequence, all subsequent cells retain the change. The ability to stabilize chance alterations is a major self-organizing principle of biological creation. We will explore some of this in greater detail later.

Conceptual creativity extends biological evolution's self-organization. As in the Navahoe and Zuni myths, biological evolution proceeds along the principle of emergent self-organization. Mutant organisms that can fit in with the surrounding environment have a better chance than the unfit. Survival of the fittest does not necessarily mean the strongest; it means the most adaptable to the conditions. The environment selects in a self-organizing way what will survive.

Each level of organization has its own principles of development and re—organization. Simpler systems become parts of more complex systems. Arthur Koestler, the author of *The Act of Creation*, says, "A part is a whole is a part."(8) Organizations at the physico-chemical level become a part of a new whole at the biological level; wholes at the biological level become parts at the cultural level. The parts and the wholes self-organize, they don't require an outside creator.

SELF-AWARE CREATIVITY

These myths say much about conceptual creativity. We can be a part of evolution's self-organization. We can be the self-reflecting innovator and part of the emergent process. The scientist, for example, takes the dual role of creative thinker and discoverer of what emerges. He is the active formulator of

hypotheses like the God of the Old Testament, but he must accept what his experiments give to him. The researcher develops theories according to his understanding; his experiment answers back according to what is inherent in nature.

Like the emerging universe of the Indians, science is self-organizing. Its organization develops from the principles of procedure: data must be empirical, experiments must replicate and be consistent with other experiments, formulas must be simple yet comprehensive. When results do not fit with other results, one must search for a better explanation. Though the path of science can not be predicted, it can be influenced by the researcher's interest, grant monies and government supports, but the ultimate content depends upon the self-organizing principles of science.

Because we are aware of our part in the process, we can have some say in our development and change. We have emerged as creators. We become part of evolution's self-organization, but it creates problems and challenges too. For example, as we help juvenile diabetics live to reproductive age, we alter the gene pool so that there are more diabetic genes around.

Not only can we alter the cellular environment of a diabetic by giving him insulin to allow him to continue to adulthood, but we can alter the genes themselves. Recombinant gene experiments make possible alterations of future generations. In one generation we have gone back to the beginning. Initially biology determined culture, now culture determines biology. Not only can we modify our culture through conceptual changes and change our biological internal climate through medicines, we have the potential to modify our genic selves. Through genetic engineering we have come full cycle like the James.

Thus in our creative beginnings we share some of the psychological truths of all the myths. We shape materials according to our wishes and wills like the God of the Old Testament. We participate in a process that cycles through time like the James. We foster what inherent Indian egg-like possibilities that reside within us. But, we are not stuck with what

we have. We are not helpless to cultivate only what is inherent in the egg, for we can change the genes. The consequences of our meddling we can not fully predict. We have to be responsive to the answers our creations give us.

THE BIG BANG

The current mythology is that the universe began in a giant explosion about 16 billion years ago. Unlike God's creation, final and complete in six days, the new mythology has the universe slowly evolving into galaxies and solar systems according to the laws of physics and chemistry.

Western and eastern cosmogonies are represented in the controversy about the new mythology. There are those who claim a singular event that extends linearly and others who propose a cyclical process. "If space is hyperbolic," says Owen Gingerich, "then the universe is open and unbounded, and the galaxies will forever rush away from one another, leading to an ever colder, fainter, and more tenuous distribution of matter. On the other hand, if space is spherical, then the universe is closed and bounded, and its expansion will eventually slow to a stop, followed by contraction and a mighty explosion. The open universe is a one-time affair, but the closed universe might be a single cycle of an infinite series of oscillations."(9)

We extend that physico-chemical and later biological evolution through our creative thinking. Because we can be aware of ourselves in the process, we can share in our evolution.
We are the only structure, yet evolved, which can reflect on our origins and create a mythology about them. Through conceptual creativity we extend and direct our destiny. It is an awesome responsibility. Can we really improve on Mother Nature or will we fold in upon ourselves contracting into a mighty explosion?

LITTLE BANGS

Some enterprises begin with a big bang, but not all have such dynamic origins. Though some geniuses like Mozart and God hear a whole composition in its final form, most like Beethoven have

only vague, initial glimpses of what, with continued working, will become a great symphony.

Some beginnings are very ordinary affairs; they are rarely glorious inspirations. As with biological creativity more children result from routine sex than are conceived in romance. Often creative change is not apparent until much later as with the origin of life itself. Living organisms originated sometime between 4.7 and 3.2 billion years ago, the former time being the date of the formation of the earth and the latter the first dated alga-like fossels. But when the exact shift from non-living to living forms occurred is open to question. In fact, Paul Ehrlich, the biologist states, "most biologists believe that there is no significant discontinuity between the living and the non living"(10)

Similarly no sharp distinction may exist between ordinary, mundane living and creative expression, at least in the early stages. The one year old child scribbles his "pre-Jackson Pollach" with the same enthusiasm and style as most other one year olds. Holding the crayon and moving it against paper to produce a mark is the new step for him. He has expressed himself.

Conceptual creativity, thus, is a process of continuation and change. Like biological creation it is one of gradual separation. As with life, does the process begin with conception? with birth? at the time of nine month separation anxiety? when we leave home for college? In short, there are many beginnings.

SUMMARY

- Some creations require an external creator, some don't.
- Sometimes we are not in as much control of the process as we might wish. Sometimes the process has it own demands.
- Myths point out that we shape materials according to our wishes like the God of the Old Testament. We participate in a cyclic destructive and creative process like the James. We foster the inherent egg-like possibilities within us, but we need not only take what is given for we can make changes,

yet there are consequences to our meddling which we can not fully predict.

- Innovative beginnings may be big bangs or little ones.
- Conceptual creativity extends biological creativity. The latter may serve also as a metaphor for the former.

REFERENCES

1. Campbell, Joseph. *The Hero with a Thousand Faces*. Princeton, New Jersey: Princeton University Press, 1968, pp.263-4.
2. Zervos, Christian. "Conversation with Picasso" *Cahiers d' Art* translated by Brewster Ghiselin. 1935. in *The Creative Process* ed. Brewster Ghiselin. New York: New American Library, 1952.
3. Heraclitus quoted in Bakewell, Charles M. *Source Book in Ancient Philosophy*. New York: Charles Scribner's Sons, 1935.
4. *Chandogya Upanishad*, 3.19. 1—3 quoted in Cambell, Joseph. *The Hero with a Thousand Faces*. Princeton: Bolling Series, 1949.
5. *Encyclopedia Brittanica* Macropedeia Vol. 5, p. 240
6. Poe, Edgar Allen. "Creation as Craft." in "The Philosophy of Composition." *Graham's Magazine of Literature and Art.* April 1846, Vol. 28, No. 4. pp. 163-164.
7. Beardsley, M. C. "On the Creation of Art," *Journal of Aesthetics and Art Criticism*. Spring 1965, No. 23.
8. Koestler, Arthur. *The Act of Creation*. London: Hutchinson,1964.
9. Gingerich, Owen, *Cosmology + 1* San Francisco: W. H. Freeman and Company,1977.
10. Ehrlich, P., Holm, R. and Parnell, D. *The Process of Evolution*. New York: McGraw-Hill Book Co. 1974.

John G. Young, M.D.

3

STABILITY PARADOXICALLY PROMOTES CHANGE IN CREATIVE SYSTEMS

Eastern Indian myths about the beginnings of the universe use a biological metaphor. Because myths and metaphors point in directions we might not ordinarily look, it seems helpful to examine some of the similarities between biological evolution and conceptual change. There are several reasons for this:

First, we extend biological evolution with a cultural one of our own, just as biological evolution extends the physico-chemical one. There are many similarities between cultural change and biology. Conceptual creativity like biological creativity is an organic process in which parts relate and change in systematic coordination.

Second, biology shows that there are many species and many ways to change, asexual and sexual reproduction, several conditions as in metamorphoses of the butterfly, and different modes of existence like the parasites and symbionts as well as autonomous organisms. So too, there are a variety of ways persons conceptualize new ideas suitable to their personality, several phases a project may go through, and different creative units from the lone artist or inventor to large research teams who require each other to bring the project to completion.

Third, we modify our cultural life through *similar processes* of creative change. Like biological evolution, many are formed, few are chosen. Some possibilities fit in better, result in more offspring, win over lesser competitors. Conceptual creativity, like

Evolutionary Creativity:
Selection in the Creative Process

Darwin's concept of evolution by natural selection, involves the selection among different possibilities. One "selects creative/innovative approaches" to come up with alternatives, then one chooses among them to develop the best approach. (l)

Fourth, in our generation we are beginning to alter our own evolution through genetic engineering so that we become even more a part of the universal creative process. We are "fooling around with Mother Nature." Hence, it is important to understand some of the similarities between biological evolution and conceptual creativity.

ORIGINATING NEW STRUCTURES TAKES TIME

I am told by Floridians, "When you are up to your neck in alligators, it is hard to remember you set out to drain the swamp." It is difficult to do anything constructive when there is chaos about you or within you. Creative change occurs slowly in chaotic conditions. Chaos opposes the integrative aspects of creativity as death opposes life. Entropy, that process that opposes form, pattern, hierarchy or differentiation moves in the opposite direction to the constructive forces in the universe. Entropy destroys, negentropy or "syntropy" builds.

We don't know the status of the universe before the "big bang," but the explosion destroyed whatever organization existed beforehand. After breaking that whole into tiny parts the integrative forces took over. Creative evolution began.

It was a *slow* process. On earth it took one and one-half billion years for physico-chemical evolution to proceed to the onset of life. Atoms randomly interacting in the primal soup only very slowly organized into more complex molecules, which eventually formed living systems. Creative change occurs slowly in chaotic conditions. The probability that order will appear by chance is low so it takes a long time. Randomness acts against chance forming useful combinations.

New structures build slowly in comparison to discovering a new idea within a familiar paradigm. Creativity at the emergent

level, that is, at the level of significant originality takes time. (2) Howard Gruber says that "Darwin's achievement was realized not in a golden moment of insight but in the slower process of constructing an original point of view."(3) In developing a new perspective one must let go of multiple old ways and form many new ones. The originator has to go through a complex letting go process in developing a highly original concept. Gruber says, "As the individual departs from accepted patterns of thought, he moves into area where basic premises defining soluble problems are less and less clear. Ill-defined problems are hard to solve, and some of them, when clarified, turn out to be insoluble. The time devoted to such matters may be not only unproductive but disruptive as well."(4)

LIMITS PARADOXICALLY ADVANCE CREATIVITY

Creating in chaos takes time. Limits serve constructive purposes in developing something new. Too few constraints can limit problem solving as much as too many. Constraints support selection as, for example, in science. Ornstein says, " Our senses limit; our central nervous system limits, our personal and cultural categories limit, language limits; and beyond all these selections, the rules of science cause us to further select information which we regard as true. By a slow, conservative process of construction, science gradually builds a stable core of knowledge. . . It constitutes another highly specialized development of consciousness, at once it most conservative, yet its most reliable." (5)

The creative process thus requires limits to establish effective change. It requires continuity too. Continuity and transformation work together. Biological systems have evolved two ways of maintaining the stability required to promote constructive change. One way to establish continuity is to keep all the elements in the same place. Another is to make sure that the elements stay in the same arrangement. This essay will focus on the former, the next essay on creative evolution will focus on the latter. Evolution provided for both of these limiting situations:

BOUNDARIES HELP FORM STABLE SYSTEMS

One of the earliest contributions to biological order was the formation of a boundary which kept molecules together long enough to react with one another. The new system superseded the former random arrangements and sped up the process of chemical combination by preventing the system from flowing away from itself. Protobiological structures were large molecules that initially performed this task. Within these semi-stable membranes certain reactions could take place to advance biological evolution.

The next stage was the formation of more sophisticated cellular membranes which established more stable boundaries. They separated cells from each other and from their environment such as a frame sets off a picture from a wall. Membranes, hence, made possible individual units that can function autonomously or as parts of larger systems. Boundaries established units that could serve as *building blocks*.

Boundaries not only separate parts from other parts; they also help to *organize information* as we take it in. Our nervous system, for example, is organized to receive information in a particular way. We organize our world in terms of boundaries. At the periphery of our nervous system we organize our world in terms of boundary recognition. The human eye, for instance, is not like a television camera, which scans a scene, produces many dots, and then sends it back to the brain to be read. Instead, the rods and cones of the eye are "boundary recognizers." The rods and cones of the eye "look for" straight and curved edges, contrasts of light and so on. (6) Boundary meets boundary.

Boundaries are necessary to conceptual thought. In abstract thinking one needs to be able to separate one group of ideas from another. The boundaries help the creative thinker to select and organize information into categories. Albert Rothenberg says, necessary to category formation is the capacity to discern and define boundaries between elements of experience and to distinguish the essential from the non-essential."(7)

Boundaries not only separate and inform, they also *contain.* Ideas also need to be contained, held together, in some way so that they can be considered simultaneously. The ability to hold a large amount of material actively in memory is an important attribute of creative genius. If you can hold all the ideas necessary to complete a problem in your head at the same time, you can work with each of them simultaneously comparing them with all other parts of the project. You can contain all the information so that all the elements can be simultaneously considered.

Let's look at a letter Mozart wrote about his creative process:

> When I feel well and in a good humor, or when I am taking a drive or walking after a good meal, or in the night when I cannot sleep, thoughts crowd into my mind as easily as you could wish. Whence and how do they come? I do not know and I have nothing to do with it. Those which please me, I keep in my head and hum them; at least others have told me that I do so. Once I have my theme, another melody comes, linking itself to the first one, in accordance with the needs of the composition as a whole: the counterpoint, the part of each instrument, and all these melodic fragments at last produce the entire work. Then my soul is on fire with inspiration, if however nothing occurs to distract my attention. The work grows; I keep expanding it, conceiving it more and more clearly until I have the entire composition finished in my head though it may be long. Then my mind seizes it as a glance of my eye a beautiful picture or a handsome youth. It does not come to me successively, with its various parts worked out in detail, as they will be later on, but it is in its entirety that my imagination lets me hear it. (8)

What a rich explanation of the creative process. Let's mine its wealth. First, he begins in a relaxed state and *allows* thoughts to come into his mind. He does not force them to be this way or that, but instead takes what is offered from his Muse.

Those that please him (he does after all have a critical faculty) he keeps in his head and hums. Here is the first important part of memory and containment. You must be able to remember what comes to you. Everyone, for example, dreams every 90 minutes each night, a gift from our unconscious, but how many dreams do we remember? Being able to keep in our head fugitive material is very important. We need to contain what comes. I, for example, will find some interesting musical material while improvising on the piano, but because I can not remember what I played long enough to work with it, I have to keep on inventing new material all the time. I remain at the inventive level of improvisation, instead of going on like Mozart to emerge with higher and higher levels of integration of musical themes. (9)

Mozart hums the themes. He works with the material to get to know it. He wants to further imprint it on his memory. He wants to move it from short-term memory to long term memory where it will have connections with other musical ideas.

The musical idea stirs further associations, just as any word will stir certain verbal associations. They lead to another melody, which links it to the first one. The first makes certain requirements that the second conforms to. The music requires certain responses that Mozart must relate to. Rather than make the music go this way or that, Mozart, instead, sees what the implications of the first theme require of the second. Thus as he works in his head, he considers the "needs of the composition as a whole: the counterpoint, the part of each instrument."

These fragments work together to produce a complete work. In one sense it is a cybernetic process. (l0) Later parts feed back to earlier parts working together to converge onto the final integration of the piece.

His first draft stirs his imagination. Parts are smoothed out. Transitions improved upon. The works grows and becomes more defined. He expands upon it, "conceiving it more and more clearly until I have the entire composition finished in my head though it

may be long." Then he sees the overall composition in his minds eye like a "handsome youth" or hears it in his mind's ear. Like the right brains s recognition of someone's face in an instant of time, the whole comes together to be taken in all at once.

Let's return to his last comment that "It does not come to me successively, with its various parts worked out in detail, as they will be later on, but it is in its entirety that my imagination lets me hear it". How can you hear music that extends over time "in its entirety"? The way I conceptualize what Mozart says is that it is similar to what a jazz musician does when he improvises. He senses the underlying melody in his head as he simultaneously explores the possibilities in his improvisation.

If you can contain all the information in one place, then you can get an overall viewpoint, a "syncretistic" experience where you sense the whole without necessarily working out all the details, which, as Mozart says, will be looked at later on. If, on the other hand, you have a poor memory, you can't contain all the elements at once. You have to write the parts down as you come to them. You have to gradually enlarge your boundaries to include more elements. You have to gradually work them out through multiple revisions as Beethoven did.

STABLE UNITS COMBINE TO FORM MORE COMPLEX STRUCTURES

Simple units may combine to form more complex structures. Often the creative act is integrating simple parts into a workable whole.

When the individual cells are combined, they relinquish some of that autonomy to take part in a larger whole. General systems theorists call this "progressive mechanization" where parts become fixed with respect to certain actions. Together the cells form tissues and at a higher level, organs and organ systems. The membrane separates structures but permits passage of information and materials to allow the larger whole to function.

Thus the cellular units are parts of the larger whole, the tissues, which, in turn, are parts of the larger whole, the organs and

so on. The whole is a part of a larger whole, which in turn is a part of a larger whole, organizes biological systems in a hierarchy. Arthur Koestler's book, *The Act of Creation,* spells this process out in excellent detail. (l1)

Erich Hertzmann writes that Mozart's creative process had a stamp of unity in any theme. But when he had to write longer works, even he did have to work to integrate the units into a larger organization:

Before Mozart wrote down the fair copy of a composition it had been worked out mentally in the form of an imaginary sketch from which he copied the music, as it were, from memory. For works of large proportions he made stenographic drafts consisting of melody and bass, while the orchestration and details were left for a more leisurely time. Music of polyphonic texture was a problem.

Since contrapuntal writing did not come to him very easily, he prepared it on separate sketch leaves before entering it in his score. The passages of double counterpoint and in fugal or canon style are so skillfully and unobtrusively woven into the fabric of the music that the listener is hardly aware of the beautiful craftsmanship. It is the balance and integration of all component parts that make for his real greatness."(12)

THE PARTS AND THE WHOLE ARE INTERRELATED

One cannot do without the other. The lower units have their separate organizations, but they are dependent upon where the larger organization takes them. If, for example, you get a viral infection of the neurons in your brain and enough individual cells die, all of you goes. If you, on the other hand, jump out of a plane without a parachute, every one of the cellular parts will die with you. The whole determines the fate of the parts and vice versa.

This part-whole, whole-part relationship also forms the organizational structure of conceptual systems. In writing this essay, for example, individual paragraphs had to work together to present a single concept. They had to be arranged in a way that you

could follow them without getting bored or lost. But the arrangement as a whole also determined what would be included in individual paragraphs because I couldn't mention certain ideas until I prepared their way with earlier explanations.

This is the constant concern of the writer. For example, as I begin a paragraph I make associations to clarify the original idea. But the associations themselves set off new associations that can take me in a different direction from my original intention. I have to make a decision whether to follow my original direction or explore this latter development which might have more possibilities. Any exploration is bound to alter the whole organization of the essay.

The parts and the whole must work together, i.e., organically. The effort to integrate the whole necessitates changes in various parts. Graf says that in analyzing the sequences of Beethoven's notebook on the Eroica "the growth of one section is directly followed by increase in an adjoining section; the changing of one part involves that of another, and the later portions of the work develop out of the earlier."(13)

Leonard Bernstein in discussing Beethoven's Symphony No. 6 in F Major, Opus 68 on public television says that Beethoven's melodies, harmonies and orchestration were mediocre. He said that what made the work such a piece of art was how each note was inevitable.'' It just had to follow from the previous one.

I do not believe that Beethoven could not write great melodies or harmonies, but instead he subordinated each to the greater purposes of the whole. When a part predominates, it kills like a cancer cell whose function no longer coordinates with the purposes of the whole organism.

SUMMARY

- Conceptual creativity shares many features of biological evolution.

- Stability paradoxically promotes change. Chaos and chance take too long.
- Membranes or boundaries allow elements to interact.
- Boundaries organize incoming information. Larger structures build from smaller units.
- Part-whole, whole-part relationships must be constantly considered to integrate creative work. One creates organically.
- Continuity and change depend upon one another in creativity.

REFERENCES

1. Young, J. *S.E.L.E.C.T. CREATIVE/INNOVATIVE APPROACHES.* Buffalo, N.Y.: Bearly Limited 1985
2. Young, J. *ibid.*
3. Gruber, Howard. *Darwin on Man*. New York: E.P. Dutton & Co., Inc., 1974.
4. *Ibid.*
5. Ornstein, R. *The Psychology of Consciousness*. SanFrancisco:W.H. Freeman and Co., 1972.
6. Bronowski, Jacob. *The Origins of Knowledge andImagination*. New Haven:Yale University Press. 1978 pp. 16-17
7. Rothenberg, Albert. *The Emerging Goddess*. The University of Chicago Press! Chicago 1979 p.265
8. See Paulhan, *Psychologie de l'invention*, p.97, who refers to Seailles, *Le Genie dans l'art*, p.177
9. Young, J. *ibid.*
10. *ibid.*
11. Koestler, Arthur. *The Act of Creation.* New York: MacMillian, 1964.

12. Hertzmann, Erich. "Mozart's Creative Process." in *The Creative World of Mozart* edited by Paul Henry Lang. W.W.Norton & Company, Inc. New York pp.28-29
13. Graf. M. *Die innere Wekstatt des Misekers* (Stuttgart: Verlag von Ferdinand Enke, 1910), p.206

4

STABLE REPLICATION SUPPORTS THE EVOLUTION OF NEW IDEAS

Within the cell the DNA molecule provides a means to replicate molecules to create another kind of stability. DNA creates a complimentary image of itself, and with another molecule RNA, riboneucleic acid, in a complex process makes proteins. Time after time, amino acids line up in the proper sequence. Protein after protein forms.

Cells can reproduce in two ways: asexually and sexually. The latter is more complex so I will look at it later on. The first, and earliest, is asexual reproduction. After the DNA molecule replicates itself, individual cells divide into daughter cells which are alike. They can form into long chains or other kinds of organizations.

The ability to copy or repeat was a major advance in evolution because it made it unnecessary to wait for chance to come up with another unit with which to build a more complex structure. Stability precedes change.

The human brain is similarly organized first to provide a stable situation and then a dynamic one. To use the example of vision: After the eye organizes the incoming stimuli in terms of boundaries and so forth, the hindbrain continues to structure the information in the same sequence just like conceptual evolution.

R. W. Gerard says, "In all human thought, the constant is adumbrated before the variable (mathematics), statics before dynamics (physics), structure before function, and classification before relationship or evolution (biology) . It is not surprising that

this is so, for thus does the brain create imaginings: remember that stimulation of the visual projection area generates static lights; of the first association area, dynamic ones; and of the second association area, moving pictures!"(l)

MEMORY PATTERNS

At the conceptual level stability occurs through memory. Because we remember, we establish continuity with the past and have something to build upon for the future. That is why it is important in any creative process to prepare by studying what has gone on before. We don't have to begin everything from scratch. Through memory we also establish and maintain a sense of self from which we innovate.

The absence of memory slows new achievement. Gruber says, "a novel achievement is often unstable simply because there exists as yet no structure into which it can be assimilated. It is therefore neglected or even forgotten."(2) This is similar to some of my patients who respond with sincere affect to an interpretation. At that instant they have true insight, but then in the next moment they lose it. Initially I thought this was resistance to the new idea, but instead I believe it is probably the inhibition that comes from no stable context in which to assimilate the idea. Frameworks take time to develop and require memory.

The DNA molecule replicates a pattern or code that makes possible a stable copy. In the brain the replication of patterns is somewhat more complex. The brain provides a means for incoming information to organize itself into patterns.

According to Edward de Bono, in his book, *The Mechanism of Mind*, the brain sorts information passively according to the sequence in which it presents itself.(3) This model of the mind suggests a *tabula rasa* or blank slate. But unlike Lockeanism, this blank slate not only receives input, but *the input itself sorts future inputs*. Early inputs alter how later inputs will be ordered. In this model information is active; the mind passive. The latter merely provides an opportunity for information to sort itself. The brain' s memory becomes a surface upon which some trace is left in the

form of altered behavior of the nerve cells. Another way of saying this: "As the twig is bent, the tree will grow." The twig remembers the initial pressures so the early direction becomes fixed and effects the latter growth.

The brain thus sorts information according to how it fits with earlier information. Memory traces arrange the input. This provides for a mental process that gives continuity. It produces the stability that overcomes chaos and creates a platform for building larger more complex concepts.

A patterning system selects from a large amount of incoming information. Stimuli constantly present itself to our brain through our sensory system. The brain, it is true, has some built-in structures developed in evolution which organize sensory impressions—the eye takes in visual input, the ear sound and so on. But it takes time to comprehend this input in a meaningful way as is shown when a person blind from birth is given sight.

Infants initially are thought to receive an undifferentiated mess, a "buzzing confusion." Gradually through repetition of certain reinforced stimuli they begin to make differentiations. After parents say, "Da Da" or "Ma Ma" enough times to make an impression, infants begin to imitate the sounds. They learn to speak their parent's language. The selection of information, although initially passive, begins to provide structures within the mind. They add language "chunks" together to later form sentences and paragraphs.

ADVANTAGES AND DISADVANTAGES OF PATTERNING SYSTEMS

Let's explore further de Bono's idea of a patterning system(4) : Patterns help us anticipate probable sequences. Being able to build in new patterns into the brain lets us go beyond the instinctual repertoire of animals. But its usefulness only goes as far as our awareness of the potential disadvantages. The innovator recognizes the advantages *and* disadvantages of a patterning

system to use its strengths as building blocks and notes its weaknesses when the pattern no longer serves its purpose.

Patterns can be added together. Without this feature cultural progress would be impossible. It gives a sense of history. Information from one generation can be given to another. But its asset is also its potential liability. Conceptual patterns group together often without fundamental reassessment. Like bureaucracies the original intent is often lost. They become Rube Goldberg solutions—partial, complex and inadequate. Their structure is difficult to break down. Habitual behavior patterns are self-reinforcing. Like self-interest groups, they work to maintain the familiar structure and themselves. Changes are more easily made by changing whole organizations or administrations than trying to make alterations within the system.

We see this happen with religious converts who "snap over" to an alternative point of view. There is often little discrimination of the positive fine points of the older viewpoint or the negative of the new. Rigid patterning systems lurch from one dogmatic position to another.

A patterning system may be initiated by a "trigger". Like the trigger of a gun, a small input gives an explosive output. General systems theorists call this the "leading part," a system is centered around a particular part where a small change makes a large alteration of the whole system. A leading part acts to bring the whole system into play. A trigger can fire off these larger chunks producing a greater effect. But a trigger is only as good as the pattern selected. One, too easily, can fire in the wrong direction—sometimes with disastrous results.

The trigger sets off a preset chain of events, thus it is fast and accurate—if the input and the program are correct. But in the language of computer programmers: "GIGO: garbage in--garbage out". What one puts into the system has to be factual to get something factual out. Moreover, because initial influences have proportionaly greater influence than later ones, the best program is rarely established the first time. The program has to be reworked

many times to operate optimally. Finally speed kills if it is not well directed: One has to take the time to choose the right program or risk firing in the wrong direction.

These stereotypic responses, though they provide structure, lack judgment that comes from getting outside the system. If a brain pattern has only a certain number of ways of responding to outside information, it will either change that information into a form it can assimilate or reject it all together. Gruber says, "Observations which might lead to change are either neglected or assimilated into existing structure. Thus, even in the face of objective novelty, the existing structure inhibits its recognition, inhibits change."(5) One thus either processes the information in the pre-formed way or gets a response, "Doesn't compute." If fine discriminations are not structured in, only rough stereotypic responses will occur.

When data structures the memory surface, it alters subsequent information. New data, then, is changed to fit the program; not the other way around. Hence to be creative or to make fine discriminations, one must get outside the system.

Words, numbers and symbols within patterning systems facilitate communication. Sequential patterns can be visual, but most often they are verbal. Although a picture can "tell a thousand words", most of us use words to communicate, even to ourselves. Labels and codes are shorthand descriptions, which facilitate the rapid transfer of information. It makes unnecessary a full description of the information to get the message across. But its efficiency, like with all information chunking, depends upon how accurate the code communicates. Abstractions, though fast, create their own problems: with all abstractions some meaning is drained off, and *what is discarded may be what is necessary.*

Using new ways of communicating, on the other hand, slows the creative process, which is another reason why true original work takes much time. Gruber says, "As the individual departs from accepted patterns of thought, he becomes less capable of

communicating with others who have not. But such communication is both the instrument and the goal of change, so that the increase in intellectual distance inhibits further change."(6)

UNIFORMITY SETS THE STAGE FOR DIVERSITY

Just as evolution provides a stable platform for effective change, so our memories provide structures we can use in forming original thoughts. To completely throw out the past is wasteful of time and effort. We need some of the old structures—though, of course, not all of them. To go back to the original chaotic conditions would be wasteful of time and energy. Without memory of older patterns, we would have to relearn everything each time. But we can not build everything from scratch—we don't have the time.

Alvin Toffler in his book *Future Shock* points out the importance of structure in a changing universe.(7) It is necessary to have points of stability to adapt to a rapidly changing conditions. Without some anchor points the whole system goes crazy. We need some dependable states in order to make reasonable alterations of our lives.

There were those who, for example, feared the coming of the industrial age. They thought it would have produced unthinking automatons, "men in their gray flannel suits." When Henry Ford brought out his model T, he used interchangeable parts. Ford also advertised, "You could have any color, as long as it was black." People thought that they too would become as little differentiated and interchangeable. How uncreative!

But the very technology that gave most Americans an inexpensive car, provided the stability that set the scene for great diversity and freedom of choice. Toffler says, "this freedom comes not in spite of the new technology but very largely because of it. For if the early technology of industrialism required mindless, robot-like men to perform endlessly repetitive tasks, the technology of tomorrow takes over precisely these tasks, leaving for men only those functions that require judgment, interpersonal skills and imagination. Super-industrialism requires, and will

create, not identical "mass men," but people richly different from one another, individuals, not robots."(8)

Continuity and change have a similar relationship in the arts. Artists establish zones of stability from which to build. In music, for example, most of us need to hear the ideas several times to retain them. So composers fix them through repetition. They impress them on our memory. They create stability by returning time and again to a particular motif, key or tone row. Just as we are about to become bored with the theme, they change it. They establish the musical ideas first, then they develop those possibilities. Our memory retains the old while discovering variations on the theme. Composers thus provide unity and variety at the same time. Part of the delight in music is the unconscious recognition of the creative process, i.e., *the establishment of continuity to produce familiarity and change to produce interest.*

Continuity provides the platform for change. When we begin a project, we prepare by steeping ourselves in the experiences of the past to develop a large repository from which to draw. We learn the skills of the field. The teacher who hands students materials and tells them to do their own thing handicaps them because they have little to draw upon. Chaos creates more chaos.

Occasionally youngsters will develop something new, but it often lacks the sophistication that comes from blending an understanding of fundamentals with a new point of view. If we are interested in music, we need to know the scales, chords and progressions. If in art, we need to know how to stretch paper, mix colors, draw. If we want to be an author, we need to know the language, grammar, and spelling. All these tools are prerequisites to creative activity. Moreover, if we expect to give our unique contribution, we have to make these skills such an integral part of us that we *automatically express them whenever we work.*

A caution: It is important to learn the skills of the past, but it is important to beware of being "bought" by them. Creators recognize that the skills have hidden assumptions about what is the

correct way to proceed. When we are looking for a new way, we might have to challenge those very assumptions that are supporting our skills.

SUMMARY

- Continuity and change depend upon one another in creativity. Creators develop stability in the form of skills or knowledge about the area in which they wish to pursue. This is what some call the preparation stage of the creative process. One can't create in chaos.
- Innovators are aware of the advantages and disadvantages of a patterning system. They don't get stuck like the bureaucrats.
- While establishing continuity with the past by learning its history and techniques, we need to beware that we might "buy" its assumptions. We have to know what *was* in the thrust to the future, but we shouldn't become caught in the preparation phase by hidden assumptions.

REFERENCES

1. Gerard, W.R. "The Biological Basis of Imagination" from "The Biological Basis of Imagination" in *The Scientific Monthly,* June, 1946
2. Gruber, Howard. *Darwin on Man*. New York: E. P. Dutton, l9-74.
3. de Bono, Edward. *The Mechanism of Mind*. Middlesex, England: Penquin Books, 1969
4. de Bono, Edward. *Lateral Thinking*. New York: Harper and Row, Publishers, 1970
5. Gruber *ibid.*
6. *ibid.*

7. Tofler, Alvin. *Future Shock* New York: Random House, 1970
8. *ibid*

5

OPEN FLEXIBLE CREATIVE SYSTEMS

MUTATIONS

In biological systems stable forms of replication overcome chaos and provide the foundation for evolutionary change. This model is present in conceptual creativity as well. The DNA molecule makes possible continuity so that subsequent generations can appear without having to wait another long time for chance to form a new organism. New generations of molecules set the stage for the formation of new cells that continue as clones of one another. Each new organism is like the parent. But evolution is not rigid.

Instead, evolution acts in a stable but flexible replication system. The fact that the coding is subject to error makes change possible. These mutations can be caused by a number of different means--from chemicals in the environment to cosmic rays altering the structure of the genetic material. Subsequent generations of molecules retain these changes from their original state. If DNA had been a rigid structure, no alterations would have been possible. Evolution might be still waiting for chance to form single cells. . .and still longer to form higher organisms.

Conceptual mutations also occur when we work very hard at a project, going over and over it until we and the project become ready for something new. Vincent Van Gogh describes these breakthroughs in his art work in a letter to Anton Ridder, "I waver less--and just because I am sitting opposite the model, *sometimes I feel more like myself.* When I have a model who is quiet and steady and with whom I am acquainted, then I draw repeatedly till there is one drawing that is different from the rest, which does not look like an ordinary study, but more typical and with more feeling. All

the same it was made under circumstances similar to those of the others, yet the latter are just studies with less feeling and life in them."(l)

Vincent never understood why his production mutated in the presence of this quiet and steady model. (I will return to this shortly)

OPEN SYSTEMS

Biological systems are open to outside influences. The DNA molecule system was not closed. It was open to outside influences. Some systems are closed like logical proofs. They don't allow alterations from the outside. The proof must follow from the elements within the system.

In a closed system you show that one result will follow from certain initial conditions. In logic a deduction relies on a closed system. No input enters from outside the system.

Take, for example, the well-known syllogism:

All men are mortal.
Socrates is a man.
Therefore Socrates is mortal.

"All men" is enclosed in the category "mortal" and "Socrates" is enclosed in the category ‘‘men. ‘‘ There fore you can deduce that "Socrates" will be found within the category "mortal".

But open the system up some. Consider another perspective. Suppose you include Rodin's "The Thinker" in the category "men." After all, he is a man--not a woman. Then you would get:

All men are mortal.
Rodin's "The Thinker" is a man.
Therefore Rodin's "The Thinker" is mortal.

Obviously I have opened the argument to error. The deduction is all right, but the second premise is wrong in this context, so the conclusion is in error.

Living systems, unlike Rodin's "The Thinker," not only are mortal; they make mistakes. The exactness of their replication is

subject to error--but that is their glory *for error leads to new possibilities*. Mutants open up new possibilities for change.

Living systems are open in other senses. They take in all sorts of outside supplies and information from their environment, and it takes from them. They exist in *mutual interaction*. Organisms take in plant and animal material, which they metabolize. They ingest and digest foreign material breaking them down into amino acids, fats and sugars. The organism, be it plant or animal, recombines these smaller units into specific building blocks to form structures and energy packets to function. Waste is eliminated. Similarly, innovators take in old materials, break them into manageable units and reshape them into new forms.

The human brain is a uniquely open living system. It has developed over eons to provide both continuity and change beyond biological evolution. The human brain is both highly specialized in function yet very flexible. Unlike animals who have most of their behavior programmed through instincts, little of human behavior is exclusively drive related. Hence, our brain is a system that *specializes* in openness.

This general responsiveness enables us to meet changing circumstances. Our brain allows us to develop an historical sense, so that we do not have to begin again with each succeeding generation, and an adaptive mechanism which allows us to anticipate and respond to alterations in our environment. Thus it serves the dual role of providing continuity and initiating change.

To be creative we must be alive. We must be open systems. Without the capacity to respond receptively to outside stimuli and inside input (from memory and imagination) we would be dead--no different from closed inert systems. We are capable of arousal; we must be to master our environment. As active creative individuals we are not only stirred by sexual and aggressive drives, but by curiosity and the desire for understanding, control and mastery.

We can be insensitive--closed systems--or we can respond in an *active receptive* way to new information. Too often we only

take in inputs in the passive way that de Bono suggests the brain as a patterning system does. But our brain has several levels of organization. We have large areas of our brain that we are only beginning to understand how they work. The right hemisphere and the forebrain, for example, are quite important to creativity, but we have little information about how they actually process information. At the functional level though, rather than the physiological level, we can see that as thinking persons we can *re-organize* information in many different ways according to different purposes.

What we want to happen will determine our choices as much as what has already happened. The future as well as the past determines present choices. If we are open and creative, we not only take in information in the passive patterning way, we also arrange and re-arrange it so that we can interact successfully in the present and meet the future openly.

For example, in writing this book I initially did a great deal of investigation into what others had written about creativity. But I did not stop there with what they had given me; instead, I thought long and hard and compared what they had said to what I had personally experienced. The input served as a part of what I had to work with, but only a part. For then I had to re-arrange the material in a way that made sense to me.

In presenting the material I had to consider many purposes which served as organizers of the information: what was the best arrangement of the information, how to present a process that is organic in a linear sequence, how to hold the attention of the reader, what was most fun to write about--because if I couldn't interest me, how could I interest you?

Creative change occurs when the new result is an *improvement* over earlier conditions. By being open, taking in outside information, and combining previously disconnected parts in a more effective way, we extend the thrust of our cultural evolution. To take our part in this thrust, we need to be aware of

where it has been, where it is now, and where it is going. Then we have the opportunity to add something new.

In this century scientists and mathematicians have also challenged the idea of closed deductive systems. They have opened up previous arguments to show their errors by adding novel perspectives. They have broadened current views and changed the paradigms. Albert Einstein, for example, altered the Newton's idea about the absoluteness of space and time. He related them in his theory of general relativity opening up physics to a new world. Researchers confirmed the new ideas in 1919. They measured light rays from a distant star as it passed close to the sun during an eclipse of the sun. The results showed that the sun's mass altered the space—time continuum around the sun so that the star's light deflected by an amount predicted by Einstein. The strong gravitational field warped the space-time continuum through which the star's light passed. Einstein's theory superseded Newton's. Physics moved into the twentieth century.(2)

Bronowski says, "Science is an attempt to represent the known world as a closed system with a perfect formalism."(3) But scientists and mathematicians in this century have show that this is an impossible ideal. The observer must be taken into account. I have felt this too in my psychiatric work.

The Many and the One

Science in psychiatry
gives counterfeit courage
to the timid.

How I wish I could rely
on the dogmas of science
knowing how well
it passes with the masses,
but I sit
with this person in pain

knowing the agony
of his lone soul
and the uncertainty
of Heisenberg. (4)

In the macro world science makes predictions based on probabilities, not closed system deductions, but that is still not enough when we deal with individuals: we must also consider the observer who no longer can be thought separate from the process of making observations. Heisenberg showed that the act of observation alters the accuracy of the findings in sub-atomic physics. (It does in psychotherapy too.) The photons by which one tries to measure the position of the particle alters the momentum of the particle. Thus both cannot be measured simultaneously. Without both measurements science cannot have a completely predictable closed system.

In mathematics Godel, moreover, demonstrated that formal systems cannot be both simultaneously consistent and complete. In a paradoxical way he used ordinary arithmetic to demonstrate the incompleteness of mathematical systems: there are always truths about the system that cannot be proven from within the system. He used arithmetic to show the incompleteness of mathematics by referring back to itself. For a more in depth presentation Douglas Hofstadter's excellent book *Godel, Escher, Bach: An Eternal Golden Braid* spells out the implications of self-reference in Godel's work. (5)

When we refer back to the observer, we open the system up for creative change. We enlarge the field of inquiry. Mathematical, scientific and personal systems must be considered open for new discovery and change—and we face the uncertainty of Heisenberg.

Bronowski also says, "Scientific discovery is a constant maverick process of breaking out at the ends of the system and opening it up again and then hastily closing it after you have done your piece of work."(6) You open the system to allow creative

alternatives; you close it up again too as not to be over-stimulated by chaos and change.

OPTIMUM AROUSAL

Human beings function best within a limited range of stimulation. Flexible stability within a particular range is a must for optimum function. The conditions for creativity must be neither too over-stimulating or under-stimulating. If, for example, they are under-stimulating, i.e., too stable, individuals initially suffer boredom. Later, as sensory deprivation studies show, they have sleep disturbances, depression, irritability, and anxiety. Under severe sensory deprivation they may begin to hallucinate.
On the other hand, if they are constantly over-stimulated they develop a similar condition with fatigue, irritability, confusion and emotional exhaustion. It takes a great deal of energy to continually reorient to rapid changes. One suffers Toffler's "future shock."(7)

Just as you can respond to external input and internal input, so you can also develop external stability and internal stability. External stability occurs when your environment is constant. Those who feel internally unstable try to make at least their outside situation stable. This leads to stereotyping and resistance to change. Those, however, who have matured enough to develop a stable sense of themselves respond much more openly to external change.

The human organism, however, can tolerate only a certain amount of change at any particular time in his life. Creative individuals can tolerate more ambiguity than most, but everyone has his or her limits. So creators develop islands of stability when the conditions about them are chaotic. My wife, Diane, for example, provides a supportive, stabilizing relationship while I go off in chaotic directions looking for creative approaches in philosophy, psychiatry, art, poetry, music and teaching. I think that I help provide relationship stability that lets her explore her creativity too. These islands provide a platform for creative change; otherwise, you may suffer disorganization or psychosis. Paradoxically the more stable you are internally and externally, the

more willing and able you are to make creative changes—when you master crawling, you get bored and want to stand up and walk. Vincent Van Gogh mentioned above did not have a very stable sense of himself. One year before he was born, his older brother died on the artist's, *birthday*. His mother never worked through the elder brother's death, so she called her second son *by the same name*. Moreover, Vincent, the younger, passed daily by the elder brother's tombstone bearing his own name and his own birthday. You can imagine that he grew up with an unstable identity. So it is interesting to note that when he is in a stable relationship with the model (an unconscious representation of his mother?), he "becomes more like himself", and he can venture into a more spontaneous and deeper revelation in his paintings. He allows his "mutations" to surface into expression.

SUMMARY

- Keep open to outside input. Don't be a closed system.
- Regulate the amount of stimulation or input so that you are not over-whelmed or under-whelmed. Find the range of input in which you are most creative.

REFERENCES

1. "Letter to Anton Ridder Van Rappard", van Gogh, Vincent. from *Letter to an Artist:Vincent van Gogh to Anton Ridder van Rappard* translated by Rela van Messel. The Viking Press, Inc. New York. 1936
2. Clark, Ronald W. *Einstein*. Avon Books: New York. 1971.
3. Bronowski, Jacob. *The Origins of Knowledge and Imagination*. Yale University Press: New Haven and London. 1978, p.108

4. Young, John G. "The Many and the One". *A Psychiatrist's Notebook*. Center for Creativity Publications: Denver. 1982.
5. Hofstadter, Douglas. *Godel, Escher and Bach: an Eternal Golden Braid*. Vintage Books:New York. 1980.
6. Bronowski, Jacob. *The Origins of Knowledge and Imagination.* Yale University Press: New Haven and London 1978, p. 108
7. Toffler, Alvin. *Future Shock*. Random House: New York, 1970 p.249.

6

CYCLES OF CHANGE IN EVOLUTIONARY CREATIVITY

The Jaynsian mythology suggests a cyclic process in creativity. Biological systems undergo cyclic changes within a larger evolutionary framework. Organisms are born, live and die. The atoms and molecules that originally formed one individual later form another. Life begats death begats life.

Yet paradoxically entropy, the force that destroys, also is a part of the larger evolutionary process. When structures no longer are useful, they need to be broken down into units which can later be used in new construction. Continuing to build in the wrong direction can sometimes be worse than doing nothing at all.

The cyclic process, however, is not completely repetitious. Changes do occur over time. Individual species live and die in ecological environments which also are born, live and die. My friend, Mike Gilbert, for example, tells me the Aspen trees initially were more plentiful in Colorado. They drank up the little moisture of the lands. They grew tall and strong. But under the shade of the Aspen branches the conifers began to gain a foothold. They eventually took the moisture the Aspens used. Most of the Aspens died off. Now the conifers predominate. (1)

Hence the cyclic process is not completely repetitious. Changes do occur over time. Evolution moves on. There is, of course, a question whether the changes are creative, i.e., an improvement. Change does not necessarily mean progress. Some might argue that human beings have a way to go to show that they are better than the dinosaurs. After all they lived for hundreds of millions of years, whereas we may blow our whole earth into smitherines after living for a few hundred thousand.

Teilhard de Chardin, the philosopher-priest, on the other hand, maintains that evolution is moving forward toward ever increasing awareness. He argues that we are progressing toward a universal consciousness. (2) Whether it is that or another big bang, time will tell.

Conceptual change undergoes a similar cycle to that of biological evolution. Ideas are born, live and die. The intellectual and cultural environments in which they live also change over time. Whether they are creative, i.e., valuable as well as new, is a question critics and historians will have to answer.

A new idea is born. It has its enthusiastic parents who nurture it and help it to grow. Gradually as it develops into maturity, they "socialize" it, that is, put it into a communicable language to facilitate its entry into the larger society of ideas.

But there are those wedded to the older views who oppose the new concept. These people may be the current "experts" who earlier fought for their ideas against the then prevailing viewpoint. Now they try to conserve their position. They worked hard to establish their place so they won't let go easily. Once they might have been considered the "radicals"; now from the viewpoint of the newer innovators they become the "reactionaries." These experts point out that the infant idea does not fit in with *their* truths. It contradicts their prevailing viewpoints.

That is true. The new idea must contradict some of the old concepts. The new idea requires a new paradigm, i.e., a new series of assumptions, definitions and procedures. When a new paradigm is being formed, the new idea is most vulnerable. It fits in nowhere well. (now-here is no-where) Reality is broken apart and put back together in a different way. It doesn't fit with the old viewpoint, but the newer framework still needs to be established.

As an infant playing in the yard, your world is flat or a little hilly. It is hard to imagine that the earth is a sphere. Later on you learn in school that the earth is like a ball. You accept what the teacher says because it is the best way to get a good grade. But when you look out around you, the horizon still seems flat. Later

on you go up in a plane and begin to visualize some semblance of curvature. But it is not until you see space shots of the earth do you believe the earth is truly a globe.

Though the earth seems flat locally, the larger perspective shows that it is round. The new idea doesn't fit in with the old one. It awaits the new perspective. Proponents of the old position and the new one fight. The conflict is a struggle for the survival of the fittest. At times this means the strongest--the ones who control the journals, and the media and the classroom--but also it means the one that fits best into the ever changing intellectual environment. The one that best explains the new data as well as the old eventually wins out. The reactionaries never give up the fight, instead they loose their influence and eventually are ignored. The Flat Earth Society becomes a joke.

Just as our idea of our world changes from a local flat territory to a curved globe, so in this century theorists like Einstein and others postulate a change to a curved four dimensional space-time world where time slows when we go near the speed of light. For those of us who do not travel at such speeds, even in imagination like Einstein, it seems to go beyond "common sense", that backyard provinciality most of us have of our world.

PARADIGM SHIFT

We tend to see what we expect to see. Expectations are built upon assumptions that we rarely reconsider, so it is not surprising that we are rarely surprised by seeing something new. We just don't see it; instead, we view it from the reference point of our prior assumptions. We refuse to shift paradigms. Edward de Bono says that we retain ideas based upon "momentum" rather that repeated assessment so we go further and further away from reality, i.e., that vision of the world that makes for most effectiveness.(3) We try to maintain stability when it is no longer useful.

Ornstein says, "The development of a successful paradigm enables a scientific community to maintain and share criteria for

the selection of problems which might be amenable to solution. It allows a number of ‘local road maps’ to be drawn up, tested, and validated by many independent researchers. But there is a danger here: parochialism...The scientist working under a successful paradigm may begin to lose sight of any possibilities beyond his own particular set of assumptions."(4)

Because it threatens stability, we refuse to consider paradigm shifts. Too often, when the facts do not seem to fit, we blame the facts. Rather than see them as *leads into the future* we dismiss them. Those who don’t ignore new findings, help advance civilization. Roentgen, for example, did not dismiss the changes he found on his photographic plates. He did not blame the plates as being defective as others did, but instead he investigated and discovered x-rays.

Creative people take advantage of facts that seem out of context. They use them as leads rather than as irritants. Instead of dismissing them, putting them into their "unconscious", they use them as an opportunity to break the context and move into unknown territory.

Innovators change paradigms by "making the familiar strange," that is, putting the problem in a new context. William J. J. Gordon suggests that you make the familiar strange to innovate and make the strange familiar to understand. He thinks the two work together for innovation and understanding in a cyclic process.(5) We understand by making familiar what seems strange using models from the past, and we create by taking a familiar or known situation and translating it into an unfamiliar situation.

We, for example, have all seen airplanes. They are familiar to us. We have also all seen sailboats. But who has seen an airplane wing on a sailboat? One inventor did just that. He put a wing on a catamaran and sailed it across the waves at 30 knots--faster than cloth sails could ever do.

Insight in psychotherapy results from a shift in context: Patients recognize they are reacting, behaving and feeling as though they were still in childhood. Not only do they become

aware of how they felt then, but also that they are still reacting as though the past situation was a *continuing reality.* When they can see the present for what it is, they shift from past-tense living to dwell in current reality.
Humor, also, results from shifting context. The comedian moves us along one framework and suddenly changes perspective. The emotions, which do not change as rapidly as the switch in viewpoint, are discharged in laughter.(6)

There is the story of the two baseball players who make a pact with one another such that the first who dies and goes to heaven will get in touch with the other and let him know how it is there. Eventually one dies and goes to heaven. He remembers the pact so he gets in touch with his friend. "Yes, Joe," he says, "Heaven is beautiful. The grounds are well kept. The sun is never in your eyes. The umpires can see straight. The fans are always cheering. You'd love it here. And you know what? You're pitching on Sunday."

You do not have to shift into heaven like the baseball players, any change in context will do. Discovery, insight, invention and humor are all the results of a creative shift of context. Edward de Bono says, "Sometimes the situation is only a problem because it is looked at in a certain way. Looked at in another way, the right course of action may be so obvious that the problem no longer exists."(7)

SUMMARY

- Ideas have a cycle of their own. They are born, live and die within a context which also evolves.
- The "experts" are usually wrong in a changing intellectual environment.
- New ideas require a new paradigm. They cannot be completely consistent with the old view. In the beginning new ideas and their creators are naked, like Adam in the

garden. The innovator is most vulnerable when not clothed with the prevailing viewpoint.
- New contexts take time to develop.

REFERENCES

1. Gilbert, M. personal communication.
2. de Chardin, Teilhard. *The Phenomena of Man*. New York: Harper & Rowe Publishers, 1959.
3. de Bono, Edward. *Lateral Thinking for Management*. American Management Association 1971.
4. Ornstein, R. *The Psychology of Consciousness*. San Francisco: W. H. Freeman and Company, 1972.
5. Gordon. W.J.J. *The metaphorical way of learning and knowing*. Cambridge: Porpoise Books, 1971
6. Koestler, A. *The Act of Creation*. New York: MacMillian, 1974.
7. de Bono. *loc. cit.*

7

FLEXIBLE STABILITY IN CREATIVE CHANGE

Stability and change are interrelated in the creative process. Either extreme, though, inhibits the evolution of constructive changes. When stability becomes rigidity, there can be no progress. When change becomes so chaotic that you can't get your bearings, there can be no progress. Stability provides regular expectation about how things go so that planning for change becomes possible, whereas chaotic conditions inhibit meaningful alterations.

Conceptual creators need conditions of flexible stability. They are law breakers and law re-makers. They are rebels and re-builders. They make creative alterations of existing structures. They oppose old configurations, eliminate parts and combine in new ways. Rather than beginning out of chaos which could take a long time, they use older structures in new ways. It is easier than beginning from nothing.

FORM A LIBERATING STRUCTURE

Creativity, in fact, often involves the establishment of structures that paradoxically provides *more freedom* than existed before the new configuration. Let's see how this can be: As I have said before, the antithesis of structure is not freedom but randomness. Chaotic conditions limit freedom. The anarchy of the French Revolution, for example, removed almost as much personal freedom as its opposite, the absolute monarchy preceding it. On the other hand a creative society provides a liberating structure. Our Bill of Rights established more freedom than individuals could establish for themselves. The structure established liberty by

limiting and making predictable the role of government in private affairs.

A liberating structure has a cycle of its own. Initially the structure increases freedom by granting predictability that randomness does not allow. This is the case in good laws or policies. At the optimum stage the structure balances freedom in such a way that they paradoxically support one another. As the structure becomes too rigid to handle changing circumstances or is overly regulated, freedom of action and effectiveness decreases. It is like a bureaucracy more concerned with meeting its own rules than what the rules were seeking to promote. In religion, according to the Christians, the Jewish law at the time of Christ was so convoluted and complex that someone had to come along and free it from itself. Christ had to overturn the legalism of the law and return to its spirit. And at the time of the Reformation of the Roman Catholic Church the complex system of indulgences blocked rather than helped a sinner experience spiritual grace. The reformers thought there was a better way to heaven. Structures that no longer liberate need to be liberated from their structure.

Stability provides for change in a way chaos never could. When there is something dependable to work with, modifications can be made. But, as in biological situations, gradual shifts in the environment over time alter the setting in which individual events occur. When the setting becomes enough different, old ways no longer fit the new context. A crisis occurs.

Biological systems handle these crises through the mechanism of evolution by natural selection. It is a two-phase process: The first is the formation of genetic variability through mutation and recombination, and the second is the selection of organisms which fit the changing environment

FIRST AND SECOND ORDER CHANGE

Biological systems are heirarchically arranged. Systems are subsystems of larger systems which in turn are subsystems of even larger systems. Conceptual systems, likewise, are heirarchically

ordered. Changes occur within individual subsystems or in the larger encompassing one.

There are two ways of making changes in systems: change the variables within a system or change the constants of the system. The former is called first order change, the latter second order change.

First order change. One makes *alterations within the system*. Automobile companies, for example, went from year to year modifying the styling. Small changes in appearance each year sold cars. Everyone wanted to get the new model, to have the new image. They operated at the first level. The system of designed obsolescence worked adequately for a while. Then the oil embargo showed us how we were spinning our wheels. It made the American public aware of the importance of gas economy and a major transformation occurred. Automakers had to consider changes in world markets and secondary changes were made. They reconsidered small cars, gas economy and international relations.

Second order change. When we alter the system itself, we make secondary changes. We *modify the structure* itself, changing the boundaries and the relationships within the system. As we change the configuration of our system, we open closed systems. We add information from outside the system to alter the inside. We emerge into higher levels of organization.

In psychotherapy, for example, we sometimes say that "the solution is the problem." By this we mean solutions which individuals or families develop to deal with situations create and perpetuate more difficulties than they started out with. To help them solve their problem creatively, we first point out that the original solution is the problem. We have to *change the system itself*, rather than make shifts *within* it. Therapists alter the boundaries of consideration about what is the difficulty.

THE CREATIVE PROCESS

There are several stages in the creative process. The first is the initial impetus. This is the situation or difficulty which

provokes one into considering a better way to do something. In biological systems change is often provoked by shifting environmental circumstances. Physical alterations of the environment--the formation of seas where land once was, the eruptions of volcanos to produce islands, changes in climate--the drying out of the land or the inundation by rains, the warming or cooling of the lands, all cause stress on organisms adapted to the prior conditions. New organisms, moreover, result in further changes that affect the older organisms as well. New plants and animals entering a territory require the adaptation of every member.

Impetus is followed by the preparation stage. Biologically this function is served by the DNA molecule which provides a basis for continuity in replication. Conceptually one gets familiar with the current state of the art and how it got to be that way. This supports skill development and prevents re-inventing the wheel.

The third stage is the active encounter with the problem, using what was learned in the preparation stage. Biologically this is what happens when the changing environment acts on different species. Sometimes in conceptual creativity the active encounter leads directly to a solution which is verified and communicated to others. Biologically the stress initiates changes which, if adaptable, will fit in, survive and multiply.

At other times the direct logical approach does not work because it rests on outmoded assumptions. These have to be brought into question before one can proceed further. Sometimes, in working very closely with a problem, one ends up not being "able to see the forest for the trees." One then has to step back from the problem to give other perspectives a chance. This stage is sometimes called the "incubation" stage because one allows the project to grow and develop in one’s unconscious. Biologically this is similar to the shift of recessive alleles into dominance. In the "unconscious" of organisms the genes have alleles, protein possibilities, that are dormant but which may be expressed when environmental conditions change.

Evolutionary Creativity:

Selection in the Creative Process

When one is relaxed and unfocused the solution sometimes comes into being. This is the "inspiration" stage. One gains insight into the problem. One gives birth to the new concept. The insight often is but the hint of a new idea. It then has to be developed into its full dimensions to become a creative solution. The final step is to verify and communicate the results.

The creative process is not linear but wholistic. It does not usually go straight through from initial impetus to communication. Most times there is a movement forward and backward as new information alters one's perception of the problem. New approaches may originate in questions raised from later stages of an earlier project. Feedback is important as the information gained in one stage alters other phases of the project. The entire process develops organically.

Unlike the God in Genesis who rested on the seventh day with His work completed, human creators work with their creations continuously. They do not necessarily work in any fixed order. They respond to what their creations tell them. Their body of work evolves. As in biological evolution, variations continually form, then selection determines which new beings will survive. This trial and error approach (or trial and success approach) relies on feedback of various trials--not a pre-set God-like vision.

In conceptual systems creators make changes by stopping long enough to break away from habitual thought patterns, altering their assumptions and looking for alternatives. Imagination, testing out models, and chance play a large part in the formation of new possibilities. Metaphors like the comparison of biological evolution with conceptual change point the investigator to new hypotheses.

To solve problems creatively and look for innovative solutions, it is helpful to have a plan to get one started. In biological evolution the plan or mechanism is self-organizing. It is based on the principle of natural selection. Although creative/innovative individuals use many different approaches,

some sequential and others parallel and cross-linked, a specific approach is helpful at least initially to get started. Then afterwards one can use a more opportunist attack as hints of possibilities and answers begin to appear.

SUMMARY

- Form a liberating structure that gives more freedom than prior condition.
- First order change is shifting the variables of a system.
- Second order change is changing the system itself, altering the constants.
- The creative process goes through the stages of initial impetus, preparation, active encounter, incubation, insight, verification and communication but not necessarily in that order.
- The creator has an active, ongoing relationship with the creation.

S.E.L.E.C.T. CREATIVE/INNOVATIVE APPROACHES

In the book, *S.E.L.E.C.T. CREATIVE/INNOVATIVE APPROACHES* (1), the stages initial impetus, preparation, incubation, active encounter, incubation, insight, verification and communication are instrumentalized into a six step process. The letters of the first words of each of the stages form the memory word: "S.E.L.E.C.T."

- Stop what you are doing.
- Examine and change your assumptions.
- Look for alternatives.
- Engage your imagination.
- Consider metaphors and analogies.
- Try it out.

If one does not select creative/innovative approaches, the selection of the best alternative is impossible. The creative process is initially divergent--different options are developed as in biological systems; then the process is convergent--those options have to be selected and integrated into a better approach. The following is a brief review of some of the ideas expressed in the book, ***S.E.L.E.C.T. CREATIVE/INNOVATIVE APPROACHES*** which focuses on the first half or divergent aspect of the creative process.

STOP WHAT YOU ARE DOING

Creator/innovators stop what they are doing to avoid the "adequacy trap." What once was adequate usually becomes inadequate as contexts change over time. Innovators, however, don’t wait for the context to change, they manage change by anticipating problems before they occur. Human beings have an advantage over biological evolution. They can imagine what might

happen in the future. Unlike biological organisms which are restricted to the present, we understand time. We can look to the past to build upon prior cultures and to the future to predict possible outcomes. Biological organisms can only respond as change hits them.

Innovators change before they have to. It is all well and good to come up with a creative solution to a difficult problem. Better late than never, but it is even better to have no problem at all. Innovators scan the horizon of the future looking for possible problems and opportunities. They recognize that the context for whatever they are doing will continuously shift. If they can anticipate some of the trends, they can plan to change with them. They prevent crises so they don't have to come up with creative solutions to them.

EXAMINE AND CHANGE ASSUMPTIONS

It is difficult for a fish to recognize the water. When we are swimming in something that forms the basis for our existence, it is hard to question it. Examining assumptions is difficult to do. Obviously without making some assumptions we would be stuck in complete indecision. We have to make assumptions to swim ahead. We rarely specify them, though we make them all the time. Yet it is only when we recognize what our assumptions are can we change them. Until then we have no choice, but to proceed with them, blindly following their consequences.

Most of us are blocked from the awareness that each moment we have options to consider things differently. When we pause long enough to become aware, when we stop long enough to examine the water in which we are swimming, we observe that in every situation we make assumptions. Only by noting *that* we make assumptions all the time can we begin to define *what* they are, and then by defining them we have a chance to alter them. We have a chance for creative change.

Assumptions form the boundary conditions in which we think. They reduce the area of consideration so we can begin. Without them we can not think--but they falsely limit also.

Innovators examine and change their assumptions. They do not consider any explanation the final one. Nothing for them is so sacred it can't be reconsidered. By challenging all assumptions they maintain flexibility in their approach to any situation. Creative people are mavericks. They are provocative. They stir things up. They seek change. They ask "why?"

Innovators alter the constraints of a problem. Too often we create boundaries where there are none. It is true that we must set some limits in order to begin thinking, but it is also important to make those limits provisional.

Innovators are not dominated by their initial assumptions. The first point of view does not become the final one. Too often the initial focus becomes the dominant focus, just as early assumptions determine later results. The assumption that the initial focus should be maintained throughout the investigation removes other possibilities. To assume that the initial viewpoint should rule distorts all other chances for solution.

We also can be dominated by a perspective we don't recognize we employ. A single point of view can restrict consideration of other viewpoints *especially if that viewpoint is not consciously stated.* Just as we state our assumptions to have the opportunity to change them, so we spell out what dominates our way of looking at the situation. Only when we know what dominates can we look elsewhere for different perspectives. Only when we can identify our perspective can we escape it to find another one. The dominant idea does not reside in the situation *but in the viewer*. We identify it to avoid it. We cannot escape an unseen enemy.

Innovators are not caught in the trap of either/or. They recognize that there are multiple ways of looking at any situation. Each gene locus has multiple allele possibilities.

Creators also don't get stuck on labels. Code words simplify and speed communication, but they don't tell the whole story. No code word can be more than a sign to stand for the object or event.

Symbols cannot substitute for reality. All abstractions eliminate certain aspects of a situation. If we assume they tell all, we run into trouble.

How we label a situation *depends upon the context in which we find it.* Context determines the name we give to certain actions. Though labels can be useful in coding communication, they can get in the way of creative change. Labels become encrusted on the person or situation. They become cliches, i.e., stereotypic responses to situations or events. Though constant regular units, such as amino acids sequences in the DNA molecule, can be useful to creative progress; when they become limiting cliches, it is necessary to change them. After all, labels are only useful groupings of characteristics. When they are no longer useful, they need to be changed.

The assumption that an event or situation can be labeled in only one way blocks creative choice. One alters those assumptions by changing the label.

LOOK FOR ALTERNATIVES

Creative people consider at least four alternatives at each juncture. When they are looking for the best possibility, they go for quantity. Biological systems such as the insects and the bacteria reproduce in large numbers to survive as a species. Just when we think that we have the cure for the problem, these species come up with another solution. Because they reproduce so frequently, they produce variants, one of which always seems to survive whatever we throw at them.

Osborn, in his brainstorming principles, says that "quantity produces quality."(l) This principle suggests that by thinking up as many answers to a situation as possible we are more likely to produce an original solution. This works whether we are brainstorming in a group or searching for solutions alone.

It is easy to consider looking for alternatives when nothing works. But, when we have one or two that do, we are liable to get caught in the adequacy trap.

By going for quantity, we go beyond ourselves. We exhaust traditional, remembered solutions. We go beyond "ordinary problem solving" to begin "creative problem solving". By pushing ourselves to consider options at the periphery of our awareness, we tap into preconscious possibilities.

Creative people defer judgment on new ideas. Sometimes they produce some ‘‘crazy ‘‘ ideas but they don’t censor them. Those ideas may suggest possibilities that could work. Creative people avoid "Killer phrases," those unthinking destructive remarks we make to ourselves and others about the faults of an idea.

Yet even a lack of positive response can be so non-nourishing that the new idea dies. Good ideas can be killed off by lack of support. An idea not supported often dies. When we are always looking to criticize, it is difficult to look for possibilities. Unfortunately, we are taught "critical" thinking in school so we won’t be taken in by false ideas, but we also need to be trained to look for and seek out possibilities. Creators seek opportunities.

Creators resist urges to criticize. When another person has an interesting idea, they try to learn from it. Even if it is wrong, they recognize it could set them off in a new direction. They look at suggestions as possibilities and opportunities, not for omissions and faults.

ENGAGE YOUR IMAGINATION

After we stop what we are doing long enough to avoid the adequacy trap, examined and changed our assumptions, and begun to look for alternatives, we engage our imagination. Without imagination, there can be no creativity or innovation.

Initially creators let their imaginations have as much range as possible. Rather than limiting their search too quickly, they think about what might happen if there were no constraints. They tolerate the opening up of infinite possibilities to discover options they might not have previously considered. In imagination, anything is possible. They stretch their imaginations to new conceptual possibilities and then temper them for practical

application. By letting possibilities come to the surface they find they can accomplish some of them.

When we project ourselves into a situation that has not yet occurred, we use "projective visualization." We conjure up an image and work with it. Albert Einstein, for example, discovered relativity by imagining himself riding through space on a light ray.

The more senses used, the more real practice seems in imagination. As children we learn by imitation. Children are great mimicks. That ability to learn complex behaviors by watching a model is much more useful than getting step-by-step directions. Children learn to copy what their parents do--rather they what they tell them to do. Modeling is more effective than direction giving because children find it easier to visualize an action than to listen to direction in words and translate them into action. Thus imitation or projective visualizing seem to be some of the best ways of learning a creative skill.

It also seems to be a way of enhancing our creative self-image. We act as we see ourselves. It is useful to imagine already having completed a creative process. What we envision for ourselves is often what we get--our images serve as vehicles for self-fulfilling prophesies. Creators deliberately program images to work for them. It organizes unconscious processes to facilitate moving towards the goal. If we imagine ourselves as creative, we become so.

How well we visualize depends upon two things: vividness and controlability. Some people can see very vivid pictures in their minds; others have only hazy images. The ability to conjure up completely clear visual images, however, can actually hinder imagination. Too vivid a memory interferes with flexible, new alterations. We need to be able to control, adapt, alter, and change images. Too precise a picture restricts us to looking at it from a single point of view.

By asking ourselves the questions, who? what? when? where? how?, we provoke an imaginative response if a reality one is not present in memory. We ask questions, and our imagination

answers with a new image. We take old images and re-work them into a new gestalt.

Receptive visualization occurs when we pose a question to our mind and wait for an image to form as an answer. Our unconscious is quite creative. It can come up with possibilities we might not consciously consider.

Probably the most famous example of receptive visualization was the German chemist Kekule's experience in a dream-like state. He saw the image of a snake chasing its tail. He recognized that it could symbolize carbon atoms in a ring, thus discovering the structure of the benzene molecule. Unconscious images sometimes surprise. Usually they are symbolic, like having a wide awake dream. We have to interpret the metaphor, and it may have several meanings.

Imagination goes beyond picturing old images in the mind; we rearrange what is possible into what might be. We transform images. We divide objects or ideas into parts; we eliminate some aspects; we enhance others; we go backward and forward from cause to consequence; we combine different parts in new ways; we integrate them into a new whole; we make selections to measure up to inherent, but newly found criteria. As we build, we fulfill what is inherently there, but which has to be discovered.

Questions provide gaps which our imagination fills. When a story or a poem is incomplete, the open gestalt urges the reader to complete it for him or herself. A poem suggests images that lead the reader to make associations, to make the poet's experience live for the reader. Together they complete the poem.

Writers involve the reader by urging them to witness the completion of an incomplete situation. Incompleteness asks for participation. It points to the future possibility of closure. The incompleteness of the open gestalt involves the perceiver in the process. It asks a question which the audience's imagination answers.

Creators consider solving the problem under different circumstances. They ask, "What would happen if?" "Suppose?" They speculate freely and often. They strengthen their imagination by asking questions, by extrapolating from the known, by examining possible effects from different causes, by taking a pattern further.

The wider experience we have, the greater resources we have for fantasy and imaginative experiences. Because we must build on something, it is important to stop what we are doing to get experiences we need as food for our imagination. Moreover, creators require a certain amount of unstructured time for fantasy. It is not a waste of time, but part of the creative process.

Questions can be stirred by associating to ideas a distance from the problem. This deliberate loosening of associations causes the imagination to roam in virginal conceptual territory. Words themselves code whole systems of thought.

The logical but imaginative, use of language is helpful in the *elaboration* of categories. It is helpful in the exploration of possibilities within a system. Resourceful innovators use what they have to find new solutions within the givens of a particular situation (first order change); originators break the boundaries and go outside the system to develop better solutions (second order change)--both approaches can work.

Some words that logical left-brained thinkers use are: list, check, diagram, select, define, classify, symbolize, verbalize, analyze, separate, eliminate, reduce, focus, work forward, repeat, copy, criticize, test. Question lists have been helpful to many innovators. Right-sided thinkers use other words such as: rearrange, modify, magnify, minimize, reverse, go backward, find alternatives, leave vague, distort, vary, randomize, re-organize, concretize, visualize, combine, synthesize, add, exaggerate, assume, play with it, generalize, leap forward, avoid structure. Any one of these words can stimulate the imagination.

CONSIDER METAPHORS AND ANALOGIES

Evolutionary Creativity:

Selection in the Creative Process

Using lists to stimulate questions is a useful method of developing the imagination. Another way to enhance your imagination involves using metaphors and analogies.

Metaphors are implied analogies. The word "metaphor" comes from the idea to "carry across." Metaphors help us look beyond the usual logical connections to other possibilities. Metaphors are not used to prove anything, but to show that there is more than one way of looking a problem. Like the imperfect replication of a DNA molecule, imprecision in metaphorical language generates multiple new possibilities. Metaphors help us consider new meanings.

Random verbs and nouns become "creative verbs or nouns" when used in stimulating associational ways. Their very randomness creates new analogies or metaphors to explore. In using random words creatively we pay attention to our associations as we make them. Then, either at the time or later, we combine them with the problem we are working on.

For example, I took the word "drift" and began to make associations with it. The problem I was wrestling with was, "How is biological evolution like conceptual creativity?" Follow my associations. Be patient if I seem to "drift" too much.

In genetics "drift," as I understand it, refers to the tendency of making sampling errors in small populations. They do not reflect the mean of the total potential of the gene pool. Certain gene combinations move apart (drift) from the majority of possible combinations when populations are small. The sampling error of taking small amounts is called "genetic drift." Smaller groups do not always reflect the larger viewpoint like the Gallup poll in 1948 did not reveal the selection of the majority. Truman, not Dewey, was elected president.

"Drift" can refer to the state of being driven or a tendency, import or meaning. Do you get the drift? Snow drifts pile in certain places and not in others because of wind and surface conditions. Drift has paradoxical meanings: Getting the drift implies gaining

the sense of the message; while drifters wander from place to place without specific direction.

The more the poet samples words to express his exact meaning, the closer he comes to expressing it. Here, the meaning moves closer around the mean of his possibilities. Fewer samples (words or ideas) to choose from might leave the meaning in doubt.

The classical musician practices a section repeatedly to avoid drifting from the correct note, while the jazz musician continually drifts--but in control--with the chord progression determining, like the snow fence, which notes of the chord scales to drift around.

Sometimes it is necessary to drift away from the majority view as in gene pools. The "right" viewpoint might be the wrong one in the long run. Evolution would not have progressed very far if the DNA molecule always replicated exactly.

Over long periods of time environments may change drastically. Continents separate, and consequently small groups of individuals with their unique gene combinations break from the majority. Later they evolve in entirely different ways like the kangaroos and koala bears of Australia. The formation of a new artistic perspective or scientific theory also seems to need a period of drifting away from the pack, a time of isolation to prevent re-absorption into the prevailing structures. Isolation prevents re-absorption.

The creative discovery process is quite similar to the psychoanalytic one: When the client free associates, he drifts further and further away from his initial thoughts. The analyst sees unconscious connections between the apparently separated thoughts. The more the clients drifts, paradoxically, the more he remains around the same unconscious conflict--if the analyst does not disturb the patient's train of thought by introducing extraneous material from the analyst's framework. The patient's associations, like the snow, piles up around certain configurations. In analysis, it is the therapist's responsibility to demonstrate these patterns; later on, the client learns to let his ideas drift and wonder about their connections. (When I first typed this I wrote "*wander* about their

connections." My unconscious drifting connected "wander-wonder-drift.") The creative thinker is like the educated client. As he lets his thoughts drift, they begin to pile up around certain configurations. The recognition of the consequent new pattern produces a new concept.

As I associate to the word "drift," I welcome random associations. I ask myself questions about them. Am I merely drifting away from the ideas of genetic drift? Do I have a sampling error in my associations? Are my thoughts piling up around concepts of specific merit?

As we deliberately loosen our associations to get off the usual pathways, we get into new territory. We have new things to think about. Some are useful, some not. We venture away, but then return to our original problem like the return of Ulysses to Penelope, an older but wiser man.

Suppose we start with an unclear idea we wish to develop. Thoughts drift through our mind, and we write them down. As more ideas drop into place, they pile around some central concern. Early random samples might tell little of the main idea, as small samples of genes tell little about the distribution of genes in the whole population. Only with larger samplings do the germinal ideas pile up around a central focus.

As I associate to the word "drift," I do not know where it will lead, but by continuing to write the ideas down as they form, a picture gradually develops which is often quite different from my original ideas. Allowing this to happen, taking the risk of drifting (and, in this case, displaying the chaos of my incipient creativity) I find something new as I move from my original focus.

My original idea about genetic drift might have been in error, but that is not the point. We are not trying to prove anything; rather we are attempting to produce some novel but useful concepts. The point is that the concept of "drift" got a chain of associations started.

TRY IT OUT--TAKE A CHANCE

Taking random verbs to get off the beaten path points out the usefulness of playing with chance. Too often we limit ourselves to the logical, rational and familiar.

Chance can be a positive factor in the search for creative solutions. It is the researcher's Muse, though he hides her under the cover of scientific rationalism. Dr. James H. Austin, the neurological researcher, says in his book, *Chase, Chance and Creativity*, "If you are completely candid with yourself, you will soon discover how much your discoveries hinge on contingencies. Every now and then, when you happen to combine both boldness and skill, you may be able to exploit a few of the lucky situations that arise. But skill alone will not be enough, for much of the novelty in creativity is decided only when you are bold enough to thrust at chance." (2)

Scientists use models to help with the discovery process. They simplify how we might approach a problem. At times chance enters. Lucien Gerardin, writing about biological models, says, "It is often true that an inaccurate model can in some cases be more useful than a perfectly accurate one. The less accurate model will give unexpected results and in trying to find out why, one can often find out more about the system concerned than if everything proceeds as expected from the start."(3)

To deliberately randomize input seems perverse. But creative solutions often come from outside usual frameworks. That is why we haven't found them "inside" before.

Chance helps in several ways: it gets us going when we are bored with our usual approach. It initiates by setting a challenge. It provokes us to look further. We utilize chance by recognizing the inherent potential in accidental occurrences and then developing it.

Random stimuli can come from travel. It can come from interesting conversations with friends--even from thoughtful adversaries. It can come from television, from computer data banks, from "junk," from reading magazines or novels. If we are alert, we can make use of all kinds of chance occurrences.

Evolutionary Creativity:

Selection in the Creative Process

In new situations we try things out not only to discover new approaches, but also to test out various possibilities. As in natural selection different options are tested to see if they can adapt to the changing environment. We verify conclusions by trying them out in reality. We don't know ahead of time which way will work. We take the pragmatic approach.

There are five different considerations you need to make to improve your chances in this adventure into the unknown. I like to think of them as the five "P's": probability, persistence, purposeful searching, perceptivity and personalized action.

1. ***Probability.*** In open systems probabilistic conditions exist. Something from the outside can always disturb the inner conditions of the system. New conditions, situations, and/or considerations can warp old frameworks out of shape.

The potential discoverer has to take a probabilistic approach. One has to go against the odds. Creative discovery is an improbable event--otherwise it would have occurred before. Creative invention also is rare because it requires tremendous work and imagination to bring it about. It is thus highly unlikely: the probability is low that such an event will happen.

2. ***Persistence.*** In a new situation we make some assumptions, consider possible outcomes and take trial action. In the short run it is unlikely that we will find, invent, build or develop something new. But creative people do not work in the short run. They know the odds are against them, but they persist. In time the improbable becomes probable.

3. ***Purposeful looking***. We can improve our chances if we consider things in a way we can learn from our results. If we wildly strike out in our search, we waste valuable time. Too often wild approaches go back over material previously examined, but not recognized. Without some plan of attack, we backtrack and needlessly repeat ourselves. A plan not only gets us going it also helps focus a meaningful pursuit.

A purposeful search involves asking questions in a systematic way so they can be meaningfully answered. The systematic asking of questions helps avoid wild, inefficient wanderings about. Meaningful answers come when we set up the questions so we can learn something from them.

4. ***Perceptivity***. Louis Pasteur said, "In the fields of observation, chance favors only the mind that is prepared." (4) Perceptivity is receptivity. It is an active process, rather than a passive one. It is like tilling the soil, preparing it for the seed to germinate.

If, however, we try to force information to fit a particular theory, we may miss a great deal. Discovery is a surprise process--a venture into the unknown.

5. ***Personalized action***. Finally, because we are *uniquely motivated*, we will look in different directions from someone else. We put information together from our unique point of view.

SEARCHING AND FINDING

It is important to be a searcher. The discovery process requires diligent looking for answers. But, it is important to be a "*finder"* as well as a "searcher--researcher". There are some who never stop looking *to see what they have*. They never learn from their trials. *Finding is recognizing the value of what you have and making use of it*. You ***S.E.L.E.C.T. CREATIVE/INNOVATIVE APPROACHES.***

SUMMARY

- Stop what you are doing to avoid the adequacy trap.
- Evaluate and change your assumptions.
- Look for alternatives.
- Engage your imagination.
- Consider metaphors and analogies.
- Try it out--Take a chance.

REFERENCES

1. Young, J. *S.E.L.E.C.T: Creative/Innovative Approaches*. Buffalo, N.Y: Bearly Limited. 1986
2. Osborn, A.F. *Applied Imagination*. New York: Scribner's,1963.(3rd rev.ed.)
3. Austin, James H. *Chase, Chance and Creativity*. New York:Columbia University Press. 1978, P.63
4. Gerardin, Lucien. *Bionics.* McGraw-Hill Book Co. 1968, pp.54-55.
5. Pasteur, Louis. quoted by Rene Vallery Radot in *Life of Pasteur*. New York: Knops. 1927.

9

CREATIVE CHOICES

When I teach creativity classes, I find two groups of people. In one group are relatively uncreative, blocked individuals seeking better choices for themselves. In the other group are individuals who can produce several different solutions, but can not decide which ones to choose. They have a problem of over-choice. They have difficulty selecting the best idea from a group of good possibilities. The former group needs to know how to fertilize, the latter how to prune.

Get the alternatives first, then decide. Creators discover the ideas first, then decide which ones to use. They get as many options as they can develop and hold off being selective as they come to mind. They don't kill the discovery process by being judgmental too soon. Then when they have made a list of many options based on the methods of the previous chapters, they choose.

I tell my students to take their "PlC". Look for the "Pros", then whatever "Interesting" associations that they might have, and finally , look for the "Cons." Edward de Bono suggests you do a "PMI" (positives, minuses, interesting ideas) which is about the same thing but in a different order. (1) They "pic" out the positives and their interesting associations *before* considering the negatives. If you don't look for the positives first, they might never come to mind. Psychologically it is more difficult to move from a negative set to a positive one, so start with the "Pros" and "Interesting associations" first. Get the PICture?

1. First evaluate the alternatives by looking on the positive side. What is good about the option? Try to see it in the best light.

2. Next check to see what interesting other ideas come to mind. Pay attention to random associations, yours and others. What

an idea leads to may be more important than the idea itself. Listen carefully to see how you might improve what is offered.

3. Only last be critical. See what problems might occur with what is offered. This is not your chance to use "Killer Phrases." Instead, look to see how you might alter the suggestion to make it workable. How might you correct the problems you see? Remember it is not as important to be correct as correctable.

ELIMINATING THE NON-ESSENTIAL

Creative waste. Many creative artists have the problem of too many good ideas, rather than too few. Gustave Flaubert said, "We must be on our guard against that kind of intellectual overheating called inspiration, which often consists more largely of nervous emotion than of muscular strength...my brow is burning, sentences keep rushing into my head...Instead of one idea I have six, and where the most simple type of exposition is called for I find myself writing similies and metaphors. I could keep going until tomorrow noon without fatigue."(2)

When there is over-choice, we must eliminate some possibilities. To those who never have any options this might seem a waste, but it is the nature of the creative process to keep some parts and eliminate others. Sedgwick says, "Pollack worked at great speed and with an intense commitment to the action itself. In his method there was little room for pre-considered judgment or studious repainting. But this does not mean that his art is nothing but a wild gesture. On the contrary, the Pollacks we see are the ones that worked. There are others which did not. This waste is in the nature of artistic productivity."(3)

Many psychologists who test others for "creative potential" emphasize the quantity of responses believing with Osborn that, all things equal, those with the most ideas are most likely to come up with the best ones. Psychologists like to deal with numbers and scores. But really original ideas come up very infrequently. It is said that a scientist is lucky to have more than two or three genuinely original thoughts in his lifetime. In fact, the value of

tests looking for quantity of ideas is quite low in predicting actual creative production. Mansfield and Busse in a review of scientists found that doing well on divergent test scores did not correlate well with highly creative scientific work.(4) Selection and integration is fundamental to mature work. Divergence is not enough; one must *converge* on a solution that works. Creative ideas must become creative solutions or they remain hints of possibilities. What we do with those ideas is important. Quantity and quality are quite different perspectives.

Consider the creative verbs to "subtract," to "eliminate," to "reduce." Though many consider the creative act synthesizing elements from different frameworks into a new integration, a new vision, the "Eureka" response of insight, the creator also must eliminate elements that previously seemed essential.

Arthur Koestler writes that Newton's act of selection was essential to his creativity. "He adopted Galileo's laws of free fall, but rejected Galileo's astronomy. He adopted Kepler's planetary laws, but demolished the rest of the Keplerian edifice."(5) Henri Poincare, the mathematician, says "To create consists precisely in not making useless combinations and in making those which are useful and which are only a small minority. Invention is discernment, choice."(6)

These verbs suggest other approaches to creative problem solving. To eliminate, to subtract, to reduce are important ways to deal with alternatives. Ask yourself: What if I left this out or that? Suppose I reduced the emphasis here or there? What could I eliminate? What would happen if I did? Simplify, simplify, simplify.

Take your chances. You can eliminate possibilities *randomly* as suggested earlier. Sometimes that may offer up new ways to evaluating the situation. My computer just moments ago eliminated this same section which I had previously worked out. For some reason I got a "BDOS ERR R/O" on the screen which made it impossible to transfer the material to the disc memory. Consequently I had to start over. Sometimes fate chooses for us,

and we have to make do. (What finally came out was better than the original presentation.)

Removing certain parts can be as innovative as adding elements together in some new form. Morris Shubin, the watercolorist, demonstrates a technique of painting in which he first covers the whole paper with watercolor. Then as he builds his design, he removes paint in certain places restoring the white of the paper beneath. He re-establishes the negative spaces. By eliminating "busy" color he improves his painting.

Irwin Shaw, the author, writes about the help editors at the *New Yorker* gave him: "One thing they taught me was the value of cutting out the last paragraph of stories, something I pass down as a tip to all writers. The last paragraph in which you tell what the story is about is almost always best left out."(7)

Eliminate what at first seemed essential. Shaw says that the point of the story is best discovered by the reader. It then makes more of an impact on him than if the author had spelled it out. Elimination of details leaves more to the reader's imagination. Less is more.

Yet that summary point may have been a necessary part of the initial phase of the creation process. The initial plan that got the process going may later have to be dispensed with. New considerations may provoke other needs. The contractor tears down the scaffolding when the building can stand alone.

To return to the biological metaphor, the placenta that provides for the nourishment of the fetus is cut away at the time of birth. One half the birth product is cast off. It could be that way in all birthing processes, that is, half of what initially seemed essential has to be cut off. A cell in meiosis, for example, gives up half its genetic compliment so that it can join with another cell at conception. Consider what might happen if you radically removed half of what you might have at first considered essential? Do you dare take that risk even in imagination?

Koestler, as I mentioned before, points out that biological systems have to give up part of their autonomy in order to integrate into the larger system.(8) They give up part of their wholeness in order to become a part of a larger whole. Not only biological systems, but conceptual and cultural systems as well have to let go of what previously seemed essential. Biological systems get rid of their waste in a regular fashion so it doesn't build up and destroy the unit as a whole.

We have to get rid of our "shit" too. Nations so prideful of their particular identity might have to give up part of their sense of self in order to join others in a world community. It is essential before we blow ourselves off the face of the earth.

GAPS AND GOALS

The gap. To return again to the problem of choice: It is relatively easy to show the uncreative group how to examine assumptions, use chance and generate alternatives--most books on creative techniques give methods for finding options. They, however, don't tell you how to choose among them or how to integrate possibilities. They don't tell you how to decide what to eliminate. Gruber says, "The punishment for pioneering is that you can never know exactly where you are. But you must sometimes act as though you think you do."(9)

When you ask a specific question or pose a clearly defined problem, it is relatively easy to choose from a number of alternatives. This is what is nice about creating within a clearly defined system at the resourceful, first order level of change. The system helps define the problem. When there is a clear *gap* between where you are and where you want to be, it is relatively easy to say whether a possibility bridges the distance.

The problem comes when you are not sure where you want to be. You just know that you don't want to be where you are. At the second level of change when the system itself needs overhauling, both criteria and solutions must be developed or discovered.

Goals. Seneca once said, "If a man does not know to what port he is steering, no wind is favorable."(10) This suggests the

necessity of a goal to determine choice. It also poses the issue of asking the right question. I once thought in reply to Seneca, "If one can make use of any port, all winds are favorable." It does not matter which way the wind blows if you are flexible and able to see opportunity in any situation. Here the goal is the *process,* rather than a specific result.

Nevertheless, when those with over-choice ask me how does one decide when they have several good options, the matter of selection becomes a very real problem. These creative people have several variations for a poem, they have many good sketches for a picture, they have many motifs to develop and explore in their music. Teachers have many good ideas and methods to get across their geography or history or biology. Research labs have many ideas to explore. Businesses have many different brands to sell. The question becomes "How do you choose from among all of them?"

GUIDELINES

Making good choices from among many possibilities is an art in itself. It is a creative act. Here are some guidelines.

Initial choices govern future decisions. Choice becomes an issue whenever you are trying to develop an idea. When you make one decision, it often determines the direction of choices for subsequent ones. Initial decisions, like early assumptions, govern later action. Though, of course, you can change your mind, but it does require greater effort than starting out right in the first place.

Criteria themselves may conflict in the converging process towards the best solution. Though you have as your first problem to diverge away from the initial conditions to find alternatives, your greatest challenge often is to arrive at the "best" solution, for example, the "bon mot" in writing. How do you find a solution that will *satisfy many different criteria*? You have to choose from among several possibilities, and some criteria may be incompatible with others.

Originality in jazz, for example, is at odds with communicability. A jazz musician has to temper his originality to foster communicability. Richmond Browne, jazz pianist and instructor of theory at Yale University wrote, "I believe that it should be a basic principle to use repetition, rather than variety--but not too much. The listener is constantly making predictions; actual infinitesimal predictions as to whether the next event will be a repetition of something, or something different. The player is constantly either confirming or denying these predictions in the listener's mind. As nearly as we can tell (Kraehenbuehl at Yale and I) , the listener must come out right about 50% of the time--if he is too successful in predicting, he will get bored; if he is too unsuccessful, he will give up and call the music "disorganized".(ll) Expressiveness in art may be at odds with elaboration and finish. Have you ever seen some of Rembrant's drawings? They are exquisite because in a few lines he says so much. They are poetry on paper. To me they have more direct expression than many of his more fully developed paintings.

Creativity thus is more than divergence. It is more than finding alternatives. We break away from what is, but then we must find a better solution. Creative people are law makers as well as law breakers. We decide what to include and what to eliminate. We *converge upon a solution that integrates differing values into a cohesive whole*. This major problem entrepreneurs, diplomats, administrators as well as writers, artists and musicians always face.

Different people use different methods and timing in their decision making. Compare two landscape painters. Both go to the scene. One, an amateur, sits down, sets up his easel, immediately draws the outlines of the objects in front of him and colors them in. He makes few choices other than to paint this particular scene and which colors to use.

The other, a professional like Andrew Wyeth, might make several sketches of details, but he also makes many rough compositional drafts. He seeks to determine alternative placements of those objects in his picture. He moves through a gradual

decision process. He tests several viewpoints. He lengthens one dimension. He shortens another. He places the major masses in different positions. He uses alternative arrangements of the lights and darks. He thinks of design possibilities as well as details.

The specific aspect that attracted him to the scene becomes integrated into the final composition. Because he has considered compositional matters, his painting "reads" as well from across the room as from up close. He has made many more decisions than the amateur who didn't even recognize that other choices were available.

Yet Wyeth's method is not the only way to work. Another might begin like the amateur above. He works fast hoping that his intuitive sense about the scene will register in his work. He relies on skills honed over years of work. The professional working this way will do many finished pieces...but show only a few. The rest he casts off. The amateur, on the other hand, does not possess that unconscious repertoire. He stops after completing his first try, frames it and puts it over the mantel. For the intuitive professional, conscious decision-making comes at the end, rather than in the beginning.

Some photographers work this way. They keep snapping pictures of a moving panorama, knowing that they might be lucky if one picture a roll turns out well. They rely on quantity producing quality. Their decisions concern which one of the many to show. Others may take hours setting up a still life. They take the time to put all the items in the most pleasing order. They make many small decisions before snapping the picture. Art is decision making process whether it comes at the beginning or the end or at stages in the middle.

Evaluate your work from a different perspective. Back off from your painting to see how it reads from a distance. Have someone read your poetry aloud. Move from the creative state of involvement to the critical state of detachment. You have to be separate from your work to give it a fair appraisal.

Many decisions. You choose not once but *often* in the search for an integrated result. You make many decisions, not one. It is most often not a matter of the single climactic "aha", but several smaller glimpses of an unrealized vision.

Most artists, for example, do not follow the myth of Michaelangelo who frees the figure from the marble. It is rare to conceptualize something as a whole though it does happen. Mozart, another great genius was known to compose a whole piece in his head while riding in a carriage.

Most often the Muse presents only a hint of possibility. There are the Mozarts, to be sure, but most of us must struggle like Beethoven, who began with the glimpse of an idea, and through painstaking work developed it to a thing of beauty. For most artists, their vision is rarely a complete one, but a *partially disclosed hint of possibility*. For them selection is a process of gradual discovery. The work evolves.

On the other hand the process is not aimless. You actively search for criteria as you look for options themselves. You might not be able to put those criteria into words, but you do have some sense of where you are going, even though at times you have to feel your way. Rudolf Arnheim says in "Notes on Creativity," "The mere shuffling and reconnecting of items of experience leads...to nothing more than a clever game unless it is steered by an underlying vision of whatever it is to be attained."(12) Recall Seneca.

Endings, partings can be difficult. When the content and the means to evaluate it are *discovered* in the process of creation, the creator decides when to end the discovery process. That may be a problem. In some contemporary art, for example, the goal is discovering the goal. Sedgwick writes, "Since the contemporary painter does not follow a preconceived plan, he is faced with a problem which did not ordinarily beset the earlier artists; he has to decide when he is finished."(13)

It is easier to paint a realistic work than an abstract one. With realistic renderings you can tell if it looks like what you are trying

to represent. With an abstract painting the end point is often very difficult to determine because you can always go on. Many times I have painted over sections which later I wished I had kept, but the opportunity to explore this or that was there and I took it. The vision comes and goes. You keep looking for the best expression, but at times it alludes you, though it seems right around the corner.

I have found that it is also difficult to determine when I am finished in my writing. My poetry teacher Lois Hayna tells me that poems "are never finished--only abandoned."(14) Poems seem to be capable of infinite revision. As you grow, your poem grows too. You see things from a different perspective.

Each time I re-write this book I think of other things to say and other ways to put down what I want to communicate. Each time I work at the book I can make improvements, and do. But when do you stop? You have to leave some things incomplete, unsaid, maybe even wrong. Another viewing may correct some mistakes, just as you learn to view things differently over time. But after a while I too will have to "abandon" what I have written to see how others will view it. Going for excellence is one thing; going for perfection another. Give it your best effort and let go of it.

SUMMARY

- Take your "PlC". Go after the "pros" and what they might lead to (interesting asides) before taking on the "cons." Even then avoid "Killer Phrases."
- Recognize that "waste" is essential to the creative process, and that sometimes you must eliminate what seemed essential at first.
- Questions provide "gaps". Create them to fill them.
- At times use chance to randomly eliminate parts of your project. Nothing is that precious that you can’t be free to play around with it. Sometimes see if you can make improvements through random reductions.

- Simplify, Simplify, Simplify.
- Some criteria may conflict with others.
- Restore negative spaces. Let your project breathe. Less is often more. Leave something to another's imagination.
- Some aspects of a project must be given up to integrate with a larger effort.
- Establish criteria in the beginning as much as you can.
- Make your best start; it is easier than beginning again.
- Find your best time for conscious decision making. Some do it best at the beginning, others as they go along, others after they come out of an intuitive binge.
- Step back to evaluate your work from a different perspective from the one in which you created it. Create in involvement; evaluate in detachment.
- Creativity is often more than one big "aha". The Muse may present possibilities reluctantly; you have to make many decisions on the way.
- Selection is often a matter of gradual discovery.
- Trust intuitive as well as conscious criteria in converging on your goal
- Excellence is one thing, perfection another. After giving it your best shot, let go of it.

REFERENCES

1. de Bono, Edward. "Cort Thinking" 1979 Edward de Bono & Associates, Limited.
2. Engle, Paul ed. *On Creative Writing*. E.P.Dutton & Co. Inc. N.Y. 1964, p.13
3. Sedgwick, John P. Jr. *Discovering Modern Art*. Random House: New York, 1966, p.145
4. Mansfield, Richard S. and Thomas V. Busse*. The Psychology of Creativity and Discovery.* Chicago: Nelson-Hall, 1981.

5. Koestler, Arthur. "The Act of Creation." in *Creative Psychiatry* #12. developed by the Life Sciences Advisory Group and edited by Frederic Flach, M.D. for Geigy Pharmaceuticals p.28
6. Poincare, Henri. "Mathematical Creation" translated by George Bruce Halstead from *The Foundations of Science*. (c) 1913, 1946 by the Science Press.
7. Shaw, Irwin. "The Art of Fiction" IV in the *Paris Review*. Sp. 79 p.256
8. Koestler, Arthur *The Act of Creation*. Macmillan 1974.Publishing Co., Inc. 1964
9. Gruber, Howard E. *Darwin on Man*. E. P. Dutton & Co., Inc.,
10. Seneca, the Younger (4? B.C.-65 A.D.)
11. Browne, Richmond quoted in Coker, Jerry. *Improvising Jazz*. Prentice Hall, Inc. Englewood Cliffs, N.J. 1964 p.15
12. Arnheim, Rudolf. "Notes on Creativity." p. 18
13. Sedgwick, John P. Jr. *Discovering Modern Art*. Random House: New York. 1966
14. Hayna, L. personal communication.

10

NEWNESS AND VALUE

GOALS

To be creative in any field, it is helpful to have some idea toward where you are heading. You need a goal, some general criteria by which to judge whether you are going toward or away from that objective. Seneca said that you should know to what port you are steering. In creative thinking steering to port is particularly difficult. You head toward a goal you may not fully recognize until till you get there.

Instead, you go ahead, comparing your thoughts and results with an internal set of criteria which serve as guidelines. They vary from field to field. The conventions, however, continually evolve. First order change moves to second order. Harold Shapero says, "Neither style nor form, in their essence, are derived from convention; they always must be, and are, created anew, and establish and follow their own laws. It is undeniable that certain periods—and the most fortunate ones—have established clearly defined patterns or standards which give the artist a basis on which to create freely. . .Where such standards exist, however, they retain their vitality only as long as they are in the process of development. After this process has stopped, they wither and die, and can be re-created only by a conscious and essentially artificial effort, since they are produced by a unique and unrecoverable impulse, and are suited only to the content which has grown with them."(l)

NEW AND VALUABLE RESULTS

The general criteria of newness and value serve as important guides in the decision-making process that every creative person needs to consider. With these criteria you can tell whether you are moving towards your unseen objective.

Evolutionary Creativity:
Selection in the Creative Process

NEW

Creative people do more than break away from the old patterns. They do more than find alternatives. They diverge from familiar patterns, but then they converge on new solutions. They break laws to remake them. They make hard decisions as to what to include and what to eliminate. Creative people innovate. They aim toward newness. This can be considered in several senses:

New as original. Originality implies being the first of its kind. It suggests something that has never been done before. And thus you must know what has gone on before—you must know history. Otherwise you end up re-inventing the wheel.

This is why, for example, most children's art lacks greatness. Though some children's work is quite original, it is, for the most part, *more rare* than most proud parents would admit. The early works hung proudly on the refrigerator or in the office are hardly much different from those on other refrigerators or in other offices across the country. Often neither the child or his parents give an appropriate assessment to the work. It is new for that child, and that is all that matters.

The work, though new to the child, is not original to the larger society in which it lives. Originality depends upon context. If you don't know the context, you can't evaluate its uniqueness.

Thomas F. Wolff in an article in *The Christian Science Monitor* writes, "Originality in art is very difficult to pin down, for it sets its own rules and conditions, and they seem to vary from age to age. One of the most original of all works of art, Albrecht Durer's "The Young Hare," resulted from nothing more unusual than an artist looking very, very carefully at a young animal, and then trying his very best to draw it exactly as it appeared." (2)

Original also implies originate. When you know what has gone on before, you also can recognize when your idea is a breakthrough. Your idea thus could start a new line of investigation. It could spawn offspring. Like a mutant that proves it can survive in changing ecological circumstances, the original

concept promotes imitation. The product germinates new possibilities which others may then develop and modify.

But being first is quite important. Who remembers Elisha Grey? He also invented the telephone but he was a few hours too late. On February 14, 1876 Alexander Graham Bell beat him to the patent office. In patent law being the first to come up with an invention and register it confers restrictive rights for a number of years. Others have to pay to use that new idea. In science, the first person to publish results gets the grant monies, despite the fact that the concept might have been about to emerge from many labs. Being first matters.

*2. **New as statistically infrequent**.* Psychologists measuring creative potential in children or adults look for rare or unusual responses to standardized tests. Newness as novelty, as out of the ordinary, would make Durer's drawing not at all new when seen in today's context. Today many artists draw realistically.

Wolff says about Durer, "We today, of course, would tend to see such an act as the very height of unoriginality, as nothing more than the slavish copying of nature. But, in its time and place, it was a truly revolutionary act."(3) It is not so much what you do, but the context in which you do it. Context determines unusualness.

*3. **New as a change from the regular way**.* Wolff writes, "To us today originality lies more in the imaginative ability to do something dramatically different (regardless of its intrinsic merit), or in the knack of inventing something out of whole cloth. . .

"Durer's originality, however, lay in his ability to perceive and to transmit a particularly full and clear image of physical reality directly to paper by means of line and color, and without following certain rigidly prescribed rules for drawing based on centuries of tradition."(4)

Going beyond the rules of the day is important for any innovation. We can, of course, create within a tradition as, for example, developing a poem in the sonnet form. But creators who break into new territory go beyond tradition. Their work emerges

beyond old boundaries like the free verse of the early twentieth century.

4. ***New as renovated, rejuvenated or regenerated***. Each generation needs to find or make new meaning. But the source of that meaning need not come *ex nihilo*, that is, from nothing; the past can fuel the future. Even Issac Newton says, "If I have been able to see farther than others, it is because I have stood on the shoulders of giants."(5) William Shakespeare likewise draws from many sources in each one of his works. The original story of *Othello*, for instance, is found in the novel *Ii Moro de Venzia* from the *Hecatommithi* of Giraldo Cinthio, published in 1565, but it also resembles the tale of *The Three Apples* in *The Thousand and One Nights*. (6) Other authors too--Goethe remolds the Faust legend, Christ re-interprets the Old Testament, Camus rewrites the biblical story of The Fall, Giraudoux replays the cuckolding of Amphitryon by Jupitor—each reworks the old stories creating new symbols for a new age. The creative writer, however, not only translates the message across time from the foreign language of the past, he also *adds new meaning*. With fresh insights, he revitalizes the stories of the past. He recreates it for the present.

Many artists look back to an older period for inspiration. Picasso takes from Ionian statues, Greek vases and African masks transforming these subjects into new syntheses. He incorporates the old, but rejuventes it by altering the viewpoint. Various ages look to the past to discover new possibilities in the old which can be renovated. Neo-classicism, neo-romanticism and other "neos", for example, re-examine earlier viewpoints.

Artists of each era take particular views of reality. They may, for example, use perspective to give the illusion of three dimensions as did Durer. For several centuries after him artists try to imitate nature. Many early twentieth century painters, on the other hand, focus on surface shapes and the act of painting. Their world is flat, the surface of the canvas is all that matters. Yet even "modern" artists need to study the past. Mondrian says, "What is

wrong with the abstract painting of the younger artists today is that they feel their painting began where mine leaves off, without going through what mine has gone through to be the way it is."(7) Now in the late twentieth century artists paint "photorealistically"—Neo-Durer. They imitate the camera. That which is rejected by one group becomes accepted and used by subsequent generations.

The look backward for inspiration occurs in science as well. Albert Einstein's relative space was an idea that Leibnitz proposed in contradistinction to Newton back in the eighteenth century.(8) Copernicus took an idea developed by Aristarcus thirteen centuries earlier. Yet both theories, when reconsidered in the light of new information, were seen as revolutionary concepts.

5. ***New as a unique, personal expression***. Striving to be different does not make you an original artist. *Striving to be yourself does*. It is here that making and fulfilling are integrated. Mozart writes, "But why my productions take from my hand that particular form and style that makes them *Mozartish*, and different from the works of other composers, is probably owing to the same cause which renders my nose so large or so aquiline, or, in short, makes it Mozart's, and different from those of other people. For I really do not study or aim at any originality."(9) He aims at being true to himself. Wolff writes, "Originality is more a matter of being than of doing, and exists in the very nature of the individual who expresses it. It is intrinsic to identity, and, on its most primitive level, is quite simply an individual's uniqueness."(l0)

But ones s uniqueness is not simple. We are both the continuation of previous generations and a unique expression of that continuity. The creation of one's self and his work are both an expression of continuity and one of change. The old is part of the new.

In the history of man the illusion that man is unique and special has been battered through an increasing awareness of who we are and how we came to be. The winds of change blow on Narcissus' pool. One image is destroyed after another.

Copernicus proposes that the earth revolves around the sun overturning the Ptolemaic system and the viewpoint of the Roman Catholics, so man loses his position in the center of the universe. Darwin then challenges the illusion that man is a unique creation of God by postulating that he evolved from simpler organisms. Freud undoes the concept that man is the master of his thoughts and behavior by showing that despite conscious uses of will power, unconscious processes determine much of what we do. Now biologists attack the idea that we are unique selves derived from a particular germ plasm by postulating that even our body cells have organelles within them that derive from foreign bodies which have taken symbiotic residence within—the centriols and mitochondria.

Thus in the review of our changing status in the universe, we must re—view our sense of uniqueness and specialness. In one perspective it is an illusion to fortify our narcissism; in another sense it is our greatness for we share in the process of evolution being both a continuity of it and a change from what went on before.

VALUE

But a creative product must go beyond the new, it must also be of value. One could, however, ask of what kind of value and for whom?

1. ***Value to the creator***. Some products have value only to the creator. A housewife paints a scene of a mountain with a lake in front of it. It has value to her because it reminds her of a pleasant time at the cabin in the summer. To others it may have no intrinsic aesthetic value. They may pass it off as "calendar art". But to the artist it had value in fixing an experience. Both the experience recorded and the activity of painting it give value.

A schizophrenic patient depicts his inner turmoil on canvas. Some paintings done with superior skills may be strangely moving. Another patient's work, on the other hand, might just seem odd. It lacks relatedness. Though some theorists say that the schizophrenic

is attempting to re-contact the world through his expression on paper or canvas, the patient often fails.

Some schizophrenics are so sensitive to rejection, they communicate in symbols only a few can read. They are only willing to let others into their private world *on their terms*, so they use symbols they can control. Others, less sensitive, are put off by the strangeness. Thus the work has value to the artist in delivering a message to those who try to understand and in denying access to others who would fail to appreciate what he had to offer. He expresses his ambivalence through his art. He relates on his own terms. Hence its value.

2. ***Value to others****.* What might have great value to the creator may have little worth to others. On the other hand, the work may be a desirable enlargement of the human experience. It may be relevant to a small group or of value to the world as a whole. It may have no significance to contemporaries and great significance to future generations.

Its worth may be aesthetic pleasure as in art or usefulness as in commerce or predictability as in science or joy as in humor. Each person or group determines a creative product's value. The determination of value depends upon the context which may relate to the creator, in other cases to a core group, in other instances to the world at large, for this generation and perhaps to generations to come. All these groups help determine the value of a creative product. Creative products fulfill the creator in the sharing with others. One communicates to complete the creative process.

SUMMARY

- Creative people have general goals in their work. Two of them are that the results be new and valuable.
- Newness can be in the form of originality, i.e., the first of its kind and as an originator, i.e., having offspring.
- Newness can mean being statistically rare.

- It can mean a change from the usual way of doing things.
- It can be a renovation of the old.
- Because each of us is unique, by expressing that uniqueness we offer up something new. Creators don't strive to be original; they strive to be themselves.
- Value comes from context. Its worth may be to the creator, to a core group, to the world as a whole in this generation or for generations to come.

REFERENCES

1. Shapero, Harold. "The Composer and his Message" in *The Intent of the Artist*. ed. August Centeno. Princeton University Press, 1941.
2. Wolff, Theodore F. "The Many Masks of Modern Art," *The Christian Science Monitor* (Boston), Jan. 6, 1981, p. 20.
3. *Ibid.*
4. *Ibid.*
5. Newton, I.
6. *The Complete works of William Shakespeare* ed. William Aldis Wright. Garden City Books, 1936 p. 936.
7. Mondrian quoted in Sedgwick, John P. Jr. *Discovering Modern Art*. New York: Random House, 1966. p. 77.
8. L. Euler, "Reflexions sur 1'espace et le temps," *Memories de l'Academie Royale des Sciences et Belles Lettres* 4 (Berlin,1748) :324-33.
9. Mozart, Wolfgang Amadeus. "A Letter." from *Life of Mozart*, by Edward Holmes. New York: E. P. Dutton and Company, Inc., 1912.
10. Wolff. *bc. cit*.

11

DIFFERING VALUES

Some take the attitude that some people are creative and others are not. It is true that some have more talent than others in specific fields such as art or science, but we are all potentially creative in some area of our lives. We all have the possibility of making changes for the better. We can all make improvements. We all can be innovative. Some may choose not to be creative, but that is another matter.

Creativity is not an all or nothing phenomena; instead, there are degrees of creative activity. This may even be true of a particular person or project: we can be quite creative in one area of life and less so in others.

Creativity implies newness and value. It suggests transformation, fulfillment, vision, and origination. Thus in assessing where we are creatively, we can examine how new and valuable the products are that we discover, invent, or make. Do they represent some improvement? Are they better than before?

The word “creativity”, moreover, asks both what persons do or make and how well they fulfill themselves and their project.(l) At the level of personal development we can examine our life to ask how far have we come? What were the odds of getting there? We can reflect back to the past to see how much transformation has occurred. We can look to the present to see how much of what was potential is fulfilled in any one particular creative act, or we can visualize the future to ask what the perspective might germinate as new possibilities--for to originate is to generate offspring and imitators.

OTHER CONSIDERATIONS ABOUT CRITERIA

Degree of transformation. We can evaluate the innovative process and question what effort it took to overcome past constraints. McPherson, for example, when considering inventions

looks at the difficulty of the problem at hand, the previous failure of other solutions tried, and even the skepticism of the "experts" in the field as to the possibility of solving the particular problem. (2)

Yet it is not that simple. Do we evaluate the creativity of the person or the product? For example, a person gets into psychotherapy and makes major developmental changes that others in his family would not dare attempt. Has he been more creative with his life than a neurotic author like Kafka? The former breaks ground in freeing up unconscious energy to go ahead with his life. The latter remains stuck, but shows the world a new understanding of "stuckness," revealing in the imagery of the unconscious what an introspective age needed.

Change context. Creative acts involve personal and contextual changes. Consider the person who starts with little but does a great amount with his life and compare him to one who has all the advantages. Some musicians, for example, like Bach grow up in a musical family. They breathe in music--whereas other composers must struggle against their families wishes and desires.

Creative worth is dependent upon the context in which we are evaluating it. How much change has occurred? How much help did we get from others? What were the original conditions?

The summator vs. the innovator. Some do not innovate as much as they culminate a trend. They say everything there is to say about a particular style in consummate fashion. Bach, for example, was a summator not an innovator, but the brilliance of his execution forced others to look elsewhere or risk becoming "manneristic." His compositional style was not new in itself, but the results of his work caused the following generation to come up with something different. The summator gives birth to the innovator.

System creation. Sometimes an individual discovers or invents something new, quite independently. But at other times events themselves find someone to bring its needs about. The

cultural milieu seems to find someone to express its unconscious potential. (Does the hero create history or history the hero?)

So many nearly simultaneous discoveries and inventions happen because the culture is ripe for change and discovery. Of course the culture is the result of many people working at the same time towards a similar goal. Such was the case in the unraveling of the T-cell (Thymus-derived cell) mystery. John Klapper and Philippa Marrack in a Denver Post story tell how after ten years of work, they and competing research teams arrived at similar results within two weeks of each other. Each of the teams leap-frogged each other stalking the T-cell recepter molecules and the genes that governed the cell's behavior.

The immunological research on the T-cell, they knew, was the key to understanding transplant rejection and the early diagnosis of leukemia. Klapper and Marrack first developed a hybrid cell: they chemically fused a normal T-cell with a tumor cell that they knew would keep on dividing. After testing 40 colonies of the fused cells, they found the receptor on the 40th one. This provided an inexhaustible supply of receptor cells. They were then able to tag the cell with a radioactive device to show just where the receptor was. Their euphoria at the accomplishment, however, was short lived. Two other labs, they soon found out, had done the same thing. One Texas researcher published his findings but hadn't identified the nature of the protein on the t-cell surface. Klapper and Marrack phoned him and told him what he had found.

Once these papers were published showing how to isolate the protein on the T-cell, multiple other papers came out describing the nature of the protein. Competing journals all wanted to be first so they rushed to publish in weeks what previously would have taken months to get into print. Each paper published helps the next researcher to start where the others left off and add his separate expertise.

Klapper and Marrack were biochemists not molecular biologists, so they combined forces with Sim and Andrei Augustin, both molecular biologists. But, leapfrogging ahead, a research

team at the National Institute of Health in Bethesda, Md. found one set of genes on the T-cell—the beta set. So with John Freed, a biochemist, Klapper and Marrack set out to determined the protein sequence of the alpha set. Sim then found the genetic codethat would unlock the hidden door to the receptor, but they were beaten to publication by a Japanese doctor and Mark Davis who had previously found the beta chain.

The researchers then asked, "After 10, 15 years of work, how could you have people arrive at the answer within two weeks of each other?"(3) In part that accomplishment was the result of the self-organizing nature of science with the publication of results. The sharing of success helps others be successful too. Thus the creative person is sometimes as much the invention of the culture as the culture is the invention of the innovator.

How well do the creative products fulfill inherent possibilities? Most writers on creativity and innovation would agree that the new creation fulfills the person in the creative process with a result that might never have been anticipated, but seems somehow so evident afterwards. The resolution fits. It is adequate, appropriate, logical, useful and valuable. The elaboration and synthesis is complex, attractive, elegant, expressive, organic and well—crafted.(4) Creative products actualize the potentials within the problem.

But the question of how well does the result fulfill the inherent possibilities begs still other questions: A pianist like Van Cliburn, for example, plays Rachmaninoff Concerto No. 3. How creative is he in "recreating" the composers ideas? What does he add to those symbols on paper? What about his interpretation: What if he transforms it into something different from what the composer intended? There are other questions: Is it more important to be authentic, for example, using the instruments of the day or to be original as in a classical jazz performance. How important is originality? How much authentic "recreation"? Both are "inherent possibilities."

Values differ. There are no final answers to these questions. Their very open-endedness is part of the evolving creative process. The criteria for selection evolve individually and culturally.

SUMMARY

- We can be creative in some areas of life and not in others. There always is room for improvement.
- The transformation can be in the product or the person.
- The degree of difficulty depends upon the context--some can do wonderful things without much effort because they are born into a supportive environment.
- Sometimes it is more creative to make a change that is difficult than to complete something well that is easy.
- Some summators force others to innovate or else be considered manneristic.
- There are many different ways to fulfill our potential and the potential of what we are working with.

REFERENCES

1. Young, J . *S.E.L.E.C.T.: Creative/Innovative Approaches* Buffalo, N.Y. Bearly Limited, 1986

2. McPherson, J. H. “A proposal for establishing ultimate criteria for measuring creative outputs.” In Taylor, C. W. & Barron, F.(eds.), *Scientific Creativity*. NYC: Wiley, 1963.

3. Parsons, Dana. “Unraveling the T-cell mystery.” The Denver Post February 3, 1985. pp lF-4F.

4. Besemer, Susan P. and Treffinger, Donald, J. “Analysis of Creative Products: Review and Synthesis,” *The Journal of Creative Behavior* Vol. 15 No. 3, 1981 p. 164

12

CONSCIOUS AND UNCONSCIOUS CRITERIA

DIFFERING CRITERIA

There are many considerations to make in choosing the best result. Some criteria are developed from previous experiences. Some are found within the current project. In any particular project certain parts work well together; others that don't are eliminated. The resulting criteria found or developed may be specific to that particular work.

Also there are standards within the field. In art or literature, for example, criteria exists about what is good art or good literature. One who does not know the history of the field might not understand those universal criteria that have developed over the centuries. Moreover, standards change with different periods of development of the field. You need to know where your specialty has been, where it is now, and where it seems to be headed. Of course, you can develop new criteria—that is a creative act in itself— but you have to be able to relate it in some way to the old, i.e., you are expanding upon the old, overcoming in, incorporating it etc.

In art, especially, the criteria vary greatly according to the period in which you are working. A critic like Sydney Harris says that you should select what converges on "essence." He says, "The primary task of art is to strip down the appearance, to remove the accidental, and to disclose the essential."(l) Yet in the earlier impressionistic period the essential was the accidental—the accidental way light fell upon all things. Take Monet: Light falls on a hay stack. He paints the changes in color throughout the day. What is essential, the hay stack, the color or the light? Is the

essential what is “out there” in front of his eyes or “in there” in his mind? Engle says, “The writer is offering not reality, but his reaction to whatever reality he has experienced.”(2) Different critics use different criteria, but they do use them.

Not only do artists use criteria as they work, they try to be consistent within whatever framework they chose. Consistency in integration is important. Sedgwick says, “In a good picture the struggle must be resolved aesthetically; that is, the problems raised in the painting must be solved in terms of aesthetic satisfaction. . .(3)

Poets have a similar problem: They not only decide when to stop revising the work, but how to end any particular revision. How do I “get out of the poem?” One thing they can’t do is give a rational explanation any more than writers can finish a short story by telling what it is all about in the last paragraph. Poets can’t explain a poem to get out of it—they must continue the metaphor to the end.

When one makes an interpretation as a psychotherapist, it is often important to stay within the metaphor. If a person is talking about his father in terms of his teacher, therapists stay within the metaphor of teaching rather than parenting. They allow the patient’s unconscious to make connections and bring associations to the surface, rather than forcing them and making too big a jump.

In research there are other criteria for selection. Researchers establish theories that will explain all the data in the simplest manner—Occam’s razor. Be parsimonious. Simple theories, though attractive, must also be predictive and the experiments must be replicable. Researchers stay within the metaphor (theoretical paradigm) of the day. Their conclusions have to fit in with other previously established laws or explain why they are the exception. If the theory is new, at the second order of change, they must show how their viewpoint explains all previous findings in a better, more comprehensive manner.

Businessmen do the RUMBA: Results must be Reasonable, Understandable, Measurable, Behavioral and Attainable.

THE PROCESS OF FINDING NEW CRITERIA

But choices are not always consciously made on objective criteria. When artists converge upon a solution, they choose among many possibilities. They attempt working with objective standards, but that is not the complete picture.

In creating they remain open to new possibilities. In moving into new territory, they try to retain what was good in the old criteria but overcome what was not so good. In trying to develop a *fresh* presentation, they may not know ahead of time just what that presentation will be. They express their creativity by honing in on a target, they can't see, but sense. They recognize a gradual fitting-in-ness as they get closer to their goal.

The gestaltists, for example, point out that an incomplete pattern tends to be filled by unconscious mechanisms of the brain. We, for instance, connect three randomly spaced dots on a page with straight lines to form a triangle. Why we chose straight lines rather than curved ones or irregular ones seems to be from habit. We take the course of least resistance. We take the simplest, most economical answer. We fill the gap. We make a choice albeit an unconscious and automatic one.

Nevertheless, individuals wrestling with a project find and create all sorts of new gaps to bridge. By working with ideas, past and present, and material and methods, they open gaps in their knowledge to span with new information. They avoid stereotypes such as automatically connecting three dots into triangles. They look for something fresh, something different, that will fulfill the developing criteria.

As creators develop criteria, even though these might not be fully articulated, they are ready for anything that might fill the gap. *Criteria and solution evolve together*. Though artists work consciously, actively searching and deciding, they also use their intuition and imagination. They rely on those parts of their mind that complete gestalts, that is, whole patterns.

In science we also rely on hunches and intuition. It is not always a rational process. Not only do we rely on chance and trial and error, but we play our hunches.

Innovative scientists learn to guess and go. Maslow says, "Creative persons have often reported their reliance on hunches, dreams, intuitions, blind guessing and gambling in the early stages of the creative process. Indeed, we could almost define the creative scientist in this way--i.e., as one who reaches the truth without knowing why or how. He just "feels" something to be correct and proceeds *post hoc* to check his feeling by careful research. The choice of hypothesis to test, the choice of this rather than that problem to invest oneself in, is proved correct or incorrect *after* the fact. We may judge him correct because of the facts that he has gathered, but he himself did not have these facts to base his confidence on. Indeed, the facts are the consequence of this "unfounded" self-confidence, not the cause of it. We call a scientist "talented" for just this reason, that he is right *in spite* of insufficient evidence."(4)

Thus choice is guided not only by specific criteria, but also by intuition or unconscious choice. The mathematician also has more possibilities than he can follow up in a lifetime. Henri Poincare says the mathematician selects from the manifold possibilities through an esthetic choice. "The useful combinations are precisely the most beautiful." (5) Even in theoretical physics, Dirac states, "It is more important to have beauty in one's equations than to have them fit experiment."(6)

What is meant by aesthetic choice? To me it is an exquisite sense of fitting together. It expresses all the possibilities in the most efficient, most elegant way. It has *rich* connections. Artists, for example, seek basic unity in a variety of forms. They display variations on a theme. The unity in the variety and the variety in the unity, both explicit and implicit, tie the manifold expressions together.

But not only artists, scientists also seek rich connectiveness in explanations. They want theories that are both simple and yet

comprehensive. Bronowski says, "The world is totally connected. Whatever explanation we invent at any moment is a partial connection, and its richness derives from the richness of the connections as we are able to make...All those who imagine take parts of the universe which have not been connected hitherto and enlarge the connectivity of the universe by showing them to be connected."(7) But just to connect the previously unconnected is not enough, the theory must be sharpened on Occam's razor, that is, be the simplest, most condensed, expression possible. The aesthetic choice is like finding a perfect diamond : much beauty and richness in a tiny gem.

CONVERGENCE IS A CYBERNETIC PROCESS

Feedback governs future choices. Though artists or scientists may begin with hunches, they examine ongoing efforts. If they are moving in a direction they sense meets the many differing criteria, they continue. If not, they retreat or go back to the beginning. They continually choose. Results establish new beginnings. Convergence is a cybernetic process. They gradually hone in on unseen goals as they move to the target. They change direction if they sense they are moving away from it.

In writing this book, for example, I began with several ideas. I developed them into separate essays, some of which I published. Later I expanded those early concepts so that one area came in contact with another. Then after writing many tentative outlines of the book, I began to try to pull these ideas together into some wholistic presentation.

Initially the concepts in the essays were several small "thought islands." Later, like the Dutch, I drained the sea of unknowledge between them. The islands became bigger and eventually touched. Then I had to devise a tour around the new land mass that would take in all the sites and not backtrack too much.

As I wrote I discovered other associations and ideas to include. Each new thought impacted on earlier ideas. New

viewpoints forced me to change those earlier concepts. I continually had to make new choices. Should I go the way I began, following my initial plan, or should I rearrange the whole work in the light of this new perspective? The future, i.e., new ideas and associations, hence, determine the past, i.e, the earlier chapters and their presentation. As I pointed out before, creative work is no way linear. Later decisions continually feedback on earlier efforts. It only seems linear in the final presentation.

Choosing and being chosen. Though artists, writers or researchers bring elements together choosing among them, the elements themselves choose them. C. G. Jung says, "The work in process becomes the poet's fate and determines his psychic development. It is not Goethe who creates *Faust*, but *Faust* which creates Goethe." (8) Harold Shapero, the composer, says, "He is not so much conscious of his ideas as possessed by them." (9) The creation creates the creator.

The product in process and the media in which one works also determine choice by imposing certain limits. They stir the imagination by posing particular problems to solve. The limits actually help the creator create, otherwise the selection process might become too overwhelming. Poets, for example, use words, so they listen to their sounds, rhythms and rhymes. Certain sound combinations work in certain places and not in others. The extra character of words enhance the meaning the poet wants to convey. Though poets are limited by the language, it also helps selection.

John Dryden, the poet, says, "The great easiness of blank verse renders the poet too luxuriant; he is tempted to say many things, which might better be omitted, or at least shut up in fewer words; but when the difficulty of artful rhyming is interposed, where the poet commonly confines his sense to his couplet, and must contrive that sense into such words, that the rhyme shall naturally follow them, not they the rhyme; the fancy then gives leisure to the judgement to come in, which seeing so heavy a tax imposed, is ready to cut off all unnecessary expenses." (10)

Robert Frost was also well known for his dislike of "free verse." He felt the limits of line count and rhyme helped the poem. He described writing free verse as "playing tennis with the net down."(ll) Taking delight in perversity and inspired by Frost's viewpoint, I once mocked this point of view in a piece of doggerel called

EXPIRED VERSE

I had overparked by time
with wretched rhymes
and jingle-jangle lines.

My metered mind
had run out of nickels
so I began to write free verse.

I moved to assonance
and dissonance, from
passonance to pissonance
and found myself
the dog's delight.(12)

Others work with constraints. Painters paint with paint. They are limited by its qualities. They approximate and overlap color. Artists respond to what the painted picture says. Sedgwick says, "The modern painting embodies its own development. The most typical kind of painting-the Cezanne, the Matisse, the DeKooning or Kline—paints itself. By this I mean that though the artist may have some very specific ideas as to the kind of picture he intends to make, the painting he eventually creates is the process of a complex process of working with and in the painting, reworking it, adjusting it within itself, sometimes actually repainting the entire surface a number of times."(13)

When we work in and with a painting, it is a matter of choosing and being chosen. In one sense the totality is self-organizing. Creators select the topic, but the limits of the media and the developing expression of the product choose them.

SUMMARY

- Creative judgment involves different kinds of criteria. Be aware of them all. Consider the intrinsic demands of the work itself, your personal standards resulting from earlier work,standards within the field, and criteria for creative work as a whole.
- Know the history of the field in which you are working. Though some standards are universal, most vary over time. Know when they have been, are now and where they might be headed.
- Trust intuitive criteria in converging on your goal as well as conscious ones.
- New work requires new standards that must be discovered in the creative process itself.
- An aesthetic sense is rich in connections and consistent in integration. Choose, looking for beauty, in science as well as art.
- Paradoxically, limits help creativity by aiding the selection process. Put the net back up to challenge yourself.
- Converge on your goal through a cybernetic process. Let new results feedback on old beginnings. Be ready to alter the old in the light of the new.
- In one sense the work of art and the artist choose one another in a self-organizing process. Allow it to happen.

REFERENCES

1. Harris, Sydney, quoted in Sedgwick, John P. Jr. *Discovering Modern Art*. Random House: New York 1966

2. Engle, Paul ed. *On Creative Writing*. E.P.Dutton & Co., Inc.:New York. 1964

3. Sedgwick *bc. cit.* p.84

4. Maslow, Abraham. *The Psychologyof Science: A Reconnaissance*. Chicago: Henry Regnery, 1969 p.132

5. Poincare, Henri. "Mathematical Creation" translated by George Bruce Halsted *The Foundations of Science.* The Science Press 1913,1946

6. Dirac, Paul. "The Evolution of the Physicist's Picture of Nature," *Scientific American*, Vol. 208 (5), 1963, pp. 45-53.

7. Bronowski, Jacob. *The Origins of Knowledge and Imagination*. New Haven: Yale University Press, 1978.

8. Jung, Carl Gustav. "Psychology and Literature" translated by W.S. Dell and Cary F. Baynes *Modern Man in Search of a Soul*. Routledge and Kegan Paul, Ltd., London

9. Shapero, Harold. "The Composer and his Message" in *The Intent of the Artist*, edited by Auguto Centeno 1941 Princeton University Press.

10. Dryden, John. "Dedication of the Rival—Ladies" from "To the Right Honorable Roger, Earl of Orrery" in *The Works of John Dryden*.

11. Frost, R.

12. Young, John G. *Blue Unicorn* Vol II, No. 3. 1979 p.27

13. Sedgwick. *bc. cit.*

13

CONDITIONS FOR CREATIVE COMBINATIONS

After the initial divergence away from the initial problem looking for possible solutions, the creative thinker must gradually focus on an integrated result. We break away from the old way to move toward a better one. The developmental process involves an elimination of some elements, a rearrangement of others and a strengthening of certain ones around a gradually recognizable theme which may or may not be sensed at the beginning of the work.

Selection and integration are interrelated in the creative process. By choosing one option, we let go of other ones. But it is more complicated than just choosing a single option because in most creative activities, we combine many possibilities into a workable whole. The whole has to work together. Each part has to "fit in."

CONDITIONS FOR NEW CONNECTIONS

Historically physico-chemical evolution preceded biological evolution. The latter, in fact, rests on the foundations of the former. So, too, the fundamentals of concept formation rest on principles we can see in physico-chemical recombination.

Let's take as a model for creative combination the example of a chemical reaction. For example, put one part oxygen and two parts hydrogen together under the proper circumstances, and we will get H20. Water, the result of the combination, is qualitatively different from the two gases of which it was made. Even if we knew all the characteristics of each of the two gases, we might never expect their combination would produce a liquid, i.e., something entirely different.

Such is the essence of creative combination. The result is brand new. Something novel emerges. There are analogous principles at the conceptual level.

Structure sets the limits. Even the simplest forms have some kind of structure. Quarks, the presumed current basic particles, have an electrical charge 1/3 or 2/3 of the electron. What "strange" structures! They even have "color" too, but no artist could paint it--it's just so much word-play. Atoms have a nucleus and an exterior number of electrons. Molecules also have a particular structure. Some with the same atoms in the same sequential order can be structurally distinct—right handed and left handed.

Ideas, simple and complex, might be seen as units of conceptual creativity. To be creative we combine them in a unique and valuable way. Ideas, although more flexible than physical bodies, do not successfully combine with every other idea. Ideas mean this and not that. They take their meaning from the context in which they reside. Certain ideas make sense together. Others may not initially, but do so in a different context.

In chemical combination the elements combine in specific ways. The combining capacity of an atom is limited by the number of electrons in the outside shell that can move easily into molecular combination. This number is called the "valence." Thus atoms combine with only certain other atoms. They are restricted by their valence. The unit's structure limits the degrees of freedom of recombination.

So too, metaphorically speaking, it is possible that ideas within certain frameworks have certain degrees of freedom. Some concepts, like the carbon atom with a valence of four, might permit four points of access. Others might permit more. They would foster more open systems.

The more words we have to describe a specific system, the more ways to interact with that concept. Eskimos, for example, have 16 different words for "snow." They have many more ways

of communicating to their fellows about their "frozen water." Their idea of snow is much more differentiated than ours. Their concept of snow has a higher valence.

Though always putting thoughts into words can restrict creative thinking, having a meager vocabulary or a limited way to conceptualize, like a low valence, also inhibits new associations. We end up with stereotypes and cliches. Limited available words hamper the formation of new concepts. It also makes for problems in getting ideas across. Poets with a small vocabulary have difficulty expressing what they feel. Compare them with Shakespeare whose vocabulary was huge and range was universal. He still speaks to us.

Yet it is not just the number of elements or the ideas themselves that limit options, it is the way they are structured. Some electrons, for example, are freer to interact in combination than are others. Some are held in closer proximation to the primary organization of the atoms. The inner electrons rarely interact with those of other atoms. So, too, some ideas may be tied tightly to fundamental assumptions; other ideas may be more incidental or peripheral. Those outside ideas may be "looser" and more ready to join with other viewpoints into a whole new configuration— like H20 into snow flakes becoming snowmen.

Other configurations are more closed. They have a valence of one. Stereotypes, for example, force either/or responses. You are either with us or against us. You can join us along this one dimension or you don't join us at all. For example, we tightly hold to our value system. Whether we are for or against birth control is a central concern to some people. But we change our clothes with the season, the fashion, the weather or the time of day. What we wear is not as vital. Delusions might be thought to have a valence of zero. No amount of reason or argument can shift any part into reasonable interaction. The whole system is closed. Like the inert gasses, those people holding fixed delusional ideas will not relate to any other viewpoint.

Evolutionary Creativity:

Selection in the Creative Process

Ideas as units have to be free from their context to enter into other combinations. They have to be free to be re-arranged. How free ideas are determines their character. At the atomic level, the energy to move electrons characterizes the structure of different elements. This is called the Pauli principle: energy required to remove an electron determines the property of atoms. (1)

Some ideas, as I said above, are more fixed than others. They are more embedded in contextual surroundings. Ideas to be combined creatively must be free to move into other contexts. If we limit our view of them to a single rigidly held perspective, we will be unable to make creative combinations. Hence it is necessary to *break down* the initial structure within which the items are fixed before reorganization can occur. Usually it takes energy and effort to alter perspectives. We have to work to escape from old ways of thinking to form units we can combine in new ways.

Consider then the creative verbs to "break apart", "analyze", "divide," "separate," "fractionate." It is often necessary to break problems down into smaller units so different aspects can be tackled one at a time. But it is not necessary to break them down in a logical order. Sometimes an apparently illogical division can lead to a better solution. Get out that conceptual cyclotron and blow the whole structure apart. You might find some interesting things. At least you will destroy much of the larger organization that was held together so tightly and free up some new units to work with.

Let's see how we might break apart the idea of birth control. You can start anywhere. You don't have to be logical. You just have to break up the previous structure. Take the "control" part. Who controls? You, your government, your pope or your pop. When do you control? Before you get together (vows of celibacy, rhythm methods, homosexuality, pills, taxes on more than one child) , when you get together (diaphragms, pills, foams, prophylactics, withdrawal, use the anus, use your imagination)

after you get together (douche, “after pill”, IUD)? What about during pregnancy? (abortion—when, where, why, how, how many?)After delivery? (adoption—voluntary, involuntary, grandparents)—Who controls then? What are the consequences of the controls, now, later? You could go on and on, breaking the problem up into smaller parts to find an interesting one to tackle.

Crutchfield suggests that the units or elements, not only be free, but *be available, selectively activated, salient, accessible and in close temporal contiguity*. to enter into creative combination. (2)

Available: elements to be combined must be capable of being brought into a focus of attention. Often I think this is what separates the genius from ordinary mortals. The Mozarts and Einsteins seem to have an extraordinary broad grasp. They bring in many diverse elements into focus at the same time.

It is like having a computer that has a memory of gigabytes as compared with one that has only a few megabytes. With a large memory you may have access to all the elements at the same time so that you can make connections in a single effort. With a smaller one you take it in serially and you might miss some combinations which are not in your awarenes. You can’t work with all the aspects at the same time.

For many nights I could not sleep because I was trying to organize the various chapters of my book in my head. This went on for a long time until I recognized the need for a “story board”. Like the series of illustrations an artist might draw up to plot out a cartoon or a commercial, a story board is a large bulletin board on which you fasten various materials and move them around as necessary. It’s like having a huge computer screen in front of you to view the situation all at once. I used a 4’x8’ board which I fastened to my wall in my office. On it I put all the materials, essays and illustrations that I had accumulated over the last decade. I could see it all there in front of me and glance back and forth integrating various aspects in a way that I could never do in my head. The amount of material that I can bring to consciousness at

the same time is not as large as those geniuses who make the major breakthroughs, so I have to use auxiliary methods to compensate.

Selectively activated: necessary elements are activated and paid attention to. Another advantage of the story board is that it can be altered over time. I recognize that certain parts are incomplete so I write notes to myself selectively pointing out places where additional thought needs to be made. I write out questions on small slips of paper and tack them to the board in appropriate places. They stir my unconscious to remind me of that void and to fill it in as chance wills new connections and associations. Surprisingly when I look again at the board I find that those questions selectively activated have answers that I did not consciously attempt to answer.

Salient: Crutchfield suggests that appropriate conceptual elements stand out from their surroundings in such a manner as to make each in some sense accessible to the other. He says, “Degree of salience depends upon the arrangement of elements in the stimulus array, upon the number and complexity of all the elements which are simultaneously present, and upon the degree of heterogeneity or homogeneity of these other elements.”(3) On a story board you can make items stand out by using color markers, different colored pins, large letters, pictures so that connections may be visually obvious.

For chemical reaction to proceed the concentration of elements must be high enough. Reactants vary in purity. Highly concentrated solutions are more likely to react than less concentrated ones. Impurities may impede reactions by effecting the closeness or distance between what you want to go together.

Impurities in thinking also prevent new combinations. Scientific ideas, for example, during the middle ages were contaminated with religious beliefs that had nothing to do with natural phenomena. The earth was considered the center of the universe because man was thought to be primary. This religious

perspective made it impossible to consider the earth revolving around the sun.

To help make the appropriate elements stand out, i.e., to remove the impurities, scientists and mathematicians use symbols. Their use prevents extraneous meanings. Opposing views (impurities) need to be eliminated or subdued to allow new combinations to take place.

Accessible: Though it is important for elements to be activated and break from their former configuration, too much energy and too much chaos also interferes with creative combination. After the "big bang", for example, the tiny particles had to cool down from intense heat to *get close enough* to unite into larger structures

Though creative people have a large tolerance for ambiguity, it is hard to think in complete chaos with thoughts flying off in all directions. On the other hand, creator's tolerance for ambiguity allows them to bring elements not usually brought together to come in contact. Ideas have to be near to get together. Many people, although they don't fly apart with their thoughts like primary particles at the big bang, nevertheless, segregate them in fixed categories so that different ideas never get together.

Ambiguity sometimes stirs anxiety so that it feels like thoughts are flying away. If one relaxes, thoughts come back together, perhaps in new combinations. Maybe this is why many creative people have their best ideas relaxing in bed or while shaving or driving. So see if you can associate in these new ways. If you can bring concepts that seem far apart into close approximation, you may make the creative connection. Try to tolerate any ambiguity long enough to bridge the gap.

Close temporal contiguity: Elements will appear together either by habit, chance or intention. Habit brings proximation but interferes with reorganization. If your environment has richness and complexity, you are more likely to find and bring thoughts and ideas together by chance. The more alternatives you have to combine, the more likely you will find a combination that works. If

you intend to bring about certain connections, make sure you consider them at the same time. Sometimes it is helpful to *force ideas together* to see what happens.

CATALYSTS

I remember freshman chemistry and making water from hydrogen and oxygen. Nothing happened when you just put the two gases together. But what an explosive effect when the catalyst platinum was added! The noise woke up the whole class.

Catalysts help creative combinations to occur. By temporarily combining with the various elements, they lower the energy amount required to cause the reaction to go to completion. Catalyst, from kata: down and lyein: to loosen, implies that in the chemical reaction the platinum loosens the bonds of the gas molecules. They then form free radicals, i.e., temporary combinations as intermediate stages to a new final combination. Catalysts therefore function as bridges spanning the gap between dissimilar elements. With intermediate combinations requiring less energy to form, the chemical reaction goes to completion.

Catalysts can help bring ideas together in new combinations. This is what happens when we use analogies and metaphors. William J. J. Gordon suggests that analogies are important means to creative combination. Through his system of "Synectics" he uses various kinds of analogies to help groups bridge the gap between where they are and where they want to be.(4)

A metaphor is an implied analogy. Metaphor, from "carry across", assists us to look beyond the logical connections to other possibilities. I have used the biological evolutionary metaphor throughout this book to show how they can be used to carry you across to a new point of view. They are not used to prove that something is one way or another, but, instead, *to show that there is more than one way of looking at a problem.*

Though some analogies and metaphors are *found* like my comparison of chemical reactions and cognitive recombinations, others are *invented.* You can use any situation as a metaphor for

any other situation. It can have an explosive effect when you begin to consider that you could put things together in an entirely new way. Edward de Bono calls these metaphors, "intermediate impossibles".(5) "Wrong" means can lead you to "right" ends. For example, my thought about platinum and the intermediate formation of radicals might be totally wrong—most of the history of science shows older views to be erroneous. Besides my memory of the theory of the experiment might be wrong--it has been more than twenty years since I took freshman chemistry. But if the idea gets you across to the usefulness of catalysts to help combine ideas, the illustration was successful.

Consider the achemists who did not reach their goal of converting base metals to gold: The goal served as a catalyst to the discovery of the principles of metallurgy and chemistry. The latter probably is more valuable than making many gold bars.

de Bono also suggests that you take random nouns from the dictionary, in the same way I suggested earlier you use random verbs, and force fit the problem with the noun.(6) The noun acts as a catalyst to create a bridge to a new way of looking at a problem. Suppose I wanted to think up other ways of looking at the concept of "bridge," and I looked in the dictionary and found the noun "sign." What happens when I put these random thoughts together? What happens when I force-fit them?

A sign might be a bridge to understanding. Its message communicates across a gap. Some signs sway in the breeze—-give with the wind. Maybe bridges need to be more flexible. A sign may go out of date. Bridges need repair over time. "De-sign" is important in bridge building. A sign may be an omen. It may foretell a possibility. The use of the force fit may make you recall some long forgotten association or create a meaningful new one.

One thing nice about using a dictionary is that words generally have multiple meanings, any one of which might connect you up with a better idea. Words are highly valenced. Not only do they *denote* specific meanings; they also *connote* wide ranging associations and implications. Hence using a dictionary as a tool,

you can usually go beyond your first considerations of the word to come up with other analogies.

Good friends can be catalysts. They will listen to our ideas without contaminating them with theirs. They want to understand our thoughts, so they ask questions. As they try to understand, their questions prompt us to consider different ways of viewing our problem. The implications of their questions give something different to attach to. Because of the interaction, we begin to see a direction that might have been hidden from view.

Even fictional characters of your own making can be catalysts to new awareness. They connect to unconscious knowledge and awaken hidden insights. They stir new associations. Thackeray, for example, writes in *The Round-about Papers*, "I have been surprised at the observations made by some of my characters. It seems as if an occult Power was moving the pen. The personage does or says something, and I ask, how the dickens did he come to think that?" (7)

All sorts of things can catalyse creativity. If you have a variety of experiences, you are more likely to make a broad range of associations. Television and travel can be stimuli to new connections. If you are receptive to those apparently random associations, you may make novel combinations.

AUTOCATALYSI S

Sometimes chemical reactions autocatalyse, that is, the products of a reaction influence the rate of its own formation. Conceptually progressive discoveries often act in an autocatalytic manner. Creativity produces hindsight that allows a new perception of the old problems. The view from the top of the mountain is different from the base, and it might reveal a better way up.

It not only acts as hindsight, it motivates. Success generates success. Performers play to the audience. When they are enthusiastic, performers play better. Audiences can make or break

some performances. If the audience's response is strong enough, the artist gives an encore. Positive feedback works both ways.

SUMMARY

- The principles of creative combination mirror those of physico-chemical and biological evolution.
- The structure of the units set limits on the possibilities.
- The freer the units are from their framework, the easier it is to enter new arrangements.
- Consider the creative verbs: to "break apart," "analyze," "separate," " fractionate," "divide." Consider random divisions.
- Make the parts available, selectively activated, salient, accessible, and in close temporal contiguity.
- Consider the use of a story board when too many ideas threaten to overwhelm you.
- Try to tolerate the ambiguity of the temporary dislocations as you attempt to make new combinations.
- Use random nouns as temporary catalysts to new combinations. Any noun can be a metaphor. Look for the applicable analogies.

REFERENCES

1. Pauli Principle described in Perkins, Peter G. *Elementary Molecular Bonding Theory.* Methuen & Co. LTD 11 New Felter Lane, London EC4
2. Crutchfield, Richard S., "The Creative Process." in Bloomberg, Morton. *Creativity.* College and University Press Publishers, New Haven, Conn. 1973 p.58—59
3. Ibid.

4. Gordon, William J.J. *Synetics: The Development of Creative Capacity*. New York: Harper and Row, 1961.
5. de Bono, E. *Lateral Thinking*. New York: Harper and Row, 1970.
6. *Ibid.*
7. Thackeray, W.M. *The Works of W. M. Thackery*. London: Smith, Elder & Co. 1898-99 Vol. XII *Roundabout Papers*. pp. 374-75.

14

INTERNAL SELECTION

In an earlier chapter I described how the DNA molecule provided a stable template for replication of similar molecules. This process overcame the randomness of the primal soup. The DNA molecule in the nucleus also produced RNA, riboneucleic acid, which in turn makes proteins. If some miscoding occurs, the DNA strand mutates, that is, it encodes a different amino acid sequence in the subsequent formation of the protein. This change provides the possibility for evolutionary shifts.

THE MEMORABLE PHRASE

Let's look into the mutation process a little deeper. In biological systems it is the "accidental choice remembered" according to Henry Quastler that becomes the successful mutant. (1) Single strands of DNA are unstable. Unless they can combine with other nucleic acids, they break down.

Sometimes the molecule combines inexactly with individual nucleic acids. What is important is that *accident becomes necessity*. These small changes are "remembered", that is, reproduced in subsequent molecular chains of DNA. New protein sometimes results. Quastler states, "For the working of the "prebiological polynucleotide system," almost all base sequences are equally effective. This means that the pattern sequence as such is completely meaningless, i.e., carries no information, is nothing but "noise." This is obviously the case if the original sequence is the result of purely random polymerization; it still applies if the original sequence was lawful in some manner that does not affect the subsequent working of the system. On the other hand, the primarily meaningless sequence acquires very definite meaning as soon as it becomes imperative that it be followed faithfully;

information has emerged through the accident of a particular strand becoming ancestor of the system, i.e., through the stability properties of the system descended from that single strand."(2) It is repetition of the pattern that creates new meaning.

It is perhaps paradoxical that creative evolution is based on remembered sequences of individually meaningless members and chance. We often think of repetition or imitation as uncreative, but creators need reliably reproduced building blocks, and chance is often a major force in finding something new.

Quastler goes on to compare what happens with composer Pierre Boulez's definition of artistic creation: "To make the unpredictable inevitable." To restate this beautifully succinct saying, he says, " if there is a truly new element in a work, then it should have been quite impossible to predict the element beforehand, on any basis; if the work is to be successful, then this unpredictable element must acquire the unavoidability of law." (3)

In the case of genetic mutation new elements randomly occur through the action of cosmic rays and other disturbances on the DNA code sequence. Musically the motif, a short series of notes, also must be made memorable. Often there is nothing special about the motif. It can be anything, but the composer works with it to establish a pattern that will be memorable. One of the methods is too repeat it several times throughout the piece. Another is to develop its possibilities by inventing variations that remind us of the motif in more indirect ways. Too much variation produces confusion; too little boredom. The audience selects against either extreme. The same happens in biology. Too much variation produces chaos so that the system cannot replicate as a whole; too little makes it impossible to adapt to changing environmental circumstances.

How then does an unpredictable element acquire the "unavoidability of law?" I think that it is a matter of organization and coordinated activity. When the accidental choice coordinates with all the other parts of the system in which it is a member, the

system as a whole has a chance to function in a better way than earlier structures.

The new molecule and the cell within which it functions must undergo two tests to determine whether the mutant will prevail in *the* system: The first is internal selection and the second external selection. The first challenge depends upon how well it coordinates with other molecules in the metabolism of the cell; the second upon how well the new cell handles the external environment. I will examine the first here and the second in the next chapter.

INTERNAL FITNESS

Evolution is based on fitness, not only in the sense of strength but also of fitting in. When the various elements within a system harmonize there is internal fitness. When a mutation occurs within the genetic complement of the cell, the resulting proteins have to work cooperatively to enhance the functioning of the organism as a whole. If the new proteins are incompatible with the rest of the parts of the cell, the entire system breaks down. The cell dies and the mutant is selected out.

Internal and external are relative terms. In the gene system the nuclear material surrounding the chromosomes could be considered "external" to the genes. In the cell system, everything outside the cell membrane could be considered external. In the organism as a whole, everything outside the skin boundary could be considered external. What is important here is not what is inside or outside, but instead, whether selection is on the basis of harmonizing with other elements within the system or on the basis of competing with them. In the former case if one is successful, they all are. In the latter if one is successful, it may be at the expense of the rest.

Internal selection is different from external selection where the strongest or most fertile prevail. Within the cell the elements must blend in harmony. They must resonate together in a way that is more effective than the previous way. Thus in internal selection fitness implies the ability of the new part to "fit in", not to

overcome the other parts within the system. Instead of being stronger and dominating others within the cellular environment, the elements must cooperate and share resources.

Lancelot White says, “Internal selection process acts directly on mutations, mainly at the molecular, chromosomal, and cellular levels, in terms not of struggle and competition, but of the system’s capacity for coordinated activity.”(4) He goes on to say, “External selection is comparative, statistical, and competitive; internal selection is intrinsic, singular, and coordinative.” (5)

Evolution thus is not entirely accidental if the result has to pass the tests of internal and external selection. Some variations will be successful, some not. There are limits to which ones can make it. L. v. Bertalanffy says, “the changes undergone by organisms in the course of evolution do not appear to be completely fortuitous and accidental; rather they are restricted, first by the variations possible in the genes, secondly, by those possible in development, that is, in the action of the gene system, thirdly, the general laws of organization.”(6)

The creative task then is to blend accidental options into an integrated whole. The accidental pattern has to be integrated into a larger system with its inherent requirements. In my own music making I have often used random note sequences as a motif to explore and develop. What you soon find, after repeating the motif over and over, is that you recognize certain patterns within the motif that suggest chord and melodic sequences. These, in turn, suggest other possibilities for development. The motif hence has its own obligations, and the fact that I, rather than someone else, am exploring its possibilities means that it will have to fit into my style of playing and my feelings at the time. As the motif presents certain restricted possibilities, my abilities, my style, my feelings also limit what ways the motif can be developed.

Internal selection is not a matter of forcing a result, but instead, working with the material, responding to its possibilities as you introduce your own requirements. The work must resonate

with what is in you and what in inherent in the accidental motif. As the work evolves the new order has to harmonize both with its own inner requirements and the standards that you set for yourself. The piece resonates in harmonic organization. When it works together, it is beautiful and you keep it. When it doesn't, you select against it. Thus the mutant and you , as a new larger system of music and musician, undergo a process of self-organization and self-selection.

In most creative work the process is not over with just one new addition to the system. Generally, several different elements are introduced over time, ordered and coordinated. As the process goes on, you frequently re-order the elements to make the piece work as a whole.

Artists, for example, must balance the forces within the picture. They continually choose as they add new elements to the design. With each addition the problem of selection and integration become compounded. The decisions are based on an intuitive sense of fitting together. All the forces in the painting must balance. This, however, does not mean that the forces must be symmetrical. This simple solution, though it has been is used to establish a sense of tranquility and calm, in too many instances just bores. The artist, therefore, has to develop dynamic balance by organizing the various possible forces so that the interacting components compensate for one another and distribute in such a way that no further change feels necessary. Lillian Garrett says that when a state of balance occurs, "no change seems possible or desirable; the whole assumes the character of necessity in all its parts; and we have a feeling of completeness." (7)

She says that balance of forces is affected by many factors: the direction of movement, as for example, a form moving in one direction is balanced by one going in the opposite direction. It is affected by the strength (weight, velocity, or intensity) of a form.

You can change the strength in several ways. You can make a form stronger by making it larger, making the shape regular and closed, making it dense, isolating it from other elements, positioning it off-center like a small weight at the end of a long

lever. You can strengthen elements by using high contrasts as in bright colors against dull ones, warm reds against cool blues. You can alter the forces by introducing an unusual shape, a strange form, a unique relationship. If you have a dynamic situation such as the choreography of a dance or the composition of a piece of music, you can increase the strength of a movement by increasing its speed, by making it last longer, by repeating the parts more closely in sequence. You take each of these forces weighing each of the elements and balance them so that no one of the forces become disproportional.

Moreover, the harmony must not only be intrinsic, it also must relate to the purpose of the project. Tipping the balance in a certain direction focuses the forces. So if you want to emphasize a specific point, you unbalance them in the direction of the desired theme. The creator thus has to make many choices to get an effective integrated result.(8)

Some of the characteristics of a good integration: Fits together with no extraneous parts. Harmonizes. Resonates: parts strengthen each other in mutual support. Coordinates elements in mutual interaction with positive feedback to enhance what needs to be enhanced and negative feedback to damp out unwanted elements.

Some other characteristics: balance, beauty, elegance. Inclusive: it accounts for most factors. Consistent. Condensed: it is parsimonious and simple. It does not waste energy. It is not redundant. Effective. Adaptive. Hierarchical organization: unifies different levels of order.

TRANSFORMATIONS

Maintain and mature. How then do systems self-organize into balanced, harmonious, dynamic structures that can take in new elements over time? How do creators organize their work into something dynamic and effective? These are major questions in biology and conceptual creativity. Biological systems must be ordered over space and time to provide stability of cyclic and

homeostatic mechanisms while instituting one-way developmental processes of growth, replication and transformation. They must maintain and mature simultaneously. Moreover, they must adapt to shifting circumstances that they themselves, in part, provoke in their environment. Creators also must hold things together while simultaneously making improvements.

You have to do two seemingly incompatible things at the same time. The two functions seem as distinct and contradictory as light which displays both the character of particles and waves. One way to understand this paradox is to note that stability and change can go on simultaneously in different dimensions. To continue the musical analogy: stability and change in creativity are like the nodes on a moving violin string. The node is where all the vibrations come together. The string continually moves, but it crosses certain areas in the same place.

Quantum jumps. The creative process is a dynamic activity which moves toward an organized result which, in turn, provokes new perspectives that foster more change. Highly organized and coordinated systems paradoxically become capable of rapid transformation.

When you play a different note on the violin, you alter the frequency of vibrations and the location of the nodes. You shift to a new pitch. Now it is true that a violin string can be continuously shortened or lengthened with the finger sliding up and down the neck of the violin, but distinct recognizable notes are leaps to different pitches, different frequencies which often are overtones of the original pitch.

In evolution also there is some evidence that sometimes changes are not continuous but *quantum jumps*. Sometimes the shifts to new species are not gradual as Darwin postulated but happen over a very short time. Missing links continue to be missing; new species suddenly come on the scene. The changeovers seem to be abrupt. (9)

I suggested earlier that stable configurations foster creative change by overcoming chaos. Very connected systems, moreover,

are paradoxically quite vulnerable to change. There is little "give" in the system so that a small trigger can cause explosive transformation. The shift can be a dramatic alteration, a brand new configuration, an upheaval of paradigms. This happens even in larger systems such as cultures. The tightly connected Japanese society, for example, underwent rapid alterations with the destabilizing introduction of western ideas. They made a major transformation in a short time.

How then can systems self-organize and re-organize into more differentiated and sophisticated systems? What causes these leaps to new organizations? Let's return to the evolutionary model. White says, "This tendency towards the formation of more complex unified patterns does not imply any vitalistic factor, since in appropriate circumstances it can be the direct result of the tendency towards arrangements of minimal potential energy. Thus the potential energy principle can, in complex low temperature quantum mechanical systems, produce a structuring or formative tendency which, under certain conditions, will shape the genetic system toward novel, stable, unified arrangements."(l0)

Though not vitalistic, White points out that organic systems require a new paradigm beyond traditional analytic, atomic and information theoretical methods. He says that the older physico-chemical understandings neglected the asymmetrical relations which are "indispensable in representing such biologically fundamental properties as the *dominance* of more or less stable structures, the spatial *asymmetries* which initiate processes, and the *one-way processes* which generate forms."(l1)

Dissipative structures. How then do these asymmetrical relations shift? Ilya Prigogene, the Nobel prize winner in 1977 in physical chemistry, proposes a theory to show how large open systems tend to organize and oppose the natural tendency toward greater entropy or disorder.

He describes “transformations”, a science of becoming which compliments the science of being, not only in the physical sciences but also in larger systems. According to him stress on systems cause “perturbations” which thrust us into a new and higher order. (12)

As time moves on evolution creates new forms through a process of transformations. Continuous energy consumption maintains open systems which he calls “dissipative structures.” These flowing wholenesses are highly organized and always in process. The more complex and interwoven the structures are, the more energy required to maintain all the connections. Hence they are more vulnerable to internal fluctuations, or those introduced from the outside like western ideas on a Japanese culture.

The system is always in flux. He suggests a paradox: The more *coherent* or intricately connected the structure, the more unstable it is. Increased coherence means increased instability. *This very instability is the key to transformation*. The dissipation of energy creates the potential for sudden reordering to a higher level of order. He proves this with mathematics far over my head.

Marilyn Ferguson interprets Prigogene’s ideas: “The continuous movement of energy through the system results in fluctuations; if they are minor, the system damps them and they do not alter its structural integrity. But if the fluctuations reach a critical size, they “perturb” the system. They increase the number of novel interactions within it. They shake it up. The elements of the old pattern come into contact with each other in new ways and make new connections. *The parts reorganize into a new whole. The system escapes into a higher order.*

“The more complex or coherent a structure, the greater the next level of complexity. Each transformation makes the next one likelier. Each new level is even more integrated and connected than the one before, requiring a greater flow of energy for maintenance, and is therefore still less stable. To put it another way, flexibility begets flexibility. As Prigogine said, at higher levels of complexity, “the nature of the laws of nature changes.”

Life eats entropy. It has the potential to create new forms by allowing a shake-up of old forms."(13)

Let's look at some of the consequences for creative integrations: First, change occurs in history. All changes extend over time and in the context of time. Without knowing the history of a situation it is hard to know where one is and how to make alterations. I made this point earlier in terms of psychotherapy that it is important to know the past in order not to repeat it.

Rather than getting just the current details we need a historical perspective. We need more than a cross-sectional view of a situation. That is one reason why I chose the evolutionary perspective to describe innovation. Moreover, we need to consider the *process* of creative change equally as important as the resulting *product*. With Prigogene, we need to consider the dynamics of the situation as well as the final equilibrium state. Rather than concern ourselves with "being", the result of the creative act, we need to think about "becoming", the process of changing.

Second, in evolution the change seems to be to one of increasing complexity. Whether that increased sophistication will lead to those improvements we call creative, only time will tell.

Third, complexity in systems causes reordering. A therapist, for example, by introducing a new way of looking at a situation initially perturbs the patient's thinking. He adds new information to a system which creates a healthy instability. This may raise anxiety. That is why there is "resistance," which, however, is not to the therapist but to the *new awareness that threatens to disturb the status quo*. If the patient can damp out the new idea by avoiding the therapist who presents it, or by rationalizing it away, or by displacing it onto someone else, or isolating the feelings it brings up, the resistance is successful and the patient does not have to change.

If, on the other hand, the "perturbance" of an interpretation causes instability in the old neurotic order, a chance for creative change is possible. By adding information that does not fit with the

patient's concept of himself, he experiences "cognitive dissonance" which forces a re-alignment of the concepts which had stabilized the neurotic condition.

SUMMARY

- Look for the memorable phrase. Make the accidental necessary. Make the "unpredictable inevitable."
- Too much change causes chaos; too little boredom.
- Internal selection is on the basis of coordinated activity. Make your selection on the basis of internal harmony, that is, fitting in.
- Balance the forces within your field for aesthetic repose. Unbalance them for change.
- Alter some dimensions but not all to develop both stability and change, maintenance and maturity.
- Highly connected open systems are inherently unstable because of high energy and information input requirements.
- Take a dynamic, historical, process approach to systems. You can destabilize a neurotic system by adding information to cause "cognitive dissonance" and force a new integration.
- Flexibility begets flexibility.

REFERENCES

1. Quastler, Henry. *The Emergence of Biological Organization*. New Haven and London: Yale University Press. 1964

2. *Ibid.*

3. *Ibid*.

4. White, Lancelot Law. *Internal Factors in Evolution*. George Braziller, New York. 1965 p. 14

5. *Ibid.*

6. Bertalanffy, L.v., The Problem of Life: An Evolution of Modern Biological Thought. (London: Watts, 1952; New York: Harper's Torch Books, 1960

7. Garrett, Lillian. *Visual design: a problem-solving approach*. Reinhold Publishing Corporation/New York. 1967 pp.124-5

8. *Ibid.*

9. Ehrlick, P, Holm, R. and Parnell, D. *The Process of Evolution*. New York: McGraw-Hill Book Co., 1974.

10. White. *bc. cit. p.56*

11. White. *bc. cit. p. 107*

12. Ferguson, Marilyn. *The Aquarian Conspiracy* J.P.Tarcher, Inc. Los Angeles, Calif. 1980 p.25

13. *bc. cit*. p.164-165

15

EXTERNAL SELECTION

Natural selection is a combination of internal selection or coordination within systems and external selection or competition between systems. I pointed out earlier that internal and external are relative terms depending upon the level of organization examined. A similar selection process goes on in cultural evolution.

When environments change, organisms have to adapt to new conditions. Those that can adapt to the new circumstances are "fit." Those mutants that become incorporated into the new organism must first survive internal selection. They must integrate at various levels of organization—genes, cells, tissues, organs, organ systems—to develop into mature reproductive organisms. The development of a separate organism requires coordination and integration—the heart does not compete with the kidneys, nor the brain with the liver.

But once an individual is formed, the new organism must compete in the outside environment in the struggle for supplies. Not only does it have to compete with others for food and space, it also must compete for mates. Finally, new organisms, in turn, cause new conditions and new adaptational requirements for its ecological niche and the process starts all over.

Social organizations also have to consider external selection. Management once only examined what was going on within the company. Peters and Waterman say that "In marked contrast to the prevailing wisdom today, management theorists of the first sixty years of this century did not worry about the environment, competition, the marketplace, or anything external to the organization."(l) Now they think in terms of open systems; they recognize that internal organizational dynamics are shaped by external events.

WHO COMPETES?

Evolutionary Creativity:
Selection in the Creative Process

As I pointed out earlier, our idea of uniqueness as individuals has come into some question. Who or what survives the competition for a spot in the ecological niche? What system do we call the "individual?" We as persons seem separate and identifiable, although I have seen some in my psychiatric practice who seem incapable of much autonomous activity. Yet the question remains. *Who* succeeds the external selection process? How do we define "the individual?"

Let's take as an illustration of some of the difficulties, the lichens. Paul Ehrlick says, "These plants consist of a fungus parasitic upon algal cells included in its thallus. Different lichens have different morphological and biochemical characteristics, which fail to appear unless the correct combination of alga and fungus occurs. The alga and fungus reproduce separately, but the lichen reproduces as well, with propagules consisting of both alga and fungus. The alga can be grown without the fungus, and the fungus can also be cultured without its algal host."(2) Which system competes as the "individual?"

The same happens in the art world. Let's reconsider the prevailing myth of the creative individual who is an island unto him or herself. Artists, for example, need a relationship with gallery owners who support their efforts. Without that interaction, neither would exist. One produces the works of art; the other publicizes the artist and sells his or her works. Those artists with no such support may not compete successfully, *even though their work might be as good or better than those that do.* Many times the gallery "makes the artist."

The art work has to be internally integrated, balanced and expressive. Artists select canvases that show good coordination of all the elements. Yet they must give what the owner is willing to sell. There has to be a proper fit with the image the gallery is trying to project. One gallery owner, for example, told me that he liked my paintings, but to show them he would have to get a different clientele, so he turned me down.

But not only must efforts coordinate, they also compete. External selection determines which individuals are chosen to survive and create more offspring in the same style. One artist's work competes with other artists for space in the gallery—and the pieces within must compete with works in other galleries for customers.

Coordination and competition thus occur at various levels of organization. The artist and the gallery owner produce a product much like the lichen. The gallery not only sells the painting but the artist to the public. Once I heard of a parody of this: A gallery sold a blank canvas with an artist's signature on it for a high price. Who or what is the "individual" that struggles to survive the external selection process? The artist and gallery owner fit into a single system.

The same happens in science. Recently I heard criticism of the awarding of the Nobel Prize to individual scientists when a whole group actually was involved in the discovery. Much of creative research is a result of the efforts of very many people as in the T-cell investigation described earlier. Progress often is the result of many efforts coordinated over time. Who is the individual that succeeds? It is the system as a whole that is selected

COMPETITION

Though "fitting in" is important to the creative process, "being fit" is also. Competition is a positive force in the creative evolution of new ideas. Feyerabend writes, "Knowledge is not a gradual approach to truth. It is rather an ever increasing *ocean of mutually incompatible (and perhaps even incomprehensible) alternatives, each single theory, each fairy tale, each myth that is part of the collection forcing the others into greater articulation and all of them contributing via this process of competition, to the development of consciousness."(3)*

As I read various references on evolution, I see the debate that began with Darwin continues. The religious viewpoint seems to be making a rearguard action, just as I suggested happens when any new idea takes over. Experts of the older viewpoint are

reluctant to give up. But such books as E.A. Wilder Smith's *The Creation of Life* shows the value of competition for man's mind.(4) Unlike my grandfather, Smith doesn't just dogmatically emphasize the religious viewpoint, instead, he points out the limitations of the evolutionary theory. As a result he and others like him force evolutionists into a better articulation of their ideas. Without such goading, it is likely the theory would be fuzzier than it is.

Unfortunately though competition may bring out a greater articulation of possibilities such as in debate or the legal system, sometimes "winning' becomes more important than finding the "truth". For example, my wife Diane, who works as a paralegal nurse, tells me that in the legal system truth often suffers and justice is quite blind. Jurors sleep during trials, lawyers chose "experts" on their prior conclusions of the case, judges refuse to admit evidence that would effect the truth of the matter because of the method the information was obtained.

On the other hand, there is much "imagination" in the law, contrary to my earlier impression. Lawyers have to discover the facts (usually only the ones that support their position) through investigation. Some informaton is not given except to the most persistent of sleuths. Then they have to convince the judge to admit the "facts" as "evidence." Finally they must persuade the jury that the interpretation of those facts is the "truth." They have to create a good story.

The same happens in science. The competition for men's minds is a process we cannot deny or avoid. Researchers have to beat the competition. (Hopefully, they have a better alligence to the truth than the attorneys.) Yet without a positive feedback on their efforts, subsequent efforts may have to cease.

AGGRESSION

Psychological conflicts about aggressive impulses can lead to creativity blocks. External selection implies the willingness to compete. Internal and external selection work together: You have to select possibilities that coordinate with the whole; you must

eliminate those that don't. Selection and integration go on simultaneously.

In writing this book, for example, I have had to cut away many sentences and paragraphs coming to my final expression. Those that didn't fit in, went. But not only do individual ideas have to compete with one another in the final draft of this book, but the concepts as a whole must compete with other viewpoints. Outside positions must be overcome or incorporated. To those holders of those positions it must seem a destructive act. The ancient Chinese sage Chuang Tzu (359-286 B.C.) said, "Division is the same as creation, creation is the same as destruction."(5) Creation means not only bringing together in a new synthesis; it also means breaking from the old.

When mutually incompatible concepts compete for recognition in the world of ideas, the external selection process is most evident. Theoreticians fight for recognition as strongly as species for survival.

SELECTION FOR THE BEST OFFSPRING

In conceptual evolution as well as biological evolution, selective success is defined as the species that survives. It is the one that can reproduce itself. In fact, one criteria for excellence in research, for example, is that it be *heuristic,* that is, stimulating further investigation. Heuristic projects reproduce themselves. They have offspring. When a research project stimulates others to investigate further in that area, the initial project opens up new areas of investigation. Ideas which break from the past offer possibilities never before considered.

It is not enough to come up with a new concept, it must have heuristic consequences. White says, "It is not the mere expression of an idea which counts in science, but the strength of the belief that it is important so that action follows; the realization of why it is important and what its implications are; and the understanding of why it is timely, which make its expression capable of leading to discoveries at a particular period in the history of science."(6)

Evolutionary Creativity:

Selection in the Creative Process

Organisms that can adapt to a changing ecology survive to reproduce themselves. Those that can't die off.

Conceptual creativity is less wasteful of biological material. We do not have to produce options physically to see how the environment will handle them; instead, through imagination we can consider possible consequences and choose the best alternative. Land points out, "Nature's "survival of the fittest" is wasteful because mutations are lost. In the mental process countless "mutations" of ideas can be evaluated in the mind, thus selected before implemented rather than through the costly process of implementation itself."(7) Conceptual creativity extends and improves biological creativity in the form of more efficient evolution.

(As I contemplate this metaphor with its emphasis on pre-selection in the imagination, I think with irony of the many rough drafts I have to eliminate, and my envy of those of my colleagues who can synthesize their ideas into viable concepts in their heads . I often don't know what I think until I hear what I say or see what I write. My conceptual creativity is not so far removed from the inefficiencies of biological creativity.)

Though we aggressively choose the best offspring, selection still implies a coordination of efforts. The system as a whole has to work in harmony. Even predators have to fit in, in terms of working together with the environment. If, for example, they kill off the entire prey population, they will starve to death too. Moreover, by eliminating the weak and preventing their numbers from getting so large that they outgrow their food supply, the predators help those they prey upon.

Selection hence involves the two-fold purpose of eliminating the no longer useful and finding a result that will harmonize and integrate into the larger whole.

WHO ORGANIZES AND SELECTS?

The process may Judeo-Christian concept of individuals sometimes see understandings that are generations have to go

Mendel and his concept of be externally organized as in the the God who creates. Highly creative beyond the current situation to develop way ahead of their time. Several by before they are recognized such as genetics.

At other times the situation may be such that many people find the same thing at the same time. The environment, as stated before, is ripe for a discovery. This is why there are so many near simultaneous discoveries like Wallace and Darwin coming up with the idea of evolution by natural selection at the same time. Like Prigogene's dissipative structures, some environments are self-organizing. The whole system orders the parts.

Though the cultural milieu sets the stage for near simultaneous discovery, as I have said before, being recognized as the first discoverer has definite consequences: The one who is first gets the recognition. He gets the grant monies for further efforts. And he gets the wrath of those who would defend the status quo.

It seems as though the two work together. The creative person is sensitive and responsive to the shifts in the intellectual climate which, in turn, provides opportunities and challenges. Both create.

NEW SPECIES

New ideas like new species break away from the past. New organisms sometimes differ so much, they can't mate with the old. Thus the new has to find its own way. The new separates off to find its nitch in the world. Jacob Bronowski says that there is a "ratchet" phenomena in evolution that gives it forward direction and does not allow new forms to fall back into the old group. (8)

New species also form with the physical separation of animal groups. The separation of colonies through the breaking away of continents like Australia from the mainland Asia has led to a wide variety of evolutionary responses.

But what are the "ratchets" of conceptual creativity? New ideas separate when they no longer fit within the old framework. To come up with a new idea, we can't just extrapolate from the past. We cannot expect the future will be a logical continuation of

what has been. Though there might be some consistency with the general thrust, creative ideas must at some level be a break from the past.

To separate from the past and find a more harmonious future, we have to have the *capacity to be inconsistent.* It is the capacity to live with inconsistency and ambiguity that separates us from the machines. Computers must be logical, we do not have to. And it is this ability to keep one foot in a continuation with the past and one foot a step away into the future that makes the selection process so complex.

SUMMARY

- Internal selection and external selection go on together—coordination and competition are both parts of the natural selection process.
- The level of organization determines which "individual" competes.
- Be willing to compete using your ideas after you're sure that they are internally fit, i.e., in harmony and working well together.
- Recognize that competition brings into focus differing viewpoints and that with it the possibility for a better articulated theory
- Don't be blocked by fears of expressing aggression. Destruction is part of creativity. You must eliminate the old to provide space for the new.
- Who organizes and selects? Sometimes it is the inspiration of a single great mind like the God of the Old Testament. Sometimes it is inherent in the changing milieu so that many come up with the concept simultaneously. It may evolve out of stresses and strains of the system itself. (cf. Prigogene's dissipative structures) Often the creator is both sensitive to the

changing circumstances and ready to meet their opportunities and challenges.

- Good ideas produce offspring. They are heuristic—they generate new research, new investigations, new paradigms, new directions.
- Truly new ideas will be different from older viewpoints. You have to be able to tolerate separateness to advance to future possibilities.
- Don't worry about being consistent with past behavior. To be innovative you must tolerate the inconsistencies that come with breaking from the logic of the past.

REFERENCES

1. Peters, T. and Waterman, R. *In Search of Excellence*. New York: Harper & Row, Publishers, 1970.

2. Ehrlick, Paul R., Richard W. Holm and Dennis R. Parnell. *The Process of Evolution*. McGraw-Hill Book Company. 1963 p.73

3. Feyerabend, Paul K. *Against Method*. London: Lowe & Brydone Printers Ltd. 1975

4. Wilder-Smith, E.A. *The Creation of Life*. Weaton, Ill.: H. Shaw. 1970.

5. Chuang Tzu (359-286 B.C.)

6. White, Lancelot Law. *Internal Factors in Evolution*. George Braziller: New York. 1965 p.112

7. Land, G. *Grow or Die: the Principle of Transformation*. N.Y.C. :Random House. 1973

8. Bronowski, Jacob.*The Origins of Knowledge andImagination*. New Haven:Yale University Press. 1978

16

INTERSYSTEM INTERACTION

SEXUAL RECOMBINATIONS

Asexual reproduction models division and rearrangement as a means of making changes within a single system. In asexual reproduction daughter cells are similar to parent cells. These clones remain the same until a mutation occurs in the arrangement of the code on the DNA molecule.

But evolution moved beyond simple fission, the breaking apart of a single cell into two similar offspring. Sexual reproduction superseded chance mutations as a means to create variety in the gene pool. The consequent variety caused by the recombination of genes provided a much larger chance for variation than mutations alone.

Another way to look at it is to think of a musical scale of twelve notes. A mutation would be to an entirely different pitch from the original notes of the scale. Recombination, on the other hand, is the variety of sequences that you can make on the original twelve tones. The history of music show the variety possible.

Francisco Ayala says that “most of the genetic variation in populations arises not from new mutations at each generation but from the reshuffling of previously accumulated mutations by recombination...The effect of recombination and random assortment is merely to reshuffle the existing genes in a population so that new combinations of alleles are exposed to selection at each generation. Sexual reproduction therefore generates a large amount of genetic diversity, greatly increasing the possibilities of evolution

and providing the population with an adaptability to a changing environment far beyond the reach of an asexual species." (1)

On each chromosome genes are linked together. But sections randomly break apart and rejoin—some invert, some are eliminated, some translocate. These various alterations then create new possibilities when organisms mate. Half the genetic complement from each individual joins together to form a new individual. Tremendous variety occurs in this way.

INTEGRATION OF TWO FRAMEWORKS

Sexual reproduction is the predominant way new combinations of genes come into being. Although change may occur with the mutation of one element with its consequent alteration of the rest of the system, most often transformation occurs when two recombined genic systems come together.

As I suggested in the book, *S.E.L.E.C.T. CREATIVE/INNOVATIVE APPROACHES*, inspiration comes from loving your Muse. Love and sexuality lead to new creations. When a person tries to modify individual parts of a single system, he mutates one idea at a time. He "plays with himself"—he remains within a single system. He is limited to "asexual" means of change. When he draws from different fields, he has the opportunity to integrate distinct whole systems. He "plays with herself"—for more fertile results. That is why Poincare suggests that in making creative combinations, you reach into widely divergent fields. He says, "Among chosen combinations the most fertile will often be those formed of elements drawn from domains which are far apart."(2)

In science, for example, it is important to have interests beyond a narrow specialty. Some think that specialists "know more and more about less and less." To do so is to become myopic, that is, nearsighted. Truly innovative workers, on the other hand, have a broad range. They are interested in areas outside their specialty and recognize the value of chance associations. Researchers, moreover, who become familiar with instruments and techniques outside their field can adapt them to their own work. F.C. Bartlett says, "Far the

most important aspect of the experimenter's need to master method and to handle apparatus is that in the majority of cases the method and the instrumentation are brought into his field of work from the outside."(3)

He also says, "An original mind, never wholly contained in any one conventionally enclosed field of interest, now seized upon the possibility that there may be some unsuspected overlap, takes the risk whether there is or not, and gives the old subject matter a new look...(but) he is unlikely to achieve much unless his preparation takes him into potentially overlapping field of scientific exploration."(4)

When two systems come together, a new integration is possible. As in meiosis half of the gene compliment is given up so that it can join with another half from the outside. Part of its separate uniqueness is given up to foster the expression of a new whole. Thus sex brings into being a new organization different from both parents yet showing some characteristics of each in a new form.

Darwin was interactionist in his thinking about evolution: Gruber says, "In the field of biology, Darwin's ideas were a thorough expression of interactionism: the development of a new species is neither an unfolding expression of properties already implanted in the organism nor a direct reflection of the impact of the environment upon it; all development is a unique product of the interaction of organism and milieu."(5)

It is a cooperative effort to achieve a new integration. Mary Wigman, the dancer, says that she does not begin with the music to develop her dances, nor does she devise a series of movements and then find the appropriate music. Instead, she and the musicians work together in the organic development of both. She says, "I do not create a dance and then order music written for it. As soon as I conceive a theme, and before it is completely defined, I call in my musical assistants. Catching my idea, and observing me for atmosphere, they begin to improvise with me. Every step of the

development is built up co-operatively. Experiments are made with various instruments, accents, climaxes, until we feel the work has indissoluble unity." (6)

Dialectical thinking is one kind of bringing together of different organizations. Here the two parts are opposites which come together, a thesis followed by an antithesis resulting in a new synthesis

Hofstadter says, "The essence of dialectical thinking is to find in each case what are the oppositions, conflicts, contrasts, contradictions, the othernesses, estrangements, alienations, that are possible in the context and to find the notion that unifies them by incorporation and using rather than destroying their tension, a notion that brings them together to belong with one another in a mutual oneness, so that for the first time they can attain to a truth of being that is open to them"(7)

An insight oriented therapist, for example, seeks to display the oppositions, conflicts, contrasts, contradictions that persons have in their lives. Generally these people have used various means to keep the contradictions out of awareness. But then they lead half a life. Therapists being sensitive to these avoidances help them overcome the estrangement they have from themselves. They bridge the alienation clients have from themselves and others. They explore various problems to seek hidden dimensions bringing them to the surface so that they can be re-integrated into the person's sense of himself. Though it is difficult, facing reality heals and makes whole.

Dialectical thinking usually concerns systems in opposition re-integrating on a higher level of organization. It generally occurs sequentially, that is, thesis, antithesis, synthesis. "Bisociation," a term coined by Arthur Koestler, suggests that any two matrices or organized systems, can come together in a new form simultaneously. The systems don't necessarily have to be oppositional. We have seen this earlier using random nouns as catalysts to arrive at new associations. The nouns and the problem do not have to be opposites--just different frameworks. Metaphors

connect ideas so that the hidden similarities show despite their different orientations. Koestler calls bisociation the "act of creation." It results from random concatenation, not deliberate choice in a single act, not a process over time. Two self-consistent, but distinct systems associate. Two frames of reference come together at one time; a third frame of reference emerges.(8) Like seeing with two eyes, the fusion of both frames of reference creates a new depth of understanding and vision.

Gutenberg bisociated when he invented the printing press. He wanted to use coin stamps cast in lead to make lasting imprints, but the only available technique was carved woodcuts placed over vellum, rubbed with a dabber. He didn't know how to develop the steady pressure to use the coin stamps to make the imprints. One day he took part in the wine harvest. He says, "I watched the wine flowing, and going back from the effect to the cause, I studied the power of the wine press, which nothing can resist. At that moment it occurred to me the same steady pressure as that exerted by the wine press might be applied to the pressing of paper, and owning to the pressure the lead would leave an imprint on the paper. To work then! God has revealed to me the secret I demanded of Him in a ray of light."(9)

"Janusian thinking," a term coined by Arthur Rothenberg, consists of "actively conceiving two or more opposite or antithetical ideas, images, or concepts simultaneously."(l0) The term derives from the Roman deity Janus, the god whose many faces looked in several opposite directions at the same time. Rothenberg points out that the discovery of the helical structure of DNA by Watson and Crick not only demonstrated that the structure of the double helix had identical sequences of chemicals running in the opposite directions, but that the discovery itself was through a janusian thinking process of considering opposites simultaneously:

Watson and Crick had been trying to determine the structure of DNA after collecting data provided by X-ray crystallography.

One day Watson was pairing like bases with like—adenine with adenine, guanine with guanine etc. but nothing worked. He was interrupted from that train of thought when Jerry Donohue came in. It was not Francis Crick whom he had been expecting. Whether the difference stirred a new response or not I don't know, but afterwards Watson began pairing unlike with unlike, adenine with thymine and guanine with cytosine. Subsequently he showed his findings to Crick who then flipped out and flipped over both of the pairs of bases and saw that "the backbones of the two chains must run in opposite directions."(11)

(There is some beauty in the recognition that DNA was so structured to continue my earlier metaphor: Sex also, when it joins unlike with unlike, is generally more fertile and the individuals concerned often run in opposite directions.)

DUALISM

When there is a failure to integrate two systems together, a dualistic interpretation is made. This has occurred in the last decade in the concept of right and left brain function in creativity.

The human brain is an amazing organ which we are just beginning to understand. Though our ignorance about our own brains is extensive, still there are some things that we do know. Let's see how this information might relate to the creative process:

Much of the recent literature suggests that brain function is to a certain extent regional, that is, certain specific areas of the brain seem to control certain behaviors. Studies of brain injuries to parts of the brain, surgical splitting of the corpus callosum, that large bundle of nerve fibers crossing the two cerebral hemispheres, and studies of normals in special testing situations have begun to show that the right hemisphere, for example, seems to function differently from the left. I do not plan to go into here a description of those experiments, but I will, instead, refer you to an excellent book reviewing much of the research, *Left Brain, Right Brain* by Springer and Deutsch. (12) Let me, however, summarize some of the results as it applies to the creative process.

Evolutionary Creativity:
Selection in the Creative Process

One of the concepts that comes out of split brain research is that there seems to be two functionally different ways of comprehending the world. Roger Sperry, Nobel Prize winner for his work in split brain investigation, concludes from his work that:

"Everything we have seen so far indicates that the surgery has left these people with two separate minds, that is, two separate spheres of consciousness. What is experienced in the right hemisphere seems to lie entirely outside the realm of experience of the left hemisphere. This mental dimension has been demonstrated in regard to perception, cognition, volition, learning, and memory. (13)

The left hemisphere seems verbal; whereas the right is nonverbal and visuo-spatial. The left seems to be more sequential, temporal and digital. Many think that the left hemisphere can deal better with rapid changes in time and can analyze stimuli better in terms of details and features; whereas the right can deal better with simultaneous relationships and with more global properties of patterns. (14)

Having two different ways of apprehending the world makes creative change even more possible. Just as our world is made up of men and women, males and females, so physiologically our brain seems to operate in two modes. Moreover, just as historically women have been considered the second sex and are only now getting recognition for their contributions beyond having babies and raising them, so the right side of the brain is beginning to get recognition as more than a "minor" hemisphere. This, however, does not mean that women are more '' right-sided'' for they tend to be more verbal (usually left-sided) than men who tend to be better at visua-spatial relationships (right-sided).

This metaphor has been carried far beyond the facts. Many have extrapolated to say that the left brain operates as a logical, analytic, digital computer and the right as a Gestaltic, synthetic, analogic one. From here the media had a field day, finding an

essential dualism in the world extending to its source the two hemispheres of the human brain.

Gardner writes in the *Harvard Magazine* about the "dichotomania", that tendency for speculators to place all of existence in a right/left, either/or category: "It is becoming a familiar sight. Staring directly at the reader—frequently from a magazine cover—is an artist's rendition of the two halves of the brain. Surprinted athwart the left cerebral hemisphere (probably in stark blacks and grays) are such words as "logical,""analytical," and "Western rationality." More luridly etched across the right hemisphere (in rich orange or royal purple) are "intuitive," "artistic," or Eastern consciousness." Regrettably, the picture says more about a current popular science vogue than it does about the brain."(15)

More recent research has tended to revise some of these ideas about the split in brain function. Studies of brain metabolism and blood flow seem to show that *both sides of the brain work together most of the time*. When one speaks there is blood flow on both sides of the brain. When one, for example, determines the angle of a line by comparing it to a chart, the flow is greater on the right, but it does show on the left. (16)

CREATIVITY AND THE LEFT BRAIN

Though the left hemisphere in the popular press gets short shrift, the left hemisphere is very important to the creative process. The left hemisphere is the hemisphere that has much to do with language, though there is some language function in the right as well. Without the ability to put information into words and pass them on to the next generation, we would have no cultural evolution. We would hardly be much more advanced from the animals whose language seems pretty much limited to dealing with the here and now.

Language leads to the possibility of building concepts from individual thoughts. It organizes our world. We see according to the words we have to conceptualize experience.

But, as I pointed out earlier, the conceptual patterns of language can restrict as well as facilitate. The left hemisphere functions can be rigidly logical or they can be loosely associative, just as words can have denotative or connotative implications. When language patterns become cliches there is the need for a fresh viewpoint. Consequently the early part of the book focused on the importance of getting out of stale situations, stopping what you are doing to examine your assumptions, noticing discrepancies, redefining problems, looking for alternatives, asking questions using "creative" verbs, using nouns as catalyses to new metaphors, and developing criteria for selection and integration.

Much of this probably goes on in the frontal lobes, another unknown area for brain research. The frontal lobes seem at least partially responsible for the ability to make categories. Halstead has shown that with the removal of the frontal lobes, individuals cannot group a collection of familiar objects in very many different ways. A normal adult, on the other hand, can group a miscellaneous collection of objects in dozens of categories for grouping—by color, shape, material, use and so on.(17)

RIGHT HEMISPHERE, WRONG HYPOTHESIS

In the popular press creativity often gets posted in the right hemisphere. If you think of the creative process being primarily artistic visualization, you might have some reason to ascribe the right hemisphere as the creative one as Betty Edwards does in her popular book*, Drawing on the Right Side of the Brain*.(18) Even the rhythms of language that are so important in poetry seem to be a function of the right hemisphere, prosody being inhibited in some right brain injuries.

But to one who sees creativity as being an improvement in any area of understanding from research, to better organization methods in business, to making a better soup, as well as a better painting, such a proposal seems rather limited. Creativity, as I understand it *requires the whole of your being.* It requires more than just the organizing potential of the right parietal areas of the

brain, it requires the frontal lobes as well. The latter seems quite important in initiating tasks, establishing categories, being attentive and persevering to complete the job. And it requires the left hemisphere with its capacity to communicate with language. You can not create with just half your brain. Creativity requires all of you. Both sides of your brain have to work together.

In a culture that tends to focus on language and logic, the move to visual and imaginative modes, however, seems a delightful change, though right hemisphere functions are no more "creative" than the left. They both have to work together—that is why we have a corpus callosum, that bridge of nerve fibers crossing between the hemispheres. Synergy occurs when we put to work functions of the mind not previously used. When both parts of our brain are working together, the cooperative, integrative effort will allow us to find better solutions—new and valuable ideas. If you have been using language and logic as your primary means to deal with situations, it will be helpful to try to use graphic and imaginative means to come up with a new point of view. On the other hand, if you have used your intuition and feelings to sort things out, you might find that trying to put it into words may help. Creators use their hidden talents to find something new and different.

SUMMARY

- Asexual change primarily occurs through mutations of genes of single systems; sexual changes occur through recombinations of genes on chromosomes that shuffle when two systems come together.
- Draw from fields far apart.
- Consider the dialectical thinking process to become aware of hidden qualities. Integrate their thesis with an antithesis to come up with a novel synthesis.

- Bisociate. Look for new patterns when you bring different frameworks together.
- Look at things from many directions simultaneously like Janus, the Roman god.
- Watch out for dualistic, either/or orientations. Maybe there is a creative synthesis that will work.
- The left brain is equally as important to innovation and creativity as the right.
- The frontal lobes initiate tasks, establish categories, attend and persevere to complete the job.
- Creativity requires the whole of your being.
- If you tend to operate from only one viewpoint—logical or intuitive, visual or verbal—it will help to develop other functions. Synergy, that enhanced working together, occurs when we use our hidden talents.

REFERENCES

1. Ayala, Francisco J. "The Mechanisms of Evolution." *Scientific American.* Sept.1978 p.63
2. Poincare, Henri. "Mathematical Creation" *Science et Method* trans by Ernest Flammarion, Paris in Brewster Ghiselin's The Creative Process. New York: Mentor Books, 1952.
3. Bartlett, F.C. *Thinking: An Experimental and Social Study*. Allen & Unwin. 1958
4. *Ibid.*
5. Gruber, H. *Darwin on Man*. E. P. Dutton & Co., Inc., 1974.

6. Wigman, Mary. “Composition in Pure Movement.”Modern Music.Jan-Feb. 1931 League of Composers, Inc.

7. Hofstadter, D. “The Philosophical Approach,” *Essays in Creativity*. Stanly Rosner and Lawrence Edwin Abt (eds.) Croton-On-Hudson, N.Y. : North River Press, Inc., 1974.

8. Koestler, Arthur. *The Act of Creation*. New York: Macmillan. 1964

9. Gutenberg. *Historie de l’Invention de l’Impremerie par les Monuments*. Hofer(Ed.), Hofer, Paris, 1940

10. Rothenberg, Albert. *The Emerging Goddess*. The University of Chicago Press: Chicago. 1979

11. Watson, J.D. *The Double Helix* New York: Atheneum, 1968

12. Springer, Sally P. and Deutsch, Georg. *Left Brain, Right Brain*. W.H. Freeman and Company: San Francisco 1981.

13. Sperry, R.W., “Brain Bisection and Consciousness,” *Brain and Conscious Experience*, ed. J.Eccles, New York:Springer-Verlag, 1966

14. Springer/Deutsch. *bc. cit*. p.185

15. Gardner, H. “What We Know (and Don’t Know) About the Two Halves of the Brain,” *Harvard Magazine* 80 (1978) :24-27

16. Begley, Sharon with John Carey and Ray Sawhill, “How the brain works.” *Newsweek*. Feb. 7. 1983 p.43

17. quoted in Gerard. R.W. “The Biological Basis of Imagination” from the “The Biological Basis of Imagination” in The Scientific Monthly,June,1946

18. Edwards, B. Drawing on the Right Side of the Brain. Los Angeles: J.P. Tarcher, Inc., 1979.

17

SEXUAL AND CONCEPTUAL CREATIVITY

A SHORT, SHORT LOVE STORY

A young man in his early twenties notices a young woman of similar age. Her hair is blond like his mother's, though different in style from two decades ago. This young woman holds herself with a carriage he wished his mother would have held. He speaks to her. She replies, "Yes, I'm from Iowa."

Gradually they get to know one another. It is not always easy for he makes assumptions about her based on his prior experience with women, especially his mother, or on his wishes of them. She, in turn, does the same. Some differences are reconciled; some remain.

They see more of each other. The early attractions give way to deeper knowledge. They become intimate. To prevent pregnancy, they use birth control. When later on they decide they want a more permanent relationship, they get married. Then they get to know one another at a new level.

A few years later they decide they want to enlarge their family. She goes off birth control. Soon she conceives. Nine months later a baby is born. She's a girl.

Over the years she grows up, first into a little lady, and later on to a young woman. One day she sees a young man. He speaks to her. She says, "Yes, I'm from Iowa....

THE BIOLOGICAL METAPHOR FOR CONCEPTUAL CREATIVITY

Though the reproductive cycle does tend to repeat certain similar patterns, it also shares in creative evolution. There are changes over the generations.

It should surprise no one that " conception" and " concept" derive from the same root *concipere*: to conceive. Biological conception and conceptual creativity share similar processes. Let's review some of them:

The first common feature is the recognition of a need. The young man's hormones induces his question to the young woman. That there is a reproductive instinct toward sexual intercourse is evident; that there is a conceptual creative drive is not established. Some like Jung think that there is a conceptual creative drive to conceptual creativity; others like Freud think conceptual creativity is motivated secondarily to other drives. Still others think that innate in the organism is a drive to mastery, that when an individual learns how to crawl, he or she wants to learn to walk, then drive, ski, sky-dive or dive into a love relationship. It is human to try to become what one can become—to fulfill one's potential.

So too , for any creative work to proceed, one has to have a drive to do it. One must feel some need to pursue the project. The impetus may come from outside like Pope Julius II's commission to Michelangelo to complete the painting of the ceiling of the Sistene Chapel. Or it may come from an inner need to express oneself or to solve some problem. Whether the impetus be from the outside or the inside, it must at some point become a need or drive felt within the creator. Internal motivation is necessary for the multiple layers of the personality to play together in the creative process. Otherwise the product may take on the surface quality of the hack.

As the young man pursues, the young woman seduces. Once they feel the need, they find ways of getting to know each other. Desire is biologically and psychologically determined. Learning about one another is the only concern; they are not initially in the baby-making business. They get involved in a relationship with no thought of having children— they are just fascinated with each other.

Evolutionary Creativity:
Selection in the Creative Process

Sometimes the courtship of an idea is just as distant from the expectation of creating something new. One is , like the young man, fascinated. At other times one is so captivated by the other, he wants to enter into a more intimate relationship. At first he may avoid pregnancy to first get to know the partner better. Later he may seek further growth and offspring may result. So too with ideas. Sometimes one is just fascinated with an idea. He enjoys playing with it. At other times one wants to really get to know the subject. He makes a commitment to investigating further. He may marry it. If he is not too fearful about attempting something new, he try to parent a new idea.

In the early stages the lovers alternate between active and passive interactions. The preparation phase of the creative process also shifts between activity and passivity. The young man pursues the young woman. Gradually he gets to know her as she does him. Each lets himself/herself be known to the other. Without the passive receptive aspect there is no relationship.

In intercourse they similarly alternate. The intentional act of getting to the bed must give way to the goal of letting go. The man who attempts to control the process often fails; he does better when he allows it to happen on its own. With the fascination of the other and the stimulation of the contact, it happens.

The cognitive creative process is similar. One alternates between activity and passivity, control and letting go. After the creator has gotten to know the problem and its elements and attempted to bring them together, he/she has to let go to allow the elements to flow together on their own. New ideas are generally at odds with our conscious conceptions and assumptions so active control tends to lead back to old assumptions rather than in new directions. One has to let go of conscious control to allow preconscious and unconscious processes to take over on their own.

At biological conception there are other analogous events. A very large number of sperm must be in the ejaculate to fertilize the egg. Although only one sperm gives its part of the genetic code to

the egg, other sperm help provide for the sperm's getting into the egg by detaching the corona radiata through enzymatic action. Males with less than 20 million sperm (considered to be low sperm count) can not fertilize the egg.

It is similar with creative ideas. An abundance of new thoughts is necessary to break into new ground. The first few ideas are usually tied too close to our old ways of viewing them. The best ideas are several steps away from initial approaches. The sperm that gets through to the egg has had its way prepared by the earlier sperm; the new thought that unites in a creative conception has had its way prepared by rejected ideas.

The sperm is active but not purposeful. The sperm once in the vagina swims rapidly but in a random fashion. The female reproductive system is the intentional half of the sex act. Her muscular contractions help bring the sperm to the egg. Random ideas in the creator's head must be organized by some principle. In the brain it is probably the wholistic organizing tendency of the right hemisphere that structures the random ideas. I tend to think of the right hemisphere as the feminine organizing part of the brain, and the left hemisphere as providing the masculine spermatic units. But the metaphor only partially works. Creativity is a highly integrated whole brained process.

In any case it often seems in creative work that there is an aesthetic principle which seems to organize the random creative impulses. Just as the vagina organizes the random sperm, the aesthetic principle helps to bring the ideas into creative combination. (Creative persons of both sexes tend to have characteristics of the opposite sex in a greater proportion than noncreative persons. Thus the woman is active to pursue and develop ideas, and the man allows the passive, receptive mothering side of himself.)

In the oviduct the sperm and the egg share their genic elements. Both the man and the woman lose control of the process which, in a species specific way, extends over the next nine

months. Though it is possible to harm the fetus while in the womb, there is little that can be done to enhance it.

Some authors question the necessity of an unconscious incubation stage, however, most creative persons describe such a occurrence. After the active and receptive preparation process has gone as far as it can go, one must let go. Subconscious processes then take over. Fortunately the length of time is not the species specific nine months but varies with the problem. A time away from the problem allows for different perspectives to be tried, some at contradictory directions from those taken at the conscious level.

Anxiety about the need to solve the problem interferes with the process. Little seems to be done that can hurry it at this stage. We have to go and let it happen, and it will, if the preparation is adequate. Wishing for results without the preliminary processes, however, is similar to a pseudo-pregnancy with its delivery of air.

Creative conception, like making love is pleasurable, but later on it requires work to bring the result into being. The creator must labor like a mother in delivery. With awe, excitement, and sometimes fear, the baby is born. The time of conceptual insight is also often filled with excitement, awe, and sometimes fear. The output seems at variance with the input filling the creator with strange feelings.

Even though the ideas are not fully worked out, most creative persons have a sense of certainty about them. The new idea, however, like the baby, is an organized potential, not a fully actualized statement. The mathematician, for example, writes his assumptions and formulations after the insight is made, not before. The formation of new ideas into a communicable product comes after the ideas are more fully worked through.

NURTURING AND LETTING GO

The new infant requires constant care. Someone must be available to meet its needs because it can't help itself. Similarly an infant idea needs intensive care. The creator has to be free to

pursue its implications when they are hot, or else he could lose them. They could turn cold very fast.

The infant, to survive and grow, requires protection and nurturance. He/she develops with stimulation and play. Premature demands that the baby conforms to society results in neurotic development. With proper stimulation and nurture the baby reaches a stage where he/she desires to learn the ways of the society in which he/she was born. The same is true with a new idea. Initially it needs to be protected and nurtured. The idea must be played with to be stimulated, to allow it to grow on its own. Premature criticism is often fatal. New ideas must first be *allowed to be*, then, with development demands can be made that it be something.

New ideas like young infants have their own time schedule. They often wake you at night. A parent must respond to them or they may die before morning. When the infant can sleep through the night, the parents can sleep through the night. Developing the idea is frequently less disturbing than the events surrounding its conception.

The child shapes the mother as she shapes him. They both grow together. The creator grows as the new concept pulls further implications out of him/her, thereby actualizing the potentials of the creator and the idea. A balanced interaction between the mother- creator and child—idea is necessary. If the child dominates, he/she may not be able to relate childish productions to society; if the mother dominates the possibilities of the idea may be lost.

Early in development the infant has the tendency to split the mother into good mother and bad mother. It is inconceivable to him/her that the mother who feeds him/her could also be the mother that makes him/her wait too long when he/she is wet. Only in later development does the mother become integrated as both in the mind of the developing child. The joys and despairs of the creative project are the same. We may over-identify with the project as the mother the child. It is hard to see the strengths of a

project when one is down and hard to see the weaknesses when one is up. Later a more even perception of the project is possible when we realize that on repeated acquaintance like mother, the project has its strengths and weaknesses and can be accepted for what it is.

Like children new ideas have to be socialized. The poetic thought must be developed into an expanded metaphor and revised several times. The painting must be matted, put behind glass, framed, and wired. The concept must relate at some level. The theory has to be written in a style that will get published. If it cannot be assimilated into the society of ideas, it could be lost.

In adolescence the sexual encounter typifies the conflict every creator has in his/her willingness to face otherness. The young adolescent is first repelled by the otherness of the opposite sex. Then the strivings of the Oedipal conflict held repressed during the latency period blossom. The adolescent becomes attracted as hormonal changes take place. Same sex peer groups break up with the onset of genital strivings and the attractions of the opposite sex.

The creator, too, might be initially repelled by the new idea because of its strangeness. Yet if he can master the anxiety and excitement long enough to become comfortable with the strangeness, the new and different begins to attract. The sexual other has a strange familiarity that both repells and attracts. The other is strange because she is opposite him sexually, but familiar because she shares the same humanness. In some ways she is like his blond haired mother. The new idea also repels and attracts. The familiarity is with the retention of the old aspects not modified in the new structure. Nothing is totally new. This strange familiarity fills the creative adventure with ambivalence. It leads to paradoxical feelings of revulsion and desire.

This is not to say that those feelings occur every time or to the same degree. Developing a spin-off from a old approach may have none of these strange feelings; they have already become

familiar. But something really new does have this feeling of otherness. Yet when the ambivalence to it is mastered, it gives the creative experience its unique texture and fascination.

Finally as the youth matures with parental support, he/she learns to be more autonomous. The parents have to learn to respect this emerging autonomy. They have to let go so that he can form a family of his/her own. They can't try to remold him/her for the rest of their lives. Just as in parenting, it is all right to let ones artistic and scientific work be incomplete. One could potentially revise forever. Besides it leaves openness for others to connect with the project. Moreover one can come back to it at a later time. Just as one doesn't stop talking with ones children when they leave home, so too it is possible to relate to those results even after they are published.

Allowing autonomy has other benefits and challenges. The new poem has insights the poet himself is unaware of and offers different possibilities for interpretation equally valid to that intended by the poet. In physics Einstein's ideas led to quantum mechanics, but he couldn't follow the consequences of quantum mechanics, saying that "God does not play dice with the universe." Thus he found himself in his later years outside the mainstream of modern physics. Yet his thoughts led to theories that fired the imagination of the next generation of physicists. So, like with parenting, it is with a mixture of sadness and pride that we must let go of our conception.

SUMMARY

- Though the reproductive cycle repeats certain patterns, it also shares in creative evolution.
- There is a creative drive to fulfill one's potential and the potential of the situation.
- Fascination often leads to greater involvement.

Evolutionary Creativity:
Selection in the Creative Process

- The creative process alternates between activity and passivity, control and letting go, involvement and detachment.
- Random thrusts become organized into new conceptions through aesthetic principles.
- The organized potential of a new idea must be nurtured before being socialized.
- Early estimations of the worth or lack of worth must be reconsidered and integrated over time.
- Truly new conceptions seem strangely familiar—they both repel and attract.
- At some point the new conception becomes autonomous and must be allowed to enter the world of ideas on its own.
- It is with a mixture of sadness and pride that creators let their conception go to struggle for acceptance outside the garden of infancy.

About the Author

John G. Young, M.D. is a board-certified psychiatrist who has a special interest in creative functioning and psychological fitness. He sees individual clients in therapy who are depressed, anxious, distracted or blocked from fulfilling their potential and collaborates with other therapists providing psychopharmacological support.

Dr. Young has a varied background. He was first in his class at the University of Massachusetts School of Engineering. In his junior year he transferred to the School of Liberal Arts where he graduated Magna cum Laude with Honors in Philosophy. The University of Rochester School of Medicine and Dentistry gave him a four-year full tuition scholarship. After he completed the psychiatry residency program at the University of Colorado in 1974, he was appointed to the adjunct faculty at the University of Colorado School of Medicine.

Dr. Young is the author of many books and articles on the creative process and person including ***S.E.L.E.C.T.: CREATIVE/ INNOVATIVE APPROACHES, OPERATING STYLES AND CREATIVE LEADERSHIP, EVOLUTIONARY CREATIVITY:SELECTION IN THE CREATIVE PROCESS, AWARENESS AND CREATIVE EXPRESSION, WILL AND WON'T: AUTONOMY AND CREATIVITY BLOCKS,*** *and* ***PARENTING THE CREATIVELY GIFTED CHILD.***

Dr. Young is an integrative multimedia artist, an accomplished painter, a published poet, a contemporary improv pianist and composer, an inventor, a professional speaker, and a seminar/workshop leader. He has taught classes on creativity, innovation and change at the University of Colorado and has been an adjunct professor with the Institute of Entrepreneurship and Creativity at Metropolitan State College, in Denver, Colorado.

Evolutionary Creativity:

Selection in the Creative Process

He has been invited to present at the "***Creative Problem Solving Institute***," Buffalo, N.Y., the ***"Creativity and Madness***" conference, Maui, Hawaii, the "***Design Management Conference***," Martha's Vineyard, Mass, and the ***"Imagination and Innovation in Litigation Symposium***" at Vail. He has had international clients as well as Coors, Proctor and Gamble, Colorado Mountain College, Public Service of Colorado, AT&T and banks, restaurants, hospitals and mental health centers.

The Creative Adventure, a two-hour video, created and produced by Dr. Young, won **The International Cindy Award, The Telly Award,** and **The Communicator Award.** In this video, Dr. Young develops the original conception that love is essential to creative functioning. He shows you how to develop maximum effectiveness using creative and innovative approaches. To market this project Dr. Young established **ADVENTURES IN CREATIVITY** in 1996 and set up a website on the World Wide Web at www.adventuresincreativity.net. Dr. Young has creative and produced other videos including ***Poems at an Exhibition*** and ***Concerto with Foxes, Deer and Other Wild Ones***. Also included at this site is an on-line multimedia magazine, an on-line art gallery, and a music site with 24 hours of original keyboard improv music.

His current focus is creating as a integrative multimedia artist, consulting to businesses and organizations in creativity, innovation and change**,** and seeing private psychiatric patients at the 777 29th Street, Boulder, CO.