Component Four:

Creative Envisioning of Sustainability

The fourth component of the Earthscore Method is specifically concerned with creativity. We must dream the sustainable life before we can live it. Students will have to invent sustainable societies. Such an inventive process will require releasing the creativity inherent in young people in ways that will make the Renaissance seem minor. There is no formula for creativity. Different domains have different ways of cultivating the creative process. The work curriculum I developed (Ryan, 1995) uses visual images, analogies, and emphasizes the first skill set. Envisioning workshops have developed other techniques. Musicians, painters, dramatists, poets, scientists and writers all have different strategies, -often those strategies are rooted in the singular experience of the person. Different educators with different learning styles will relate to creativity in different ways. In the Earthscore approach to education, there is a basic necessity to respect the intuition and discipline that foster creativity. Perhaps the best way for educators to cultivate the creativity of their students is to figure out how best to cultivate their own.

Creative envisioning involves an instant vision of a complex process. The vision occurs in the mind like a fist in the hand. There is a spontaneous, intuitive appreciation of a pattern. Peirce would call this “the firstness of thirdness.” Seeing creativity in the context of Earthscore means deepening our understanding of the firstness of thirdness.

The Firstness of Thirdness

Recall that pure firstness is the realm of spontaneity, freshness, being such without regard for any other. It is possible to cultivate this capacity to be comfortable in pure firstness. The disciplines of Zen and yoga and T'ai Chi all enlarge a person's capacity to be open to the new and the unfamiliar. One Zen master is quoted as saying "To become accustomed to anything is a terrible thing."

In the Western tradition this capacity to be comfortable in pure firstness is recognized as "negative capability". Recall the famous quote of Keats about Shakespeare:

> "...it struck me, what quality went to form a Man of Achievement, especially in Literature & which Shakespeare possessed so enormously --I mean Negative Capability, that is when man is capable of being in uncertainties, Mysteries, doubts, without any irritable reaching after fact and reason... (Olson, Charles; *The Special View of History* p. 14)

Fact is the category of secondness. Reason is the category of thirdness. To be comfortable in pure firstness means you can simply be there, you trust the quality of your being, without the need to grasp facts or see patterns. Sometimes this trust yield new insights, new visions, sometimes it does not. But clearly new insights, new patterns often do come out of random experience in firstness, the quality of "uncertainties, Mysteries", what the cybernetic thinkers call "noise". The firstness of thirdness grows out of firstness. Staying with the noise, trusting to possibility, often results in a recombining of patterns one already knows in radically new ways.

While the firstness of thirdness grows out of firstness, it needs to be informed by patterns learned in thirdness. Rigorous attention to the disciplines of mind we teach in school pay off in the capacity to recombine knowledge from disparate disciplines in imaginative ways. Obviously, the balance between rigor and imagination is hard to maintain, especially in a school setting where there is responsibility for the safety of children. But in the Earthscore Notation itself, there is room and respect for both learning the disciplines (thirdness), and for letting children have spontaneous experience of themselves and nature. (firstness).

In this context of the balance between rigor and imagination, I will provide two concrete examples of creative work relevant for the Earthscore educator: Lovelock's Gaia Hypothesis and the artistic version of Earthscore. Both creative endeavors resulted from a combination of allowing the mind to be comfortable without any patterns and rigorously understanding patterns.

In the 1970's, NASA hired the atmospheric scientist and inventor, James Lovelock, to help figure out if there was life on Mars. Lovelock reasoned that if there were life on Mars, the life forms would use the fluid medium of the atmosphere to “make deals” which would sustain their differences. But since we know the atmosphere of Mars is uniform and without differentiation, there is no trading going on. It's a boiled-down soup; therefore, there is no life on Mars. NASA didn't like this conclusion and promptly fired Lovelock. Now a worker displaced from NASA, Lovelock returned to his countryside laboratory in England. He found himself thinking about the differentiation in the atmosphere of the earth. The atmosphere's peculiar mix of gases could not be explained according to the laws of chemistry. Twenty-one percent oxygen in the atmosphere was an anomaly in terms of how gases would ordinarily mix. Yet twenty-one percent oxygen was critical to maintaining life on the planet. Four-percent less and many forms of life would die of oxygen starvation. Four-percent more and most woodlands would burn up with the next lightening fire. Other such anomalies struck Lovelock. Three-percent salinity in the ocean supported many life forms which would die if that percentage were altered. A constant range of temperatures had been maintained over the history of the earth, despite a twenty-percent rise in the temperature of the sun.

Lovelock intuited that the maintenance of all of these mechanisms could be explained by positing that the earth itself is a self-regulating, self-correcting, “living” organism. His creative envisioning, his abduction in scientific terms, his firstness of thirdness was that life is as much a part of earth as feathers are part of a bird. Inspired by his fellow villager, William Golden, the author of *Lord of the Flies*, Lovelock named his intuition the Gaia Hypothesis, after Gaia, the Greek Goddess of the Earth.

Stated simply, Lovelock's "Gaia Hypothesis" argues that the Earth is a living organism. Not metaphorically, but cybernetically. Thinking rigorously in circuits, thinking cybernetically, a very imaginative scientist has given us a rather startling and rich understanding of the earth. As of this writing, Lovelock and others are busy identifying mechanisms of planetary self-correction and a scientific consensus about the validity of this hypothesis is steadily building. As is proper in the scientific method, the abduction, or initial guess, must be confirmed by careful induction from evidence. Once such a guess enters the realm of scientific law, then we can safely deduce from that law certain predictions about what will happen to the self correcting mechanisms of the planet. If the Gaia Hypothesis holds up, these predictions will help us learn to regulate our behavior in accord with the cybernetics of the earth.

Regulating our behavior according to the self correcting mechanisms of the Earth is critical for a sustainable society. Learning how to achieve such self regulation, as a flexible species in a flexible environment, is what Earthscore education is about. To make clearer to educators just how this works in the realm of creative envisioning, or the firstness of thirdness, I will briefly describe the artistic version of Earthscore. This artistic version can be adapted into an educational setting.

Artistic Version of Earthscore

The biologist C.H. Waddington pointed out that humans transmit information over generations in two ways: genetics and language. After a study of how Monet, Cezanne and other modern painters had sweated blood to see nature without words, Waddington suggested it may be possible to formalize this type of silent success. He called for an information transmission system based on perception of environmental realities rather than speech or writing. The artistic version of Earthscore, based on video perception, is a notation that can organize such an information system. It took me over twenty years to develop. A good deal of that time was spent letting go of the language patterns that described what I saw with my eyes and becoming comfortable with the uncertainties, the noisy firstness of the video images themselves.

The difficulty of inventing a notational system suitable for the natural world becomes evident when we make a comparison between recording nature on video and playing music on a piano. Video is a perceptual device with which we can look at the natural world. The natural world can often be a buzzing, blooming confusion. We have never codified a clear system of 'notes' in nature. By contrast, there is a clear system of musical notes encoded in the piano. In fact, the piano was constructed to play these notes. We do not know the 'notes' according to which nature was constructed. A notational system designed to interpret the natural world must somehow be based on clear 'notes' elicited from the natural world.

For example, in order for videographers to record salmon spawning in a way that is faithful to the spawning process itself, they must understand the 'notes' or what we can call 'figures of regulation' guiding the 'performance' of the salmon. Ecological videographers must know how to read these underlying figures of regulation, or notes in nature, just as dance videographers must know the choreography of the dance they are recording. Once the underlying figures of regulation for salmon spawning in a particular river are identified and put together, i.e. composed into a score, then videographers who know the notational system and that particular score can record and monitor the salmon run year after year, generation after generation. If a particular performance of the salmon as recorded does not comply with the score, then the videographers are in a position to scan the ecological system for perturbations and alert us that something might be disturbing the underlying figures of regulation for the spawning run. This may result in a revision of the score for monitoring the performance if the disturbance of the salmon is for natural reasons and/or a correction of some human activity that is ecologically destructive to the salmon run.

Video recording and playback, with its possibilities of time lapse and slow motion, enables us to understand natural patterns in a non-verbal way. Think of time lapse film studies of budding flowers and slow motion studies of insects. Watching these moving images, it is possible to understand the pattern presented in a single gestalt without rational inference using language. Again, this is Peirce's hybrid category of the firstness of thirdness, now deployed in the realm of perception. Muybridge's famous photos of a running horse, done on a wager about whether the four hooves were ever all off the ground at the same time, is another perceptual instance of such firstness of thirdness.

The firstness of thirdness in nature can be understood in a rigorous formal way using the catastrophe theory of the mathematician, Rene Thom (1975). Catastrophe theory is a qualitative method for modeling discontinuous phenomena. The theory models the states of nature as smooth surfaces of equilibrium. When the equilibrium is broken, catastrophe or discontinuity occurs. Thom has proven that in natural phenomena controlled by no more than four dimensions, there are only seven possible equilibrium surfaces, hence only seven possible discontinuous breaks, i.e., only seven elementary catastrophes. Thom named these seven as follows: fold, cusp, swallowtail, butterfly, hyperbolic umbilic, elliptic umbilic, and parabolic umbilic.

Catastrophe theory is to the medium of video what Euclidian geometry is to the medium of paper. Television and video monitor and record events (Cavell: 1982). Just as Euclidean geometry offers a formal understanding of geometric surfaces and solid objects, catastrophe theory provides a formal understanding of events or changes from states of equilibrium, i.e., discontinuous phenomena. Based on Euclidean Geometry, someone faced with tiling a wall knows with mathematical certitude that of all possible regular polygons (equal-sided, two dimensional shapes) only three (hexagon, square, triangle) can fill the plane packed edge to edge. Based on catastrophe theory, someone observing nature with a video camera knows with mathematical certitude that there are only seven kinds of discontinuity possible in any natural phenomena controlled by four dimensions or less. Just as the continuous relational circuit constitutes the "staff" of the Earthscore Notational System, so these seven elementary models of discontinuity constitute the basic "notes" of the system.

To suggest how these notes function in the Earthscore Notational System, I ask the reader to imagine a section of a stream in which there is a continuous flow of smooth water. The flow of water has four dimensions: length, width, depth, and rate of flow. Changes in these dimensions occur because of changes in the shape of the streambed and variations in the amount of rainfall. Catastrophe theory can model how changes in these dimensions control changes in the way the water behaves. The models provide both a control surface for the changing dimensions and a behavioral surface for the discontinuous action of the water itself. For example, if the width of the streambed begins to narrow very gradually, suddenly a *fold* will appear in the water's shape. If both the rate of flow and the depth of the stream increases, the water may jump into the air as if jumping over a *cusp*. If a twig catches the water as it comes down, you may get a droplet forming at the end of the twig before it falls to the next surface. In catastrophe theory such periodic droplet formation, in-between the cusp surfaces, would map on the *butterfly* model. The butterfly is a like a cusp except it has another surface half way between the upper and lower surfaces, a pocket, on which the droplet could form. The swallowtail and the three umbilical models function in a similar manner.

Whatever way the four controlling dimensions change, there are only seven possible surfaces on which the corresponding changes in the behavior of the water can be mapped, only seven basic “figures of regulation” for the water's behavior. Let me note in passing another way of modeling water flow which has developed recently called chaos theory (Gleick: 1987). Chaos theory is particularly useful in approaching turbulence, a domain in which catastrophe theory has not yet been very helpful. To my knowledge, the formal interrelationship of these two modeling systems has yet to be worked out, but in principle both could be integrated into the Earthscore Notational System.

In nature, the combinations of the basic seven catastrophes are multiple and not readily apparent. Yet the underlying structural stability of discontinuous phenomena in nature can be understood by careful observation. Each “event pattern” can be understood in terms of its 'chreod'. Chreod is a term taken from the Greek that means “necessary path:” “chre” meaning “necessary,” and “ode” meaning “path.” If any natural process is disturbed it will return to the pathway necessary for its structural stability, like a flooded river returns to its riverbed. These necessary pathways of nature, or chreods, can be intuited though an artistic use of video observation,- i.e., firstness of thirdness, - and then rigorously modeled using the seven elementary catastrophes and variations on these seven (Casti 1988: 149 ff.).

In my own work as a video artist, I have repeatedly returned to moving water as the richest single source for developing a vocabulary of “chreods” in nature. Water takes so many different shapes such as billows, droplets, back curls, waves, fantails, and cascades. Each of these shapes exhibits a different pathway in which water can flow, a different chreod. In 1975, I spent the year recording over thirty-five chreods on videotape at the waterfall in High Falls, New York. In 1983, I did a study of the Great Falls in Paterson which I edited into a tape with five sets of seven different kinds of chreods. In 1984, I did a study of the coast of Cape Ann above Boston. In 1986, I crossed the Atlantic Ocean on a sixty-foot North Sea Trawler and videotaped over thirty hours of ocean waters. In 1993, I produced a study contrasting water patterns with fire patterns called *Water Fire Water* using images from waterfalls in the Shawangunk Mountains. Building up a vocabulary of chreods can give us an articulate set of notes with which to score natural phenomena. For example, I did a tape of horseshoe crabs laying their eggs in the Jamaica Bay of New York City,- a natural process regulated by a chreod. The crabs only lay their eggs in the wet sand during the ebb tides created by the full moon in June. This assures maximum protection for the eggs from predator birds and land animals. The birthing activity takes place within a necessary figure of regulation. If you destroy that figure of regulation, that chreod— by stripping the beach of sand, for example— you have destroyed the natural process of birthing in that site.

To sum up my discussion of modeling nature with video, or the firstness of thirdness, I am saying that the difficulty of discovering clear "notes" in the buzzing, blooming confusion of nature can be resolved with systematic observation of an ecology by video teams trained in Threeing and schooled to identify the chreods of an ecosystem. Their "negative capability" would be enlarged. Their systematic observation of "everything" using firstness, secondness and thirdness would insure that we did not miss anything significant. By identifying the chreods we can then rigorously model the underlying structural stability of the various events in the ecosystem. We can then find out, through more observation and study, how these various chreods relate to each other. The syntax of interrelationships between these chreods would, in effect, constitute the “score” for the ensemble of recurring events that constitute that particular ecosystem.

In terms of Lovelock's hypothesis, we would learn how Gaia actually operates cybernetically in our own locale. We would be eliciting the score from the ecosystem itself by careful observation. Once we know the score, we can observe and monitor how the ecosystem actually performs or fails to perform in compliance with that score. Failure to comply would mean that we need to reinterpret our score and/or to correct any behavior of ours that is making the ecosystem incapable of performing according to its natural score. The process of interpretation is reserved for the fifth component of the Earthscore notation.

An information transmission system based on shared perception of environmental realities would go a long way toward achieving environmental justice. When you have information transmission based on speech or writing, you inevitably have authority structures. Someone telling somebody else what to do. This starts when the developing integrity of a child's perceptual system is stunted and linked up with the language commands of adults. "Stop daydreaming out the window and come help me!" Creating a system based on shared perception gives us an authority based on many eyes looking out of many heads and would help offset tendencies toward language based authoritarian regimes, even green authoritarian regimes.

For educators working directly with Earthscore, it is possible, if the students have video and still cameras, to set them to work collecting chreods from the local ecology. Without cameras, it is possible to ask them to sketch patterns in nature. This could be done in a science, math or art class but also in literature. One particularly good point of crossover from chreods into literature would be a study of the poetry of Gerard Manley Hopkins. Hopkins believed that the patterns of nature could be “inscaped” directly. By this he meant that direct perception of a particular event in nature could yield the underlying pattern, in our vocabulary, a chreod. I will end this section with a few examples from his journals to remind us the perceptual acuity that is possible for us all and that an artistic use of video, according to the Earthscore Notation, would cultivate.

> About all the turns from the scapings from the break and flooding of the wave to its run out again I have not yet satisfied myself. The

shores are swimming and the eyes have before them a region of milky surf but it is hard for them to unpack the huddling and gnarls of the water and law out the shapes and sequences of the running (Hopkins [1872] 1953: pp. 126—127).

The next morning a heavy snowfall...looking at the elms from underneath you saw every wave in every twig (become by this the wire-like stem to a finger of snow) and to the hangers and flying sprays it restored, to the eye, the inscapes they had lost. They were beautifully brought out against the sky, which was on one side dead blue, on the other washed with gold. (Hopkins [1870] 1953: 119—120).

Questions to be developed

Exercises to be developed.